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ESSAYS
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ESSAYS
ON
AGRICULTURE,

BY THE LATE
THOMAS GISBORNE, Esq.,
OF YOXALL LODGE, STAFFORDSHIRE.

REPRINTED, BY PERMISSION, FROM THE QUARTERLY REVIEW.

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1. CATTLE AND SHEEP.
 2. AGRICULTURAL DRAINAGE.
 3. ANCIENT AGRICULTURAL LITERATURE.
 4. HIGH FARMING. AN UNPUBLISHED FRAGMENT.

THIRD EDITION.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1854.

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PREFACE.

THE Author of this volume of "Essays on Agriculture," the late THOMAS GISBORNE, of Yoxall Lodge, Staffordshire, was born in 1787, and died in 1852. He was an extensive landowner in the counties of Stafford and Derby; he personally farmed a considerable acreage of arable and pasture land, and was especially conversant with the dairy and with cattle and sheep feeding. Mr. Gisborne was also well acquainted with the agriculture of Scotland, both Lowland and Highland. Few agriculturists of his day were more generally known in their class; few men, in public or private life, were more beloved. His talents, his various attainments, his warm heart and popular manners, his ardent love of field sports, made him the delight of numerous friends. A Member of the British House of Commons for a quarter of a century, he was well known as a "public man," and his speeches and pamphlets on various subjects were numerous; but it is the purpose of the present volume, simply to collect, in their entirety, his valuable writings on Agriculture.

The first three Essays were written by Mr. GISBORNE in 1849 and 1850, and originally appeared in Nos. CLXVIII., CLXXI., and CLXXIII., of the *Quarterly Review*. The article on *Agricultural Drainage* was subsequently carefully revised by him, and separately published by Mr. MURRAY, in 1851, passing rapidly through two editions.

The proofs of this first reprint were submitted by the deceased Author to the further revision of his schoolfellow

and neighbour, the late Sir Robert Peel, who, on the system and under the superintendence of Mr. Josiah Parkes, had early deep-drained his Drayton estate. An extant private letter from that eminent statesman to Mr. Gisborne, dated Whitehall, 26th June, 1851, is not only a high testimony to the value of this Essay, but an interesting evidence of the earnestness and sagacity of Sir Robert Peel, amidst the distractions of public life, on subjects affecting the progress of agriculture. The following is an extract:—

“I do not think the article admits of improvement by addition; certainly not by omission. Would it be easy to present engraved plans and sections of the ordinary four-foot Drain for the reception of 1½-inch Pipe; and of the Tools used in making the Drain and laying the Pipes and Collars? Some people understand such an appeal to their Senses in half the time they comprehend one to their Reason.—Many of those who drain extensively neglect to have a *plan* of the Draining of each field made at the time that the work is done: a hint as to the advantage of this might be advisable.”

Mr. GISBORNE had intended a similar revision and re-publication of the articles on *Cattle and Sheep* and *Ancient Agricultural Literature*; but death intervening, they are now reprinted as they originally appeared in the Review, with the addition only of the Tables of Contents.

The fourth Essay, on *High Farming*, is a posthumous publication. It was written in 1851–2, and designed for the same channel of publicity. A printed proof of “High Farming” was found in his Study; but the latter part appears not to have received the Author’s final correction, nor had it then been fully approved by the Editor of the Review.*

Mr. GISBORNE had also meditated a succession of articles on other agricultural topics, which would doubtless have been composed and published, had his life been spared. There is reason to believe that the earliest paper

* The proof is endorsed by Mr. Gisborne as “corrected,” so far as the last paragraph in pages 235–6 of this volume.

he contemplated was one on "Woods and Plantations." He had also intended, at the suggestion of the Earl of Lonsdale, a dissertation on the "Revival of Agriculture in Britain"—considering that a decided era was ascertainable; and the history would have been carried down to, and have embraced, the introduction and development of the turnip and green crop systems of farming, which constitute the grand basis of improvement and progress in British, as contrasted with the declension of Roman, Agriculture, so clearly traced and described in his Essay on "Ancient Husbandry."

The above circumstances—of the degree of ultimate revision of the respective Essays by their Author—are thus particularly stated, because some of his views are subjects not only of pending discussion and difference of opinion, but of naturally important and enduring interest. Truth and public enlightenment, however, were the sole aim of the writer, and if now alive, he would have honestly abandoned any demonstrated error; he scorned sinister falsehood and ignorant prejudice, and he had little sympathy with their victims.

The sterling merit and popularity of these remarkable contributions of Mr. GIBBORNE to the periodical literature of his times, amply justify the collection and republication of his Essays in a complete and permanent form. It is a vulgar error to regret that eminent literary men of the present age should have "wasted" their labour as "writers of reviews." No greater fallacy has been current. Even the minor periodicals are in some sort the nurseries of national literature. They are essentially cosmopolite, as the medium of much foreign communication with the Republic of Letters. The higher class of Reviews maintains the standard of literature, and contributes to the purification of the public appetite and taste for knowledge, whilst it creates and trains up a certain number of superior writers. Perhaps, in no instance, can it be proved that Contributors of any class have, in consequence, failed to

make the best use of their faculties and accomplishments. On the contrary, the attraction and remuneration of Reviews largely increase and encourage the productions of authors, and open new markets for books. A Reviewer tests his own powers, and perfects them in a leading Periodical; and Time, aided by the accumulation and reprint of his contributions, gives him a permanent celebrity and the widest sphere of influence. It is scarcely necessary to cite the increasing number of such Essayist collections in our own days, not excluding "Essays from the *Times*!" Such authors become instructors of Posterity.—Thus the brilliant names, in our own generation, of Walter Scott, Southey, Jeffrey, Hazlitt, Mackintosh, Sydney Smith, Arago, Brougham, Guizot, Thiers, the two Mills, McCulloch, Senior, G. C. Lewis, Macaulay, Croker, Wilson, James Stephen, Lord Mahon, and Albany Fonblanque, become fixed stars in the firmament of literature.

The liberality of the Proprietor of the *Quarterly Review* permits the present publication. The *political* opinions of Mr. GIBBORNE, it is well known, were not in accordance with the principles on which that able Periodical is habitually conducted. Nevertheless, the sagacity of its Editor discovered in Mr. GIBBORNE, and produced on neutral ground, a highly-gifted Contributor, whose mental labours might otherwise have never been brought to light. These mutual relations constitute real liberality; may they be everlasting!

The entire Agricultural and Political Essays and Speeches of Mr. GIBBORNE, in Parliament and "out of doors," with a brief memoir of their author, are in the press, and will be early published. In the meantime this portion, consisting exclusively of Essays on Agriculture, cannot be unacceptable to the Land Owners and Tenant Farmers of Great Britain and Ireland. The proprietors and tillers of the soil must now depend solely on themselves. Contests between "Protectionists" and "Free Traders" are exhausted discussions. Agriculturists can henceforth only

ask the Legislature for Fair Play, in acts of free trade for *all* classes.

The personal life of Mr. GISBORNE was, for nearly half-a-century, connected with the stirring events and party-action of his day; but in all his writings on Agriculture, and in his speeches at Farmers' Meetings and Agricultural Societies, he ever avoided controversial politics. On such occasions and times, Agriculture was his only text; his single object the advancement of the Art of Husbandry.

H. S.

Yoxall Lodge, Staffordshire,
20th October, 1853.

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CATTLE AND SHEEP.

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CATTLE AND SHEEP.

WE purpose to confine ourselves on the present occasion to that department of agriculture which is engaged in furnishing a supply of animal food to the inhabitants of these realms. Though we trust that we may be pardoned for offering to our readers, almost exclusively, statements and remarks drawn from our personal experience and observation, we hope it will not be supposed that we are indifferent to the rich and interesting literature of contemporary agriculture. Mr. Stephens' "Book of the Farm"* (of a new and improved edition of which one volume has just reached us) is only one of several comprehensive Manuals that have been received with very general approbation by the classes best able to judge of their merits. The agricultural magazines published on both sides of the Tweed may well be referred to with satisfaction, as evidences of the spread of curiosity and speculation as to all questions connected with this great department of national industry; and though neither France nor Germany has of late been sterile in the same line, we believe we may

* "The Book of the Farm; detailing the Labours of the Farmer, Farm Steward, Ploughman, Shepherd, Hedger, Cattleman, Fieldworker, and Dairymaid." By Henry Stephens, F.R.S.E. Second Edition, in 2 vols., with numerous Illustrations; 8vo.; Edinburgh and London, 1849.

safely say that foreigners are ready to admit, as yet, the superiority of this branch of our insular manufacture. At any rate, the great extent to which their best writers rely on the facts and reasonings of ours, cannot be questioned. Nor can it be denied that this rapid succession of dictionaries, treatises, pamphlets, journals, and the large circulation which many of them deservedly attain, are features of the time—and features somewhat remarkable when we call to mind that, within the memory of living men, agriculture had scarcely advanced since Virgil wrote the *Georgics*; that the volumes of Tull and Arthur Young were the only agricultural publications which could be found in an English farmer's library, even where such a phenomenon existed; and that in the department of cattle-breeding, in which we have now distanced the rest of the world, the Roman poet appears to have had much the same perception of the cardinal virtues of a bull or cow, as most of the practical British farmers of those generations which preceded Collins and Bakewell.

Up to their time cattle and sheep were produced according to the generosity of the land on which their lot happened to be cast. Perhaps we owe it to difficulties of internal communication that very distinct races maintained, in some districts of small extent as compared to the surface of Great Britain, a separate existence. Over the rest of the country some little attention was paid to the qualifications of the ox as a beast of draught, but beyond this the cow was merely a milk and calf producing animal.

The bull was selected for his proximity, and his best recommendation was that he had given sufficient evidence of the talent which Mr. Shandy desiderated in Obadiah's grave pet. "Their bull gendereth and faileth not." When he had served the parish in this capacity for three or four years, he was discarded, from a prevalent and probably well-founded idea that uncanonical connexions were, on more than one account, inexpedient. He was then marched off to Stilton or Porchester Castle to feed French

prisoners ; or, if his size and substance were favourable, he was degraded into an ox, and took his place in the team. Of his progeny, the males, with the exception of a successor or two in his own vocation and a few oxen for the plough, were made into very immature veal. The females were reared. Such as were seasonably prolific, and as showed milking qualities, succeeded their mothers in the dairy ; and the remainder, after having been indulged with the best pasture which the district afforded, served to relieve, with the tenderness of youth, the uniformity of old cow beef which formed the staple supply of the provinces.

Of the pure races we must speak more definitely. England preserved the Devons and the Herefords. We add, with some hesitation, the appropriately-named Long-horns, which still struggle for a separate existence in a small district round the point where the counties of Warwick, Derby, Stafford, and Leicester approach each other. To fix on a known point, we should say they hail from Atherstone. Some splendid horns from this race are preserved by Lord Bagot at Blithfield. As late as the year in which the General Agricultural Meeting was held at Derby, a bull of this sort obtained a prize. The earliest, and that very recent, representative of the Short-horn, of which we have knowledge, was a large, uncouth, patch-coloured animal from the district of Holderness—a milk-seller's cow. Wales furnished a mean, black, mountain bullock, dignified with the name of a Runt, which still appears in considerable numbers in the markets of the western and southern grazing districts. Perhaps the improvement which has of late years been made in this race by the infusion of West Highland blood can hardly be called a cross. We apprehend that both races speak Gaelic. Scotland gave us the unquestionable West Highlander, whose headquarters are now fixed in Argyleshire and West Perth, and the somewhat more equivocal Galloway ; perhaps even the rough east country stot, from Aberdeenshire and its associate counties, may claim some *locus standi* in this enu-

meration. In Ireland we trace no distinctive breed. The distinction of the Irish ox and heifer was, that they were the worst-shaped and worst-fleshed animals which ventured to appear in an English market. "Good things scarce: plenty of Irish," because an almost proverbial description of a cattle fair. The same system of haphazard breeding, which overran a large portion of England and Scotland, prevailed universally in Ireland. As with the human, so with the bovine race. Each endowed with a marvellous fecundity: maidens and heifers equally precocious. The same circumstances of penury, hardship, and neglect which made the Irish (not "the finest," but) the most degraded peasantry who came into permanent contact with civilization, made the Irish ox the most degraded of oxen.

So stood the case a short century ago. But a great change was at hand. The early systematic improvers of our stock took the readiest, and perhaps, under the circumstances, the most scientific course. Having come to a definite, and, in the main, an accurate, perception of the objects which it was desirable to attain, they selected and commingled, without any regard to affinity of race, the animals which appeared likely to realize their vision. Immediate success attended their efforts. The merits of the first cross are proverbial, and even while we write, the newspapers offer us a confirmation of the proverb in the statement, that the prize ox, which this year (1849) furnished the baron of beef for the Christmas festivities at Windsor Castle, was bred by Prince Albert, was an animal of rare symmetry, quality, and fatness, and was the produce of a buffalo cow by an Ayrshire bull. In sheep, Bakewell put together white-legged and black-legged, horned and polled, long-woolled and short-woolled. Nor was the case much different in cattle. The late Earl Spencer traced much of his standard short-horned blood to a Galloway cow, which is still, we believe, a luminary of the Herd-book, and which produced one or more animals of agricultural celebrity. Still the desire for something distinctive prevailed; and as every

three or four years brought a fresh generation of these animals, their fleeting series enabled a successful experimentalist to establish something of uniformity within the limits of one human life. So, from most heterogeneous materials, breeds both of cattle and sheep, having respectively distinctive qualities, were called into existence. Of either sort, one—of cattle, the improved short-horn, and of sheep, the new Leicester—obtained a decided pre-eminence. They gained a footing in almost every agricultural district of England and Scotland. The uncivilized herds and flocks of our predecessors shrank before them as rapidly as the red man before the white in the New World; and though fashion certainly pushed them into some districts for which they were unsuited, and in which they degenerated rapidly, yet in the main they have retained their conquests. No doubt they trenched on the dominion of the old and pure races. They drove in their outposts and even made inroads into their territory. Meanwhile the possessors of the old races were not insensible to the spirit of improvement which was abroad, nor to the fierce competition which was forced upon them. To them, as to men in higher station, three courses were open. They might discard their own stock as unequal to the occasion, and adopt that which the enterprise of other men placed within their reach; or, following the example before their eyes, they might aspire to success by crosses of which their own herds should be the foundation; or, thirdly, they might seek improvement by judicious selection and rejection within their own domains. Happily, they adopted the last course, and the purity of our old races of cattle was maintained. Who would not regret the disappearance of the beautiful Devon and the picturesque West Highlander? Either position or design had kept these races pure, and they retained all the distinctive marks of purity. Thus they were improved without being adulterated, and remain to this day as marked in their respective characteristics, as they were before an improved short-horn or a new Leicester had been called into existence. Their im-

provement has perhaps not been so rapid as that of the new breeds, but they did not start from so low a point of degradation. Nor should it be forgotten that they occupy districts below the average of the kingdom in fertility. On the whole, they have maintained the contest for superiority with various success—a success regulated perhaps at times by fashion and caprice, but resulting on the whole in good judgment and truth.*

We should now, perhaps, be in condition to estimate the results of a struggle which has continued for more than half a century. But before we can pronounce even a qualified opinion, we must have a very clear perception of the principles on which a decision ought to be founded. The real and only question for the farmer is, what breed of cattle will, year by year, yield me the largest money return per acre, or per given quantity of various sorts of food consumed by them? And this question is not settled by saying, Taken—10 tons of short-horns and 10 tons of Devons; 50 tons of food of equal quality were consumed by each lot; the short-horns gave beef as 21 to 19, or *vice versa*. 1st. We must know the respective histories of each 10 tons; we must have a debtor and creditor account of each up to the time of weighing in. The one may have credit for services in the dairy, the other for services in the team; or the creditor side may be blank in the case of either or both. We must *here* consider the breeder and the feeder as one man. Before we can answer the question

* A split has arisen in the Herefords, of which we cannot explain the origin, but which we regret, though we cannot say that it has produced any deterioration. The difference, though small, is decided, and the respective parties are of course very positive. The general Hereford is an animal with a white face, upward horns, and a tawny side. The animal of the offset has a speckled face, generally a broad white stripe down his back, and shorter legs and more horizontal horns than his relative. Of the speckled-faced Herefords, the late Mr. Price, Earl Talbot, and Sir F. Lawley have been the most distinguished breeders. The contest between speckled-face and white-face is not worth carrying on.

“Facies non omnibus una
Nec diversa tamen, qualis decet esse sororum.”

so interesting to him, we must know the antenatal cost of each 10 tons, and their respective debits and credits up to the day when they leave the hands of the beef manufacturer for the shambles. 2ndly. We must know which fetched the most money—the beef represented by 21, or that by 19. It is easy to say, “I have bred a beast of rare symmetry, great size, early maturity, first-rate quality.” Equally ready are the inquiries, “After how many failures?—At what cost?—How stands the balance?” These questions are answered by many brave and contradictory assertions; by many wild and contradictory guesses; but by no statistics on which we can found a safe conclusion. And, yet, on the answer depends, on average agricultural farms suited to any description of cattle, the whole question of successful breeding and feeding. The statistics are not forthcoming; first, because few farmers keep any accounts but a cash-book; and, secondly, because considerable intricacy arises from the circumstance that the breeder and feeder (in the case of cattle) are ordinarily not the same person. To those who give to the public accurate statistics of one farm, or of one animal, we are under great obligations; but the questions at issue can only be solved by a multitude of instances. Being, therefore, without the sure monition of arithmetic, and left to our own observation, aided by the opinions of men of sagacity, and finding no very definite or decided preponderance in those opinions, we are not in condition to offer to our readers any guidance on which we could safely advise them to found their practice. But, we may mention some of those characteristics of the various animals which we have under review, which must be important points of consideration whenever increased knowledge shall enable us to bring the main question to a definite issue. Before we do so, we may be allowed to premise, in a single sentence, that in the breeding of cattle—as in every other important human pursuit—national objects are promoted by the successful skill and industry of individuals. The first vocation of a cattle-

breeder is to furnish his countrymen with the dairy ; with all its multitudinous comforts and luxuries. We scarcely know a more important national object of its class, than to place a free supply of milk within the reach of the great body of our population. The next vocation of the breeder is, to supply animal food—milk and animal food in the case of cattle—wool and animal food in that of sheep. Animal food is suited both to our climate, and to the hard-working energy of our people. The breeder has to cater for appetites, which bodily exertion has made rather active than critical ; as well as for others, of which sedentary and intellectual pursuits have blunted the desire for quantity, but at the same time stimulated the appreciation of quality. Bearing these objects in view, we proceed to remark on those qualities of the various descriptions of agricultural animals which subserve to their attainment.

From their general and hitherto progressive prevalence, the new breeds of cattle and sheep claim our first notice. We have already adverted to the manner in which (if at the expense of a little accuracy we may use the most expressive phrase) they were *created*. To the short-horns we must award the merit of uniting milking qualities with a propensity to get fat, to a degree which rarely, if ever, had been previously found in the same animal. We doubt, however, whether the mothers of the prize bullocks are the animals which fill the milk-pail. To that very simple agricultural implement is, as we fancy, to be traced the slack and bare loin which is the characteristic failing of this breed. In the shambles at Birmingham, where a large proportion of the well-fed cows from our dairying districts are slaughtered, you may generally perceive the blue and bare spot on the loin, though the rest of the carcass is loaded with fat. The advocates of the new breeds claim for them, that with a given amount of food, and in a given time, they will yield a larger weight of beef and mutton than animals of the old races. With some qualification we are prepared to admit the claim. In the case of se-

lected individuals, previously brought to a certain age, or point, of maturity, we think that the claim is well founded. Our qualification has reference to the previous history of the animals. As we hinted above, we must begin at the beginning. We have no doubt, we might almost say experience has proved, that if 1000 short-horned females were subjected to the breeding process in competition with 1000 West Highlanders, Devons, or Herefords, not only in the first named would there be more failures of produce, but among the products there would be more animals of low quality, coarse, and utterly exceptionable, than would be the case in any of the three old races. As little doubt have we that 1000 Leicester ewes would produce fewer lambs, and among those fewer more rickety, wry-necked, and turn-in-the-head, than 1000 ewes of any other breed. This is because, though art may improve upon nature, it never can become so unvarying and sure in its operation. The varieties and incongruities which have been introduced on account of their connexion with some coveted quality, will from time to time re-appear. The concoctor of a new breed is always liable to disappointment. He introduces into his herd some unknown animal on account of certain apparent excellences, but he cannot tell what qualities, though latent in the individual, run in the blood. The flat side, vulgar head, or hard flesh of some paternal or maternal ancestor may re-appear in the offspring. We have heard Mr. Buckley of Normanton, the owner of one of the oldest and purest flocks of Leicester sheep, say that, from time to time, gray faces and black feet appeared among his lambs. We have before us a letter from the late Earl Spencer to a friend, who had consulted him on a point in breeding, in which he says, "Your cross will not justify a very high-priced bull, but, in order to secure you against *anything monstrous* in his stock, you must ascertain that you have several generations of real good blood." With such incidents a breeder of horses is familiar. He selects a bay mare with black legs, and unites her with a

male having the same characteristics. If the produce should be chestnut, with a bald face, and what the dealers call white stockings, we can assure him of sympathy from many fellow sufferers. To disappointments of this class the proprietors of original, or very old, races are less liable. Every connoisseur in cattle is aware, that, in a drove of short-horned bullocks or heifers, there will be more diversity of shape, of quality, of colour, and of aspect, than in a corresponding drove of West Highlanders, Devons, or Herefords. Another difficulty besets the breeders of short-horns, and all others who have attained to animals of great merit by many mixings and crossings. You have selected the breeding stock for size, symmetry, propensity to fatten, or for what a Frenchman would call a "*je ne sais quoi*;" and a breeder, a sparky appearance. When you have secured the recurrence of these qualities in their offspring, as far as bovine frailty permits, you have invariably attained this object at some sacrifice of fertility. We have known some breeders of short-horns who have been, and perhaps still may be, desirous of having bulls with the heads of heifers and the thighs of bullocks. The offspring of such males is always deficient in quantity, and is of weak constitution; the progeny inherits the paternal effeminacy. When such a blunder has established itself in a herd, it can only be redeemed by recurrence to a male,

*"cui turpe caput, cui plurima cervix,
Et crurum tenuis à mento palearia pendent."*

These are the true and natural indications of taurility.

Our lamented friend, Mr. Edge of Strelley, having shaped in his imagination a breed of cattle formed on his own model, great size, symmetry, and a propensity to fatten, spared no expense to realize his vision. Aided by a most correct eye, and with no prejudices, personal or local, he selected at any cost, and from any quarter in which he found them, the animals, both male and female, which he thought likely to answer his expectations. Nor was he disappointed in the qualities of their offspring.

But after some years, when he seemed to have attained, or to be on the point of, perfection, he came to a dead lock ; his females, though much solicited, refused to give him produce. On this ground, and on this only, we believe, he broke up his herd and discontinued the pursuit. Lord Spencer, an enthusiastic advocate of short-horns, admitted in more than one public speech that, in his herd, fecundity had diminished to an inconvenient degree, and was only maintained by a degree of care and attention which could hardly be extended to the general breeding stock of a kingdom. We know the ready answer—The females are too fat. But that is not the whole question. We lately inspected a herd of Herefords, the property of a distinguished and (we speak on the authority of his farming accounts) very successful agriculturist. The breeding cows and heifers, living solely on crushed gorse, were considerably above the point of marketable beef in fatness. We have no doubt they would be very bad milkers. The bulls were loaded with fat ; but there was no deficiency of calves ; the drafts on account of barrenness were very few. The expression of the owner was, “I have no trouble on that score.” Twins were by no means unknown in the herd. Since short-horns have been very generally introduced into the midland counties, barrenness has been a great “trouble” to the cheese-making farmer.

We will endeavour to sum up impartially. Even the improved short-horn is by nature a coarse animal, requiring a good climate and a generous soil, and unprofitable for *merely* feeding purposes. Sterility is a serious tax on any herd which, by great care and attention, has attained to a respectable quality of flesh, and to symmetry of form. The dairy sustains the short-horns. The cast cows soon acquire a rough coating of fat, and form a valuable supply of low-priced beef for the manufacturing and colliery districts—for those appetites which we have described as being active without being critical. But we should be unjust if we did not assign to the short-horns one quality of

great value in an agricultural animal—composure of mind. The males have lost the combativeness of their species. We can hardly conceive a more ludicrous sight than a bull from Althorp, or Babworth, thrust into the arena at Seville, or Ronda. The females yield precedence without contest. If you introduce a little petulant Highland cow into a dairy of short-horns, of which every individual is double her own weight, she at once becomes mistress and leader of the herd. We have been in the habit of attending annually a sale of fat cattle where the stalls are filled with beasts of various descriptions. The short-horn is released from the stake to which he has been tied for four months, and proceeds to the hammer with all the solemnity which befits an animal who is walking to his own funeral. The West Highlander, as soon as he ascertains that he is free, rather in frolic than in fury breaks through the ring of his intending purchasers, blunders over a fence, and celebrates his recovered liberty by most extraordinary antics. The butchers get but a passing view of him. “Now, gentlemen,” says the facetious auctioneer, “you must shoot him flying.” His sale proceeds without the solemn pinching and punching, and the wise looks which, in the case of a more patient animal, are preliminary to a bid. Some excitement has been produced by the scene, and, if the gin-bottle has done its duty, he generally sells well. But we beg pardon.—We must not altogether pass by the important point of early maturity. Here the short-horns claim a decided pre-eminence. We will not altogether negative the claim, though we do not find it borne out by the declared ages of the animals which are exhibited for prizes at the Smithfield show. We only desire to ask and to receive candid answers to two questions, and, in order that we may dismiss the subject, our questions shall have reference to new Leicester sheep as well as to short-horned cattle. Have, or have not, these two breeds possession of the most fertile districts which are devoted to breeding? Have they, or have they not, during their

two first years, more indulgence than falls to the lot of the young of other breeds?

So many general points have entered incidentally into this review of short-horned merits, that we can be more concise respecting the old races. We will take Devons and Herefords together as having many points in common. They are confessedly prolific; neither are suited to a farmer whose rent is to be made by the produce of his dairy; we reckon little of the services rendered by their bullocks in the team; human labour must be at a low ebb where it can be profitably associated with so slow a beast as an ox; bullock-teams and railways will not, we think, long co-exist. We must admit that something will be sacrificed, for we are not insensible to the superior quality of meat of mature age. The claims of these two races are founded on good constitution, on the very rare occurrence of animals without merit, on a considerable capacity to bear hardship without suffering, on symmetry sustained with less care than in any artificial breed, and on the high quality of their beef. When their symmetry does fail, it is generally in the fore-quarters; where the high-priced beef lies, they seldom fail. They are unrivalled in the deep cut of lean meat well covered with fat along their whole top and sides, which butchers find so acceptable to their best customers. If compelled to give a decision between the two races, we should say, with much hesitation, "If you wish to please your eye, take the Devons; if your pocket, the Herefords."

We approach the West Highlander with some fear, lest we should ramble into romance instead of adhering to plain agricultural truth. How can any man leave either his garret in Grub-street, or the tails of a set of lumbering short-horns in a Lincolnshire homestead, to visit the free and spirited denizen of Gare Loch Side, Glen Lyon, and the storm-swept Hebrides, without feeling some excitement? Unless the West Highlander has gazed on you from a rocky knoll in his native glen—unless you have

felt how much he ornaments and animates the scene, you will not admire and love him as we do. The first merits of a West Highlander are his hardihood and his great industry. Whether you order him to find his living on a black moor in summer, or to gather up the crumbs which have fallen from the rich man's table on your feeding pastures in winter, he is equally prosperous and cheerful. In storms or severe weather you never see him setting up his back and shivering under a hedge or wall; he is constantly working for his bread. We knew a grazier who always cleaned up his pastures in winter with West Highlanders, and who objected on principle to giving them any fodder, even when there were several inches of snow on the ground, saying that it only taught them idle habits. Some years back we saw annually at Falkirk a lot of West Highland bullocks bred by Mr. Stuart of Harris, and brought by him to that market. They were the best lot of one man's breeding which we ever saw; Mr. Stuart kindly gave us their history. From the day of their birth they had never been under cover; neither they nor their mothers had ever received a scrap of food from the hand of man. In the summer they roamed through the mountain glens. The Atlantic storms throw up on the west of Harris long ranges of sand-hillocks, which become fixed by the roots of a coarse grass, to which, if we remember right, Mr. Stuart gave the name of Bent. We believe it is the same grass which such of our readers as visit Paris may see extensively planted on the railway sides between Boulogne and Abbeville for the purpose of fixing the drifting sands. Mr. Stuart's herd, when driven from the hills by storms and snow, retreated to these sand-hills, and found from them all that they ever received of shelter and food. Both summer and winter they were almost independent of man. The bullocks began their southern travel by a sailing voyage of 60 miles over a very uncertain sea; they then walked about 220 miles to Falkirk, mostly over open moors, on which they bivouacked at

night, picking up a living by the wayside as they journeyed. At Falkirk they appeared healthy and lively, fresh as from their native glen, firm in their flesh, and with the bloom of high condition on their long and silky coats. Nor, indeed, were their health, strength, and condition superfluous; for, through the intervention of Mr. Carmichael, or some other eminent Scotch dealer, we believe that their general destination was the Vale of Aylesbury (another walk of nearly 400 miles, for it was before railways were in general use for cattle), where they revelled in the, to them, unwonted luxury of such pastures as are found on the farms of Mr. Senior or Mr. Rowland, and before the day twelvemonth on which they had stood on Falkirk Moor, they had probably all appeared in the shop of Mr. Giblett, or some other West-end butcher. The West Highlander is eminent for the excellence of his flesh; it is not very easy to put on, but when there, it is of first-rate quality and price. This animal does not compete in size with the short-horn or Hereford, but, in the hands of Mr. Stuart, and of the principal Perthshire and Argyleshire breeders, he seems to us to be large enough. About six years ago one bred by Mr. Campbell, of Monzie, obtained the first prize in his class at the Smithfield show, and was sold to a butcher for nearly £50. At the same time the higher and more barren glens furnish the same animal in a smaller compass, and to a gentleman residing in his country mansion he is almost as well worth having for his beauty as for his beef. The West Highlander has one natural defect, which, however, skilful men have much remedied by judicious selection and rejection without tampering with his purity. He has it in common with the wild and with the least cultivated races of his species—with the bison, the buffalo, both of Italy and South Africa, the bullock of Caffraria, and the mountain bull of Spain. The defect is thinness in the thighs and a general falling-off in the hind-quarters. It is a grave agricultural failing. The West Highlander is not very docile, nor very obser-

vant of artificial boundaries. His habits of free ranging are not very easily overcome.

Having carried our readers to the Highlands, we must, at the risk of being somewhat episodal, request that on their return south they will accompany us to Falkirk Moor on the second Monday or Tuesday in either September or October. They will there witness a scene to which certainly Great Britain, perhaps even the whole world, does not afford a parallel. On the Monday morning they will see the arrival on this flat and open moor, of flock after flock, to perhaps the average number of 1000 in each, of sheep—some black-faced with horns, some white-faced and polled—the individuals of each flock being, however, remarkably uniform in size and character. They will probably observe that the flocks arrive in pairs, the first being a draft of wethers, and the second of ewes, from the same farm. Each flock will be attended by two or three men, and at least as many dogs. They take up their respective stations on the moor without confusion, and stand in perfect quietude in little round clumps, which are separated from each other by only a few yards. The dogs are the main guardians, and though they are generally lying down and licking their travel-worn feet, no unruly animal who breaks the ranks escapes their vigilance, but is instantly recovered. Among the shepherds friendly recognitions are taking place; the hand and the mull are freely offered and accepted, and the news from Ben Nevis, Dunvegan, Brahan, Jura, John o'Groat's and The Lewis is communicated in a singularly soft language, strange to southern ears. We doubt whether we do not much under-rate the whole number of sheep thus collected at 100,000. Mr. Paterson, Mr. Sellers, Mr. Kennedy, and Mr. Cameron, of Corachoilie, will each have several thousands on the ground. We have heard that this last patriarch has 50,000 head of cattle and sheep on his several farms. The greater part of the sheep are in the hands of their respective breeders, though no inconsiderable number

have been purchased, without being seen, at the Inverness wool fair, by dealers who are perfectly acquainted with the qualities of every large flock. Soon after the groups have been collected in the manner which we have described, a large number of agricultural-looking gentlemen on horse-back and on foot begin to move among them; these are partly southern dealers, but more generally the large turnip-growers from the east coast of Scotland, and from the northern and eastern counties of England. The merits of each flock are so accurately known by those who have an interest in frequenting Falkirk, that a cursory inspection suffices. No stranger accustomed to the bustle and the crowd, the handling and the haggling, of an English fair, would suspect that transactions of a magnitude to which Barnet, St. Faith's, and Wey Hill, afford no parallel, were on the eve of taking place. The owners are seldom with their flocks, but their whereabouts is easily ascertained by those who want them. "What are ye seeking for the Gordon Bush ewes? or for the Invercashley wethers the year?" says the purchaser; and if the parties are well known to each other, a price is named within 1s. or perhaps within 6*d.* a-head of what the vendor means to accept. A few words pass about the abatement of the odd shilling or sixpence, and with a half-jocose complaint that the vendor was shabby with his lucky penny last year, several thousand sheep have changed hands. The news of the price at which the best lots are sold spreads through the fair, and, within a very trifling percentage, the value of every other lot is at once ascertained. A large proportion of the lots pass from year to year into the same hands. No purchaser of a smaller number than 500 must expect to get sheep at first hand from any of the standard flocks; indeed, these magnates generally decline to divide their lots at all. On the outskirts of the fair will be found small, mixed, and inferior lots, where the buyer may have haggling for 1*d.* a-head to his heart's content. The settling at Falkirk is as peculiar as the dealing. No man brings money, *i. e.*

currency, with him to Falkirk. On a portion of the moor adjoining the sheep-ground, and adjoining also to long lines of booths, a wooden penthouse about 5 feet square announces itself by exterior placard to be "The Royal Bank of Scotland;" the British Linen Company, the Commercial Bank, and every other banking company north of Tweed appear there also by similar wooden representatives. The purchasers come to the fair provided with letters of credit, and, stepping into the tabernacle to which they are accredited, bring out in large notes the amount required; these are handed to the vendor in an adjoining booth, and are probably, within a very few minutes, at his credit with the issuer or with one of his rivals; for a Scotchman, dealing with a banker who is very reasonable in his charges, and who is to be found in every village in the land, always throws on him the responsibility of keeping his money. The bankers in the aggregate carry from the ground the same notes which they brought in the morning, a few scratches of the pen in their books having sufficed to balance all these large transactions. The clearing of the ground is as orderly as the other proceedings of the day, and, under the superintendence of the best herds and the best dogs in existence, the immense fleecy mass moves off, with almost military precision, on its southern and eastern journey.

What shall we say of the gathering of the morrow? Every isle and holm which opposes its rugged crags to the fury of the Western Ocean between Islay and the Orkneys; every mainland glen from the Mull of Cantyre to Cape Wrath, pours in its pigmy droves, shaggy and black, or relieved only, as to colour, by a sprinkling of reds, and of duns, graduating from mouse to cream-colour. From Northern and Eastern Sutherland, Caithness, Ross, and Inverness they come in, longer on the leg, smooth, and vulgar. From central Argyle, Perth, and from some of the islands, come the carefully-bred West Highlanders; these are the flower of the show, engage every one's talk,

and attract every one's attention; every individual of them is a delight to the eye of a connoisseur. Aberdeen and Forfar send in droves of large and bony, but useful, bullocks. A few Ayrshire cows and heifers for the dairy, some miscellaneous lots, and a few Irish, make up the account. We do not know the numbers; we have heard of 30,000, and again of 60,000. The October show is the most imposing. The almost universal colour is black; the moor is in appearance one black mass. You may be accommodated with every size, from that of a Newfoundland dog to a bullock of 100 stones. The cattle are mostly in the hands of dealers, having been bought up at the Northern and Western markets; many, however, of the best West Highlanders are brought to the tryst by their breeders, and you may see a kilted laird from the Hebrides standing, like Rob Roy, at the tails of his own bonny stots and queys. Every dealer in small cattle offers you Skye beasts, and you would be inclined to attribute almost miraculous productive powers to that celebrated island, till you were informed that (as a merchant would say) "that is the favourite brand," and that large numbers of these beasts are brought from the other Hebridean isles to the Skye markets. To speak generally, every one of these animals has his predestined course; the smallest, called six quarters, from being only eighteen months old, will clean up the rough pastures and eat a little straw in Clydesdale, Dumfriesshire, Cumberland, and the neighbouring districts. The older of the small cattle will proceed to Brough Hill, a very favourite fair with dealers, because it is said to be attended by more gentlemen's bailiffs than any other in the United Kingdom. The finest West Highland heifers are for Yorkshire, and the bullocks for the counties of Leicester, Northampton, and Buckingham. The heavy north-eastern bullocks will supply the Lothians with stall-feeders, and will go in large numbers for the same purpose to Northumberland, Lincolnshire, Norfolk, and the south eastern counties of England. These

are all Norfolks when they get to Smithfield market. The proceedings are as orderly, and the dealings on as large a scale, as those of the preceding day. A few small lots of a score each may be found, but generally they run from 50 to 300 and upwards. A purchaser of less than the whole of one of these large lots gets his number, not by a selection, but by a cut: a drover passes through the black mass, and cuts off by estimation the number; they are then counted and made up to the required figure by alternate selections on the part of the buyer and seller. A third day follows, but it is not of much account. The cattle are for the most part miscellaneous lots, and what a Scotchman calls his shots, and an Englishman his culls. We have been somewhat minute in describing these proceedings, because they are on a scale of magnitude quite unknown to Southern agriculturists. We can assure our readers that the men who carry them on are quite equal to the occasion. We always considered our annual intercourse with them to be both a privilege and a pleasure. No trading class can furnish more intelligent men than the Scotch stock-farmers, perhaps, indeed, than the Scotch agriculturists generally; men well educated, of courteous and simple manners, of great intelligence and much general information, enterprising, and keenly alive to every reported improvement. We never could associate with them without drawing rather disagreeable comparisons. Many of these men are originally and still from the Cheviot district of the border; several of them hold stock farms in districts separated by hundreds of miles from each other, besides a more agricultural farm on which they reside. Their system must be excellent, for they only see their mountain farms a very few times in the year. Others hold only one farm and reside on it; and of these, some on the west coast of Sutherland have long been the resident gentry and quasi lairds of the district, though holding under their great superior, the duke of that ilk. Till the very recent introduction of roads and inns, their houses were the only refuge of the traveller from the

mountain and moor. We must always have a grateful recollection of a lady who strongly objected to these innovations on her generous and refined hospitality. Though 60 miles from her doctor, and dependent on coasting traders for luxuries and fashions, she looked back with regret to the days when she had no conveyance but a horse or a boat.

Having spoken of the stock-farmer and of the shepherd, we must introduce to our southern readers the third member of the triumvirate, the Dog. To any inquiry of a Scotch shepherd as to the race of one of his faithful ministers, you would receive the answer, "Hout! he is jist a collie." But this designation is far too indiscriminate, for it is applied equally to the malapert animal which, at the sound of your wheels, rushes from every black hut, and, having pursued you for a few score yards with his petulant yaffle, gives his tail a conceited curl and trots back to inform the family that he has driven you off the premises. Far different is the sheep-dog. Whether employed in driving on the road, or herding on the hill, his grave and earnest aspect evinces his full consciousness that important interests are committed to his charge. When on duty he declines civilities, not surlily, for he is essentially a good-tempered beast, but he puts them aside as ill-timed. At an early age the frivolity of puppyism departs from him, and he becomes a sedate character. At home he shares his master's porritch; lies on the best place before the fire; suffers with complacency the caresses of the children, who tug his ears and tail, and twist their little fingers into his long coat; and, without inviting familiarity from a stranger, receives him with dignified courtesy. When accustomed to the road he will, in his master's temporary absence, convey the flock or herd steadily forward, without either overpacing them or suffering any to ramble; and in the bustle of a fair he never becomes unsteady or bewildered. But the hill or moor is his great theatre. There his rare sagacity, his perfect education, and his wonderful accomplishments, are most conspicuous. On

the large sheep-farms a single shepherd has the charge of from three to six or more thousand sheep, varying according to the nature of the country and climate. In performing his arduous duties, he has in ordinary seasons no assistance except from his dogs. Those shepherds who have studied political economy introduce the principle of division of labour into their kennels. When on the hill they are usually accompanied by two dogs: of these, one is the driving-out, and the other the bringing-in dog. To the first he points out a knot of sheep, and informs him by voice and action, that he wishes them to be taken to a distant hill. The intelligent animal forthwith gathers the sheep together, and acts according to his master's instructions. By similar means he informs the second that a lot of sheep, on a distant hill, are to be brought to the spot on which he then stands; and with equal certainty they are shortly at his feet. To either dog he indicates the individual sheep which he is to catch and hold. The eagerness and impetuosity with which the dog rushes at the neck of his captive would lead you to suppose that the poor animal was in great danger. Nothing of the sort. The dog follows Izaak Walton's precept, and handles him as if he loved him. The hold is only on the wool. The sheep stand in no habitual terror of the dog; though within a few yards of him, the elder will quietly chew the cud, and the younger shake their heads and stamp with their feet, provoking him to frolic, or mimic war. We have spoken here, simply, of the daily occurrences of the sheep-walk—milk for babes—for we fear 'that the more staggering, but not very ill-authenticated, instances of canine shepherding, with which we might fill our pages, would prove too strong for southern stomachs. Whoever has not read the Collie stories of the great Ettrick herd and bard, has anyhow a rich amusement before him. We love the long face, sharp nose, and sincere countenance of the sheep-dog:—

“ His honest, sonsie, baws'nt face
Ay gat him friends in ilka place.”

One word of advice to our southern friends who rent Scotch moors for grouse-shooting: keep on good terms with the shepherds. With a little encouragement, a collie dog will find every grouse-nest on the moor. A dinner for the shepherds, with whisky in moderation, followed by tea and a dance for their wives and daughters, are among the cheapest and most effectual modes of moorland game-keeping. "*Experto crede.*" *

We hardly know how to apologise for this wild digression; but we must recall our thoughts from their wanderings, and return to more homely matters. Having spoken of Short-horns, Devons, Herefords, and Highlanders, we should be unjust if we passed altogether without notice the great improvement which has taken place in the last thirty years in Irish cattle. Though large in amount, it has not been in any uniform direction. As far as we know, there is still neither a race nor a breed of cattle in Ireland. We have heard of Kerry cows, and we know there are cows in Kerry; but, though rather extensively versed in cattle, we have no idea what a Kerry cow is, as distinguished from any other mongrel. The improvement

* We wish that some competent classical authority may be able to assure us that in the *Odyssey*, 14th Book, lines 24 and 26, the words "*Οἱ δὲ δὴ ἄλλοι,*" "*Οἱ τρεῖς,*" and "*τὸν δὲ τέταρτον*" refer to the *κυνὲς τέσσαρες* which are mentioned only two lines before; and not, as some commentators suppose, to four assistant swineherds, who have not been previously mentioned at all. The latter interpretation receives some colour from the number of portions into which the supper was divided, which favours the idea that the number of Eumæus' assistant herds was four. Still, however, we are inclined to hope and believe that Homer spoke of the dogs. It is curious to find that the ancients were so well aware of the refined education which the canine race are capable of receiving, that the poet could, without comment, represent that Eumæus had sent a dog, *alone*, to take a fat pig from his country station to the city, where, for very good reasons, he was somewhat chary of trusting himself. In the "*Υμνος εἰς Ἑρμῆν*," Apollo's cows were committed to the sole custody of four dogs,

"*ἥύτε φώτες ὁμόφρονες*"—

equivalent to the saying of our South Country hinds, "he's as 'cute as a Christian." We knew an old Whig lord, who, during the long Tory rule, always said of his favourite dog, "He has more sense than any of our ministers."

in Irish cattle began, we believe, by the introduction of long-horned bulls from the neighbourhood of Atherstone. The rage for short-horns quickly crossed the Irish Channel, and contributed its share to the general progress. Into the mountain districts there has been a large infusion of Scotch Highlanders. We saw lately a drove of some hundreds of small cattle from the county of Down, of which nearly one-half showed unmistakeably the Highland cross, and a few had a touch of the buffalo. We have been told that a resident Irish nobleman has buffalo milking-cows for domestic use. The general result is, that Ireland now supplies a large quantity of very useful second-rate bullocks to the Leicester and Northampton fairs, and furnishes beef, quite equal in quality to the average of the United Kingdom, to Liverpool, Manchester, and the surrounding district. This comes for the most part in the shape of strong heifers, admirably grazed, and the supply is now continuous through the whole year.

From cattle we must descend to sheep. The sheep is by nature an animal of the mountain and the wilderness, and the sheep of agriculture is eminently artificial. If we should attempt to reduce the various sorts into races, or even, with one or two exceptions, into breeds, we should find the task far beyond our knowledge and powers. We know that, from time immemorial, a small dingy white sheep, which has had the honour to give a name to the first quality of mutton and of flannel, has existed on the mountains of Wales. Probably these, if any, have a title to the name of Ancient Britons. Very similar were the fleecy inhabitants of the Scotch Highlands till they were superseded, it is said not above 150 years ago, by a black-faced sort from England, which have again been driven from all but their most rugged and inhospitable fastnesses by an incursion of white faces from the border. To the old race, which still exists in Wales, in Orkney, St. Kilda, and in the parks of some Highland lairds, the Portland sheep seems to bear a close affinity. In the hands of

persevering Scotchmen, the black-faces have attained a consistency and an uniformity which does not exist in England; the old Norfolk is their nearest English representative. The Cheviots, also, have much improved by their migration to the north; they have also acquired considerable consistency, and we doubt whether it has been judicious to tamper with it by the introduction of Leicester blood. A white-faced horned sheep, which inhabits a moorland district called the Derbyshire Woodlands, the old Cambridgeshire, and a Dorsetshire sheep, bear to each other a marked resemblance. The Southdown, far the most comely of our English sheep, has about him several of the characteristics of an old race. But how gat he without his horns? In agriculture the Southdowns are invaluable. Grazing the shortest and driest pastures—bearing, from their hardihood and from the closeness of their fleece, confinement on a claggy lair, either in the turnip-field or in the fold, better than any of their congeners—they are not only of more general utility to the mixed farmer, but they also yield a supply of mutton considerably above the average in quality. The black-faced Shropshire ewe is a vulgarized Southdown, which has acquired size and has lost quality. We hear that a big Cotswold sheep is studying refinement, and trying to force himself into favour. But of all the polled and white-faced sorts, the New Leicester, though he may of late have somewhat declined in favour, remains still far the most important. With no pretensions to be a race, they have become, beyond all dispute, a very distinct breed. The New Leicester tup, in his best form, has a smart head, is long and low, with a tabular back, with wide rumps, “thick,” as graziers say, “through the heart of him,” with wonderfully covered sides and shoulders, but very inferior to the Southdown in his legs of mutton. The colliers in the north say that “a little fat mutton makes a many fat potatoes.” To furnish that mutton is the vocation of the New Leicester, and he performs it worthily. He is mutton food for the million; and sincerely we hope

that, in his present or in some improved form, he will be brought year by year more within their reach. With some deductions, analogous to those which we urged in the case of the short-horn, we must admit his superiority over his competitors in this particular, that he yields, at the least cost, and in the shortest time, the largest weight of meat. There our eulogium must end. His flesh is coarse, his wool is inferior, his constitution is tender. Obesity of body and serenity of mind act and re-act on each other, and have conspired to make a Leicester tup a marvel of idleness. He is equally difficult to provoke to love or war: he dies soft under hardships. Showmen find it to be their interest to place together a giant and a dwarf—the extremes of the human race. In order to exhibit at one view the extremes of the “genus ovinum,” with a Leicester ram, prepared for the show, should be coupled a Welsh ewe from Cader Idris, fresh from the hill, newly shorn, and having just weaned her lamb. We throw out the hint to Mr. Burgess or Mr. Stone.

If the sheep of agriculture is an indefinite animal, the agricultural pig is still more so. Every tyro in breeding has tried his hand on them. Every gentleman farmer presents his friend with “a gilt of my own breed.” “Encourage the breed of pigs,” said the Bishop of Chester (now of London) to his clergy, if credit is to be placed in the metrical version of his lordship’s Charge, indited by the Rev. Sydney Smith. We hope that what was enjoined on a parson is not forbidden to a reviewer, for we have had our experience in pig-breeding. We inherited a long-legged sow, hog-backed, bristly-maned, flat-sided, slouch-eared, rather a ferocious-looking animal. Twice a year she was followed down the lane by an almost interminable series of little grunters—reduplications of mamma—sixteen, eighteen, we believe even twenty at a litter. But how could these satisfy the eye of a critic? So we began afresh, and a few years of judicious selection and crossing gave us animals of almost perfect symmetry. The litters,

however, from far in the teens, dwindled to six, four, and at length our favourite sow produced one. Nor was this all. The roaded bacon three inches thick, for which, when trimmed with beans, we have seen gastronomes of undoubted authority desert farther-fetched dainties, was replaced on our table by six inches of rather flabby fat, unredeemed by lean. So when we could not even save our bacon we gave up the pursuit; and we are inclined to think that our experience was a sort of epitome of high breeding. A snub-nosed race, called Chinese pigs, or Tunks, have some distinctive marks. They may, for what we know, claim an antiquity coeval with the Shee-king and Shoo-king, though, indeed, we are not precisely aware of the authority on which they are said to have come from "the Flowery Land." They are funny little fellows; pert and queer in their ways; very symmetrical; poor breeders, and not exactly the pigs to furnish contract bacon. The Neapolitan, the Portuguese, and the Berkshire pigs have many points in common. For a constant supply of pleasing pigs we should select the Lisbon market. They are the only cleanly animals of a domestic nature (we make no exceptions) in Portugal; very uniform, very symmetrical when fat, and of sufficient activity to get their living in the chestnut-woods during the early part of their lives. To this feeding we should have attributed the delicacy of their pork, if we had not heard, on good authority, that in America mast-fed bacon is very inferior both in firmness and quality to that which is fed on grain. Whether the animal which, by an agreeable alliteration, is called a Hampshire Hog owes any of the celebrity of his bacon to acorns and beech-nuts, we will not pronounce. We are inclined to attribute a good deal to careful and scientific curing. Pigs, both in their natural and domestic state, deteriorate if exposed to cold. We are told that the wild boars of Barbary, Bengal, and Scinde are much finer animals than those which endure the severity of a northern winter in the forests of Germany. Nature made the pig

an animal of great activity and spirit. Man, in the due exercise of the power which has been conferred upon him of moulding nature to his own convenience, has made him a creature of flitches and hams. We think, however, that, in the case of the pig, the transforming power has been exercised rather wantonly. Of all the overloaded animals which deform our cattle-shows, none so entirely outrages delicacy as the *improved* pig. Unless his legs shrink under the weight of his shapeless carcass; unless his belly trails on the ground; and unless his eyes are quite closed up by fat, he has no chance of a prize. The extremes of domestic swine are Prince Albert's prize pig at the one end, and the pig whose domestic hearth is in the hut of the Finn, all the way from St. Petersburg to Archangel, at the other. This latter is an animal of skin and bone. From his looks you would not suppose that he has any vitals; there seems to be no room for them. His bristles, if not his ornament, are at least his distinction. He furnishes them to our markets to an extent both in quantity and value which, but for custom-house statistics, would be thought fabulous, and to which we only reconcile our judgment by recollecting that he appears, by these his representatives, on the toilet-table of every lady, we might almost say of every female, in Great Britain. As to flesh, if one could conceive such an animal to be ever subject to the tender passion, the epithalamium with which Porson honoured the union of the lean master of Benet with a leaner bride would be highly applicable to him:—

“ Though you could not, like Adam, have gallantly said,
 ‘ Thou art flesh of my flesh,’ for flesh ye had none,
 You at least might have said, ‘ Thou art bone of my bone.’ ”

Such are the extremes. “ *Medio tutissimus ibis.* ”

But in swinecraft we are pigmies when compared with the ancients. Ulysses, at one swine-station in Ithaca (and we are told that he had others on the mainland), which was under the care of Eumæus, had 600 breeding sows. They were lodged in twelve stately chambers (fifty in a

chamber), built of quarried stone, and adequately furnished with yards, fenced in by a substantial paling. The male pigs (πολλὸν παῦροτεροι) were only 360. This disproportion of numbers is accounted for by a statement of the insatiable voracity of the "godless suitors." So much for swine. On the subject of turkeys, geese, fowls, rabbits, and "such small deer," we must refer our readers to the "Book of the Farm." Be it noted, however (though not mentioned in this new *Stephani Thesaurus*), that the prime turkeys of East Anglia, whom we apologize for classing among "small deer," are *capons*. This is true at least of the huge Goliahs, the glories of Guildhall, one of which an astonished Paddy pronounced "fit to draw a gig."

In comparing the merits of the various agricultural animals which furnish food to man, we have frequently spoken of quality, and we wish to explain a little more definitely what we intend thereby. We consider firmness in the fat and a fine grain in the lean to be the criteria of quality. We believe that in those animals where fat and lean are associated, the firmest fat invariably covers the finest-grained lean. Any person who has had the good fortune to eat Highland venison with fat on it, will have observed that the fat of a stag differs from that of a Lincolnshire tup much as heart-of-oak differs from the wood of a Weymouth pine or poplar. The wild deer's fat is a substance of firm texture, hardly degradable, we should think, into dips or short sixes. The fat of the fallow-deer possesses much of the same enviable quality. When we descend from the forest and the park to the pasture and stall, we can form a series both for sheep and beasts which will hardly be called in question. For sheep—the Mountaineers, the Southdowns, various nondescripts, down to the New Leicesters. For beasts—Scots generally, Devons, Herefords, indiscriminate crosses and mongrels, down to the Improved Short-horns. In each case the butchers' shops will confirm our lists. There the animal which stands at the top will sell for at least 1*d.* per lb. more than the

animal which stands at the bottom. In both cases, in the article of quality, the new and very artificial breeds stand decidedly below all their competitors. To them must be awarded the merit of producing a coarse article in great abundance and at a low price, suited to those whose appetites are keen and not critical, and whose means are limited; whereas the old races will furnish an article of higher quality for those whose tastes incline, and whose means permit, them to be more fastidious. Whether any individual farmer shall produce one article or the other must be left to his own decision; and, if wise, he will decide the point on the same grounds of position, facilities, and connexion which determine a cotton-spinner to make forties cotton-twist, or to make one-hundred-and-sixties; and which determine a calico-printer to manufacture prints for ladies, or prints for housemaids.

Our readers will have observed further that in all these lucubrations we have made a marked distinction between races and breeds, and we wished to state the basis on which that distinction rests. Of late years certain sages have brought prominently before the public a science to which, in the prevailing rage for a Greek nomenclature, they have given the name of Ethnology. This science occupies itself in investigating the localization, the affinities, and the distinctive qualities of the various races of men. It is a circumstance which we would rather call satisfactory than singular, that the observations made and the facts collected—made and collected with true philosophic indifference as to the conclusion to which they might tend—all lead to the belief that mankind have sprung from one original pair. At this conclusion, on grounds merely philosophical, Cuvier and Humboldt have both arrived. We call the conclusion satisfactory, because it may re-assure some very worthy people, who discountenance philosophical investigations because they entertain narrow-minded apprehensions that revelation will not be able to take care of itself. As men multiplied, their different families were placed in different

circumstances of climate, soil, food, security, and demands for exertion, both mental and bodily. These external circumstances produced modifications both in the form and capacities of their bodies, and in the qualities and capacity of their minds. When successive generations had been so long subjected to the same influences that these modifications had become so far engrafted and permanent, that they were found in all the individuals who remained under the influences, and would endure for long periods even in those who were removed from them, a distinct race of men had been called into existence. Two familiar illustrations of this permanence will occur to every one: the Jew, though by ethnologists he would only be considered as one subdivision of an important race, is said to have maintained his national physiognomy in all the various circumstances in which the Dispersion has placed him: and we know that the Negro, when not contaminated by white blood, retains his woolly hair, his thick lips, his long heel, and his mental incapacities, though he has been transplanted for generations from the banks of the Tchadda to those of the Mississippi. To any investigation into races of animals the aid of language is wanting altogether: history also is more silent, and tradition more obscure, than in the case of man. Still considerable materials remain to those who may be inclined to pursue an interesting inquiry, for which we have neither leisure nor knowledge. Even zoologists, who seldom pretend to have much respect for the Mosaic records, seem, on the whole, inclined to an orthodox conclusion—to wit, that animals came as individual pairs from the hands of the Creator. This opinion is favoured, it must be owned, by operations of nature of which unphilosophical people are daily witnesses. Nature permits the connexion of many animals and birds, which have considerable apparent similarity, to be productive of offspring, but refuses to carry fertility further. The horse breeds with the ass, the dog with the fox, the pheasant with the domestic fowl, the goldfinch with the canary; but all the

offspring are sterile. On the other hand, the buffalo breeds with the short-horn, the dray-horse with the Shetland pony, the deer-hound with the poodle, the Dartford fowl with the bantam, the Caucasian with the Bushman ; and all the offspring are fruitful. And yet the outward dissimilarity is greater in the individuals forming the respective pairs in the latter series than in the former. Is it an unnatural hypothesis, then, that, in all cases in which the offspring of a connexion is fruitful, the father and mother are both descended from one original pair ? We think not ; but for our immediate purpose—and it is a practical one—it is sufficient that we should feel assured that the same influences of climate, soil, security, ease, or hardship, which have exercised so permanent an effect on man, have also formed different races from animals originally of the same type.

To come to our own case of cattle—where we find much uniformity of size and shape, a self-colour, and a similarity of disposition and aspect, recurring generation after generation, and even remaining after the external circumstances of the animal have been materially changed, we have reason to conclude that these distinctive marks have been produced by natural causes ; in short, that Nature without the interference of man has produced a race of cattle : and further, we shall be confirmed if we find that this race does not require the assistance of man to preserve it from deterioration. Should history, ancient painting or sculpture, or even reasonable tradition, give evidence that animals, having the same distinctive marks, existed at a remote period, our conclusions will have received still further confirmation. On the other hand, we witness daily the immense power which man possesses of modifying the various animals which he has reduced to domesticity. Sir John Sebright bred pigeons to a feather ; and thirty years ago we were used to see here and there dairies of sheet cows, which some very fanciful gentleman had called into existence. But these artificial animals had a constant ten-

dency to relapse, and to lose those coveted distinctions which the sedulous care of man had impressed upon them. Still, by patient and judicious perseverance a breeder of cattle may produce considerable uniformity, and impress distinctive characters and qualities on the animals which he calls into existence; and by dint of liberal rejections may maintain the distinction for a lengthened period. When he has done so he may be fairly said to have created, for all agricultural purposes, a new breed of cattle; and in this sense Collins (perhaps), and Bakewell (certainly), may be said to have respectively created a breed of cattle and of sheep. But these breeds never have become, and probably never would become, races. We have abundant evidence that their distinctive qualities can only be maintained by the sedulous care of man. When Devons, or Herefords, are transplanted from the banks of the Exe, and the Wye, to those of the Hawkesbury, their offspring continue to be Devons and Herefords. But the short-horn, under similar circumstances, resolves himself into his elements; and distinct traces of all the mongrels out of which he was concocted re-appear within a few generations. In Midland dairies short-horns have nearly supplanted all other breeds. No one can move among them without observing how very inferior they now are to what they were ten years ago. When they came from the north they had all the merits which belong to the breed. Under the ordinary care of the dairy-farmer they have deteriorated rapidly. Several large farmers have appealed to the north again, and have procured bulls of undoubted blood (whose dams and sires were No. this, that, and the other, in the herd-book), without producing any very satisfactory results. We doubt whether improvement is to be found within the limits of the herd-book; our faith is, that, when an artificial breed has been created by crossing, it can only be maintained by crossing. We looked lately through stalls containing 50 short-horned cows in course of preparation for the Birmingham meat-market. Where-

ever one appeared somewhat better than her neighbours, the invariable explanation was, "She has a good cross in her." When Bakewell died he left on his farm a good flock of sheep, perhaps for their purposes the best in the kingdom. His successor imagined that a breed had been created which could perpetuate itself and its merits; but, under that system, and in his hands, the flock came to a melancholy end—size, constitution, fertility, flesh, wool—all gone; nothing but a little tallow left. The successor of this gentleman was a Derbyshire man; and he brought with him on to the farm a good flock of sheep. They had in them a good deal of Bakewellian blood; but when their owner saw them dwindle, he had recourse to a large roughish ram from the limestone district of his native county: a big-headed, big-boned, big-muscled animal:—

"omnia magna,

Pes etiam."

Under such management this flock, of which we have now lost sight, for a long time retained its celebrity.

We have appealed to self-colour as one characteristic of a race of cattle. We have done so partly because, with few exceptions, quadrupeds in a state of nature are self-coloured; and we are not aware of any wild animal whose colours are patchy or glaring. The British wild cattle, as preserved in the parks at Chillingham, Cadzow, Chartley, and Lyme, are of a dingy white, with tawny ears. The cattle of mountainous countries, which have been very inaccessible to agriculture, are always of self-colours—black, red, or dun. The Caffrarian cattle are black. The queer little cow which, within the memory of man, had a pure existence in Normandy and the Channel Islands, and which, being celebrated for the richness of its milk, came to our markets under the name of an Alderney, was fawn-colour, with tawny ears. So-called Alderneys are still brought to those vicinities in which gentlemen's seats abound; but by crossing they have lost their uniform colour, and some

of their other characteristics. The voice of antiquity indicates self-coloured cattle. The bulls which Nestor sacrificed on the strand at Pylos were *παμμέλανες*. The bull which escaped Mercury, when at three days old he started on a foray to drive Apollo's cows, was *κυάνεος*, probably black; but, whatever were the exact shades, certainly self-coloured. The bull, over whose sacrificed carcass the oath of the *Ἑπτὰ ἐπὶ Θῆβαις* was sworn, was black. Indeed the only instance which occurs to us, in which party-coloured cattle are alluded to by any classical author, is the line in which Virgil declares his own toleration of motley:—

“Nec mihi displiceat maculis insignis et albo;”

and this very expression seems to indicate the prevalence of self-colours, and that the variety which he mentions was not in very general favour. Then comes the *vexata quæstio* of horns. Wide-horned and lofty-horned are constant epithets applied to cattle in the Greek authors. It always appeared to us that, in a claim for antiquity of race, any animal who came into court without horns exhibited a *primâ facie* case against himself. On the other hand, a gentleman, who is as enthusiastic as ourselves about Scotch cattle, but who, while we prefer the Highlander, fixes his affections on the graceful Galloway, always maintains that horns raise a presumption of a bar sinister in the escutcheon, and considers our horned cattle as the offspring of what Mr. Thomas Moore calls “a museum of wittols.” The Hereford brings good evidence that he is the British representative of a widely-diffused and ancient race. The most uniform drove of oxen which we ever saw consisted of 500 from the Ukraine. They had white faces, upward horns, and tawny bodies. Placed in Hereford, Leicester, or Northampton market, they would have puzzled the graziers as to the land of their nativity; but no one would have hesitated to pronounce that they were rough Herefords. The splendid cream-coloured ox of Lombardy

is a Hereford in form. You might dye him into a Hereford, but all the dappling in the world would not make him into a short-horn. So much for modern affinities. There are hints also from antiquity. The calf "*fronte niveus videri, cætera fulvus*," must have been a Hereford. According to the description in a fragment of Bion, the bull which ferried Europa across the sea from Crete was so complete a Hereford, that he might have come from the herd of Mr. Price or Sir F. Lawley. We are gratified by these evidences of permanence. A few years ago we had some apprehension that, under the influence of fashion and favour, the democratic insurrection of the breeds would have swept away the races. We knew the origin of the breeds; they had been loosely put together under our own eyes. Nothing in their career satisfied us that we knew accurately what was to come. Our aspiration was for something standard. We did not think that what Horace Walpole called the union of "nobody's son with everybody's daughter" was a satisfactory basis on which to found the supply of cattle for a great beef and mutton eating nation. Now the tide has turned. The new breeds have manifestly declined in popular favour. They will no doubt still occupy the position which may be due to their ascertained utility. The current of authoritative decision has also turned. It did for many years run in favour of the new breeds: now the balance is the other way. At every important exhibition the highest prizes have of late been carried off by the races. As good Conservatives we rejoice at this, for they are the Bovine aristocracy, and we wish to see them maintain their position in society. If we should seem to our readers to have spoken with too little favour of those enterprising and persevering men who originated our new breeds, and have carried them to their present point of excellence, we beg at least to disclaim all sympathy with those scoffers who represent the breeders and the bred as being much on a par in intellect—

"Strong as his ox, and ignorant as strong."

In our estimation, no man ever became an eminent breeder without possessing many very valuable mental qualities—the power of accurately observing matters both important and minute, and of appreciating their value—judgment and decision—perseverance—and another quality still more valuable than these, self-reliance.

Having travelled so far with our mute companions, we must say a few words on their more immediate preparation for the final stage in their career.

Of cattle made fat on natural pasture little need be said. No doubt a grazier, to be successful, must exercise considerable judgment in the selection of animals, and must discern with an experienced eye when his land is stocked to the exact point at which it will give the greatest produce. We have heard it said of one old gentleman, that he could tell when there was half a bullock too much or too little in one of his hundred-acre fields. A very small proportion of the grass land in England will, unassisted, turn out animals of the degree of fatness which is required by modern customers, and a still smaller proportion in other countries. Such lands, however, do exist about Boston and other fen-land vicinities in Yorkshire and Lincolnshire; sparingly on the alluvial borders of some of our principal rivers, and in the vales of Belvoir, Aylesbury, and Evesham. Equal, perhaps, to any of these, and far above their average, are the splendid upland pastures which are found in Burton, Great Bowden, and other townships in Leicestershire (many of which our fox-hunting friends overlook, with an enthusiasm not purely agricultural, from Carlton Clump near Kilworth Beauchamp), in Braybrooke and Fawsley in Northamptonshire, and in Lidlinton and another township, of which we forget the name, in Rutland. Nor must we omit the celebrated hundred-acre field at Cestus Over, of which local tradition sayeth, that, on a fine showery day in May, the farmer laid down his stick on a bare spot, and, being hastily summoned home by his dinner-bell, left the stick behind him. After his dinner he smoked only one pipe, and, returning straight

to the field, was unable to find the stick, which, having in the interval been smothered by the growing grass, was only discovered when the pasture was eaten bare in the succeeding winter.

The history of the grazing lands in the Midland Counties is singular. For no other district has nature done so much, and industry and science so little. A generation, with which many of us who are still in a green old age have had personal intercourse, saw these upland pastures in a state of ploughed common fields, the enormous ridges having been produced by many centuries of ploughing, the furrow being always turned upwards. These ridges still remain (and he is a good hunter who skims them cleverly), very frequently describing an easy double curve. When inclosed, and devoted to pasture, these lands were not sown with artificial grasses, but were left to acquire the turf with which it pleased Nature to clothe them. For forty or fifty years they improved progressively. From that time they have been stationary, at least, if not retrogressive. Except a little, and generally very imperfect, *soughing*,* they have received no improvement. Lord Gardner and Mr. Little Gilmour fly over the same ox-fence now, which was charged of yore by The Meynell, Lindo, and Germaine. Some graziers, to be sure, have diminished the size of their fields by subdividing, and some have increased it by grubbing up fences, and no doubt such spirited men were, in this British Bœotia, considered to be improving farmers. But "*adhuc sub judice lis est.*" The real improvements in agriculture passed these men by, or were brought to their doors without exertion on their parts:—take as an instance the improvement of cattle, and the improved mode of conveying them to market. They had a monopoly, and the sluggishness which attends monopolies. But John Bull will never submit to be stinted in his beef.

To avoid, however, all disagreeable points—somehow land of a quality which would graze cattle had become

* An old Midland county term for Under-draining.—EDITOR.

inconveniently scarce, in proportion to the demands of John's increasing family; and thus stimulated, his ingenuity has found a substitute in an immense extension of artificial feeding. Our ancestors had an ample supply of beef from August to November. By dint of lattermaths and a little hay, a few beasts were kept on, rather in a stationary than in an improving condition, till the cold weather had fairly set in; then they were slaughtered, and by pickling and salting dry (nothing exists now on which Mr. Moore could found his joke, "hung beef, my Lord, if you try it,") furnished beef for the winter and spring. A stalled ox was a luxury, and a rare one. We believe we need not go far back to the period when the Midland Counties did not furnish a single systematic stall-feeder. By most farmers the process was considered to be ruinous. Artificial green food is now grown on land of every description. The tables have been turned on the mere grazier. The mixed farmer overwhelms him with numbers, with weight, and with fatness. We have daily under our eye lands, now united into one farm, which bring to market annually 250 beasts, averaging about 100 Smithfield stones each, and a still larger number of fat sheep. Within thirty years those lands supplied about a score of the former, of about two-thirds the above-named individual weight, and only a few score of the latter. On two somewhat smaller and neighbouring farms the change has been still greater, and in the same direction. The mere grazing farms have receded in value more than any other lands in Britain. Men of capital, occupying largely in the Lothians, Northumberland, Yorkshire, Lincolnshire, and Norfolk, have improved their systems, have stood their ground, and have many of them been blessed with prosperity. Those who live in the vicinity know the melancholy list of Leicestershire and Northamptonshire graziers who, starting with undoubted capital, and carrying on business on a large scale, have occupied as their fathers occupied before them, and, with no fault but that of belonging to a

stationary system, have been overwhelmed ; have disappeared from the scene ; having commenced with property and ended with debt. Our remarks apply with increased force to the second and third rate grazing-lands of the Midland District. A few years ago we should have looked for the least improved district of agricultural England from the top of Robin a-tiptoes, on the confines of Rutland, Leicester, and Northampton. No prospect could, in an agricultural point of view, be more melancholy. Large spongy pasture fields, so encumbered with vast ant-hillocks that nothing but an accomplished hunter could gallop among them with safety, bounded by rambling fences—land of considerable power and inconsiderable produce. “I went by the field of the slothful ; and lo, it was all grown over with thorns, and nettles had covered the face thereof, and the fence thereof was broken down. Then I saw and considered it well : I looked upon it, and received instruction.”*

The stall-feeding of cattle is no modern invention, though, as a general agricultural practice, it may almost be said to be new in England. The “stalled ox” is cited as a luxury in the Book of Proverbs. The difference between stall-fed and grass-fed oxen is marked in the daily consumption of Solomon’s household—“Ten fat oxen, and twenty oxen out of the pastures.” But though stall-feeding is now general as well as ancient, no agricultural practice has proved a more fruitful occasion of controversy. Cooked food and raw food, warm food and cold food ; open yards, open sheds, and close cattle-houses ; tying by the neck and turning loose in boxes : each of these practices has its enthusiastic and unhesitating advocates. So also as to the description of food. The object is admitted—the greatest produce at the least cost. One man would be ruined but for gorse ; another cannot dispense with hay ; a third

* We are told by a resident that something in the way of improvement has been done near Robin a-tiptoes, and that much remains to be done.

declares hay to be superfluous, and that the object may be attained by the "corpus vile" of straw. So in roots : mangold-wurzel has its enthusiastic advocates, and equally so parsnips, carrots white and red, cabbage, and swede turnips respectively. And, again, in the cerealia and their congeners ; men of nice observation discriminate between the beneficial effects of each : some by chemical analysis ; some by the Baconian process of induction ; and the result is, that meals of every description—barley neat and barley malted, grains, linseed, oil and oil-cake—are accepted and rejected with most perplexing confusion. We really wonder that those who feed by book do not throw up the case in despair. We should be as unwilling to decide these points on the conflicting testimony of the correspondents of agricultural journals as we should to give a verdict on the evidence of Irish witnesses. The controversies will generally be best settled by a reference to local facilities. Gorse is good—where you have poor and congenial land and ready access to a water-wheel or steam-engine to crush it effectually. Grains are good—where you are near a large brewery and can buy them at or under 4*d.* per bushel. Hay is good—where you have meadows which are effectually manured by some river or stream ; and you may, or perhaps you must, make straw an article of diet to your feeding-cattle, where hay would cost you 3*l.* per ton. We believe that 10*s.* per ton would more than balance the feeding-value of any two sorts of meal. Where a stall-feeder has on his premises the means of grinding or crushing, there can be no doubt as to the economy of consuming by his cattle any sort of unmarketable corn. Where he is distant from a mill, it may be economy to give it whole. We do not think that the controversy between barley and malt is ripe for decision. As to roots : if you are so fortunate as to occupy a deep dry loam, you may grow parsnips or carrots, or anything else short of tropical exotics ; but beware of them on the sharp gravels or shallow sands, from which, by a plentiful

application of manure, you may coax an ample crop of turnips, and may feel yourself much at your ease as to the mode of using them, as you may draw them off, or consume them on the land, in all weathers. On land which, however well drained, has an inclination to be sticky, you must make up your mind to have more trouble with your green crops; but if used tenderly, it will give you a heavy weight of mangold-wurzel, turnips, or cabbage. They should, however, be sown early, for you will have no comfort with them if they remain on the land after November.

So we dispose of all articles in general use for cattle-feeding—except *oil-cake*. It is amenable to no local facilities, and is just as applicable to one situation as to another. In spite of repeated denunciations, it maintains its ground. The popular tradition respecting it is singular. For many years linseed-crushers threw what they considered as the refuse of the mill to the manure-heap. A cottager's lane-fed cow, having access to one of these heaps, was observed to be frequently feeding at it; and she gave evidence, by the sleekness of her coat and the increased fulness of the pail, that the food was highly beneficial. So it came into use, and was soon found to produce fat as no article had ever produced it before. Veterans of our standing will remember the denunciation of cake-fed beef. It had an unnatural taste—the shambles where it prevailed had an unnatural smell—the grain was coarse—the fat was liquid or rancid—the meat would not keep—and so forth. Now Mr. Giblett or Mr. Slater gives 6*d.* per Smithfield stone extra for a Norfolk-fed Scot (the animal of all in the market which has eat the most oil-cake), simply because they dare not send any other sort of beef to the nobility and gentry who are their customers. No other article of food (except perhaps bean-meal, which has the disadvantage of making the flesh hard) gives to a butcher the same full confidence that the dead weight of an animal will be fully equal to his appearance when alive. All the pre-

judices against this food were founded on the three letters O I L. Persons who are prejudiced neither investigate nor reason, or they would have discovered that linseed-cake consists of the husks and farinaceous parts of linseed from which all the oil has been expressed by most powerful machinery; and that though the quantity of oil expressed from a given quantity of seed has been constantly on the increase in consequence of improvements in the machinery, there has been no corresponding, nor indeed any, decrease in the fat-producing properties of the cake. A more refined investigation would have informed them that a ton of cake contains less oil than a ton of any sort of grain. The same delusion which appalled the consumers delighted the producers of beef. They fancied that it was about to lead them to an important discovery. They argued, not illogically—"If the remains of oil in this article of cake have such great feeding properties, how vast must they be before any oil has been expressed from it!"

Forty years ago we saw at Bretby, under the charge of Mr. Blackie, and at Swarkestone Lowes, then occupied by Mr. Smith, the earliest systematic stall-feeder in the midland counties, considerably extensive preparations for crushing, and steaming, and steeping linseed. Some other feeders went a step further, and said, "If oil adulterated with husks, &c., is so feeding, how much more feeding must oil unadulterated be!" and they gave the oil neat. But all the parties soon relinquished such practice. The result did not bear out the *à priori* reasoning. The beasts so fed never got very fat, and the fat they had was very loose and oleaginous. Experience soon showed that neither linseed nor oil could be used with advantage until they were let down by a very large admixture of chopped straw or of some other low-qualified matter. On this experience the recently-renewed practice of feeding with linseed (of which Mr. Warnes is the apostle) is founded. We give the account of the preparation in his own words:—"One pailful of linseed-meal to eight of water." This makes a

jelly. "A large tub being conveniently placed, a bushel of pea-straw or turnip-tops cut into chaff is put in; two or three hand-cupsful of the jelly are poured in," stirred up, &c. "Another bushel of the turnip-tops, chaff, &c., is next added;" and so on till the tub is full. And besides this, when Mr. Warnes begins to have a near view of the butcher, he adds "barley or pea-meal to the mixture." The prejudices against cake are now exploded. It has a fair hearing, and stands or falls on its merits. No doubt it is expensive food; but it is so effective, so clean, so easily stored, and so much less liable to pilfering than any sort of meal, that we expect to see it stand its ground.

When farmers have determined on the description of food, how are they to give it?—hot or cold? cooked or raw? We have seen an argument as follows (we have not space to extract the passage, but we will state the argument fairly):—A certain sustained temperature of body is necessary to the health and growth of every animal. Liebig has shown that this animal heat is produced and sustained by combustion—oxygen inhaled into the lungs burns carbon which it finds in the blood—if it does not find carbon enough in the blood it seizes on the carbon which exists in the fat, and if there be no fat, then on the carbon in the muscle of the body. Food supplies the carbon to the blood, and through the blood to the fat and muscle. If you introduce a quantity of cold food into the stomach of an animal you lower the temperature of its body. The first duty of the food so introduced will be to furnish as much carbon for combustion as will restore the normal heat, and the residue only can be applied to making fat and muscle. If you give warm food, the quantity required for the above purpose will be smaller, and the residue applicable to fat and muscle will be larger. Therefore there is a waste of food in giving it cold. We detect no flaw in this reasoning: but a sort of instinct founded on long experience always prompts us to look out for practical qualifications of abstract reasoning. We were just pre-

paring to say to the reasoner—"Before we can consent to found our practice on your argument, you must prove to us that burning the extra food in the body is not the cheapest way of restoring the heat destroyed. Charge yourself with the very considerable outlay requisite for warming the food—with the fuel—with the labour and waste: take into account that, when you have heated your food, it will cool very rapidly while it is before the beasts; that it will cool very rapidly while it is being divided into portions; that any which is left must be heated over again." We were just going to say, "When you have taken all this into the reckoning, tell us the result," when we stumbled on the following passage in an account of the Cattle Lodge at Howick:—"The opinion of the feeder is, that the animals did not thrive so well on steamed straw as when it was given naturally. We believe that, with the exception of linseed—if, according to Mr. Warnes' experiment, that is an exception—it will not be found that the cooking food for cattle, even if it be beneficial, will repay the extra cost," &c. Remembering that Mr. Warnes has been the great advocate for warm and cooked food, we turned back to his experiment, and we find as follows:—"Eight Scots shut up in October: four fed "on the cold linseed mucilage;" "the other four have had boiled linseed." "His own opinion, and that of many other farmers who have seen the animals, is, that the four fed on raw linseed are superior to their competitors." Mr. Warnes says, "But admitting the fattening properties of both systems to be equal, the cold must possess the greater advantages—1st, because firing is dispensed with," &c. And again, "So satisfied has Mr. Warnes become of the superiority of the cold linseed, that he means at once to adopt it in the feeding of the rest of his cattle." It is somewhat singular that we have made the whole of these extracts from the same publication in which we had previously found the Liebigian argument, which we have abstracted, put forward as conclusive. Year by year prizes have been offered

to agricultural machine makers for the best apparatus for preparing warm and cooked food for cattle. Many feeders have within our knowledge gone to a great expense in putting up such an apparatus. Every one of them has, we believe, discontinued its use. Nothing is so contemptible as to sneer at unsuccessful experimentalists. Truly our very best hopes for agriculture are founded on the entire explosion of the spirit which used to prevail at our farmers' market-tables in this respect. The reasonable experimentalist is now looked up to as a general benefactor. The patriotism of those who, having the means, make promising experiments, either in agriculture or in anything else, without a view to their own personal advantage, takes a very rational line. Every one knows and regrets that many discoveries, made by ingenious men in the spirited prosecution of commercial enterprise, though they have proved to be of great national advantage, have failed to realize a profit to the inventors, and have in some unfortunate cases resulted in their ruin. We are inclined to believe that the experiment of giving warm and cooked food to cattle has failed.

We have already adverted to the very ambiguous sounds emitted by the oracles when consulted on the subject of the lodging of cattle. Our own experience, in a moderately-sheltered situation, is, that beasts do best in open sheds well flanked, but open to the S. or S. E. The Norfolk man is prodigal of his straw, and his beasts come out beautifully clean. The Midland and Western man is perforce more economical, and the same cleanliness is hardly to be attained. We know an instance in which cows lie habitually without litter, and are decently clean. Their hind legs stand on a strong flag (the produce of the district, probably of the farm), and behind them is a flagged trench fourteen inches wide and three deep. In twelve years no injury has occurred to the cattle from this trench. At regular intervals holes of an inch diameter are drilled through the flag in the bottom of the trench,

and communicate with a drain. The more solid matters are removed with the least possible labour, by means of a shovel which exactly fits the trench. The fore parts of the animals lie on the natural ground. The feeding beasts are as prone to recumbency as in any well-littered stalls, and, except on the east coast, we have seldom seen a cleaner cow-house. The arrangement for bullocks is more complicated, involving the necessity of a drain covered by a bored flag or grating into the middle of each stall. We are bound to admit that the tails, to the great injury of their cleanliness, are apt to slip into the trench when the animals lie down. We wish we could suggest a remedy short of docking that ornamental member. On this farm the proportion of arable land is very small, and every straw is cut up for cattle-keep. The cow-house which we have described is a great favourite of ours, because it solves a difficulty which very much perplexes every improving Midland and Western farmer, namely, scarcity of litter. We are inclined to think that the sphere within which this difficulty is felt is extending; the tendency of modern agriculture being to longer courses, and to a less frequent recurrence of straw-giving crops. The real vocation of straw on farms having a large proportion of grass-land, if not on all others, is to give bulk to more nutritive articles of cattle-keep. When it is cut up and properly sugared, cattle will eat it to the stumps. Box-feeding is a recent practice, and highly commended. It must involve a liberal use of straw or other litter. The idea that the animal should be confined for months in a loose box, from which nothing is removed, is not very comfortable; but the practice is connected with the consideration of the injury which manure may suffer by exposure to the weather. We know one spirited experimentalist who has gone to a very material expense in roofing, in order that he may have the whole of his manure under cover until it is laid on the land. This is a strange innovation on the practice which prescribed repeated heapings and turnings before the

manure was brought into use. Some years ago we read in an agricultural journal, that to mix up a large quantity of snow with a heap of manure was highly beneficial, and philosophical reasons, which we have forgotten, were given for the practice. Should the doctrine of a dry lair now prevail, the liquid-manure tanks will be deprived of their principal source of supply.

Till very lately flesh-meat in general, and beef in particular, had its seasons of plenty and low price, succeeded by scarcity and high price, just as regularly as summer and autumn are succeeded by winter and spring. The extremes were from August to December, when naturally-fed beasts poured into the market, and from February to June, when those which were fed artificially came in by dribblets. Those who have watched the markets for the few last years will have observed, first a tendency to equalization, and then to a complete turning of the tables, which has been fully developed in the season now in progress. The first-named period gave, in the year 1848, to Smithfield, for the Monday's market, from 2000 or 2500 bullocks, with a price for the first quality from 3s. 10d. to 4s. 4d. per stone. The second period, now in progress in 1849, is giving from 3200 to 3600 bullocks, with a price for the first quality from 3s. 4d. to 3s. 8d. Nor do these figures represent the full difference of the supply of meat, because there can be no doubt that a larger amount of dead meat comes in by railway in the cold months than in the warm. This is a great revolution, which we have no doubt will be in some degree counteracted by an increased prevalence of artificial feeding in summer, either as auxiliary to grass-feeding, or as independent of it.

We have now brought to a close the principal remarks which have occurred to us as bearing on that vocation of the occupier of land, in pursuance of which he furnishes a supply of animal food to his country. We take leave of our cattle-loving friends, and we hope they will not think us less friendly to them because we have omitted any pro-

minent mention of the distressing position in which we and they are placed by the unprecedentedly low price of this article of agricultural produce. Whatever measures they may consider it incumbent on them to take with reference to protection or to taxation, general or local, we think it must be wise to keep these matters quite distinct from the question of the most efficient practice. We cannot look around us and doubt that, in order to maintain our position, to the most efficient practice we must resort; and if our remarks can assist any struggling farmer in discovering and adopting it, we shall have attained our object.

We had hoped to have included in this article some remarks on draining, a subject so intimately connected with artificial feeding that it may almost be called its foundation. But time and space forbid. A few memoranda which we had made must be returned to our desk, perhaps to be re-produced on some future occasion.

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PREFACE TO SECOND EDITION.

PROBABLY many of the persons who will see this Preface, are aware that I contributed to the "Quarterly Review" an article on Agricultural Drainage, which appeared in its 171st Number, and which, in the year 1850, was reprinted by Mr. Murray in a separate form. Mr. Murray has now requested that I will revise this reprint for a second edition. It would be troublesome to divest the thing of its reviewing form; but as it has become a treatise, I think that I may drop with advantage the critical spirit. I have, therefore, struck out several passages having reference to controversial writings, which it is no longer necessary to keep before the public; I have woven into the treatise a few matters which further experience and observation have brought to my notice; but the main principles and arguments remain as they were. I have increased confidence in them. Since the article was first written, I have continued to employ in draining from 15 to 20 men both winter and summer. A drain made in summer is, in the article of excavation, generally somewhat more costly than the same work executed in winter; but it is less liable to injury from slips, or to interruption from bad weather. The carting of materials is also less troublesome in summer, and the work is generally executed in a cleaner and more perfect manner. I am partial to summer draining when it can be done without unreasonable interference with crops. Several of my neighbours carry on drainage perseveringly on the system which I have endeavoured to explain; and I believe that, without

an exception, they coincide with me in opinion as to its beneficial effects. I have had the opportunity of watching for more than three years the operation of 4-foot drains 9 yards apart on 40 acres of the stiffest clay which I ever saw in any county, absolute clay to the surface without any covering of soil. This draining was not executed by me, nor does the land belong to me. I could wish any agriculturist, who doubts the efficacy of deep drains in clay soils to see this land, and to converse with its present owner; who, some years ago, before it was drained, abandoned its cultivation in despair. I doubt whether any water has either remained on or ran off its surface since it was drained. It forms part of the disafforested forest of Needwood, and is in the parish of Tatenhill, county of Stafford. I have seen it stated in an agricultural publication, that deep drainers have been compelled to diminish the intervals between their drains with which they originally commenced. This has not been the case with me, nor with any other deep drainer with whom I am acquainted. I began with 9-yard intervals, and now use 12 on similar land, and am satisfied with the result. I put my draining to a severe test. I invariably abolish the ditches in the fields which I have drained, and never admit a grip, or water furrow. For autumn-sown crops, wheat, vetches, or beans, I always give the last furrow across the slope of the land. In short, I throw every possible impediment in the way of the superficial discharge of water. I believe that, with the exception of one or two hours during the deluge which burst the Holmfirth Reservoir, and which was general over the Midland Counties, no water has run from the surface of my drained lands for the last three years, and none stands on them an hour after rain has ceased. I think that these facts are sufficient proof of the efficiency of the draining. Lord Wharncliffe has proposed a herring-bone system of draining, consisting of a somewhat deep main drain running in the line of steepest descent, into which discharge a series of parallel shallow drains, drawn

across the slope of the land. His Lordship gives a general adhesion to the doctrine, that steepest descent is the true line of drainage. I do not therefore see why his shallow drains are not placed in that direction. Nor does his Lordship profess any confidence in the shallow system; but recommends it on the score of economy. I think that Mr. Parkes, in a small publication entitled "Fallacies, &c.," has shown that his Lordship's system, taken as a whole, is not entitled to that recommendation. Were I to adopt his Lordship's system, I must abandon, 1st, the principle of depth, and 2nd, the principle of direction; and if I abandoned those two principles, I had much better put this treatise into the fire than send it to Mr. Murray for republication.

I trust that my readers will have the kindness to impute the egotism which pervades this Preface to a sincere conviction on my part that I have derived more advantage from the statements which practical men have kindly given to the public, of the results of their own operations, than from any other sort of agricultural reading.

T. GISBORNE.

Yoxall Lodge, April 10, 1852.

AGRICULTURAL DRAINAGE.*

PINDAR bequeathed to us the maxim “*Ἀριστον μὲν ὕδωρ*,” to which the Portuguese have added the equally pithy proverb, “Water is wealth.” The present state, the early history, and the ancient remains of eastern and southern countries concur in informing us, that the first and most successful efforts of agriculture were directed to an artificial supply of water to the various objects of cultivation. The special promise made to the Israelites was, “The land, whither thou goest in to possess it, is not as the land of Egypt, where thou sowedst thy seed, and wateredst it with thy foot, as a garden of herbs: but the land whither thou goest is a land of hills and valleys, and drinketh water of the rain of heaven.” And so our northern and sea-girt isle drinketh the rain of heaven to repletion; “*immensum cælo ruit agmen aquarum*.” We do not span our valleys with aqueducts, and rib the sides of our hills with superficial courses, to convey adventitious water to our agriculture. On the contrary, we invoke ingenuity to devise, and science and labour to execute, subterranean

* 1. “Journal of the Royal Agricultural Society.” Vol. IX., Art. XI., “On the Failure of Deep Draining,” &c. By Wm. Bullock Webster. London, 1848.

2. “Mecchi’s Experience in Drainage,” &c. Third Edition. London 1848.

3. “Essays on the Philosophy and Art of Land Drainage.” By Josiah Parkes, C.E. London, 1848. Longman and Co.

conduits to relieve our cultivated lands from the excess of water which they receive from the skies. When the agricultural interest congregates for the purpose of mutual condolence or congratulation, their pattern men never fail to declare that draining is the foundation of agricultural improvement—and that if there be salvation for them, it is to be found in draining. Every here and there a booby exists who says, “How can you expect grass to grow if you take the water away from it? How in a dry summer?” But he is overwhelmed at once by the rush of the agricultural mind in an opposite direction. Through the length and breadth of the land a crusade has been preached against water. Pipes and collars are the devices of this national movement. This is “the piping time of peace.” We have put our necks into the collar, have taken suit and service, and have sworn allegiance to this cause. We find ourselves associated with a very motley crew, who are brought together indeed by some unity of object, which they not only seek to attain by various and incongruous means, but carry on a fierce internal controversy, in which every disputant accuses the plan of his opponent of failure, and boasts largely of his own success. We will endeavour to impart to our readers the conclusions on which, after some experience, a close observation of the works of those who claim to be authorities in this matter, and a painful and ill-requited attention to the literary and oratorical war which is raging around us, we have determined to base our own practice.

But before we take a prospective view of our craft, we must glance at its early history, and at the various steps and stages by which it has arrived at its present position. Though the ancients for the most part courted water as an ally to their agriculture, they did not hesitate in many cases to encounter it with great energy and perseverance as its enemy. They were not slow to perceive the extraordinary vegetative capacity of those amphibious lands which are deposited by large rivers within the debateable

margin of two elements, of which their agricultural poet says,

“ Huc summis liquuntur rupibus amnes
Felicemque trahunt limum.”

Any person disposed to acquire, at a small expense of time and trouble, a general knowledge of the war which men of old carried on with the marsh and the fen, may consult the first two-and-thirty columns of the great work entitled, “The History of Embanking and Drayning of divers Fens and Marshes, both in Foreign Parts and in this Kingdom; extracted from Records, Manuscripts, and other authentic Testimonies by William Dugdale, Esq., Norroy King of Arms.” This indefatigable man, though a very voluminous writer, scorns any superfluous exordium, and commences his book and the history of antediluvian draining by the following sentence:—“That works of draining are most ancient and of divine institution we have the testimony of Holy Scripture.” After a passing notice of the draining of the earth on the subsidence of the Deluge, he proceeds to say, “That those nations which be of greatest antiquity, and of chief renown for arts and civility, are also famous for their works of this nature, is evident from the practice of the Egyptians, the Babylonians, the Græcians, the Romans, and several others of which I shall give instance.” In pursuance of this purpose our author furnishes us with a detail of various works of draining, embankments, and outfalls commenced in Egypt shortly after the Flood, and carried on to the Christian era. Among the illustrious promoters of the art he names Mysis, Sesostris, Sabacon, Psammeticus, Necos, Psammis, Bocchoris, Darius, Amasis, Alexander, the Ptolemies, Cleopatra, and Augustus Cæsar. He takes a somewhat discursive view of a navigable channel from the Nile to the Red Sea, which was commenced by Sesostris before the Trojan war, and, after several futile attempts by succeeding princes, was completed by a Ptolemy. The various routes by which the traffic of

Europe passed to the Indies do not escape his observation ; and he settles the track of Solomon's voyage from Eloth to Ophir. For this varied information he cites, among his authorities, the sacred books of Exodus, Kings, and Chronicles, and appeals to the secular testimony of Herodotus, Theocritus, Strabo, Diodorus Siculus, Josephus, and Eusebius. Having thus happily dispatched Egypt, our author proceeds to Babylon. We learn, on the authority of Herodotus, Pliny, and Strabo, that the drainages of Belus and Gobaris were effected by improved outfalls, whereas their female successors in the art, Semiramis and Nitocris, worked by embankments. Nor are we left ignorant that it was Sir Walter Raleigh's opinion that the reason why "there is so little written of Belus, who succeeded Nimrod as the first Assyrian monarch, is that he spent much of his time in disburthening the low lands of Babylon, and drying and making firm grounds of all those great fens and overflown marshes which adjoined to it." Passing into Greece, our author, who never rashly rejects the miracles of a heathen god or of a popish saint, holds an even hand between Thessalian tradition, which imputes the draining of the lake Bæbeis to Neptune, and the opinion of Herodotus, which inclines to an earthquake ; "but," says he, "no man can deny it to be a very remarkable work of draining, or that it is now a place of extraordinary pleasantness." Unless our schoolboy recollections deceive us, either some "Musa Etonensis" or old Latin poet says,—

*" Ut ferus Alcides Acheloia cornua rupit,
Dum petit amplexus, Deianeira, tuos."*

We now learn, with reference we suppose to this story, that Achelois roared as a river, and not as a bull, and that the mythical horn broken off by Hercules was one of the river's devious courses ; for "they which collect truth out of fables say that Hercules, who was generally beneficial, for Æneus his father-in-law's sake restrained the exorbi-

tant overflowings of the river with banks and trenches, and drained a great part of the adjacent country; and that this was the cornucopia which the poets made to be the emblem of plenty." We will not drag our readers through the Pompeian Marshes, the Fossa Mariana, or the Fucine Lake. Suffice it to say, that the alternate reclamations and re-floodings of these and other Italian swamps are faithfully recorded, from the consulate of L. A. Gallus and M. C. Cethegus unto the reign of Theodoricus. For all this we have the usual medley of authorities, commencing with Livy, Pliny, and minor Latin annalists, and ending with the Odyssey, the *Iter ad Brundisium*, and some inscriptions from a temple at Terracina. We are reminded, moreover, that a Roman consul, who had reduced his provinces to a state of tranquillity, was ordered by the senate, "*ne in otio militem haberent*," to employ his legions in winning lands from the sea on the coast of Latium; "neither is the employment thought too mean for the legions, though consisting of freemen:" a very natural reflection for Norroy King of Arms, being himself a practical drainer, and which he specially commends to the notice of the authorities at the Horse Guards.

For the drainages in the Belgic region our author claims no higher antiquity than A.D. 863. He assures us, on the authority of Kilianus, "the learned Euredius," Sermundus, and the edicts of the Pistensian synod, that, in 863, Baldwin the First, son-in-law of the Emperor Charles the Bald, commenced the works about Bruges. These works appear to have endured till the year 1169, when—a breach having occurred, "the which the Flemings could by no means fill up, neither with wood, nor any other matter, for that all sunk as in a gulf without any bottom"—by agreement between Floris, earl of Holland, and Philip, earl of Flanders, a thousand men, expert in making of dykes, were sent to stop the breach: "who being come to the place, they found a great hole near unto this dam, and at the entrance thereof a sea-dog, that, for six days toge-

ther, did nothing but cry and howl very terribly. They, not knowing what it might signify, resolved to cast this dog into that hole; whereupon a mad-headed Hollander, getting into the bottom of the dyke, took the dog by the tail, and cast him into the midst of the gulf, with earth and turf after him; so as, finding a bottom, they filled it up by little and little." Hence the name Hondtsdam, and the dog in the armorial bearings of the town of Dam.

"I now descend to Holland and Zealand," whence he proceeds to Friesland, Holstein, and Mexico. But we spare our readers even an enumeration of the authors, commencing with "P. Bertius de Aggeribus," and ending with "Pierius Winsemius de rebus Frisicis" and "the learned Schoneveldeus," who are cited by this man of singular research in support of scraps of history, quasi-geological deductions, moral reflections, and queer anecdotes. At length we are fairly landed on the sea-board of Kent, and find the history of English embanking and draining given, after our author's peculiar fashion, in 832 folio columns. We have waded through them; and hardly know whether to exhibit this feat to our readers as an example or as a warning. We will endeavour to impart to such of them as have not trod the path before us, a general idea of the ore and of the dross which this mine contains; leaving to their own taste the decision whether they will work it further. But we must premise that even those who are acquainted with the "Monasticon" cannot read this work without marvelling at the extraordinary industry of the man, and at the strange objects to which it was applied. He devours public records and other documents, which represented Blue Books in his day, with all the voracity, and digests them with more than the accuracy, of our Joseph Hume. He revels in dates, measurements, and prices. He affects no originality, and indulges in little disquisition. He ransacks all literature, the most standard and the most obscure, for anything

which, by a liberal construction, can be considered analogous to his subject. From an epic poem to a catalogue, nothing comes amiss to him. The result is, that the work of which we speak has no more to do with the *philosophy* of embanking than of billiards, nor more with the *art* of draining than of music. To be sure, in the former case, the words which recur from time to time are marsh-banks, fen-dikes, weirs, and dams, not cushions, cannons, and hazards; and in the latter, sluices, gates, spouts, and clows, not flats, sharps, and semitones. But, beyond a familiarity with these terms, a student of Dugdale will learn nothing either of the philosophy or of the art. Three thousand five hundred names of persons, and nearly five thousand names of places, are the staple of the work. It may interest some of our readers to know that Thomsons, Dicksons, and Jacksons had not yet appeared on the scene; whereas Swetebloides, Thunders, and Forshames have perhaps now departed from it. The name of every person who sat on a commission of sewers from the time of the third Henry to that of the second James is recorded, as well as the name of every plaintiff and defendant in a marsh-land suit, and of every place immediately or remotely connected with these litigations. When A. sues B. for having failed to repair a dyke or scour a sluice, the plea, the answer, the replication, the rejoinder, the evidence, the adjournments, the rehearings, and the verdict, are given with the utmost minuteness. Probably a diligent student might extract from this work a digest of marsh-land law, and show how, from time to time, it was advanced and settled. Then we have a record of every session of sewers and assembly of jurats through twenty-one reigns, and a full account, or more frequently a copy, of each of their *proprio motu*s and presentments. These sometimes produce curious matter, as in the following instance:—

“In 6 Edward II. the jury for the hundred of Cornylo exhibited a presentment unto Hervic de Stanton and his fellow-justices itinerants, imparting that the Prior of

Christchurch in Canterbury did, about ten years then past, divert the course of a certain water, called Gestling, in which such felons as were condemned to death within the said hundred ought to suffer judgment by drowning; so that by this turning of that stream, those condemned persons could not there be drowned as formerly; and that this was to the prejudice of the King. . . . The Sheriff, therefore, had command that he should cause the said gutter to be put into the same condition as it was before; and the said Prior was amerced."

A fair sample of these documents, which run through hundreds of columns, we take at random from a presentment of the jurors at a session of Sewers in 13 Elizabeth:—

" 15. That Mil-lane, from Tholomer's drove, and reaching from the crest in Mampasse to the pipe in the drove, be made in height 4 feet, and in breadth 8 feet, by the Dean of Ely and Lord Berkley.

" 16. That the lands between Sorrell Dyke and Belly-mill Dyke do make Sorrell Dyke and Belly-mill Dyke in height 6 feet and breadth 8 feet."

This presentment, of which we have copied the 15th and 16th articles as being among the shortest, runs on to No. 120. Somewhat more interesting is a detailed account of the early efforts of Francis and William, Earls of Bedford, to improve the great level, for which they and their participants received 95,000 acres of land.*

Being in the neighbourhood of Thorney, we will here allude to a singular statement with reference to that lordship which we find in a tract printed in 1629, and entitled "The Drayner Confirmed, and the Obstinate Fenman Confuted :"—

* A work, in two thick quarto volumes, published in 1830, by Mr. Wells, registrar of the Bedford Level Corporation, gives a full account, historical, legal, practical, and statistical, of the drainage of the Great Level of the Fens. The account is as minute as Dugdale's, with less entertaining gossip, but no doubt possesses great local interest.

“ At Thorney Abbey my Lord of Bedford lets between three and four hundred acres of rising ground upon which the abbey stands, for 300*l.* per annum, whereas the rest of his lordship of Thorney, containing sixteen or seventeen thousand acres of drowned ground, is esteemed and now lyeth of little or no value. Yet it appeareth by the historie of William of Malmesbury (vouched by Mr. Camden), who lived about twelve hundred years since,* that in his time it represented a very paradise: for that in pleasure and delight it resembleth heaven itself; in the verie marishes bearing trees that for their straight tallnesse, and the same without knotts, strive to touch the starres. A plaine there is as even as the sea, which with greene grass allureth the eye; so smooth and level that, if any walke along the fields, they shall find nothing to stumble at. There is not the least parcel of ground that lyes waste and void there. Here you shall find the earth rising for apple trees, there you shall have a field set with vines, which either creep upon the ground or mount on high upon poles to support them, for in those days vineyards were very frequent in England.”

Perhaps the Fenland vineyards are as figurative as other portions of this description, but there is no reason to doubt that the latter end of many portions of the Fens was worse than the first. In accordance with the above recital are the facts largely stated by Dugdale, and confirmed by subsequent observations, of submerged forests of the finest trees, whose roots are fixed in solid earth many feet below the present drowned surface of the fen, with other evidences of pristine fertility. On the other hand, “large rudders done over with pitch, as also anchors, barge nails, and other naval instruments,” found many feet below the now solid ground at Eye in Suffolk, give evidence that that place was, as its name imports, formerly

* That would be about A.D. 420. No doubt the meaning is, in the twelfth century. William of Malmesbury is supposed to have been born about 1050.

an island. Such metamorphoses are appropriately noticed by Ovid in a passage beginning—

“ Vidi ego quod fuerat quondam solidissima tellus
Esse fretum, vidi factas ex æquore terras”—

and they are largely spoken of by Amm. Marcellinus and other ancient writers. Dugdale and his predecessors impute these changes to earthquakes, between which opinion and the modern theory of alternate subsidence and elevation, we must leave the Dean of York to decide.

The legal details in Dugdale's work are infinitely tedious. Still they present several points worthy of observation, and give evidence of an equal administration of justice in very early times of our history. We find, almost invariably, a performance of its public duties enforced on property, and local jobbing repressed with a firm hand. Our author, rejecting the Britons as barbarous, and the Saxons as illiterate, fixes on the Romans as the first who recovered lands by banking out the sea in England, fortifying himself by a fanciful interpretation of a passage in “the famous Tacitus, an author of that time.” On the authority of monastic records he declares a marsh-land common law, administered by twenty-four elective jurats, to have been in existence A.D. 796, and to have been then designated in “unquestionable documents,” as “*antiquas et approbatas consuetudines*.” The most important power of the jurats was that of levying a rate, and distraining for non-payment, for which distress, in case of imminent common danger, there was no replevy, “*quia necessitas defensionis talis inopinata, si venerit, legi communi vel justitiæ subesse non poterit*.” But in 35th Hen. III., the sheriff of Kent, on a threatened irruption of the sea into Romney Marsh, replevied the distresses. The king instantly issued his writ and letters patent restraining the sheriff, and, in consequence of “the controversies risen between the jurats and the marshmen,” he sent down “Henry de Batho, a famous justice itinerant of that time, to hear and determine them.”

He framed on this occasion ordinances which settled the "laws and customs of Romney Marsh," and are frequently referred to in royal commissions and Acts of Parliament as "The famous ordinances of Henry de Batho." "They have been long ago made the rule and standard whereunto all the other marshes and fens in this nation were to conform." Romney Marsh is the subject of the first chapter on English affairs. We recommend it as a fair sample of our author's matter and manner. It will be interesting to most readers, though probably the majority will not wish to pursue the subject further.

The monastic orders were large landowners in all the English fens, from which circumstance our author is led to favour us with a considerable amount of legendary lore. We are informed that "Ethelreda, called vulgarly Audrey," and subsequently St. Audrey, performed numerous miracles, and founded a religious house of nuns in Ely, of which she became abbess. To us, among the most marvellous of her miracles are, that, having been married to "Tombert, a prince of the Southern Gyrvi or fenmen, at his death she retired into the Isle of Ely, a pure virgin, notwithstanding she was his wife almost three years:" "that about five years from the beginning of such her retirement, Egfrid, king of Northumberland, being highly inflamed with her beauty, obtained her for his wife;" and, finally, that "after she had been wedded about twelve years, she, without any free leave of her said husband, as a queen and a virgin repaired to the monastery in Coldingham in Scotland." It is perhaps less surprising that, when at the close of one year King Egfrid desired to have her domestic society again, she, by a series of miracles very analogous to those performed by Moses in the wilderness, resisted all his attempts to recover her. In like manner "St. Guthlach, a devout hermit," founded the abbey of Crowland, where, before "that devout servant of Christ, no countryman could endure to dwell by reason of apparitions of devils which were frequently seen there;"

and that these apparitions were formidable we are assured by a description of them as they appeared to Guthlach in his cell—"black troops of unclean spirits which crept in under the door, as also at chinks and holes, and coming in both out of the sky and from the earth, filled the air, as it were, with dark clouds. In their looks they were cruel, and of form terrible, having great heads, long necks, lean faces, pale countenances, grisly beards, rough ears, wrinkled foreheads, fierce eyes, foul mouths, teeth like horses', spitting fire out of their throats, crooked jaws, broad lips, loud voices, burnt hair, great cheeks, high breasts, rugged thighs, bunched knees, bended legs, swollen ankles, preposterous feet, open mouths, and hoarse cries,"—a particularity of description which might suffice for a Russian passport, or for the *Hue and Cry*.

We are next favoured with the authentic anecdote and original rhymes about King Cnut and the sweet singing of the "Monckes in Ely." Then, many columns are occupied by the assault of William the Conqueror on the Isle of Ely—his futile attempts to carry the position by means of a witch—the prodigious feats of Hereward the Saxon—and the final conquest, after a seven years' siege, in consequence of the treachery of an abbot. The narrative of the Fenland insurrection in the time of the Commonwealth, which was headed by the notorious Lieutenant-Colonel John Lilburne, "a person," says Dugdale, "of a most turbulent spirit, and who since died a quaker," though abundantly garrulous, is somewhat more in the tone of sober history. Cornelius Vermuden, a native of the Low Countries, contracted with Charles I. to recover a large extent of drowned fen, over which certain royal rights extended, on conditions by which all existing rights appear to have been fairly compensated. Under this contract Vermuden and his participants recovered 74,000 acres of previously worthless fen so effectually, that the average crops of wheat on it were three and a half quarters per acre, oats eight quarters, "and for six years together seven

quarters of oats on one acre." Vermuden and Co. received their stipulated remuneration in the shape of 24,500 acres of the reclaimed land. On this they built a town called Sandtoft, erected a church, and introduced as settlers 200 families of Walloon and French refugee Protestants. For eighteen years they held quiet possession. According to Dugdale's representation, Lilburne gathered round him three classes of malcontents: 1st, those patriots to whom a royal grant under the great seal was an unjustifiable exercise of prerogative; 2ndly, the jealous John Bull, to whom the vicinity of a foreigner and a Frenchman was an offence; and 3rdly, the unreclaimed man,* who even in civilized societies, lingers on the margin of the waste and of the fen. These parties, "taking advantage of the present distractions," broke down the sea-banks, let the water in on the houses, crops, and cattle, and destroyed works which had cost 200,000*l.* in the erection. They seized by force the property, which they did not destroy, and Lilburne appropriated to himself the parsonage house at Sandtoft (using the church as a barn) and several thou-

* All writers on marsh-land affairs afford abundant evidence of the existence and of the turbulence of this class. In James I.'s time they adopted a new mode of warfare, "by bringing of turbulent suits in law, and making of libellous songs to disparage the work," of which kind I have here thought fit to insert one, called "The Powtes Complaint,"—a dozen stanzas, of which probably a couple will suffice for our readers:—

"They 'll sow both beans and oats where never man yet thought it,
Where men did row in boats, ere undertakers bought it:
For they do mean all fens to drain, and waters overmaster,
All will be dry, and we must die, 'cause Essex calves want pasture.

"Wherefore let us entreat our ancient water nurses
To shew their power so great, as t' help to drain their purses;
And send us good old Captain Flood to lead us out to battle,
Then two-penny Jack, with scales on 's back, will drive out all their
cattle."

We knew a clergyman of the old school who complained vehemently when a marsh was drained in the vicinity of his parsonage. He said it had been worth several pounds a year to him in pike and wild ducks. Our reverend friend was a most expert snarer of woodcocks. A neighbouring squire gave him a quarter of beef every Christmas on condition that he should not set springes on his estate.

sand acres of land. When the injured parties attempted to obtain redress by law, Lilburne, by his influence with the Parliament, the army, and the magistrates, parried their efforts for eleven years; and though they at length got a decree of the Council of State in their favour, the nature of the case rendered it impossible that they should receive any adequate redress.

Here we must close our notice of this singular work: a laborious structure framed on a model which is assuredly little suited to the habits of modern writers, and as little to the fastidious tastes of modern readers. Yet it was highly esteemed by our ancestors. It has been several times reprinted, and we learn from the preface to an edition which was published in 1772, that ten guineas was the sum "at which this work when it can be met with on sale, which rarely happens, is sold." It still holds a place in our libraries, and the copies which come into the market are freely bought at the price of some guineas. In the edition of 1772 the spelling has been modernized, and the black letter, in which names of persons and places was originally printed, discontinued.

If Dugdale had not detained us so long we would willingly have given our readers an abstract of the Tract entitled "The Drayner Confirmed." It was printed in the year 1629, and again in London, 1647. It is anonymous, and from certain similarity of style and expression, we should, but for its practical tendency, be inclined to attribute it to Sir Wm. Dugdale. It contains some curious Fenland history, and enumerates eight Acts of Parliament, between the 9th Hen. III. and 12th Edw. IV., all passed with a view to the improvement of the fens. But the main object of the writer is to incite his own countrymen to a general measure for the drainage of the fens in Lincolnshire and five adjoining counties. He undertakes to show: 1st, that it would be honourable to the King and profitable to the Commonwealth; 2ndly, that it is feasible; and 3rdly, how a competent reward may be apportioned for

them that should undertake so great a work. He adverts to the fact that some "overthwart neighbours" (the Hollanders, to wit) had proposed to drain our fens on condition of receiving one-third part of the land recovered. Against this project the author argues with stubborn patriotism, and shows the absurdity of our allowing foreigners to "empty themselves" into our marshes, while we are sending our own countrymen into Ireland, Bermuda, &c. Still he is not wholly destitute of cosmopolitan feelings, as evinced by the declaration, "neither yet would I be understood to be so envious to strangers, as that I had rather the water than they should possess the land." The whole treatise is quaint, clever, and entertaining. We have endeavoured in vain to obtain a printed copy. That which we have (by the favour of a friend) is in manuscript.

In addition to the two volumes by Mr. Wells to which we have referred, we possess much valuable literature on the subject of Fenland drainage in voluminous reports to Parliament, in the works of Rennie and Telford, and in the "Transactions of the Institution of Civil Engineers." We cannot at the moment refer to any printed evidence of Mr. Tycho Wing's services to the cause, but we know that no man has laboured more assiduously to diffuse useful knowledge among Fenmen, and to incite them to scientific practice. Many publications, both ancient and modern, have reference to the state of Holland, Zealand, Sleswick, and Holstein, and to the creation of territory in those extraordinary countries. The never-ceasing resistance which is there carried on against a devouring element is of the highest interest, both historical and scientific. This subject, however, we pass by the more willingly, because a very able article expressly devoted to it in the 174th No. of the "Edinburgh Review," leaves little to be supplied or desired. The student of Fenland literature will observe two instances of the slow manner in which great projects ripen, though, when founded on a correct appreciation of man's ability to add to his power or enjoyment, they seldom

fail to recur to his mind in due season. In the very commencement of the seventeenth century Cornelius Vermuden and the author of the "Drayner Confirmed," pointed out the methods of draining Whittlesea Mere and the adjoining country, almost as they are enacted in the statute of 1844, and strongly recommended their execution. In like manner, in 1640, Adrian Leeghwater proposed to drain the Sea of Haerlem by means which, with the substitution of wind for steam power, are analogous to those which are now in course of employment.

Some years ago a Grand Ducal work was published in Florence, giving a history of the operations carried on by that persevering family in the Tuscan Maremma. The work consists of a thick octavo volume, accompanied by a thin quarto of plates and statistics, the whole got up in superior style. The general engineering appears to be good, and plans are given of the principal bridges, locks, and weirs, as well as drawings of the tip-waggons, pile-drivers, and other engines. The object of the operation appears to have been, in part at least, sanitary. Tables are given of the population at different eras in the Maremma, with notices of the proportion of sick admitted into the Royal hospitals, previous and subsequent to the drainage. The whole work is interesting, both as it relates to the recovery of land and the increase of salubrity.

So much for the first phase of the controversy between agriculture and water. It may rather be called the recovery of land than its improvement—absolutely so in the cases where large surfaces of water have been replaced by cultivated land, and partially, to say the least, in the more ambiguous cases of what old Dugdale calls overflown marshes, where the contest has been settled in favour of dryness and solidity. Our readers will observe that we have not entered into the process of recovery—that has not been our object; but we have wished to give them a succinct account of the existing literature on the subject, and to indicate to such as are interested where they may find

treatises, historical, legal, scientific, and practical, on an art, which, on the present occasion at least, we do not propose to teach.

Two other cases remain in which water appears as an opponent of agriculture. The first is that in which rain, falling on pervious lands, and filtered through them much to their benefit, reappears in the shape of springs on the surface of lower lands not equally pervious, much to their injury. The second is the case of lands which, from closeness of texture, are not able to pass down the rain which falls upon them, and can only get rid of the portion which the plants growing on them do not consume, by superficial discharge or by evaporation. The combat with these two cases marks two distinct eras in the history and progress of draining. The first enemy the Romans encountered manfully, as was their wont. Their remedies were, open and covered drains from three to four feet deep, the latter being half filled with small stones or very clean gravel previous to the return of the earth. In the absence of stones and gravel, "*sarmentis, vel stramine subjecto cooperiantur, vel quibuscunque virgultis,*" branches, straw, or any kind of twigs. They fortified every important outlet with stonework or other masonry. For non-filtration on tenacious lands they appear to have had no other remedy than clean furrows, water-gripping and open cuts running across the slope of the hill. Their sensibility to the evil of surface-water is shown by the many and minute directions for getting rid of it, which are given by all their agricultural writers—Cato, Varro, Columella, Virgil, Pliny, and Palladius. This whole matter is ably treated by Mr. Dickson, in his fifteenth and sixteenth chapters of "*Husbandry of the Ancients,*" where the reader will find an ample reference to all the authorities.

The earliest notice of English draining which we have discovered, is contained in a broadside in vol. iv. of the Collection of Proclamations, &c., once belonging to James II., now in the library of the Society of Antiquaries, London.

"Herein," says the writer, who dates from Paine's End, the 16th of Nov., 1583, "is taught, even for the capacity of the meanest, how to drain moores, and all other wet grounds or bogges, and lay them dry for ever." The draining for wet grounds is of a shallow order, and is illustrated by a herring-bone pattern. The main drain is to be filled with stones; but our capacity is certainly too mean to understand how an open course for the water is to be maintained in the lateral drains, or "slope drayners," as the writer calls them. The directions for executing them are as follows:—"Dig them one foote deepe at the least, and one foote broade in the bottome, and not above two inches broade at the top, so will the top close up againe and the bottome will be hollow,"—"so shall you lose no ground. The charges for ten acres is 26s. 8d., besides carriages, which charges, the earth which you cart out of the ditch and drayners, being wel spread, wil countervail for the manuring of the ground." The directions "To draine Bogs" contain all we know at the present day, or nearly so, with the exception of the use of the boring-rod.

Our researches into agricultural literature have brought us acquainted with Walter Blith, "a Lover of Ingenuity," and Andrew Yarranton. Like other writers on husbandry, both published at a time of great agricultural depression. The former, about 1640, in "The English Improver," "discovered to the kingdome that some land, both arable and pasture, may be advanced double or treble," other five or ten, some twenty fold, &c., &c. The latter, in 1677, in "England's Improvement by Sea and Land," taught his countrymen to "outdo the Dutch without fighting, to pay debts without moneys, to set at work all the poor of England with the growth of our own land," and many other things. We have but a few words with him, for, though he does not entirely overlook draining, he says nothing on it to our purpose. His grand remedies are—1st. To lower the rate of interest to landowners by means of a registry of deeds. This, according to him, would enable them to take a cer-

tificate of registry to the Bank of England, or to Overend and Gurney's, and to discount it at 3 per cent. So much for landlords. 2nd. For tenants he has public granaries, in which they are to deposit their corn, and to receive for it corn-notes; these will pass from hand to hand "actually equal to cash," which, consequently, can never be scarce. 3rd. Manufactures are to be encouraged by a strict monopoly of the home market. He concludes thus:—"If any gentleman, or other, please to put pen to paper, in opposition to what is here asserted, I shall give him a civil return, bound up with the second part, where these seven heads shall be treated on"—two will suffice:—

"3rdly. Demonstrate and make it appear how Ireland may be brought to twenty years' purchase, and made as useful to England, and of as great strength, as Norway is to Denmark."

"6thly. How to employ six thousand young lawyers and three thousand priests for the good of the public and mankind."

This second part we have unfortunately been unable to discover. We beg pardon for digression, but we could not wholly pass by remedies so admirably suited to our own wants and times.

Our copy of the first edition of Walter Blith's book is without date, but it was evidently published before Charles and the House of Lords were set aside, for in the title-page it speaks of the "Kingdome," and it is addressed to the two Houses of Parliament. A large type, a wide margin, and a liberal incorporation of Tusser's Rhymes, only extend the work to the modest size of 168 pages. But in 1652 matters are much changed. Walter Blith, "a Lover of Ingenuity," has become Captain Walter Blith. The word "Kingdome" is dropped out of the title-page. The "third impression, much augmented," is dedicated to "The Right Honourable the Lord Generall Cromwell." The author's ideas, as well as his book, have evidently expanded at the rapid rate then in fashion. He thus describes the

state of the farming interest in his days. He says that the smaller farmers live worse than "those in Bridewell:"—

"And for the best of them, they live as uncomfortably, moyling and drudging; what they get they spend; plow, sow, and reap, and all to bring the year about; and can they make even at year's end, if servants' wages can be payd, rent discharged, and teems maintained, and family alive, all is well. I dare say fewer estates are raised, tho in itself an honest calling, than by any calling or employment whatsoever; Whistle it in and whistle it out, as the proverb is."

In proposing his remedies, he discourses of leases, of tenant right, of employing more capital, of vermine (game), and of "slavish custome never affecting ingenuity," as glibly as Richard Cobden, and as confidently as John Bright. He also proposes means for silencing the great plea of the labourers—"Will you set us on worke? We will work if you'll provide it." He speaks very disparagingly of all the agricultural writers of his day except "Master Gabriel Plats," but bears the following testimony to the estimation in which Lord Bacon's works were then held:—"But Sir Francis Bacon's *Natural Historie* let it have high esteeme, 'tis full of rarities and admiration for true philosophie, and shall be acknowledged as a sun in the theore to these poor and low moonelight discoveries." With all this, however, we cannot now occupy ourselves. It is when our author comes to draining and irrigation, on which he is more diffuse than on any other single topic, that he becomes a man after our own heart. Page after page he insists on the absurdity of putting water of irrigation on the top of your land till you have effectually drawn the existing water out of the bottom:—

"And for thy drayning trench it must be made so deepe it go to the bottome of the cold spewing moyst water that feeds the flagg and rush"—"a yard or foure feet deep, if ever thou wilt drayne to purpose." And again, "to the bottome, where the spewing spring lyeth, thou must go,

and one spade's graft beneath, how deep soever it be, if thou wilt drayne thy land to purpose. I am forced to use repetitions of some things, because of the sutablenesse of the things to which they are applyed, as also because of the slownesse of peoples apprehensions of them, as appears by the non-practise of them, the which wherever you see drayning and trenching you shall rarely finde few or none of them wrought to the bottome." "But for these common and many trenches, ofttimes crooked too, that men usually make in their boggy grounds, some one foot, some two, I say away with them as a great piece of folly, lost labor and spoyl, which I desire to preserve the reader from."*

Equally sagacious are the directions about outfalls "to take thy water clearly from thy drayne." On the subject of straightening tortuous and sluggish watercourses, this man of the Commonwealth was in advance not only of his own day but of ours:—

"A straight water-course cut a considerable depth in a thousand parts of this nation would be more advantageous than we are aware of. And though many persons are interested therein, and some will agree, others will oppose; one creek lyeth on one side of the river in one lord's manor, and another lyeth on the other side: why may not one neighbour change with another when both are gainers? I dare say thousands of acres of very rich land may thereby be gained, and possibly as many more much amended that are almost destroyed."

And he proposes a law which shall give facilities for this improvement, and shall protect all interests. Having discoursed to the Lord General on seven prejudices to land,

* In the materials for forming the conduit in a covered drain, no advance seems to have been made from the time of Cato to that of Walter Blith. Cato says, "*Sulcos lapide consternito. Si lapis non erit, perticis saligneis viridibus quoquoersus collatis consternito. Si pertica non erit, sarmentis colligatis.*" Blith's directions are: "Thou must take good green faggots, willow, alder, elme, or thorne, and lay it in the bottome of thy works; or rather, take great pibblestones or flintstones."

he thus proceeds:—"The eighth prejudice may be the many water-mills, which destroy abundance of gallant land; turning it to a bog, or to mire, or else to flagg, rush, or mareblabb; some mills, worth 10*l.* or 12*l.* per annum, destroy land worth 20*l.*, 30*l.*, or 40*l.* per annum. I knowe it of my own knowledge."—Every word of which is as true in the year 1849 as it was in 1652; and the remedies which he proposes are now even more appropriate and efficient, because we are able to substitute steam power for wind and horses, which he contemplated. To prostrate the weirs on all our sluggish streams would be the greatest recovery of "gallant" land which now remains feasible in England. The day of their doom is probably at hand. Most of our water corn-mills are of barbarous structure, inconveniently situated as to roads, and expensive in the maintenance of their weirs, floodgates, banks, and goats. Many on the larger streams lose one-third of their time in winter from excess of water, and those on the smaller the same amount in summer from deficiency. We remember an instance in which all the mills on the river Soar, in Leicestershire, stood still for six weeks continuously on account of flood. Through all the north and centre of England, as well as through considerable portions of the west, good engine-coal is delivered at all railway stations at from 4*s.* to 7*s.* per ton, and 3*s.* 6*d.* per ton is not an uncommon price at the pits. These prices will be more effective enemies to the beggarly water-mills, and more powerful friends to the gallant lands, than Walter Blith's denunciations. In a report made by Mr. Josiah Parkes to the President of the Board of Health, we find the following remarks, to which we give our hearty assent:—

"The sluggish rivers of the midland and southern counties of England oppose great impediments to land-drainage, being usually full to the banks, or nearly so, and converted into a series of ponds by mill-dams erected at a few

miles' distance below each other; so that frequently no effectual drainage of the richest alluvial soil, composing the meadows, can be made without forming embankments, or by pumping, or by resort to other expensive means. The greater number of corn and other water-mills throughout England ought to be demolished for the advantage of agriculture, and steam-power should be provided for the millers. I believe that such an arrangement would in most cases prove to be economical for both parties.

“A striking example of the economical and beneficial result arising from the destruction of mill-dams, and the substitution of steam for water power, has recently been exhibited under the operation of ‘The Rye and Derwent Drainage Act,’ resulting from the wise and friendly co-operation of the Earls of Carlisle and Fitzwilliam (the chief proprietors), with other landowners, to knock down three mill-dams and give the millers steam, thereby restoring the river to its natural bed and proper function as the great artery of drainage, and enabling thousands of acres of land to be drained and reclaimed, or brought into more profitable cultivation at a very moderate cost. This excellent work has its termination at New Malton, in Yorkshire.

“If all the rivers of England were surveyed, from the sea to their source, the mills upon them valued, the extent of land injured or benefitted by such mill-dams ascertained, and the whole question of advantage over injury done to the landowners appreciated and appraised, I have little doubt but that the injury done would be found so greatly to exceed the rental of these mills, deduction being made for the cost of maintaining them, that it would be a measure of national economy to buy up all the mills and give the millers steam power.”

We wish our limits would permit us to follow the Captain through the dissertation on over-ploughing, thick and thin sowing, and various sorts of manures, and to extract a very

acute passage on the application of chemistry to agriculture. We strongly recommend the third edition of "The English Improver" to such of our readers as are not scared by a discursive style and great neglect of arrangement, and are willing to winnow a great deal of corn out of a very confused heap of chaff. The work is embellished by a frontispiece, at the top of which the royal and parliamentary forces encounter each other in hostile array. In the centre they are beating their swords into ploughshares and their spears into pruninghooks ; and at the bottom they are ploughing with two horses abreast, and performing other agricultural operations. Various plates give drawings of a wind-mill fitted with a scoop or lading-wheel for draining fens, and a great number of agricultural tools and implements ; among others, "The Harfordshire wheeled plough," condemned by Blith for its clumsiness, but still retaining its place in parts of that county ; and "The double Plough, ploughing two furrows at one time," which still lingers in the midland counties. Nor must we forget a picture of the gallant Captain, given in connection with a water-level devised by himself, and which seems to be identical with one lately re-introduced into this country from Italy, and patronized by Prince Albert and other eminent agriculturists. The Captain's figure is very imposing, but in most unagricultural garb—a wig as fine as the Speaker's ruffles, trunk-hose, and spurs. He holds in his hand the levelling-staff, which is fitted with a sliding bull's eye after the modern fashion. We part from this sagacious veteran with much affection. A fine patriotic spirit pervades all his reflections, as well as a strict morality, tinged perhaps with a little puritanism.*

* Since we penned the above, we have observed that Mr. Parkes introduced Captain Blith to his hearers in a lecture delivered at Newcastle before the Royal Agricultural Society, and published in vol. vii. of their Journal. Mr. Parkes has selected for quotation from Blith several of the same passages as ourselves, and he mentions one remark-

In England the two cases of injury from water which has passed through the earth, and water which has not, are very frequently complicated, and run into one another by an almost insensible gradation. Except in very barbarous and some sub-alpine districts, the era of draining for *mere springs* has passed by, and the work has on the whole been well executed. We possess better materials for forming a conduit, and some better tools, but probably no other advantage over old Elkington.* We know very little beyond what he taught us, and perhaps do not require to know more. Joseph Elkington was a man of considerable genius, but he had the misfortune to be illiterate, and to find a very inefficient exponent of his opinions, and of the principles on which he conducted his works, in John Johnstone. Every one who reads the work, which is popularly called Elkington on Draining, should be aware, that it is not Joseph who thinks and speaks therein, but John, who tells his readers what, according to his ideas, Joseph would have thought and spoken. In one portion of the book, entitled "On Hollow and Surface Draining in general," which is discussed in nineteen sections, Johnstone teaches avowedly in his own person, his first sentence being, "This is a part of the draining system not coming within the limits of Mr. Elkington's practice." It is enough to say that these nineteen sections do not contain a single suggestion of any value to a modern drainer. A reader who has some previous acquaintance with the subject will get a general idea of Elkington's discovery and method from the earlier portion of the *book*, though, unless he has seen some of Elkington's *work*, he will not therefrom form an adequate opinion of his sagacity. Johnstone, measured by general capacity, is a very shallow drainer. He

able point which had escaped us, that this old drainer "prescribes, in all cases, excepting for water-meadows, the driving the drains right up and down the fall of the land."

* "An Account of the most approved Mode of Draining Land, according to the System practised by Mr. Joseph Elkington." By John Johnstone, Land Surveyor. Edinburgh, 1797.

delights in exceptional cases, of which he may have met with some, but of which we suspect the great majority to be the products of his own ingenuity, and to be put forward with a view to display the ability with which he could encounter them. We shall pass by such cases altogether. No doubt they are numerous in the aggregate; but they form a very small percentage of the work of draining which has to be done or *redone* in Great Britain. They are, moreover, for the most part too complicated to be quite understood without actual inspection, too varied for useful classification, and must be left to the skill and sagacity of the operator. A slight modification of Johnstone's best and simplest plan, with a few sentences of explanation, will sufficiently elucidate Elkington's mystery, and will comprehend the case of all simple superficial springs. Perhaps in Agricultural Britain no formation is more common than moderate elevations of previous material, such as chalk, gravel, and imperfect stone or rock of various kinds, resting upon more horizontal beds of clay or other material less pervious than themselves, and at their inferior edge overlapped by it. For this overlap geological reasons are given, into which we cannot now enter. In order to make our explanation simple, we use the words gravel and clay as generic for pervious and impervious material. Our drawing is an

attempt to combine plan and section, which will probably be sufficiently illustrative. From A to T is the overlap,

which is in fact a dam holding up the water in the gravel. In this dam there is a weak place at S, through which water issues permanently (a superficial spring), and runs over the surface from S to O. This issue has a tendency to lower the water in the gravel to the line M *m*. But when continued rains overpower this issue, the water in the gravel rises to the line A *a*, and meeting with no impediment at the point A, it flows over the surface between A and S. In addition to these more decided outlets, the water is probably constantly squeezing in a slow way through the whole dam. Elkington undertakes to drain the surface from A to O. He cuts a drain from O to B, and then he puts down a borehole, an Artesian well, from B to Z. His hole enters the tail of the gravel; the water contained therein rises up it; and the tendency of this new outlet is to lower the water to the line B *b*. If so lowered, it is manifest that it can no longer overflow at A or at S, and the surface from A to O is drained so far as the springs are concerned. Though our section can only represent one spring and one summit overflow, it is manifest that, however long the horizontal line of junction between the gravel and clay may be, however numerous the weak places (springs) in the overlap or dam, and the summit overflows, they will all be stopped, provided they lie at a higher level than the line B *b*. If Elkington had driven his drain forward from B to *n*, he would at least equally have attained his object; but the borehole was less expensive. He escapes the deepest and most costly portion of his drain. At *x* he might have bored to the centre of the earth without ever realising the water in this gravel. His whole success, therefore, depended on his sagacity in hitting the point Z.—Another simple and very common case, first successfully treated by Elkington, is illustrated by our second drawing. Between gravel hills lies a dish-shaped bed of clay, the gravel being continuous under the dish. Springs overflow at A and B, and wet the surface from A to O and from B to O. O D is a drain 4 or 5 feet deep, and having an adequate outlet,

D Z a borehole. The water in the gravel rises from Z to D, and is lowered to the level D *m* and D *n*. Of course it ceases

to flow over at A and B. If Elkington's heart had failed him when he reached *x*, he would have done no good. All his success depends on his reaching Z, however deep it may lie. Elkington was a discoverer. We do not at all believe that his discoveries hinged on the accident that the shepherd walked across the field with a crow-bar in his hand. When he forced down that crow-bar, he had more in his head than was ever dreamed of in Johnstone's philosophy. Such accidents do not happen to ordinary men. Elkington's subsequent use of his discovery, in which no one has yet excelled him, warrants our supposition that the discovery was not accidental. He was not one of those prophets who are without honour in their own country; he created an immense sensation, and received a parliamentary grant of one thousand pounds. One writer compares his augur to Moses' rod, and Arthur Young speculates, whether, though worthy to be rewarded by millers on one side of the hill for increasing their stream, he was not liable to an action by those on the other for diminishing theirs. He appears to have generally used stones as a conduit, but occasionally a sort of drain-brick, the pattern of which came from France. The duty was not then taken off such materials, and formed a sore impediment to their use and improvement.

After Elkington, we find no notability in draining till we come to Smith of Deanston, and his name at once introduces us to modern practice and modern controversy. We have now to deal with the case of lands which get rid of the rain which falls upon them so slowly, that it becomes either an hindrance to fertility, or an inconvenience to agriculture, or both. This evil is often, perhaps oftener than not, complicated with an almost imperceptible oozing of bottom-water squeezed through the earth by the pressure of superincumbent subterranean reservoirs, existing in higher grounds, situated sometimes at a considerable distance. But the surface-water is the main point, and the bottom-water, if we may so call it, is amenable to the same treatment, and, except in one occasional case,* will be removed by the same means. But we can get on no farther without definitions; and here we are in a difficulty. The nomenclature of draining is indefinite, because the ideas of those who have practised the art have been confused. Probably no other art ever had so long an infancy. In the word soil, we include, for our present purpose, the whole depth to which land is treated in our operations. All our readers will have heard of soils open and stiff—pervious or permeable, and impervious—porous and retentive. We mean to select for use the last pair of these epithets. By porous soils, we mean those which, in their natural state, are capable of filtering through themselves all or the greater part of the rain which falls upon them.

* When we said that no one had yet excelled Elkington, we were speaking of the treatment of mere springs. In the complicated case to which our text refers, Mr. Parkes has often and most skilfully combined his own more peculiar practice with Elkington's discovery; removing the water from above by parallel thorough-drains, and giving to that which is squeezed up from below an easy access to the same drains by boreholes. This combination would however be useless in the hands of a man who did not inherit somewhat of the old prophet's sagacity. He appears to have dropped his mantle on a man of his own county. Mr. Parkes has introduced a great improvement by securely piping down his boreholes, and by connecting those perpendicular pipes with the pipes in his drain.

By retentive soils, we mean those which, in their natural state, retain the whole or the greater part of the rain which falls upon them, until it has run off by superficial discharge, or has been exhausted by evaporation. Of the terms cut, trench, and drain, we shall use exclusively the latter; and as the word sough or surf has been popularly extended beyond its original meaning, which was simply the artificial aperture left in the re-filled drain for the passage of the water, we shall drop that word altogether, and substitute the word conduit. Our predecessors have used almost indifferently the phrases surface-draining, hollow draining, the frequent drain system, furrow-draining, and thorough-draining. Of these we shall select the last, as best descriptive of our object. We call that thorough-draining which assimilates retentive soils to porous to this extent, that it enables them to filter through themselves to the depth of the drains all the rain which falls upon their surface; or if that object cannot be entirely attained, the thoroughness of the draining varies inversely as the quantity of water got rid of by other means. By water of drainage we mean all water existing among the particles of soil beyond that which they are able to retain by attraction. The water of drainage in any soil will stand at a level like any other dâmmed-up water. In order to avoid circumlocution, we shall ask leave to call this level the water-table. In using the word attraction, we shall drop capillary, which is a favourite with writers on draining. We drop it because it conveys no definite idea to our mind as connected with particles of soil; because attraction is perfectly intelligible; and because every one may, by the simplest experiments, and the use of his own eyes, convince himself that particles of soil have an attraction for water so strong as to overcome to a certain extent the force of gravity.

Imperfect attempts at thorough-draining were probably first made in the southern counties of England. The conduit was usually formed of thorns or other twigs, the

cuttings of the hedges, covered with straw. In Leicestershire nearly a century ago, and perhaps earlier, a conduit was formed in clay at the bottom of the drain by a superimposed turf (locally called clod-soughing); and the practice is not quite exploded in that and other counties, which are backward in their agriculture. Attempts, moreover, were made in various parts of England to form a conduit by means of a mole-plough. This instrument had a great but very transient reputation. Smith of Deanston was therefore by no means the author of thorough-draining, but he saw much more clearly than any of his predecessors the benefits to be derived from it, and he has the high merit of having brought them prominently before the public. No doubt whatever can exist that Mr. Smith gave the first effectual impulse to the practice, and to that extent his name is justly associated with thorough-draining. One sentence in an article which he furnished to "The Third Report of Drummond's Agricultural Museum," makes a considerable approach to a right conception of the advantages of thorough-draining, as they are now revealed to us.

"When soil is immediately incumbent on open rock, especially on whin or green-stone, which is very open from its many fissures, the land is always uniformly fertile. If, therefore, we observe carefully the operations of nature, we shall never be at a loss for principles to guide us in the cultivation of the soil. In the last stated example, the open rock under the soil affords frequent and pretty uniform channels of escape for the water; hence the obvious suggestion of the *frequent drain system*."

So utterly innocent was poor Johnstone of any such ideas, that in a chapter on "Hollow-draining in General," he publishes such stuff as follows:—

"In soils that are so tenacious as to retain water on the surface till evaporation carries it off, such as are found in Sussex, Surrey, and in many other counties, this method of draining has been tried, and found entirely to fail."

. . . . "Open trenches, with the ridges and water-furrows properly formed and directed, is the only method whereby its drainage can be effectually accomplished. It is necessary to lay it up in ridges properly placed, and to cut *small open drains* across the ridges where requisite, communicating with each other, and with the furrows; and thus all the water-furrows operate as drains"—a singular conception, certainly, of an art on which he published a book in quarto. Smith's execution was inferior both to his conception and to his zeal. The depth of his frequent drains was not sufficient to attain even the benefits which he foresaw; the materials for his conduit were cumbrous. The quantity of surplus left after refilling, when 15 in. of stone are put into a drain several inches wide at bottom, is very objectionable; and his prices for the execution of the work, when transferred to England, are fabulous. He has the merit of having first stated boldly that all drained lands should be worked flat without ridge or furrow, and he prescribes the line of steepest descent for the general direction of drains, and gives correctly some of the reasons for that practice. If his powers of reasoning had been equal to his zeal, or even to his perception, he would not have allowed himself to be outstripped, as he has been, by others in an art which he had in some degree made his own.

Josiah Parkes, C.E., in a work entitled "Essays on the Philosophy and Art of Land-drainage," published last year,* has very materially extended the objects and benefits of thorough-draining, and for every extension has given authentic instances and philosophical reasons. Mr. Parkes's style is clear and unaffected, and we think that very few holes can be picked in his reasoning. His first Essay is entitled, "On the Influence of Water on the Temperature of Soils;" also, "On the Quantity of Rain-water and its Discharge by Drains." It is the first attempt which we have seen to reduce

* The former of these Essays had appeared in the Journal of the Agricultural Society in 1844, and the latter in 1846.

draining to a science ; and, where want of data forbids that object to be obtained, Mr. Parkes indicates very clearly the avenues to future success. The treatise is somewhat too scientific for general agricultural readers, and on that account not fitted to be transferred in the form of a connected abstract into our pages ; but, it contains several interesting tables, and is pregnant with important facts and accurate deductions, of which we shall avail ourselves, without further acknowledgment, in the remarks on thorough-draining which we propose to offer to our readers. Mr. Parkes's second Essay, the Newcastle Lecture, to which we have already referred, is more popular in its nature, and very practical. Every farmer may read it with advantage. Mr. Mechi has given us " Experience in Drainage." He is an experimentalist in agriculture, and we should think a very sanguine one. With respect to many of his speculative conclusions, we should be sorry to give a directly adverse opinion ; but we fear that, in order to escape doing so, we must take refuge in the modified Scotch verdict—not proven. We could not speak harshly of a gentleman whose assistance we crave at our toilet every morning, who imparts so freely to the public his failures as well as his successes, and who appears to bear so good-humouredly the banterings of the London Farmers' Club and the " Mark Lane Express." Moreover, Mr. Mechi asks very acute questions, and makes shrewd remarks, some of which we may not improbably call to our aid.

Here we take our leave of draining literature, and descend to practice. We will assume, without proving, that water of drainage, stagnating in the soil, is prejudicial to esculent vegetation. If this be not so, all that we and our predecessors have learnt and written, has been learnt and written in vain. We will assume, also, that to raise the temperature of what are familiarly and justly called our cold soils, will be beneficial to vegetation. Having made these assumptions, we will prove—1st, that the main

cause of the coldness of these soils is the removal of the water of drainage by evaporation; 2ndly, that their temperature is very much raised during the vegetative season of the year by the removal of this water by efficient drainage; 3rdly, we will state the reasons for our conviction that, in all soils, the existence of the water-table within less than 4 feet of the surface of the land is prejudicial to vegetation; 4thly, we will show that the water of drainage will be best removed at a reasonable expense, and the level of the water-table will be best reduced by frequent parallel drains of a depth never less than 4 feet; 5thly, that the direction of these drains should, as a general rule, be in the line of steepest descent; 6thly, that pipes and collars form a better and cheaper conduit than any other which has been hitherto adopted; and, 7thly, we will give our opinion on the disputed point whether, in the most retentive soils, drains of 4 feet will effectually remove the water of drainage.

1st. The main cause of the coldness of retentive soils is the removal of water of drainage by evaporation.

The evaporation of water produces cold: it cools wine; in hot climates it produces ice. These facts are known to every one. To determine the actual degree of cold produced by the evaporation of one pound of water from soil is rather a complicated, and not a very certain, operation; but scientific reasons are given for an approximation to this result—that the evaporation of one pound of water lowers the temperature of 100 lbs. of soil 10° . That is to say, that if to 100 lbs. of soil holding all the water which it can by attraction, but containing no water of drainage, is added one pound of water which it has no means of discharging except by evaporation, it will, by the time that it has so discharged it, be 10° colder than it would have been if it had the power of discharging this 1 lb. by filtration; or more practically, that if rain, entering in the proportion of 1 lb. to 100 lbs. into a retentive soil which is saturated with water of attraction, is discharged by evaporation,

it lowers the temperature of that soil 10° . If the soil has the means of discharging that 1 lb. of water by filtration, no effect is produced beyond what is due to the relative temperatures of the rain and of the soil. Mr. Dickenson, the eminent paper-maker, who has several mills and a considerable landed estate in Hertfordshire, has deduced from a series of observations, which are, we believe, entitled to great confidence, that of an annual fall of 26 inches of rain, about 11 are filtered through a porous soil. The whole of this 11 inches (and probably more) must be got rid of by a retentive soil, either by evaporation or by superficial discharge. The proportions in which each of these means will operate will vary in every case, but this will be an universal feature—that these 11 inches will maintain in undrained retentive soils, at all except some accidental periods of excessive drought, a permanent supply of water of drainage, which will be in constant course of evaporation, and will constantly produce the cold consequent thereon. Retentive soils never can be so warm as porous, for a simple reason. Every one knows, or may know, that if into two flower-pots, with holes in the bottom, are put respectively equal portions of gravel and clay, equally heated to any point short of torrefaction, and if equal quantities of water are administered to the surface of each, water (water of drainage) will run from the gravel long before it begins to run from the clay. Gravel can hold by attraction much less water than clay can. At the time when each is saturated by water of attraction, and neither holds any water of drainage, evaporation will begin to act upon the water in each, and will act most strongly in the vegetative period of the year. The cold produced will be in proportion to the quantities of water evaporated respectively, and will of course be greatest in the retentive soil. We will reserve a further cause of coolness in retentive soils, which is also connected with evaporation, till we have spoken of the depths of drains.

2nd. The temperature of retentive soils is very much

raised during that period of the year in which vegetation is active by the removal of water by drainage.

Many experiments have shown that, in retentive soils, the temperature at 2 or 3 feet below the surface of the water-table is, at no period of the year, higher than from 46° to 48° , *i. e.* in agricultural Britain. This temperature is little affected by summer heats, for the following short reasons. Water, in a quiescent state, is one of the worst conductors of heat with which we are acquainted. Water warmed at the surface transmits little or no heat downwards. The small portion warmed expands, becomes lighter than that below, consequently retains its position on the surface, and carries no heat downwards.* To ascertain the mean heat of the air at the surface of the earth over any extended space, and for a period of eight or nine months, is no simple operation. More elements enter into such a calculation than we have space or ability to enumerate; but we know certainly that, for seven months in the year, air, at the surface of the ground, is seldom lower than 48° , never much lower, and only for short periods: whereas, at 4 feet from the surface, in the shade, from 70° to 80° is not an unusual temperature, and in a southern exposure, in hot sunshine, double that temperature is not unfrequently obtained on the surface. Now let us consider the effect of drains placed from 2 to 3 feet below the water-table, and acting during the seven months of which we have spoken. They draw out water of the temperature of 48° . Every particle of water which they withdraw at this temperature is replaced by an equal bulk of air at a higher, and frequently at a much higher, temperature. The warmth of the air is carried down into the earth.

* When water is heated from below, the portion first subjected to the heat rises to the surface, and every portion is successively subjected to the heat and rises, and each, having lost some of its heat at the surface, is in turn displaced. Constant motion is kept up, and a constant approximation to an equal temperature in the whole body. The application of superficial heat has no tendency to disturb the quiescence of water.

The temperature of the soil, to the depth to which the water is removed, is in a course of constant assimilation to the temperature of the air at the surface. From this it follows necessarily, that during that period of the year when the temperature of air at the surface of the earth is generally below 48°, retentive soils which have been drained are colder than those which have not. Perhaps this is no disadvantage. In still more artificial cultivation than the usual run of agriculture, gardeners are not insensible to the advantage of a total suspension of vegetation for a short period. In Britain we suffer, not from an excess of cold in winter, but from a deficiency of warmth in summer. Grapes and maize, to which our sombre skies deny maturity, come to full perfection in many regions whose winters are longer and more severe than ours. However, we state the facts, without asking to put a large amount therefrom to the credit of our drainage. A friend of ours, who lived on the north side of a hill in a subalpine district, did not see the sun for three months in the year. He maintained that this was an advantage: that during those three months the sun was worth nothing to any one: whereas in summer he enjoyed the early beams of that luminary for some hours before he appeared to his neighbours on the south side of the hill, as well as his declining rays after they had lost him. Perhaps our readers may think that what we and our friend take by our respective notions is much on a par. To a beautiful provision of nature, by which, during seasons of excessive heat, summer rains are made subservient to the double purpose of cooling the arid surface and conveying warmth to the deeper recesses of the soil, we can advert only cursorily, on account of insufficient data. We have no satisfactory British experiments with reference to the surface-heat of the earth. Professor Leslie's only commence at 1 foot below the surface. Schubler's experiments, made near Geneva, in the year 1796, are strictly superficial. His thermometers were sunk in the soil only to the depth of $\frac{1}{12}$ th of an inch. In

that sunny clime he found the *mean* heat of soil, at that depth, to be at noon, for six successive months, 131° . If that were his *mean* heat for six months, we cannot doubt that it is frequently obtained as an extreme heat in the hottest portion of our year in England. Mr. Parkes gives temperatures on a Lancashire flat moss, but they only commence at 7 inches below the surface, and do not extend to midsummer. At that period of the year the temperature at 7 inches never exceeded 66° , and was generally from 10° to 15° below the temperature of air in the shade, at 4 feet above the earth. At the depth of 13 inches the soil was generally from 5° to 8° cooler than at 7 inches. Mr. Parkes's experiments were made simultaneously on a drained and on an undrained portion of the moss; and the result was, that, on a mean of 35 observations, the drained soil at 7 inches in depth was 10° warmer than the undrained at the same depth. The undrained soil never exceeded 47° , whereas after a thunder-storm the drained reached 66° at 7 inches, and 48° at 31 inches. Such were the effects at an early period of the year on a black bog. They suggest some idea of what they are, when in July or August thunder-rain at 60° or 70° falls on a surface heated to 130° , and carries down with it into the greedy fissures of the earth its augmented temperature. These advantages porous soils possess by nature, and retentive soils only acquire them by drainage.*

* The only temperature of thunder-rain given in Mr. Parkes's Tables is 78° . This, we imagine, must be an extreme heat. We have heard, with much satisfaction, that Mr. Parkes is, by means of his numerous staff stationed at the works which he is carrying on in many parts of Great Britain, Ireland, and (we believe) France, conducting a series of experiments on the temperatures of water of drainage, which tend to show an increase in some proportion to the length of time for which the drainage has been executed. We know no experiments connected with agriculture to the result of which we look with more hopeful expectation. Any agriculturist may, by means of a delicate thermometer, conduct and record such observations on his own farm. Probably the water of drainage from firm land may be expected to be higher in temperature than that from the quoted bog in summer, and lower in winter.

3rd. In all soils the existence of the water-table nearer than 4 feet from the surface of the land is prejudicial to vegetation. Here open upon us the yelpings of the whole shallow pack. Four feet! The same depth for all soils! Here's quackery! We think Mr. Parkes must have stood in very unnecessary awe of this pack, when he penned the following half-apologetic sentence, which is quite at variance with the wise decision with which, in other passages of his works, he insists on depths of four feet and upwards in all soils:—"In respect of the depth at which drains may, with a certainty of action, be placed in a soil, I pretend to assign no rule; for there cannot, in my opinion, be a more crude or mistaken idea than that one rule of depth is applicable with equal efficiency to soils of all kinds."* Those words—equal efficiency—are a sort of saving clause; for we do not believe that when Mr. Parkes wrote them, he entertained "the crude or mistaken idea" of ever putting in an agricultural drain less than 4 feet deep, if he could help it. We will supply the deficiency in Mr. Parkes's explanation, and will show that the idea of a *minimum* depth of four feet is neither crude nor mistaken. And as to "quackery"—which occurs *passim* in the writings and speeches of the shallow drainers—there is no quackery in assigning a minimum. Every drainer does it, and must do it. The shallowest man must put his drains out of the way of the plough and of the feet of cattle. That is his minimum. The man who means to subsoil must be out of the way of his agricultural implement. These two minima are fixed on mechanical grounds. We will fix a minimum founded on ascertained facts and on the principles of vegetation.

Every gentleman who, at his matutinal or ante-prandial toilet, will take his well-dried sponge, and dip the tip of it into water, will find that the sponge will become wet above

* Smith of Deanston may perhaps be open to some observation, for we believe that he did unadvisedly recommend, in thorough-draining, an equal depth and equal distance for parallel drains in all soils.

the point of contact between the sponge and the water, and this wetness will ascend up the sponge, in a diminishing ratio, to the point where the forces of attraction and of gravity are equal. This illustration is for gentlemen of the Clubs, of London drawing-rooms, of the Inns of Court, and for others of similar habits. For gentlemen who are floriculturists, we have an illustration much more apposite to the point which we are discussing. Take a flower-pot a foot deep, filled with dry soil. Place it in a saucer containing three inches of water. The first effect will be, that the water will rise through the hole in the bottom of the pot till the water which fills the interstices between the soil is on a level with the water in the saucer. This effect is by gravity. The upper surface of this water is our water-table. From it water will ascend by attraction through the whole body of soil till moisture is apparent at the surface. Put in your soil at 60° , a reasonable summer heat for nine inches in depth, your water at 47° , the seven inches' temperature of Mr. Parkes's undrained bog; the attracted water will ascend at 47° , and will diligently occupy itself in attempting to reduce the 60° soil to its own temperature. Moreover, no sooner will the soil hold water of attraction, than evaporation will begin to carry it off, and will produce the cold consequent thereon. This evaporated water will be replaced by water of attraction at 47° , and this double cooling process will go on till all the water in the water-table is exhausted. Supply water to the saucer as fast as it disappears, and then the process will be perpetual. The system of saucer-watering is reprobated by every intelligent gardener; it is found by experience to chill vegetation; besides which, scarcely any cultivated plant can dip its roots into stagnant water with impunity. Exactly the process which we have described in the flower-pot is constantly in operation on an undrained retentive soil: the water-table may not be within nine inches of the surface, but in very many instances it is within a foot or eighteen inches, at which level the cold surplus oozes into

some ditch or other superficial outlet. At 18 inches, attraction will, on the average of soils, act with considerable power. Here, then, you have two obnoxious principles at work, both producing cold, and the one administering to the other. The obvious remedy is, to destroy their *united* action; to break through their line of communication. Remove your water of attraction to such a depth that evaporation cannot act upon it, or but feebly. What is that depth? In ascertaining this point we are not altogether without data. No doubt depth diminishes the power of evaporation rapidly. Still, as water taken from a 30-inch drain is almost invariably two or three degrees colder than water taken from 4 feet, and as this latter is generally one or two degrees colder than water from a contiguous well several feet below, we can hardly avoid drawing the conclusion that the cold of evaporation has considerable influence at 30 inches, a much-diminished influence at 4 feet, and little or none below that depth. If the water table is removed to the depth of 4 feet, when we have allowed 18 inches of attraction, we shall still have 30 inches of defence against evaporation; and we are inclined to believe that any prejudicial combined action of attraction and evaporation is thereby well guarded against. The facts stated seem to prove that less will not suffice.

So much on the score of temperature; but this is not all. Do the roots of esculents wish to penetrate into the earth—at least, to the depth of some feet? We believe that they do. We are sure of the brassica tribe, grass, and clover. All our experience and observation deny the doctrine that roots only ramble when they are stinted of food; that 6 inches well manured is quite enough, better than more. Ask the Jerseyman; he will show you a parsnip as thick as your thigh, and as long as your leg, and will tell you of the advantages of 14 feet of dry soil. You will hear of parsnips whose roots descend to unsearchable depths. We will not appeal to the Kentucky carrot, which was

drawn out by its roots at the antipodes: but Mr. Mechi's, if we remember right, was a dozen feet or more. Three years ago, in a midland county, a field of good land in good cultivation, and richly manured, produced a heavy crop of cabbages. In November of that year we saw that field broken into in several places, and at the depth of 4 feet the soil (a tenacious marl, fully stiff enough for brick-earth) was occupied by the roots of cabbage, not sparingly—not mere capillæ—but fibres of the size of small pack-thread. A farmer manures a field of four or five inches of free soil reposing on a retentive clay, and sows it with wheat. It comes up, and between the kernel and the manure it looks well for a time, but anon it sickens. An Irish child looks well for five or six years, but after that time potatoe-feeding, and filth, and hardship, begin to tell. You ask what is amiss with the wheat, and you are told that when its roots reach the clay they are poisoned. This field is then thorough-drained, deep, at least four feet. It receives again from the cultivator the previous treatment; the wheat comes up well, maintains throughout a healthy aspect, and gives a good return. What has become of the poison? We have been told that the rain-water filtered through the soil has taken it into solution or suspension, and has carried it off through the drains, and men who assume to be of authority put forward this as one of the advantages of draining. If we believed it we could not advocate draining. We really should not have the face to tell our readers that water, passing through soils containing elements prejudicial to vegetation, would carry them off, but would leave those which are beneficial behind.* We cannot make our water so discriminating; the general merit of water of deep drainage is, that it contains very little. Its perfection would be, that it should contain nothing. We understand that experiments are in progress

* We do not deny that some subsoils contain matter prejudicial to vegetation, but generally they are not worse than a *caput mortuum*; seldom quite so bad.

which have ascertained that water, charged with matters which are known to stimulate vegetation, when filtered through 4 feet of retentive soil, comes out pure.* But to return to our wheat. In the first case, it shrinks before the cold of evaporation and the cold of water of attraction, and it sickens because its feet are never dry; it suffers the usual maladies of cold and wet. In the second case, the excess of cold by evaporation is withdrawn; the cold water of attraction is removed out of its way; the warm air from the surface, rushing in to supply the place of the water which the drains remove, and the warm summer rains, bearing down with them the temperature which they have acquired from the upper soil, carry a genial heat to its lowest roots. Health, vigorous growth, and early maturity are the natural consequences.

We think we have established that all soils will be benefited by the removal of the water-table to 4 feet, which must suffice under this head; and we think every candid reader will be convinced that, by this single operation of lowering the water-table, many soils, hitherto sterile, and consequently much underrated, may be made into useful agricultural land. We will take together the fourth and fifth heads: they will occupy only a few sentences. They relate to the depth and direction of the drains by which the water-table is to be lowered.

Water can only get into drains by gravity, which only acts by descent—technically, by fall; the fall must be proportioned to the friction which the water encounters on its passage. Suppose drains 4 feet deep to be placed 12 yards apart on level land, it is plain that water at that depth, lying at the intermediate point between the two drains, will not get into either of them. A fall of some inches will be required to enable it to overcome the friction of 6 yards of retentive soil. In order, therefore, to lower the water-table to 4 feet at all points, the drains must be

* Since this Essay was first printed, a portion of these experiments has been communicated to the public by Professor Way.

some inches deeper than 4 feet. If the land lies on a slope (say 4 inches to the yard), drains of 4 feet, if driven on the line of steepest descent, will effect the object; because, though water at 4 feet, lying at the intermediate point between two drains, in a line at right angles to them, cannot for want of fall get into either of them by travelling 6 yards, it will find a fall of 4 inches at less than 7, and of 8 inches at less than 8, yards. If we must speak quite correctly, this intermediate water will never get into the drain till there is a fresh supply; it will descend perpendicularly, pushing out that which lies below it, and will be itself displaced by a fresh arrival from the heavens. In order that the whole soil, if homogeneous, or nearly so, may be drained evenly, it is manifest that the drains must be parallel. Extra friction in the soil must be met either by making the drains deeper, or by placing them nearer. On this point, which is one of practice rather than of principle, each case must be left to the sagacity of the operator. We doubt whether in any natural soil the friction is so great as to resist a fall of 1 inch in a yard. If we are right in this point, we should always attain the object of lowering the water-table to 4 feet by 4-foot 6-inch drains, parallel, and 12 yards apart. We have already stated one advantage which results on a slope from driving the parallel drains in the line of steepest descent: to wit, that when they are so driven, all water which lies at the same depth from the surface as the bottoms of the drains, can find a fall into one or the other by travelling a little more than half the distance between them; whereas, if the drains are driven across the slope, half the water so situated as to depth can only find a fall into the lower drain, and in order to reach it must travel distances varying from one-half to the full interval between the two. Smith, of Deanston, stated one reason for the steep course, namely, that on slopes alternate horizontal beds of porous and retentive soil frequently cropped out; that the water issuing from the lower edge of the porous runs over the

surface of the retentive ; that a drain driven across the slope in the retentive leaves this issue untouched : whereas a drain driven in the line of the slope cuts every one of these horizontal beds, draws the water to the depth of the drain out of the porous, and stops the overflow. Some one comes forward, and says,—“ I have seen a case where the alternate beds are parallel, not overlying, perpendicular, not horizontal, and lie in the line of the slope. There your rule will not apply.” Quite true ! but Smith’s case frequently occurs, and is worthy of a general observation ; yours is very rare, and is not. You must deal with it according to your ingenuity. But perhaps the greatest recommendation of the steep drain is, that the water gets so freely out of it ; it is no sooner in the drain than you are rid of it : whereas, in the horizontal drain it lingers lying against the lower side, oozing through the land and inviting attraction. In very steep lands, the general direction of the natural cracks is across the line of slope, for the same reasons of gravity as in landslips, breaks in embankments, and other similar cases. Many valleys seem to have obtained their present form by a succession of little landslips, which are still in progress where a stream is washing away the foot. In such cases the steep drain cuts through all the cracks, and relieves them of their water.

We now come to the conduit.

If sticks, straw, clods, and the mole-plough have not entirely fled before modern improvements, we should unworthily detain our readers by occupying a single line in giving them a parting kick. Stones must not be dismissed quite so summarily : they form an imperfect conduit, but we cannot say that in no situation is it advisable to use them. Many wet common lands, on their enclosure, and many of the slopes of moorland hills, when first brought into arable cultivation, are exceedingly encumbered with stones. It is almost as cheap to bury them in 4 or 5 feet drains as to cart them into heaps. We have seen instances where as many stones came out of the drain as would form

the conduit. Such soils are generally very firm. A narrow slab or inch board, fitting the bottom of the drain, will be a secure foundation for stone, a foot in depth, laid in the form which its nature may suggest. We will answer for the board. In taking up considerable lengths of drains 5 and 6 feet deep, and so laid more than sixty years ago, we have seen no instance in which either oak, alder, birch, or willow has been materially decayed; twigs and sticks, from similar depths, have been equally sound and tough. In the comparatively rare cases to which we have referred, we permit, without approval, the use of a stone conduit. We know no instance in which it is worth while (as Smith recommends) to quarry and break stones to form a conduit.

We shall shock some and surprise many of our readers, when we state confidently that, in average soils, and, still more, in those which are inclined to be tender, horseshoe tiles form the weakest and most failing conduit which has ever been used for a deep drain. It is so, however; and a little thought, even if we had no experience, will tell us that it must be so. A doggerel song, quite destitute of humour, informs us that tiles of this sort were used in 1760 at Grandesburg Hall, in Suffolk, by Mr. Charles Lawrence, the owner of the estate. The earliest of which we had experience were of large area and of weak form. Constant failures resulted from their use, and the cause was investigated; many of the tiles were found to be choked up with clay, and many to be broken longitudinally through the crown. For the first evil, two remedies were adopted; a sole of slate, of wood, or of its own material, was sometimes placed under the tile, but the more usual practice was to form them with club-feet. To meet the case of longitudinal fracture, the tiles were reduced in size, and very much thickened in proportion to their area. The first of these remedies was founded on an entirely mistaken, and the second on no conception at all of the cause of the evil to which they were respectively applied. The idea

was, that this tile, standing on narrow feet, and pressed by the weight of the refilled soil, sank into the floor of the drain ; whereas, in fact, the floor of the drain rose into the tile. Any one at all conversant with collieries is aware that when a *strait* work (which is a small subterranean tunnel 6 feet high and 4 feet wide or thereabouts) is driven in coal, the rising of the floor is a more usual and far more inconvenient occurrence than the falling of the roof: the weight of the two sides squeezes up the floor. We have seen it formed into a very decided arch without fracture. Exactly a similar operation takes place in the drain. No one had till recently dreamed of forming a tile drain, the bottom of which a man was not to approach personally within 20 inches or 2 feet. To no one had it then occurred that width at the bottom of the drain was a great evil. For the convenience of the operator the drain was formed with nearly perpendicular sides, of a width in which he could stand and work conveniently, shovel the bottom level with his ordinary spade, and lay the tiles by his hand ; the result was a drain with nearly perpendicular sides, and a wide bottom. No sort of clay, particularly when softened by water standing on it or running over it, could fail to rise under such circumstances ; and the deeper the drain the greater the pressure and the more certain the rising. A horseshoe tile, which may be a tolerably secure conduit in a drain of 2 feet, in one of 4 feet becomes an almost certain failure. As to the longitudinal fracture—not only is the tile subject to be broken by one of those slips which are so troublesome in deep draining, and to which the lightly-filled material, even when the drain is completed, offers an imperfect resistance, but the constant pressure together of the sides, even when it does not produce a fracture of the soil, catches hold of the feet of the tile, and breaks it through the crown. Consider the case of a drain formed in clay when dry, the conduit a horseshoe tile. When the clay expands with moisture, it necessarily presses on the tile, and breaks it through the crown, its weakest

part.* When the Regent's Park was first drained, large conduits were in fashion, and they were made circular by placing one horseshoe tile upon another. It would be difficult to invent a weaker conduit. On re-drainage, innumerable instances were found in which the upper tile was broken through the crown, and had dropped into the lower. Next came the $\cap$ form, tile and sole in one, and much reduced in size—a great advance; and when some skilful operator had laid this tile bottom upwards we were evidently on the eve of pipes. For the $\cap$ tile a round pipe moulded with a flat-bottomed solid sole $\bigcirc$ is now generally substituted, and is an improvement; but is not equal to pipes and collars, nor generally cheaper than they are.

Almost forty years ago, small pipes for land-drainage were used concurrently by the following parties, who still had no knowledge of each other's operations:—Sir T. Wichcote, of Asgarby, Lincolnshire (these we believe were socket-pipes)—Mr. R. Harvey, at Epping—Mr. Boulton at Great Tew, in Oxfordshire (these were porcelain 1-inch pipes made by Wedgwood, at Etruria)—and Mr. John Read, at Horsemonden, in Kent. Most of these pipes were made with eyelet-holes to admit the water. Pipes for thorough draining were incidentally mentioned in the Journal of the Agricultural Society, for May 1843, but they excited no general attention till they were exhibited by John Read (the inventor of the stomach-pump) at the Agricultural Show at Derby in that year. A medal was awarded to the exhibitor. Mr. Parkes was one of the Judges, and brought the pipes to the special notice of the Council, and was instructed by them to investigate their

* The tile has been said, by great authorities, to be broken by contraction, under some idea that the clay envelopes the tile and presses it when it contracts. That is nonsense. The contraction would liberate the tile. Drive a stake into wet clay; and when the clay is dry, observe whether it clips the stake tighter or has released it, and you will no longer have any doubt whether expansion or contraction breaks the tile. Shrink is a better word than contract.

use and merits. From this moment inventions and improvements huddle in upon us faster than we can describe them. Collars to connect the pipes, a new form of drain, tools of new forms,—particularly one by which the pipe and collar are laid with wonderful rapidity and precision, by an operator who stands on the top of the drain—and pipe-and-collar-making machines (stimulated by repeated prizes offered by the Royal Agricultural Society), which furnish those articles on a scale of unexampled cheapness. For all these inventions and adaptations we are mainly indebted to Mr. Parkes. The economical result is, a drain 4 feet 6 inches deep, excavated and refilled at from $1\frac{1}{4}d.$ to $2d.$ per yard—the workmen earning 12s. and upwards per week; and $333\frac{1}{3}$ yards of collared $1\frac{1}{4}$ -inch pipes for 18s.—being 12s. per thousand for the pipes, and 6s. per thousand for the collars; larger sizes at a proportionate advance. We shall best exemplify the improvements to our readers by describing the drain. It is wrought in the shape of a wedge, brought in the bottom to the narrowest limit which will admit the collar by tools admirably adapted to that purpose. The foot of the operator is never within 20 inches of the floor of the drain; his tools are made of iron plated on steel, and never lose their sharpness, even when worn to the stumps; because, as the softer material, the iron, wears away, the sharp steel edge is always prominent. The sloping sides of the drain are self-sustaining, and the pressure on its floor is reduced to a minimum; the circular form of the pipe and collar enables them to sustain any pressure to which they can be subjected; the adaptation of the bed in which they lie to their size prevents their wriggling. They form a continuous conduit, and whose continuity cannot be broken except by great violence. However steep the drain, the water running in the pipe can never wash up its floor. They offer almost insuperable impediments to the entrance of vermin, roots,* or anything

* I am afraid that I must materially modify this expression, as far as roots are concerned. The words “almost insuperable impediments” are

except water, and they are more portable both to the field and in the field than any other conduit previously discovered : cheap, light, handy, secure, efficacious.

Perhaps some of our readers will boggle at this word efficacious. Doubts will begin to trouble inexperienced minds ;—Will water get freely into these narrow-bottomed drains ? Will pipes of this small capacity convey it away ? The scepticism is natural ; but on each point we are able to offer them abundant consolation and conviction—consolation from experience, conviction on argument. We have seen hundreds of drains wrought in the manner we have described, and laid with pipes, and in no instance where the land contained water of drainage have they failed to run freely. We never heard any one say they did not. This ought to satisfy every person who is not of his own knowledge aware of an instance to the contrary : “ Quod semper,

not applicable. My own experience as to roots, in connexion with deep pipe draining, is as follows :—I have never known roots to obstruct a pipe through which there was not a perennial stream. The flow of water in summer and early autumn appears to furnish the attraction. I have never discovered that the roots of any esculent vegetable have obstructed a pipe. The trees which, by my own personal observation, I have found to be most dangerous, have been red willow, black Italian poplar, alder, ash, and broad-leaved elm. I have many alders in close contiguity with important drains, and, though I have never convicted one, I cannot doubt that they are dangerous. Oak, and black and white thorns, I have not detected, nor do I suspect them. The guilty trees have in every instance been young and free growing ; I have never convicted an adult. These remarks apply solely to my own observation, and may of course be much extended by that of other agriculturists. I know an instance in which a perennial spring of very pure and (I believe) soft water is conveyed in socket pipes to a paper-mill. Every junction of two pipes is carefully fortified with cement. The only object of cover being protection from superficial injury and from frost, the pipes are laid not far below the sod. Year by year these pipes are stopped by roots. Trees are very capricious in this matter. I was told by the late Sir R. Peel that he sacrificed two young elm trees in the park at Drayton Manor to a drain which had been repeatedly stopped by roots. The stoppage was nevertheless repeated, and was then traced to an elm tree far more distant than those which had been sacrificed. Early in the autumn of 1850 I completed the drainage of the upper part of a boggy valley, lying, with ramifications, at the foot of marly banks. The main drains converge to a common outlet, to which are

quod ubique, quod inter omnes " is, if we remember right, a sufficient ground of faith ; but, on argument, the water must get into the drain, and must get into the pipes. This is a matter on which we have seen even sensible men so muddle-headed that we fear we must be elementary. We will assume the drain to be 4 feet deep, and the water-table to be at 1 foot below the surface of the earth. Every particle of water which lies at 3 feet below the water-table has on it the pressure of a column of water 3 feet high ; this pressure will drive the particle in any direction in which it finds no resistance, with a rapidity varying inversely to the friction of the medium through which the column acts. The bottom of our drains will offer no resistance, and into it particles of water will be pushed, in conformity with the rule which we have stated : rapidly, if the medium opposes little friction ; slowly, if it opposes much. The water so pushed in runs off by the drain, the column of pressure

brought one 3-inch pipe and three of 4 inches each. They lie side by side, and water flows perennially through each of them. Near to this outlet did grow a red willow. In February, 1852, I found the water breaking out to the surface of the ground about 10 yards above the outlet, and was at no loss for the cause, as the roots of the red willow showed themselves at the orifice of the 3-inch and of two of the 4-inch pipes. On examination I found that a root had entered a joint between two 3-inch pipes, and had travelled 5 yards to the mouth of the drain, and 9 yards up the stream, forming a continuous length of 14 yards. The root which first entered had attained about the size of a lady's little finger ; and its ramifications consisted of very fine and almost silky fibres, and would have cut up into half a dozen comfortable bores. The drain was completely stopped. The pipes were not in any degree displaced. Roots from the same willow had passed over the 3-inch pipes, and had entered and entirely stopped the first 4-inch drain, and had partially stopped the second. At a distance of about 50 yards a black Italian poplar, which stood on a bank over a 4-inch drain, had completely stopped it with a bunch of roots. The whole of this had been the work of less than 18 months, including the depth of two winters. A 3-inch branch of the same system runs through a little group of black poplars. This drain conveys a full stream in plashes of wet, and some water generally through the winter months, but has not a perennial flow. I have perceived no indication that roots have interfered with this drain. I draw no general conclusions from these few facts, but they may assist those who have more extensive experience in drawing some, which may be of use to drainers.—T. G.

being diminished in proportion to the water which runs off. Into the spot which offers no resistance, be it large or be it small, the water above that level must be pushed till the column is so reduced that its weight will not overcome friction. As friction will be greatest at the intermediate point between two parallel drains, the water will stand a little highest at that point and will decline in a regular gradation to the level of the bottom of each drain. Take a familiar illustration—for, like Walter Blith, we are obliged to use repetitions, though we will not follow his example in saying why. In a soil which is saturated with water—(and by saturated we mean that, in addition to its water of attraction, it has the interstices between its particles filled with water of drainage)—sink a deep hole, no matter how narrow; it will stand full of water. Draw the water out rapidly—it will fill again from the bottom. Into the space where there is no resistance the water must come. This is a parallel case to the bottom of the drain from which the water runs off—the point of non-resistance remains, and to it all the water in the soil must come up to the limit which we have above assigned. Will the small pipes carry off the water? This is a mere question of capacity, and can be decided by accurate calculation; the calculation is given at length in pp. 43-45 of Mr. Parkes's Essays. We will only state the result. If an acre of land be intersected with parallel drains 12 yards apart, and if on that acre should fall the very unusual quantity of 1 inch of rain in 12 hours, in order that every drop of this rain may be discharged by the drains in forty-eight hours from the commencement of the rain—(and in a less period that quantity neither will, nor is it desirable that it should, filter through an agricultural soil)—the interval between two pipes will be called upon to pass two-thirds of a table-spoonful of water per minute, and no more. Inch pipes, lying at a small inclination, and running only half-full, will discharge more than double this quantity of water in forty-eight hours. The mains or receiving drains are of

course laid with larger pipes. Experience has established this average, that a 3-inch pipe will discharge the water of 9 acres, 4 of 16, and so on; the quantity of acres being equal to the product of the diameter of the pipe in inches multiplied into itself.

We were astounded to find at the conclusion of Mr. Parkes's Newcastle Lecture this sentence:—"It may be advisable for me to say, that in clays, and other clean-cutting and firm-bottomed soils, I do not find the collars to be indispensably necessary; although I always prefer their use." This is a barefaced treachery to pipes: an abandonment of the strongest point in their case—the assured continuity of the conduit. Every one may see how very small a disturbance at their point of junction would dissociate two pipes of 1 inch diameter. One finds a soft place in the bottom of the drain, and dips his nose into it 1 inch deep, and cocks up his other end. By this simple operation the continuity of the conduit is twice broken. An inch of lateral motion produces the same effect. Pipes of a larger diameter than 2 inches are generally laid without collars; this is a practice on which we do not look with much complacency; it is the compromise between cost and security, to which the affairs of men are so often compelled. No doubt a conduit from 3 to 6 inches in diameter is much less subject to a breach in its continuity than one which is smaller; but when no collars are used, the pipes should be laid with extreme care, and the bed which is prepared for them at the bottom of the drain should be worked to their size and shape with great accuracy.

To one advantage which is derived from the use of collars we have not yet adverted—the increased facility with which free water existing in the soil can find entrance into the conduit. The collar for a $1\frac{1}{2}$ -inch pipe has a circumference of 3 inches. The whole space between the collar and the pipe on each side of the collar is open, and affords no resistance to the entrance of water; while at the same time the superincumbent arch of the collar protects the

junction of two pipes from the intrusion of particles of soil. We confess to some original misgivings that a pipe resting only on an inch at each end, and lying hollow, might prove weak and liable to fracture by weight pressing on it from above ; but the fear was illusory. Small particles of soil trickle down the sides of every drain, and the first flow of water will deposit them in the vacant space between the two collars. The bottom, if at all soft, will also swell up into any vacancy. Practically, if you re-open a drain well laid with pipes and collars, you will find them reposing in a beautiful nidus, which, when they are carefully removed, looks exactly as if it had been moulded for them.

And now for the controversy between the deep and the shallow.

We shall dismiss with a very few words two classes of writers on the subject of draining—1st. Those who limit the advantages of a drain to the water which is passed into it from its own surface, and who therefore enjoin that it should be filled with porous material, and that it should be shallow. 2nd. Those who will not drain 4 or 5 feet deep because it makes the ground too dry for the roots of plants. This idea must have come from some garret, having been conceived by an ingenious recluse brooding over his ignorance, and reasoning as follows :—What makes vegetation burn up? The absence of water from its roots. What takes away the water? Deep drains. Ergo, deep drains are the cause of burning. We will supply a formula :—Why does vegetation burn? Because its roots are very superficial. Why superficial? Because they won't face the cold of stagnant water. What removes the cold and the water? Deep drains. And the facts exactly coincide with our logic. Deep-drained lands never do burn. Nothing burns sooner than a few inches of soil on a very retentive clay. No land is less subject to burn than the same soil when, by 4 or 5 feet draining, a range of 3 or 4 feet has been given to the previously superficial roots.

Having dismissed these two small matters, we must

treat more respectfully a lingering scepticism as to the efficacy of deep drains in very retentive soils; and instead of wondering at this scepticism, we wonder rather that deep thorough-draining has so rapidly made converts. Representations are made of soils which consist of some inches of a moderately porous material reposing on a subsoil which is said to be impervious; and we are told that it is of no use to make the drain deeper into the impervious matter than will suffice for laying the conduit. If the subsoil is impervious, as glass or even as cast-iron or caoutchouc are impervious, we at once admit the soundness of the argument. We only want to ask one question—Is your subsoil moister after the rains of mid-winter than it is after the drought of midsummer? if it is, it will drain. Mr. Mechi asks, shrewdly enough, “If your soil is impervious, how did you get it wet?” This imperviousness is always predicated of strong clays—plastic clays they are sometimes called. We really thought that no one was so ignorant as not to be aware that clay lands always shrink and crack with drought, and the stiffer the clay the greater the shrinking, as brickmakers well know. In the great drought 36 years ago, we saw, in a very retentive soil in the Vale of Belvoir, cracks which it was not very pleasant to ride among. This very summer, on land which, with reference to this very subject, the owner stated to be impervious, we put a walking-stick 3 feet into a sun-crack without finding a bottom, and the whole surface was what Mr. Parkes not inappropriately calls a net-work of cracks. When heavy rain comes upon the soil in this state, of course the cracks fill, the clay imbibes the water, expands, and the cracks are abolished. But if there are 4 or 5 feet parallel drains in the land, the water passes at once into them, and is carried off. In fact, when heavy rain falls upon clay lands in this cracked state, it passes off too quickly, without adequate filtration. Into the fissures of the undrained soil the roots only penetrate to be perished by the cold and wet of the succeeding winter; but in the drained soil the roots follow the threads of vegetable mould which have been washed into

the cracks, and get an abiding tenure. Earth-worms follow either the roots or the mould. Permanent schisms are established in the clay, and its whole character is changed. An old farmer in a midland county began with 20-inch drains across the hill, and, without ever reading a word, or, we believe, conversing with any one on the subject, poked his way step by step to 4 or 5 feet drains in the line of steepest descent. Showing us his drains this spring, he said—"They do better year by year; the water gets a habit of coming to them." A very correct statement of the fact, though not a very philosophical explanation. Year by year the average dryness of the soil increases, the cracks are further extended, and seldomer obliterated. A man may drain retentive soils deep and well, but he will be disappointed if he expects what is unreasonable. No intelligent and honest operator will say more, than that money judiciously expended in draining them will pay good, and generally very good, interest. If you eat off turnips with sheep, if you plough the land, or cart on it, or in any way puddle it when it is wet, of course the water will lie on the surface, and will not go to your drains. A 4-feet drain may go very near a pit or a water-course without attracting water from either, because water-courses almost invariably puddle their beds, and the same effect is produced in pits by the treading of cattle, and even by the motion of the water produced by wind. A very thin film of puddle always wet on one side is impervious, because it cannot crack.

No system of draining can relieve soils of water-of-attraction. That can only be exhausted by evaporation. Retentive soils hold it in excess; its reduction by evaporation produces cold; and therefore retentive soils never can be so warm as porous. Expect reasonable things only of your drained retentive soils, and you will not be disappointed. Shallow drainers start with the idea of a drop of water falling on the top of the soil, and working its solitary way through narrow and tortuous passages to a drain; and they say that it would be lost in the labyrinth, which we think very likely. They have no idea that the

water operated upon by the drain is that which lies at the level of its own bottom, which runs off, and is replaced by that which was immediately above it. And on account of this operation, which we have before explained, it is necessary in retentive soils, in which friction is greater than in porous, to have the drains deeper, in order to lower the water-table to the same extent. A column of 6 inches may suffice to push water from the intermediate point between two drains in a porous soil, and it may require a 12-inch column in a retentive. In that case the drain in the retentive soil must be 6 inches deeper than in the porous. Ignorance says, Drain shallower because your soil is retentive. Experience and reason say, Drain deeper. We may here notice, that in clay lands the portion within 1 or 2 feet of the surface is almost always more retentive than that which lies below; simply, we apprehend, because its particles have been comminuted and packed close by the alternate influences of wet and dry, heat and cold. When dried below by drains, and above by evaporation, it is certain to crack and become permeable; and this operation may, if necessary, be assisted by subsoiling or other artificial means.

The practice of deep thorough-draining is not quite new in England, for, if we remember right, Arthur Young states that the best draining which he saw in his agricultural tour was in Yorkshire, on an estate of Lord Rockingham's, by parallel drains 4 feet deep running in the line of steepest descent. Nothing more was heard of the matter till a few successful cases in Kent and Sussex were offered to the notice of agriculturists. No sooner, however, was the practice advocated strongly by Mr. Parkes and others, than a host of correspondents of various agricultural publications furnished more instances of the abandonment of deep draining on account of failure than, we verily believe, they could have authenticated cases of practice. Probably it is not now necessary to advert further to such statements. We believe that they have

subsided into quiet oblivion. The practice so derided and maligned has advanced with wonderful strides. We remember the days of 15 inches; then a step to 20; a stride to 30; and the last (and probably final) jump to 50, a few inches under or over. We have dabbled in them all, generally belonging to the deep section of the day. We have used the words "probably final" because the first advances were experimental, and, though they were justified by the results obtained, no one attempted to explain the principle on which benefit was derived from them. The principles on which the now prevailing depth is founded, and which we believe to be true, go far to show that we have attained all the advantages which can be derived from the removal of water in ordinary agriculture. We do not mean that, even in the most retentive soil, water would not get into drains which were laid somewhat deeper; but to this there must be a not very distant limit, because pure clay, lying below the depth at which wet and drought applied at the surface would expand and contract it, would certainly part with its water very slowly. We find that, in coal mines and in deep quarries, a stratum of clay of only a few inches thick interposed between two strata of pervious stone will form an effectual bar to the passage of water; whereas, if it lay within a few feet of the surface, it would in a season of heat and drought become as pervious as a cullender. But when we have got rid of the cold arising from the evaporation of free water, have given a range of several feet to the roots of grass and cereals, and have enabled retentive land to filter through itself all the rain which falls upon its surface, we are not, in our present state of knowledge, aware of any advantage which would arise from further lowering the surface of water in agricultural land. Smith, of Deanston, first called prominent attention to the fertilizing effects of rain filtered through land, and to evils produced by allowing it to flow off the surface. Any one will see how much more effectually this benefit will be attained, and this evil

avoided, by a 4-feet than by a 2-feet drainage. The latter can only prepare 2 feet of soil for the reception and retention of rain, which 2 feet, being saturated, will reject more, and the surplus must run off the surface, carrying whatever it can find with it. A 4-feet drainage will be constantly tending to have 4 feet of soil ready for the reception of rain, and it will take much more rain to saturate 4 feet than 2. Moreover, as a gimlet-hole bored 4 feet from the surface of a barrel filled with water will discharge much more in a given time than a similar hole bored at the depth of 2 feet, so will a 4-feet drain discharge in a given time much more water than a drain of 2 feet. One is acted on by a 4-feet, and the other by a 2-feet, pressure.

We have something to say on the score of authority. The late Sir Robert Peel was a great drainer. He began shallow, was disappointed at the results, and adopted deep draining. He began with miscellaneous conduits—but settled into pipes and collars. Within the last six or seven years of his life, Sir Robert Peel drained 2000 acres in the counties of Warwick, Stafford, and Lancaster—a portion (perhaps considerable) on the requisition of tenants. Reports were industriously circulated, by speech and writing, that Sir Robert was dissatisfied with the results of his deep draining, in consequence of which a letter was addressed to him, to which he gave a prompt reply. He laid his correspondent under no restrictions as to the use of that reply, and it has been kindly communicated to us. We extract the following sentences:—

“It is utterly untrue that I am dissatisfied with the experiment of deep draining. I have had many prejudices to contend against; the purely stupid ones against any novelty—any innovation on the old system of agriculture; those, too, prompted by self-interested jealousy of the new machinery which innovation renders necessary. . . . I have permitted some drains to be laid at less than 4 feet, partly to humour tenants, on strong clays, who wished to

avoid the expense of very close draining at the additional depth. . . . If I had a field in my own occupation, of stiff clay, I should place close drains 21 or perhaps 18 feet apart; but I should prefer 4 feet, notwithstanding the additional expense, to 3."

After a caution against dogmatizing and presuming "that a rule good in their own case must necessarily be good in every other," he thus proceeds:—

"I can conceive a case in which, if you had a limited sum to expend—say 4*l.* an acre—the nature of the ground might be such that the increased closeness might compensate for diminished depth—I mean, for instance, that drains 18 feet apart and 3 feet deep might be more effectual than drains 25 feet apart and 4 feet deep."

Sir Robert then touches on the importance of "breaking up that indurated mass which the trampling of many successive years has formed," to which, as he says, sufficient attention is seldom paid. Probably the words "in my own occupation," quoted above, have reference to the consciousness of the writer that stiff clays are frequently so occupied after drainage as to render the operation of little or no value. The whole letter shows a complete acquaintance with the subject of thorough-draining.

Perhaps the Earl of Lonsdale was the first large land-owner who, *by personal observation*, became convinced of the agricultural advantages of deep draining. He picked up this knowledge during his able superintendence of the metropolitan roads, and has applied it very diligently on his extensive estates, and is, we believe, applying it still. But he must speak for himself. On the 22nd Sept., 1849, at an agricultural gathering in Carlisle, he made the following very decisive observations:—

"My noble friend has alluded to my draining. I will tell you frankly where I learnt the art. My noble friend has spoken of my management of the metropolitan roads. That was a little plaything compared to what I have since experienced. It is a fact, however, that I learned draining

not in the country, but in the town, even in the great town of London, and then forgot it until I came in possession of my property in Westmoreland and Cumberland. Many of you, I dare say, know that some portion of the county of Middlesex is low and flat, with a strong clay. We found that what we called shallow draining took a little water off the surface of the roads, but did not strengthen or harden the foundations; the roads were soon in as bad a state as ever. After various consultations upon the subject with a friend of mine, we determined to drain 5 or 6 feet deep. From that moment their maintenance did not involve half the previous expense. We had extensive powers in that Act, and I remember on one occasion we were driving a drain through a gentleman's garden, which it was necessary to do on that particular spot. The owner, of course, was offended, and cried out: he lustily protested against our interference, appealed to the Legislature, and in every way opposed our measures. We, however, persevered in our drainage; and two years afterwards the same gentleman came to us and said, 'I can't think what has happened to my garden, for the vegetables come a month earlier than they used to do, and remain good on the ground a month later.' Originally, I admit, then, I learned draining in the metropolitan roads; and all my other experience in later years leads me to think, notwithstanding what has been said in its favour, that shallow draining of 2 feet, or $2\frac{1}{2}$ feet deep, is three-fourths of your money thrown away. I know gentlemen at public meetings are apt to make concessions about draining, but upon that point I am very firm, because I believe, nay, I know, I am sure, that deep draining is decidedly the best; and I never yet in all my experience—and I have gone over as much land as any one in the kingdom, for though late in life I have again taken to the chase, and keep a pack of hounds at Tring; and, with reference to Hertfordshire, Buckinghamshire, Oxfordshire, and Bedfordshire, I can say that I am perpetually riding over farmers' lands in those counties, and I

know, I say, as well to what depth that land is drained as if I had seen or done it myself. I look upon it, and I wish you to view it in the same light, that when you are putting in shallow drains you are incurring a dead loss; and I would urge you to examine the difference between the effect of the two systems, for nothing can be more striking than the contrast presented by land under deep and shallow draining. I have seen this exemplified on the estates of two friends of mine, the Duke of Northumberland and the Duke of Bedford, two noblemen of very opposite opinions, and each residing in different parts of the country, but both most energetic in endeavouring to improve their lands. The Duke of Bedford, although his predecessor laid out large sums of money in shallow draining, has now entirely discarded the system. In fact, deep draining is the only system that can with a certainty of success be adopted; and I would advise you, gentlemen, before you lay out money upon what is called shallow draining—especially as capital is not yet cheap, and you would still have to pay more than $3\frac{1}{2}$ per cent. for it—to consult and examine those lands that have been subjected to the other system. In particular soils, no doubt, you may drain a little too wide, and you will have to rectify the evil, as it is called, afterwards; but as to the depth of the drain, there can be no dispute. It was only the other day I received a report from a tenant on a farm of my own near Whitehaven, which was as wet a place as could be conceived, and I believe the land was rather looked upon with dismay by the farmer when he saw it cut and hacked about in that fashion; but this year he has reaped the benefits of deep draining, and he reports to me that while the occupiers of the adjoining farms formerly always secured their crops before him, he now gets his in before any of them, and his harvest this year has come three weeks earlier than usual. Such has been my experience on this important subject."

Space forbids our taking more than a passing notice of

the Acts of Parliament which have been recently passed for advancing public, and facilitating the advance of private, money on the security of lands to be improved by draining. They mark the strong hold which the subject has on the minds of agriculturists. Both the Acts and the evidence on which they are founded will be interesting to those landowners who require *as alienum* to assist in carrying out their improvements.

One word with our readers before we part. They may dislike the terms to the use of which we have been driven, and we are by no means unconscious of their imperfections; but we hope that we have so limited them by definition as to remove much of their ambiguity. Our purpose has been to bring, in a connected view, before them the objects and the advantages of thorough-draining, and to explain in a popular way the principles on which those objects are carried out and those advantages are attained. That to remove water, which is either injurious to vegetation or obstructive to agricultural operations, is one object of draining, is patent to every one. That if it be removed by superficial discharge it will carry off with it elements beneficial to vegetation, because they form the most soluble part of soils, no one will doubt, though he may not have fully realized to himself what very hateful things furrows, and ditches, and water-grips, and other artificial aids to this superficial discharge really are. It requires but little observation to discover that, with few exceptions, porous soils are fertile, and, with equally few, very retentive soils are sterile. But the persons are less numerous who are aware that the greatest object and the most important advantage of thorough-draining is, that it warms and ventilates retentive soils. Of warmth we have spoken largely. Ventilation is more obscure. But close observation of agriculture and of horticulture will not allow us to doubt that alternation of fresh air and of fresh water are conducive to fertility. It is not unreasonable to suppose that as stagnant air ceases to sustain the lives of men and ani-

mals, and stagnant water the lives of fishes, so stagnant air and water may cease to administer to the purposes of vegetation. In cultivable land in our climate, porousness, either natural or artificial, is the only known avenue to warmth and ventilation.

Some points of practice have found their way into our dissertation, but we have not sought to give a manual—indeed, we have studiously endeavoured to avoid it. If we should give a stimulus to amateur draining, we shall do a great deal of harm. We wish we could publish a list of the moneys which have been squandered in the last forty years in amateur draining, either ineffectually or with very imperfect efficiency. Our own name would be inscribed in the list for a very respectable sum. Every thoughtless squire supposes that by the aid of his ignorant bailiff he can effect a perfect drainage of his estate; but there is a worse man behind the squire and the bailiff—the draining conjuror. We knew a jockey at Newmarket, a solemn and mysterious man. His first master told us that he was an idiot—that he could never in his life get a reason from him. “But,” said he, “he is an inspired idiot on horseback.” So the village conjuror, by dint of mystery and one lucky hit among a score of failures, is supposed to receive inspiration as soon as he takes the draining spade in his hand. These fellows never go direct about their work. If they attack a spring, they try to circumvent it by some circuitous route. They never can learn that Nature shows you the weakest point, and that you should assist her—that *Hit him straight in the eye* is as good a maxim in draining as in pugilism. An evangelical clergyman complained to the Rev. Charles Simeon that when he wished to preach extempore, utterance was denied to him; he supposed because he lacked faith. “*Olli subridens*,” the venerable man replied; “No, my dear brother, justification is by faith, but extempore preaching is by works.” Neither the squire nor the bailiff nor the conjuror lacks faith, but they are sadly deficient in good works—in edu-

cation, in knowledge, in science, in accurate thought, in experience—in short, in everything which in complicated operations conduces to success. If you wish to drain, we recommend you to take advice. We have disposed of the quack, but there is a faculty, not numerous but extending, and whose extension appears to us to be indispensable to the satisfactory progress of improvements by draining—a faculty of draining engineers. If we wanted a profession for a lad who showed any congenial talent, we would bring him up to be a draining engineer.

What we preach we practise. After thirty-six years of experience, we became tired of struggling with unskilful workmen, bad tools, and worse supervision. A perusal of one of Mr. Parkes's essays induced us to look carefully into his works, and we then asked his assistance. Of course we do not mention Mr. Parkes's name to the exclusion of, or even in preference to, that of any other engineer who may have equal abilities and attainments; and if we did, we should only lead the great majority of those who wish to drain into error, for we believe that, except in cases of considerable extent, it is hardly possible to secure his services. We cannot disparage our own skill, and in truth we called in Mr. Parkes as a measure of economy. A short detail of our proceedings (similar, no doubt, to those of other land-owners with other engineers) will best explain how we have secured that advantage. We proceeded together to the ground, where we made trial-holes, and concerted outfalls, and directions, and depths, and frequency. We have no doubt that Mr. Parkes would have been quite as well satisfied to settle all these points without any concert on our part. Then we began to differ. We were impatient, and wanted to begin, but Mr. Parkes would not turn a sod till he saw pipes and tools and fifteen tolerable spademen, with their ordinary spades and picks, on the ground. He furnished us with a list of tools, which we procured from Mr. A. Lyndon of Birmingham. They appear to be of a very enduring sort, and are extremely

liked by the workmen; a set for from fifteen to twenty men costs five guineas. Mr. Parkes calculated the number and sizes of the pipes which would be required, and then made the contract for them—certainly 10 per cent. lower than we should have procured them, simply because the makers knew that Mr. Parkes was well aware at what price they could be afforded, and was prepared, in case of necessity, to establish a tilery, as he had previously done on estates in several counties. Pipes, tools, and spademen being at length provided, Mr. Parkes brought a foreman, with whom he set out drains, and left the work under his superintendence. To this man we paid 20s. per week. He understood pretty accurately the prices of work, and dealt fairly between the employer and the labourers. He instructed them in the use of the new tools. He measured up the work, kept the accounts, paid the men, and *laid every pipe and collar with his own hands*. It would be scarcely more absurd to set a common blacksmith to eye needles, than to employ a common labourer to lay pipes and collars. For these services we paid to Mr. Parkes 5s. per acre drained, and some travelling expenses. In each of the two years preceding that on which we had Mr. Parkes's assistance, we drained similar and adjoining land. We do not believe that Mr. Parkes would have varied either the direction or the depth of any of our drains. He would have made them less frequent—intervals of 12 yards instead of 10, and 10 instead of 8. Allowing for this, we find that the saving on Mr. Parkes's draining, after it is debited with every charge, is more than 10s. per acre. We verily believe that, in the case of a totally-inexperienced land-owner or bailiff, the saving would be reckoned by pounds, not by shillings. Our readers will expect that we should say something about cost. We do not think that we ever saw so favourable a combination of circumstances, that efficient thorough-draining of retentive land could be executed at from 4 to 5 feet deep, under 4*l.* per acre. We have seen few or no cases in which it might not be executed

for 5*l*. The minimum price for excavating and refilling a 4-feet 6-inch drain is, according to our experience, 1½*d*. per yard. This low price is generally in those clays which require the most frequent drains. The maximum, 2½*d*., except in cases where there is actual rock. The frequency with which the pickaxe is used is nearly an accurate measure of the necessary advance of price.

Our parting word shall assure our readers, that every reported case of failure in draining which we have investigated has resolved itself into ignorance, blundering, bad materials, or bad execution.

POSTSCRIPT.

SINCE the substance of this Essay was first published, a dry March has afforded us the opportunity of investigating accurately the effects of some drainages executed in the manner which we have recommended. In the winter of 1846-7 we drained a portion of an old forest which had never received any culture—drains 4 feet 6 inches deep, in the line of steepest descent, parallel, 9 yards apart, the conduit formed of 1-inch and 1½-inch pipes collared, the shape of the land a regular plane, with an inclination of about 1 inch in a yard. Six inches of light brown moderately friable soil on a *very* retentive clay, which passed at 4 feet deep into a somewhat opener clay or marl. Surface before drainage plashy in wet weather, and covered with a fuzzy grass, blue in summer and white in winter, on which no animal would willingly graze, and barely worth, to let, 5*s*. per acre. In the first summer after drainage the herbage was visibly improved. In the second autumn the cattle grazed it bare. During the second winter it was covered with a dressing of lime and soil, at an expense rather under 5*l*. per acre. In this, the third summer, it has a very good herbage, and any neighbouring farmer would give for it, to graze only, 25*s*. per acre. We con-

sider the expenditure on this land to have paid about 10 per cent. At the end of a dry fortnight in March we sunk a trial-hole, 6 feet long, 2 feet wide, and 5 feet deep, in the direction of the drains, and at the intermediate point between two. The water in the hole stood at 4 feet 3 inches from the surface, or 3 inches above the bottom of the drains. During a fortnight which passed without material rain, the level of this water-table was not perceptibly varied. A pash of rain then raised it about six inches, but four dry days reduced it to its previous level. Every face of the trial-hole was a net-work of cracks. We consider this draining to have done its work effectually; and we had the pleasure of showing this trial-hole to two considerable land-agents, who had previously doubted the efficiency of 4-feet draining in very retentive land. Early in the autumn of 1849 we drained land very similar to that just mentioned, and similarly in all respects, save that the drains were 12 yards apart. Simultaneously with the trial-hole above mentioned, we sank three of the same depth, dimensions, and direction, at points, 4, 5, and 6 yards respectively from one of these more recent drains. The water stood in these holes at 2 feet 2 inches and 2 feet 3 inches from the surface, and during the dry fortnight sunk from 1 inch, decreasing regularly, to half inch per day. The pash of rain above mentioned raised this water to within 15 inches of the surface. It then subsided in a ratio diminishing from $1\frac{1}{2}$ inch to half inch per day, till, by the crumbling of the sides, and consequent puddling of the bottom, these holes lost their experimental character. This trial confirmed our previous experience, by showing that retentive land deep drained does not effectually part with its water, till a considerable period of drought, heat, and perhaps vegetation, has passed over it. Our third investigation was on land of nearly the same character and slope as those which we have named, differing, however, in that it was overhung by a hill rising at 5 or 6 inches in the yard to the height of 50 feet, the rise terminating in a

plain of some extent. The steep ground had a subsoil of semiporous marl, was not drained, and showed little sign of wet. The drains in the lower land were in the line of its descent, and were driven well into the point where the steeper rise commenced. In this ground we sunk four trial-holes at points equidistant from the drains, and in their direction. The appearances disclosed by three of these holes were not satisfactory. The water-table was less lowered than in the previous case, and even after they had been opened and exposed to a dry wind for some days, their faces, and that which fronted the hill in particular, remained dark and damp, and water was evidently squeezing through them. In the fourth trial-hole the water-table stood several inches lower than in the other three, and all its faces exhibited the cracked appearance which is usual in well-drained land. About 3 yards from the upper end of this fourth trial-hole a deep drain passed between it and the hill. The inevitable conclusion appears to be, that, in land so situated as we have described, some sort of cutting off drainage is essential to a perfect cure. A single deep drain passing under the hill, at the point where the steeper rise begins, may not be effectual, because, whenever its depth (be it 4, 5, or 6 feet) is exhausted by the fall of the land, the water from the higher ground having passed under it will appear at the surface. We are about to drain some land similarly circumstanced, and we have set out the drains in the direction which a collier expressively calls half-rise, bisecting the right angle formed by the line of steepest descent and the horizontal line. We hope by this compromise to secure, with respect to every portion of the land drained, most of the advantages of a drain in each of these directions.

The late Sir R. Peel took an interest in the reprint of this Essay. On the morning of the day on which he made his last speech in the House of Commons, he addressed a letter to us on the subject of the reprint. We cannot, indeed, we know not why we should, deny ourselves the

gratification of quoting from his letter the following testimony—"I do not think that the article admits of improvement by addition, certainly not by omission." Sir Robert then suggests that drawings of some of the necessary draining tools should accompany the reprint. We have selected from a sheet of patterns, furnished to us by Mr. Walter Adams Lyndon, of Birmingham, those tools without which, in our opinion, 4 or 5 feet drains cannot be neatly or economically executed.

A suggestion made by Sir R. Peel in the letter to which we have referred, will carry most weight if given in his own words: "Many of those who drain extensively neglect to have *a plan* of the draining of each field made at the time that the work is done. A hint as to the advantage of this might be advisable." The plough soon obliterates all superficial traces of the drains; and we know by experience how soon every one concerned either forgets, or remembers very inaccurately, their precise position.

The very inappropriate and unpleasing name of cesspool has been given to a device for securing at all times an easy inspection of the working of drains, at points in their intermediate course. At the confluence of two or more drains, or at any suspicious point in an important drain, a perpendicular drop of 2 or 3 inches is made in the floor, and (as we have seen at Drayton Manor) an earthenware article, of length proportioned to the depth of the drain, and shaped like a chimney-pot, is introduced. It is made with such holes as may be requisite for receiving the nose of a pipe from each delivering-drain at the higher level, and the nose of the discharge-pipe at the lower. In lieu of the chimney-pot, a hole a foot square, bricked up (with the same arrangement of the noses of the pipes) to the surface of the ground, will answer the same end. The top in either case may be covered with a stone flag or wooden lid. Lift up the lid, and a glance shows you whether the drains concerned are doing their duty. These peep-holes are very cheerful things. Nothing gladdens the heart of an agriculturist more

than to see his drains running merrily. In permanent grass they may be placed anywhere, and some unobtrusive corner can generally be found for them in arable land. We finish with masonry every important outfall, and consider the few shillings which this costs one of the most satisfactory items in our drainage expenditure.

July 20, 1850.

No. 1.—*Section of Land before it is Drained.*

1. Surface Soil.	3. Water of Evaporation.
2. Water-Table.	4. Water of Capillary Attraction.
5. Water of Drainage or Stagnant Water.	

No. 2.—*Section of Land after it is Drained.*

1. Surface Soil.	3. Water of Capillary Attraction.
2. Water-Table.	4. Water of Drainage, or Stagnant Water.

No. 3.

SKETCH OF THE WHEAT PLANT

at different periods of Vegetation, showing the depth to which the fibrous roots can be generally traced in free mould, taken from a drawing in the Drummond Agricultural Museum in Sterling.

DRAINING IMPLEMENTS.

ANCIENT AGRICULTURAL LITERATURE.

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ANCIENT AGRICULTURAL LITERATURE.*

EARLY in the eighteenth century Adam Dickson was born at Aberlady in the county of East Lothian. His father followed the profession of theology and the practice of agriculture, and brought up the son to his own pursuits. A liberal education at the University of Edinburgh qualified him for the former, and experience on his father's large farm, aided by intercourse "with the farmers of that opulent county, who are many of them not unfit to converse with men of letters," made him an adept in the latter. He was, says his biographer, "a man of a very lively apprehension, of an ardent mind, and of a clear and sound judgment." In 1750 he was ordained minister of Dunse in the shire of Berwick; but even at that early period the anticipatory growlings of the storm which was destined a century later to rend the Kirk of Scotland in twain, were now and then heard, and an opposition to his settlement was raised among the parishioners of Dunse. Such, however, were "the ability, good sense, and engaging temper of Mr. Dickson, and such the candour and generosity of his conduct, that his most sanguine opponents soon became his greatest friends." Having thus happily

* "The History of Agriculture in Ancient, Mediæval, and Modern Times." By Chandos Wren Hoskyns, Esq. 12mo., 1849.

surmounted his ecclesiastical troubles, he had time to turn his attention to the spirited exertions which were at that period overcoming, in the county of Berwick, much greater difficulties than had been encountered by the improving agriculturists of his native shire. For several years he vexed his agricultural soul with the books of husbandry which had been published in England, and which "were ill calculated for the soil and climate of Scotland." Moreover, "many of them consisted chiefly of uncertain speculations on theories not well supported by the history of facts." By these circumstances and considerations Mr. Dickson was led to "select for himself a corner of literature for which the habits of his life had peculiarly qualified him." In the year 1764 he published the first volume of a "Treatise of Agriculture," and the second some years afterwards. With this treatise we, with some compunction, acknowledge ourselves to be entirely unacquainted, and must therefore accept the assurance of Mr. Dickson's biographer, that it "has ever since been held, not only to be the book best adapted to the practice of the Scottish farmer, but, upon the whole, one of the most judicious and practical treatises on the subject ever published in Britain." Soon after the completion of this his first work, Mr. Dickson was translated from Dunse to Whippingham in East Lothian, and there he spent the last six years of a life which was accidentally terminated by a fall from his horse. During that period he prepared for publication, "by years of anxious study," a work of considerable interest, of which we propose to give some account to our readers.

The two branches of Mr. Dickson's education qualified him better than most men who either preceded or have followed him, to trace the analogy between ancient and modern agriculture, and to supply the connecting link. In 1788 this work was printed in Edinburgh by Mr. Dickson's representatives, under the auspices of the then Duke of Buccleugh, in the form in which the materials

were left by their author; painfully deficient in the curtailment, condensation, and arrangement which they would have received if he had superintended their publication. The mere omission of duplicate, triplicate, and quadruplicate long quotations from ancient authors, accompanied at each repetition by a diffuse translation and commentary, would reduce "The Husbandry of the Ancients" from two volumes to one. To the anonymous editor we are indebted for nothing but a very common-place dedication, and a meagre account of Mr. Dickson contained in six pages.

Agricultural literature occupied a far higher position among the ancients than it has hitherto attained in our day. A mere enumeration of the names of those authors whose works remain, and the testimony which many of them bear to the merits of Mago the Carthaginian, whom they declare to have been the father of agricultural literature, will leave no doubt on the question of precedence. To Hesiod, Theophrastus, Xenophon, Cato, Varro, Virgil, Columella, Pliny, and Palladius, whom have we to oppose? A few notices of agriculture may be found in Lord Bacon's works, and Sir H. Davy wrote an agricultural book, which was by no means one of his most successful efforts; and here, as far as we know, our first class must end abruptly. We are not insensible to the merits of Arthur Young and Jethro Tull, but we can hardly put them on a par with Cato and Pliny; and we doubt whether we could not even now farm more successfully by following the directions of the two ancients than of the two moderns. We have a few pastoral and bucolic poets to whom we must oppose Theocritus and Homer, who are not included in our former list and who are infinitely superior to any of them, with the single exception of Hogg, as practical shepherds, neat-herds, and swine-herds. Nor is a study of these old writers a mere matter of fancy. We could take up almost any one of them and begin with him the agricultural year—prepare the field—sow the crop—weed it—reap it—harvest it—thresh and winnow it—ascertain the weight per

bushel, and the yield in flour or meal—market it—buy, feed, clothe, and lodge the agricultural slaves—purchase, rear, and sell the cattle and fowls—collect and prepare the manure—and make out, at the end of the year, a more accurate balance-sheet than could be furnished by half the farmers in Great Britain. For all this we are mainly indebted to Mr. Dickson. The agricultural writers had received their fair share of criticism; but it was not likely that passages which were rendered obscure by obsolete names and technical phrases would be elucidated by scholiasts and commentators—albeit doctors and professors *eruditissimi necnon illustrissimi*—to whom a modernised version would have conveyed a very imperfect idea, on account of their total ignorance of the art which was the subject of discussion. Philology could not elucidate the operations of the “*vervactor*” and “*imporcitor*” to Madame Dacier, nor could the Muse explain to Mr. Martyn the connexion between the “*buris*” and the “*stiva*.” Mr. Dickson thus alludes to some of his controversies with these profound men:—

“As all the commentators explain the passages concerning ploughs in a sense different from what I have done, it is with great diffidence that I deliver my opinion. At the same time I use the freedom to observe, that it is not in the least surprising that the whole class of commentators should go wrong in a matter of this kind, as there are none of these learned persons that seem to have given themselves the trouble to acquire any knowledge of the nature and construction of ploughs, or of the various uses of the several parts.”

He himself brings to his task competent classical knowledge, an intimate acquaintance with the existing practices of agriculture, and abundant zeal and industry. Nothing, however, can exceed the dulness of his dissertations. For instance, eleven dreary pages, and the collation of more than thirty passages from Cato, Varro, Virgil, Columella, Pliny, Saserna, and Palladius, will convince the persevering

reader that the “*vimineæ crates*” mentioned in the first *Georgic* were not, as “the learned commentator Popma,” in his controversy with Servius, supposes, dung-carts, but clod-crushers; and that the “*rastrum*” of Columella and others was identical with the “*quadridens*” of Cato, and was the implement used by the “*occator*.” Dickson appears to us to have generally succeeded in making out his point, though in some obscure passages he seems rather to have been determined to make a meaning than to have succeeded in finding one, and in those cases he is not very scrupulous about altering the text of his author. On the whole, however, he has evolved an intelligible and consistent system of agriculture as pursued by the Romans, and has brought before us some incidental but very interesting notices of the modes of cultivation practised in Greece, Sicily, Gaul, and Britain. The Reverend thresher has beat out the grain, but has left it jumbled up with the straw and chaff in one confused heap, which we will endeavour to reduce into more marketable dimensions. But before we do so we must shortly notice the more recent labourer in the same field, Mr. Wren Hoskyns. This author ventures on a far larger range than his predecessor; and though his book only consists of 160 very small pages, he finds room for a great deal of mild moralizing, and for many and rather ambitious dissertations, which have no very close connexion with the “*History of Agriculture in Ancient, Mediæval, and Modern Times*.”

Mr. Hoskyns is evidently a well-informed and accomplished man. He appears to have a genteel knowledge of practical agriculture, though in that respect he cannot be compared with our hard-handed pastor. The persevering reader will have to follow him through page after page of simple reflections, very nicely got up and prettily worded, without encountering a syllable of which he can disapprove. It is a relief to find something to deny—or even to doubt; and we present the following passage as a favourable specimen of Mr. Hoskyns’s more adventurous flights. Though

we are not prepared absolutely to contest its doctrine, Cicero and Seneca certainly rise to our minds as stumbling-blocks in the way of our according to it an unqualified assent:—

“If one may be allowed the reflection, agriculture *ought to have been* carried to greater perfection by the Romans than by any other nation. The habits of the farmer's life do—at least as far as all experience hitherto has gone—to a certain extent indispose the mind for an abstract idea. This was a marked want in the mental constitution of a Roman. When Pilate asked *What is truth?* he put a question which might be cut upon brass or adamant, to stand for ever as the characteristic question of a Roman. The first blunder of every English schoolboy, in his early attempts to translate English into Latin, is his natural and simple attempt to give a direct rendering of abstract terms from his own language into the other. Even the word *action*, the most energetic, perhaps, of abstract terms one could select at hazard, he would unconsciously endeavour to express in Latin by a word which, to every Roman ear, would mean a *sea-fight* or a *suit at law*. An abstract idea was nonsense to a Roman; a *true* story, a *true* book, or a *true* man would at once have found a place and a recognized meaning in his understanding. But when the Roman asked, *What is truth?* the question was not particular, but generic: it applied to the whole catalogue of abstract ideas; to that entire department of the human mind which is able to reflect *upon itself*, and express *thought* separate from objects.”

We must confess that this goes beyond us. Two and two are four. No idea can be more “abstract,” no thought can be more “separate from objects.” Does Mr. Hoskyns really mean that this idea was “nonsense to a Roman”?

The only portion of ancient agriculture with respect to which Mr. Hoskyns gives us any material information that is not contained in Dickson's work, is that of Egypt. Even that section, however, comprises nothing more than

the ordinary Scriptural allusions, a reference to Egyptian remains in the British Museum, a dissertation on hieroglyphics and on the origin of alphabets, and a long quotation from Pliny, descriptive of the rise and subsidence of the Nile, and of the agricultural operations consequent thereon.

Our knowledge of the subject in question has not only been confirmed, but also very much enlarged, of late years. The notices of it which occur in Diodorus, Strabo, Pliny, Plutarch, and other writers, have been brought together by Sir Gardner Wilkinson in the first volume of the second series of his "Manners and Customs of the Ancient Egyptians." They receive a most interesting illustration from the drawings which this distinguished traveller and his fellow-labourers have brought to light from the tombs. Not only is the manner in which these men of old performed the operations of husbandry placed strikingly before our eyes, but we are admitted at once into the penetralia of the economical, and, we might almost say, moral management of a farm. The owner, attended by his faithful dog, watches the work; the scribe or clerk, with his desk and double stand, containing black and red ink, receives and records the tale of corn, cattle, poultry, and even eggs; the labouring men and beasts plough, sow, reap, thresh, winnow, are rewarded and punished; and, finally, the despised neat-herd leads before us an ox, one of Pharaoh's fattest kine, whose fair proportions are, no doubt, intended to be a satire on the deformity of his attendant. Our enumeration contains less than one-half of what is vividly portrayed. Sir Gardner, intimately acquainted with present Egypt, traces in many instances the analogy which exists between ancient and modern practice. Most of our readers are probably acquainted with his work; those who are not have a rich treat in store.

We can hardly suppose that Mr. Hoskyns was ignorant of Dickson's book, which has been frequently quoted in the "Royal Agricultural Journal" and other kindred publica-

tions. We think that some recognition of the labours of a predecessor, who probably very much lightened his own task, would have been no more than a graceful tribute. Mr. Hoskyns's mediæval and modern dissertations are foreign from our present purpose. He has a long passage on the application of steam to the *cultivation* of the soil, and expresses a strong opinion that the hitherto-failures have resulted from a misdirection of the power. A steam-engine, he says, should dig, not plough. We are told that digging is a very satisfactory, ploughing a very unsatisfactory, operation. We read on the tiptoe of expectation, hoping to learn how a steam-engine shall be made to dig ; but Mr. Hoskyns cruelly passes on to determine how much coal would lift a man from the valley of Chamouny to the top of Mont Blanc. We have been obliged to qualify our praise of Mr. Hoskyns's book, which is, however, by no means uninteresting ; indeed, we rather think it is suited to a considerable class of non-agricultural readers.

Before we return to our more homely instructor, who occupies himself almost wholly with Roman husbandry, we must despatch, in a few sentences, the little information which we have been able to gather on Grecian and Carthaginian agriculture. Though Attica was arid, Laconia swampy, Megara rocky, and Corinth dependent on importation for a supply of food, the art of the husbandman was not without its literature. Pliny laments over forty Greek treatises on agriculture, which were lost in his day ; and Columella reckons them at fifty. The pursuit may not have been held in high esteem, but its operations were certainly familiar to the educated class. Hesiod was strictly an agricultural writer ; and the allusions to farming operations in Homer and Theocritus are definite, and entirely practical. Eubæus, *σὺβάτης ὄρχαμος ἀνδρῶν*, is no fanciful swine-herd ; and, however ideal the ditties of Lycidas and Thyrsis may be, their shepherding is quite real. In the passage relating to the capture of Dolon, Hector's spy, Pope, following Madame Dacier, has made a sad hash

of a simile which is perfectly plain to those who understand the proprieties of ploughing. In the agricultural compartment of Achilles' shield, we see before us no poetical field, but a deep loamy fallow, the texture and colour of which indicate that it is receiving its third furrow; and in the crop of grain which is falling before the sickle, we have an accurate division of labour which a Norfolk farmer might do well to imitate:—

βασιλῆς δ' ἐν τοῖσι σιωπῇ,
Σκῆπτρον ἔχων, ἐστέκει ἐπ' ὄγμου γηθόσυνος κῆρ.

This must have been in the palmy days of protection. Probably few of our living poets would be capable of giving, and as few of their readers of appreciating, so detailed an account of the simplest farming operations. These notices of agriculture in Herodotus and Thucydides are only incidental; but a work by Theophrastus, which has descended to us, is by no means, as Mr. Hoskyns intimates, a mere “botanical catalogue of plants.” It contains many useful practical directions, and frequently discriminates, with much accuracy, between the modes of husbandry suited to different countries and climates.

Xenophon is said to have bought and occupied a farm near Smyrna, where he wrote the agricultural treatise commonly called his *Œconomicks*, and which is frequently appended to the *Memorabilia*. It treats of farming, gardening, and household management, under which last head it gives valuable instructions for the government of wives. Cicero praises this treatise highly. It contains the passage in which Cyrus the younger exhibits himself to Lysander as ‘The Persian farmer;’ “ut intelligatis,” says Cicero, “nihil ei tam regale videri quam studium agricolendi.”

The few notices which we possess of Carthaginian agriculture are singular, and scarcely reconcilable with each other. Heeren reckons the fertile provinces of Carthage in Africa to have been about equal in area to Ireland; and divides the remainder of their African territory between

Nomad tribes and Lotophagi. It appears from Diodorus, Polybius, and Strabo, that the Carthaginians received large supplies of grain from Sardinia and Sicily. Heeren, of whose research and judgment it would be impossible to speak too highly, says : *

“ The foreign colonies of Carthage were always chosen for the purposes of commerce ; but those within her own territory were, at least for the most part, inland, and fixed upon for the promotion of agriculture. . . . It was a general principle of Carthaginian policy to improve, as much as possible, the cultivation of their lands, and to accustom the native tribes under their subjection to do the same. . . . They, in fact, appear to have attached more importance to agriculture than to commerce. . . . It is plain that families of the first rank were in possession of large estates, from whose produce they drew their income ; while on the contrary, there is not a single trace, in the whole history of the republic, of their being concerned in trade.”

It is difficult to reconcile these opinions of Heeren's with Cicero's statement that a preference for trade and navigation, and a neglect of agriculture and arms, were the main causes of the weakness of Carthage.† The modern, however, derives much support from indisputable facts relating to Carthaginian literature. Kings, or perhaps presidents, but at all events great generals, were among their agricultural writers. “ Mago, the Carthaginian, and Hamilcar (says Columella) held it not beneath their dignity, when they were unoccupied by war, to contribute by treatises on farming their quota towards human life.” We learn from several sources that the books of Mago on agriculture amounted to twenty-eight ; that they were translated into Greek by Cassius Dionysius of Utica ; that on the final destruction of Carthage, when the whole literature of the conquered nation was given over by the Romans to their

* We quote from the translation published at Oxford in 1838. ..

† De Republicâ, 2. 4.

African allies, these twenty-eight treatises were considered so valuable, that they were specially excepted, brought to Rome, and by the senate ordered to be translated at the public expense. Pliny says that D. Silanus, belonging to one of the first families, surpassed the other translators. They are treated as of great authority by Varro, Columella, Palladius, and Pliny; and in the appendix to Heeren will be found thirty-one distinct passages in which the maxims of the Carthaginian author are handed down to us. It is singular enough that no one of these passages has any reference to the cultivation of any species of grain. One passage gives directions for the grinding or pounding of maize, barley, lentils, vetches, and sesame. Another strongly recommends landed proprietors to be resident—"He to whom an abode in the city lies close at heart, has no need of a country estate." The directions for culture apply solely to vines, olives, the nut tribe, poplars, and reeds. We unfortunately do not learn the structure of his humanity-hives, but it appears that he disapproved of destroying the bees when the honey was taken. Columella vouches, on personal experience, for the excellence of the Punic receipt for making the very best wine, "*passum optimum*." Farriery (including the symptoms of broken-wind in horses, and a prescription), a critical operation to which male animals are subjected, and the gestation of mares and female mules, are all brought under review; and we have the astounding statement, that in Africa the latter females were nearly as prolific as the former. This is more surprising, because Cato—who died before his "*Delenda est Carthago*" was fulfilled, and accordingly shows no acquaintance with Mago's writings—makes the same assertion. "Upon the health of black cattle," says Varro, "I have borrowed a good deal from the books of Mago, which I made my herdsmen carefully read." And not only does the Carthaginian treat of the health of cattle, but he gives directions for buying oxen for the plough, so precise that they will perhaps interest our readers. Both Heeren and Dickson have translated

the passage, but as each appears to us to fail in giving the precise meaning, we have ventured on a translation of our own:—

“The young oxen which we buy should be square in their form, large limbed, with strong, lofty, and dark-coloured horns, broad and curly fronts, rough ears, black eyes and lips, prominent and expanded nostrils, long and brawny neck, ample dewlaps pendant nearly to the knees, a wide chest and large shoulders, roomy-bellied, with well-bowed ribs, broad on the loin, with a straight, level, or even slightly-depressed back, round buttocks, straight and firm legs by no means weak in the knee, large hoofs, very long and bushy tails, the body covered with thick short hair of a red or tawny colour, and they should be very soft handlers (*tactu corporis mollissimo*).”

Palladius gives directions in nearly the same words, without, however, intimating that he derived them from Mago—a very tidy ox, whether he be purchased in Libya in the year B.C. 600, or in Northamptonshire A.D. 1850. More than one Mago figures in Carthaginian history, but the agricultural writer is supposed to have lived in the time of Darius, and to have been the founder of the great Punic family from which Hannibal sprang.

Of the Roman agricultural writers Cato claims precedence as first in time, and first in honour. The Censor died, aged 88, in the year 150 B.C. He is treated with great deference, and is much copied by most succeeding authors on the same subjects. He was a practical husbandman, having inherited from his father a Sabine farm. In his writings he recommends careful and precise, but by no means high farming. Most of his maxims tend rather to a limitation of outlay than to active improvement; and he falls under the lash of Plutarch, for having heartlessly recommended the sale of worn-out oxen and slaves. Whenever Cato rises to our mind's eye, it is in the form of our venerable friend Joseph Hume. Had we an historical painter, our financial reformer ought to sit to him for the

figure of Cato denouncing to the senate the extravagance of Scipio's camp. "In parsimoniâ," says Livy, "in patientiâ laboris, ferrei prope corporis animique: quem ne senectus quidem, quæ solvit omnia, fregerit." We are far, however, from insinuating that a future satirist will have occasion to say—

"Narratur et prisci Josephi
Sæpe mero caluisse virtus."

Two Sasernas (father and son) lived between the time of Cato and Varro, and wrote on agriculture. Their works have not descended to us; but they are quoted as of acknowledged authority by all the succeeding writers.

Varro, "Romanorum doctissimus," lived through nearly the whole century which immediately preceded the Christian era. He was one of Pompey's generals and admirals, and was subsequently librarian both to Julius and to Augustus Cæsar. His own very valuable library was wantonly destroyed by Anthony. He was a very voluminous writer, but a philological treatise, and his "De Re Rusticâ" are all that remain to us. The latter work was written when he was eighty years of age, and is in the form of a dialogue. It is in three parts, and is dedicated to his wife. He was a practical agriculturist, and frequently refers to the operations on his own farm, but he relies principally on the authority of Mago, and some Greek writers. The work is by no means servilely rustic, but diverges from time to time into mythology and ethics.

Some fascinating sentences in the "De Senectute" hardly warrant our placing Cicero among the agricultural writers. Though they display some practical knowledge, they relate rather to the amenities than to the labours of husbandry. In his opinion "vita rustica parsimoniæ, diligentiae, justitiæ, magistra est" (*Pro Rosc.*); "aratores" are "id genus hominum quod optimum atque honestissimum est." (*In Verr.* 2.) Agriculture, with him, is rather an honour to princes, and the ornament and solace of declining age, than a painful struggle with thorns and thistles brought forth by the

ground, which yields bread to man "in sorrow" and in the "sweat of his face."

Of the Georgics we need only say, that they afford not the least striking instance of the exquisite skill with which the Roman poet could borrow more than a foundation, and rear on it a structure possessing all the charms of originality. Perhaps, none but an agricultural reader will fully perceive the perfect harmony which is maintained in the Georgics between the imagination of the poet, and the homely science of the farmer. The two characters never clash. Whenever the farmer comes on the scene—however smooth the verse and elegant the diction—the directions which he gives are precise, ample, practical, and sound. The poem becomes a hand-book of husbandry. Virgil (born B.C. 70) succeeds Varro in the catalogue of agricultural authors.

Columella usually personates the classics of agriculture, and horticulture, to our imagination: partly, perhaps, because his works have come to us nearly entire and in large volumes; but principally, we think, because we know him merely as an agricultural writer, whereas most of his rivals or coadjutors are familiar to us as kings, generals, statesmen, orators, philosophers, or poets. He was a Spaniard, and apparently born about the time of the Christian era. He occupied a Pyrenean farm, and speaks more largely of his success in cultivating the vine, than in any other department of husbandry. He introduces to us an uncle of his own name as an eminent flock-master, who much improved his sheep by introducing rams from Africa. We suspect that on this statement is founded the popular opinion, that Columella established the Merino sheep in Spain. Columella makes free use of the agricultural writers who preceded him, particularly of Mago, to whose authority he submits with willing deference. Among the Latin authors whom he cites with respect, is Julius Græcinus, the father of Agricola. Columella's work is divided into twelve books—two on farming and farm-premises—but which contain also some

directions, partly moral and partly physical, on the selection and management of agricultural slaves: three on the vine, olive, and orchard fruits—two on agricultural and domestic animals, from which, on prudential grounds, he excludes the sporting-dog—one on poultry—one on bees. In the 9th book he attempts, with small success, the supplement to the *Georgics* which Virgil indicated:—

“Verum hæc ipse equidem spatii inclusus iniquis
Prætereo, atque aliis post me memoranda relinquo,”

and breaks into verse on the subject of gardening. Three more books treat of the bailiff, his wife, wine, vinegar, jampots, and the kitchen garden.

Pliny died A.D. 79. His contributions to the agricultural library are a small portion of the great work which he has left as a monument of his industry and research. We have no reason to suppose that he had any personal knowledge of agriculture. He was in that instance, as in many others, a diligent, but not always a discriminating compiler. Of the elder authors, to whose own works we can still refer, he uses most freely Mago, Cato, Varro, and Virgil. He speaks of Columella, but for the most part slightly.

Palladius published A.D. 355. He was a landed proprietor in Sardinia, and also near Naples. He wrote fourteen books of a farmer's calendar, and a poem on the art of grafting. He seems to have been rather a servile copyist from the older writers, but his work was much esteemed in the middle ages, and was translated into English, in 1803, by Thomas Owen.

Thus we have before us a series of literature, devoted to one object, extending over eight, and, in the Roman department alone, over five centuries. No one can wade through the whole mass without observing the striking fact, that neither at the end, nor during any part, of the series, does agriculture present itself as a progressive art. We are introduced to no improvements, to no newly-invented implements; we are told of no practices abandoned

as obsolete or superseded. We find, with the single exception of lucerne (and perhaps cytissus), no new object of culture. From Cato to Palladius the same routine is prescribed, and generally in the same terms. Their most refined practices—those in which they made the nearest approach to a successful application of mechanical power—may be traced in the historical books of the Old Testament, and in the prophets. We encounter a few prudential and very cautious maxims about trying experiments; but we are told of no fruit (if there be an exception, it is in the case of vineyards); and as we work down the series we meet with increasing complaints of diminished produce, and declining profits. The characteristics of Roman agriculture, as described in the books, were—system, accuracy, and great vigilance against waste. It was careful, painstaking, garden-like farming, with very few artificial or adventitious aids. We exclude, altogether, from our consideration the degraded period when Roman farms were screwed down to 4 acres (7 jugera) apiece. This state of things—if indeed it ever existed—was social, not agricultural. The story of Attilius Regulus, who, having heard—while he was pursuing a career of conquest in Africa—that the bailiff of his 4-acre estate was dead, and that his farming slave had run away, immediately sent to the senate a catalogue of his spades, hoes, rakes, and spuds, and informed them that, unless they took these implements into their special care, and procured for him another bailiff and another slave, he should leave the command of the army and come home to look after his property, is very amusing, but is of no agricultural import, unless it be at O'Connor Ville or Sniggs End. But, when the Romans got wiser, in our estimation, though worse perhaps in that of M. Louis Blanc, farms took the size which was adapted to the convenience of culture. Farming which was carried on without expensive implements, and without powerful machinery, did not offer the inducements which now exist to large holdings. Probably $62\frac{1}{2}$ acres (1 plough), or 125 acres (2 ploughs) of arable

land, could be cultivated as economically as a larger breadth.

Before we describe the Roman course of culture, we must say a few words on their system of occupation. In this we find a progressive change, and a constant approximation to modern practice. The first definite accounts represent proprietors residing on their own lands, and joining personally in all the labours of agriculture. Called off from time to time to war, or council, when the demand for their public services ceased, they returned to their homely occupation. Before the time of Cato, however, the habitual residence of the proprietor had become more rare. The claims or the attractions of Rome and other cities prevailed, and the farmhouse (villa) was delivered over to the custody of the bailiff (villicus); pleasant and even luxurious apartments being reserved for the occasional occupation of the owner. Cato gives directions suited to this state of things, of which Varro and Columella make whining complaints, intimating that, in their day, Roman landowners were more inclined to hold up their hands in the circus, and theatre, than to apply them to the plough and pruning hook. Though one passage from Cato is rather long, we hope that those of our readers who are acquainted with it will not be sorry to have it brought back to their recollection; and that those who are not will be interested by it as we have been ourselves. We are again obliged to discard Dickson's translation:—

“When the proprietor arrives at the villa, and has paid his respects to the household gods,* he should, if he possibly can, go round his farm on that day; if he cannot do that, certainly on the next. When he has completed his own inspection, on the morrow he should have up his bailiff, and inquire of him what work has been done, and what remains to be done—whether the work is sufficiently forward,

* Cato is very precise in this matter. In his directions to the bailiff he expressly forbids him to allow his wife to do “rem divinam,” or to employ any one to do it on her account. “Scito dominum pro totâ familiâ rem divinam facere.”—c. 143.

and whether what remains can be got through in due season—what has been done about the wine, corn, and all other matters. When he has made himself acquainted with these things, he should then compare the work done with the number of days. If work enough does not seem to have been done, the bailiff will say that he has been very diligent—that the slaves could not do any more—that the weather has been bad—that slaves skulked—that they have been taken off to public work. When the bailiff has given these, and many other, reasons, bring him back to the actual details of work done. If he reports rainy weather, ascertain for how many days it lasted, and inquire what they were all about during the rain. Casks might be washed and pitched, the farmhouse cleaned, corn turned, the cattle-sheds cleaned out and a dung-heap made, seed dressed, old ropes mended, and new ones made; the family might mend their cloaks and hoods. On public holidays old ditches might have been scoured, the highway repaired, briers cut, the garden dug, twigs kidded, the meadow cleared, thistles pulled, grain (far) pounded, and everything made tidy. When the slaves have been sick they ought not to have had so much food. When these matters are pretty well cleared up, let him take effectual care that the work which remains to be done, *shall be done*. Then he should go into the money account, and the corn account; examine what has been bought in the way of food. Next, he should see what wine and oil have come into store, and what have been consumed, what is left, and how much can be sold. If a good account is given of these things, let it be taken as settled. All other articles should be looked into, that if anything is wanted for the year's consumption it may be bought; if there is any surplus it may be sold; and that any matters which want arrangement may be arranged. He should give orders about any work to be done, and leave them in writing. He should look over his cattle with a view to a sale. He should sell any spare wine, oil, and corn, if the price suits. He should sell old work-oxen, and

culls, both cattle and sheep; wool and hides, old carts and old iron implements; *any old and diseased slave*; and anything else which he can spare. A proprietor should be seeking to sell rather than to buy."

Cato would have been invaluable as master of an Union workhouse.

The next phase of occupation was called "Politio." The politor or partuarius was a resident working partner, bringing no capital into the concern, but receiving, as his remuneration, a stipulated share of the produce. His proportion of grain varied from one-ninth in the best land, to one-fifth in the most sterile. An elaborate calculation leads to the conclusion that, on an arable farm of 125 acres, a politor would receive from 30 to 35 qrs. of various kinds of grain as his share; but the information does not seem to be of much value, as we are ignorant what privileges of maintenance, for himself or his family, he received from the produce of the farm. It is difficult to ascertain the exact terms of partnership; but it appears that the course of husbandry to be pursued was prescribed by them.

"*Liberi Coloni*"—*i. e.* farmers paying rent and cultivating wholly on their own account—first appear in the pages of Columella;* and in a passage too long to extract, he discusses the pros and cons of this mode of occupation. He comes to this general conclusion, that a farm never produces so much as when it is occupied by the proprietor: that even under a bailiff, unless he is very rapacious (and taking that word as his text, he enumerates the various modes in which a bailiff can cheat), it will produce more than under the hands of a tenant; but that if it be of that sort on which a tenant cannot commit very great waste, is distant, and not easily accessible to the owner, in that case it had better be let. His rules for the management of tenants are so applicable to all times, that we cannot curtail them,

* Cato uses the word *Colonus*, but it is evident from the context that he indicated thereby not a tenant farmer, but a yeoman resident on his own land.

and we give them in Dickson's tolerably faithful, though very clumsy translation :—

“A landlord ought to treat his tenant with gentleness, should show himself not difficult to please, and be more rigorous in exacting culture than rent; because this is less severe, and upon the whole more advantageous; for when land is carefully cultivated, it for the most part brings profit, never loss, except when assaulted by a storm or pillagers; and therefore the farmer cannot have the assurance to ask any ease of his rent. Neither should the landlord be very tenacious of his right in everything to which the tenant is bound, particularly as to days of payment On the other hand, the landlord ought not to be entirely negligent in this matter, for it is certainly true, as Alpheus the usurer used to say, that good debts become bad ones by being not called for. I remember to have heard it asserted by Lucius Volusius, an old rich man, who had been consul, that that estate was most advantageous to the landlord, which was cultivated by farmers born upon the land; for these are attached to it by a strong habit from their cradles. So indeed it is my opinion, that the frequent letting of a farm is a bad thing; however, it is still worse to let one to a farmer who lives in town, and chooses rather to cultivate it by servants than by himself. Saserna used to say, that from such a farm a lawsuit was got in place of rent.”

The younger Pliny, in a letter to Calvisius Rufus, discusses the desirableness of purchasing an estate which had been offered to him. He states that it was very much worn out, and was consequently offered to him at a much lower price than that for which it had previously been sold; that it would be necessary to displace the tenants, who were without capital, and had been repeatedly distrained and sold up; and that the investment would pay him 4 per cent., the usual interest on loans being at that period 6 per cent. The standard agricultural sentence about bad times, “*communi temporis iniquitate*,” occurs in Pliny's letter.

We grumble by prescriptive right. Pliny, the ever self-

complacent orator, advocate, senator, and poet, is a most discontented landowner. His farms are a constant trouble to him:—

“To Naso.—A storm of hail, I am informed, has destroyed all the produce of my estate in Tuscany; while that which I have on the other side the Po, though it has proved extremely fruitful this season, yet, from the excessive cheapness of everything, turns to small account.”

“To Genitor.—Nor is this all; for not only the farmers claim a sort of prescription to try my patience as they please by their continual complaints; but also the necessity of letting out my farms gives me much trouble, as it is exceedingly difficult to find proper tenants.”

The desirable size for a farm is discussed by several of the writers, and generally in the prudential spirit of Virgil's maxim:—

“laudato ingentia rura,
Exiguum colito.”

Columella prefaces the maxim,—“That the farm ought to be weaker than the farmer,”—by saying that it was “derived from the Carthaginians, who were a very acute people.” Palladius says epigrammatically, “*fœcundior est culta exiguitas, quam magnitudo neglecta.*” But on this point Pliny is most diffuse—though we believe that Dickson erroneously interprets expressions which Pliny applied to ownership, and not to occupation. When he says—“*sex domi semissem Africæ possidebant, cum interficit eos Nero princeps,*”—we cannot suppose that half of the province was absorbed by what we should call six farms, and that the bailiffs of these six unfortunate gentlemen were the sole occupiers. He declares, however, by less equivocal expressions, that the ancients were of opinion that it was very desirable to limit the size of farms.* The stories which he tells have

* Nevertheless large arable farms were known to remote antiquity. It may not be safe to found on the numbers in the highly poetical and figurative book of Job; but we learn from a purely-historical statement in the book of Kings, that Elisha was ploughing with twelve yoke of

also the same tendency as the maxims which we have cited. For one we must find room and a translation :—

“I cannot forbear stating one instance from old times, from which we may perceive both that questions of culture were brought judicially before the people, and also how men of that time were in the habit of defending themselves. C. Furius Cresinus, a freedman, became the object of much ill-feeling on the part of his neighbours, in consequence of his gathering from a very small field much more produce than they could obtain from very large ones. He was accused of attracting the crops from other fields by charms. Sp. Albinus appointed a court day to hear this charge ; and Cresinus, fearing that he might be found guilty, when the tribe were about to pronounce their verdict, brought his live and dead farming stock into the forum ; and he brought with him a stout wench, and Piso says that she was in good case and well clad. His iron implements were exceedingly well manufactured, the spades were strong, the shares powerful, and the oxen in high condition. Then he said, ‘These, Romans, are my charms ; but I cannot show you, or bring into the forum, my mental labours, my vigils, nor the sweat of my brow.’”

On the subject of farm-buildings it is difficult to gather much from these writers, principally because, as we have said, they were complicated with the villa, which was, as its name implies, the country abode of the landlord. On this point Cato forgets his usual frugality, and recommends comfort approaching to luxury, with a view of attracting and retaining the residence of the proprietor. Columella is very elaborate on this subject. In the first place, he is fastidious as to situation, both on the score of health and jucundity, and his only prudential maxim is, that a villa should be situated at some distance from a high road, as otherwise all your idle acquaintance will be dropping in

oxen, himself with the twelfth. This, on the Roman computation of 60 odd acres to a plough, would make the prophet the occupier of arable land to the extent of 800 acres.

upon you, and will very much interrupt the business of the farm. In giving the plan of the villa, he is very diffuse on the apartments of the proprietor, the winter apartments, the spring apartments, the summer apartments, and the bath-rooms; and on their respective aspects: the pleasure grounds come in also for a specific notice; but his directions for the "*Rustica*"—which includes the kitchen, the servants' lodgings, and the stables—and the "*Fructuaria*," which comprise the oil-cellar and press-room, wine-cellar, hay-loft, granary, &c., are less precise and intelligible. Both Cato and Varro prescribe, in general terms, that the farm should not be too large for the villa, nor the villa for the farm, and point out the inconveniences of each excess; and both give instances of known parties by whom respectively each of these maxims has been transgressed. It is not, however, till we come to Palladius, in whose time tenant-farming had become more usual, that we find any directions which are conformable to our notions of a farmhouse and buildings. He says that the buildings ought to be proportioned to the value of the farm; and that, in case they were burnt down, the extreme sum allotted to rebuild them ought not to exceed two years' rent: a sum which in our climate would be very inadequate to fulfil our notions of improved agriculture—probably it would not do much more than erect apartments and offices for Mr. Huxtable's pigs.

From the earliest antiquity oxen seem to have furnished the moving power to the plough, though in a single passage, to which we have already alluded, Homer says that in heavy fallow mules are far preferable. As the Romans assigned 60 odd acres to each plough, they assigned to it also 3 labourers, a proportion which did not include vine-dressers, or those who were employed in olive and fruit orchards. A passage in Columella indicates that a portion of the labourers employed on a farm were "*soluti, quibus major est fides;*" but the bulk were slaves, and they were sometimes worked in fetters, "*alligati.*" The younger

Pliny says that he must let his land because he does not possess "vinctos." Cato and Columella prescribe that the ploughman should be tall, because he will preside with more power at the stilts; whereas short and strong-backed men can do stooping work with more ease. A *bubulcus* should be humane, but have a terrible voice, in order that by it the oxen may be urged to work without being much harassed by the whip or goad. Columella gives the singular direction, that if you have any particularly vicious men among your slaves, you should make them vinedressers, because that work requires clever fellows, "ac plerumque velocior est animus improborum hominum." Tallness and strength are of importance in the *bubulcus*; but of none in the overlooker, who ought to be "sedulus ac frugalissimus." Cato gives a complete dietary for the establishment:—

"For the bailiff 100 lbs. of wheat per month in winter; one-eighth more in summer.

"For the female housekeeper and shepherd, 75 lbs. each per month.

"For the slaves 4 lbs. of bread each per day in the winter.

"From the time they begin to dress the vineyard, 5 lbs. per day till they have figs, when they revert to 4 lbs."

In addition to this bread the slaves had a restricted allowance of an article called *pulmentarium*, which appears to have been a dried compound of olives, apples, pears and figs. Pliny says that the name is derived from *puls*, which was the food of the ancient Romans—"pulte autem, non pane, vixisse longo tempore Romanos manifestum." When the *pulmentarium* was exhausted, they had in lieu an allowance of salt fish and vinegar, with a small portion of oil; and each person was allowed rather more than a peck of salt in the year. For three months after the vintage the beverage of the slaves was a weak wine called *lora*, in the consumption of which they were unrestricted. Columella and Pliny give the particulars of its manufacture, and

Dickson supposes it to have been equal to small beer. For the rest of the year they had real wine, and, by a very elaborate calculation, Dickson makes out the daily ration to have amounted to rather more than a pint and a half English. We take all our quantities on trust from Dickson. Any person who is curious on the subject will find the data given at length in his work.

Cato, having fed his household, proceeds to clothe them. The passage is not very clear, but we take it to mean that each individual received a tunic (a jacket without sleeves) annually, and a saga, three and a half feet long (probably a smock frock) biennially; also a pair of good wooden clogs every second year. Cato prescribes, that before you serve out a new tunic or saga, you should receive the old one, to be used in the manufacture of *centones*—that is, rough cloaks of patchwork, serviceable also as bed-quilts. Ausonius, in the preface to his *Cento* from Virgil, has many quaint allusions to the origin of the literary term.

We have said that the general tendency of these old writers is against *high farming*, by which we mean a large outlay with a view to increased produce. At the same time they are unanimous in their condemnation of slovenly and indolent farming. They prescribe a degree of accuracy and care which is certainly unknown in our general husbandry. This we shall see more fully when we come to speak of their course of culture. They insist on a most careful application of all the internal resources of the farm, and guard most anxiously against any neglect or waste of an article which may be used in reproduction; but there are very few indications of their having looked beyond the boundary fence for any means of augmenting the fertility of their lands. Cato's maxims all tend to repress outlay; and Pliny discusses the whole question in a passage which is too long to quote, but which is remarkable both for its sentiments and expressions. He brings forward, apparently with some hesitation, the unanimous opinion of the ancients, that (in plain English) nothing pays worse than

high farming—"nihil minus expedire quam agrum optimè colere." He gives an instance of a very rich man who ruined himself by farming for ostentation. He says there is a mean course, and he appears to intimate (though the passage is obscure), that a tenant, working himself and having a family which must be maintained, may do some things with profit which would be ruinous to a proprietor who lived at a distance, and hired the labour which was employed in doing them. He defends the ancients against the charge of having recommended bad farming. He says that by their oracular expression, "*bonis malis*," they merely meant that you should do things well and cheap; a point at which we have been aiming all our lives, and have never hit it.

Having cleared away these preliminary matters, we will now accompany the Roman farmer into his arable lands, and into his meadows and pastures, and will describe the management which he applied to each. We will take the latter and shorter subject first. As to pasturing, the details are few; but it is a pursuit much commended by the writers, on the characteristic ground that it calls for little outlay. Columella reports Cato to have answered the inquiry, how a man could get rich quickest by farming? "By being a good grazier." How next? "By being a middling grazier." "I regret," says Columella, "to add, that to the inquiry, repeated a third time, so wise a man should have replied, 'By being a bad grazier;'" though, as to his second answer, there can be no doubt that middling grazing is more profitable than the best management in any other line of agriculture. Pliny admits the two first responses to be genuine, but snubs Columella by discrediting the third. He says that Cato's purpose was to inculcate that we should depend most on those returns which were got at the least expense.* Meadows are included in the same category of commendation. All the writers

* Mr. Hoskyns gives a different interpretation to the passage, but has evidently mistaken its meaning.

agree that they were called by the ancients, "*prata quasi parata*," as being always ready to produce without culture. If you have water, says Cato, make water meadows rather than anything. If you have no water, make dry meadows to the utmost extent you can. Minute directions are given for passing the water slowly and evenly over the land, without allowing it to stagnate. Too much water is said to be as objectionable as too little. "No doubt," says Columella, "the natural grass which a rich upland produces will make finer hay than any which you get by watering; but from thin land, whether it is stiff or light, watering is the only way in which you can get a crop." Pliny particularly recommends to turn over your meadows any water which runs from a highway. Columella and Palladius give precise instructions for renewing hassocky and mossy meadows by the plough. You will get fine corn crops from them after their long rest—"post longam desidi-
diam." They are to be ploughed and well summer-worked, and sown in autumn with turnips or beans, and the next year with corn. In the third year they are to be very carefully worked till every weed and root is extirpated, and then sown with vetches and hay-seeds (the hay-seeds, says Pliny, may be collected in the haylofts and mangers), and the vetches are not to be cut till they have shed a part of the seed. The land must be worked quite fine and even with hoes and clod-crushers, so as to break down everything which might be an impediment to the scythe. The water is then to be laid on, but very gently if the surface is loose, because a force of water would wash the soil from the roots of the grass, and hinder them from making a strong turf. For the same reason you must not permit the new-sown grass to be trod by cattle. In the second year, if the ground is dry enough, small cattle may be admitted after the hay is cut; and if it has become very firm, the larger cattle in the third. If you wish for a full crop of hay, you must clear your early and weak meadows of cattle in January. Lands less subject to burn may be

pastured till February or March. The manure, which should be the greenest you have, "*recentissimum*," and which may with advantage have hay-seeds mixed with it, should be laid in February on such parts of the meadow as cannot be watered. It seems probable that the majority of Roman meadows were ill-drained, so much stress is laid on the evil of treading them with cattle. Pigs also were interdicted, on account of their rooting propensities. M. Porcius is brought forward to testify to the value of meadows. They are less subject to injury by storms than any other part of the farm; they require the least expenditure; they give a crop every year, and, indeed, more than one, for the pasturage of the aftermath is of as much value as the hay. The Campus Rosea is said to have been the most valuable plot of land in Italy. We had hoped, and indeed believed, that the story of the stick was genuine Leicestershire; but Cæsar Vopiscus, the ædile, is produced both by Varro and Pliny, to vouch that in that celebrated field he laid down his stick overnight, and could not find it in the morning, because it was smothered in grass. The time which we claim, however, on behalf of Cestus Over is not a whole night, but only while the farmer ate his dinner and smoked one pipe.

The Romans frequently mowed their meadows twice, first in May, and secondly in August or September, and watered them between the mowings. They mixed the second crop with oak and elm leaves, and used it as fodder for sheep. Dickson calculates, on somewhat uncertain grounds, that the first mowing of a Roman meadow produced more than two and a half tons of hay to the statute acre. That the crops were large appears probable. To mow a *jugerum*, three-fifths of a statute acre in a day, is said to require a good workman, whereas an ordinary English labourer reckons an acre to be a day's work. All the writers prescribe that the grass should be cut before the seed is ripe, and before the stalk has become dry. Pliny boasts of a discovery of whetstones, which would sharpen

a scythe with water ; whereas the Cretan whetstones, which alone were known to their ancestors, would only sharpen with oil, in consequence of which every mower had a horn of that liniment tied to his leg. The Italians used short, the Gauls long scythes. Every maxim of English, and even of Scotch haymaking is diligently set forth : precautions against rain, against undersweating, and overheating. Pliny supposes that when hay is got too green the sun sets the ricks on fire. We have by no means exhausted the subject ; but

“*Claudite jam rivos ; forsan sat prata biberunt.*”

The Roman agricultural course, with the partial exceptions to which we shall have occasion to advert, was of the simplest possible description—a crop of grain and a fallow. Every year one-half of the arable land was in grain, one-half in fallow. One-third of the fallow was sown with some sort of green crop to be mowed for the cattle, and this portion of the fallow, and this alone, was manured ; the result being, that the arable land was manured once in six years, and in that period bore three grain crops and one green crop.* This we should bear in mind when we come to consider what effect a long perseverance in this course had on production. The naked fallow received three or four ploughings during the summer, besides the seed furrow. To sow the grain in autumn was considered to be far the best practice ; but any portion of the land which, from bad weather or other impediments, could not be completed in autumn, was sown in spring. The grain was wheat or barley. The wheat was of many varieties ; white, red, black, bearded, and smooth are expressly mentioned ; and these do not exhaust the catalogue of names.

* Dickson ascertains by an elaborate calculation that, on a well-managed farm, sufficient dung was made to manure three-tenths of the land annually. It appears, however, from Cato and other writers, that a large portion of the manure was devoted to grapes, olives, and other fruit. Cato assigns half to fruit and half to grain, which would make the portion of arable land manured annually even less than we have stated.

Some are said to be suited to free and dry, others to strong and moist land. Siligo, triticum, and far adorem appear to have been the favourite sorts; and the two first varieties cannot have been very far removed, if Pliny's statement, that siligo sown on certain lands for three years turns into triticum, be correct. He, however, starting with the maxim, that no book is so bad that something may not be learned from it, picks up a good many loose stories, and he is, if we remember right, the author who vouches that if oats be sown on a certain day of the moon, they will come up barley. Of barley there were several varieties, both in colour and form of the grain—"longius leviusque, aut brevius, aut rotundius, candidius, nigrius, vel cui purpura est"—of which Pliny says that the white was least able to stand bad weather. All the authors agree that barley prospers only in a free and dry soil. It was sown in September and October, and again from January to March. Spring sowing appears to be less condemned in the case of barley than of wheat.

The mode of sowing grain affords, perhaps, the most marked distinction between Roman and modern practice. Their system was twofold. The land was well reduced by the *irpex*, which was our harrow, and was used both for pulverization and for drawing weeds to the surface, and by the *crates*, which was an implement for crushing clods. Both these were worked by oxen. If the land were naturally dry, it was next drawn into ridges (similar, probably, to our turnip ridges) by a double mould-board plough. The seed was then sown by hand broadcast on these ridges, and the major part, of course, settled into the furrows. It was then covered by hand with *rastra*—i. e. rakes,* and lightly, for the ridges certainly were not

* There is little or no evidence that the *rastrum* was ever drawn by cattle, though, from the expression "*gravibus rastris*," used by Columella in his poetical book, and "*iniquo pondere rastri*," by Virgil, commentators have assimilated it to our harrow. As Columella was speaking of an implement to be used, not on the farm, but in a garden, the reasonable conclusion is that it was to be worked by hand. Probably a

obliterated. They are always spoken of as a beneficial defence against drought to the corn growing on dry land. If the land to be sown were moist, so that injury to the crop from wet might be apprehended, the seed was scattered on the reduced and level surface, and, the double mould-board plough being introduced, by its operation most of the seed was covered up in the ridge. Several of the writers say that he was a clumsy ploughman who required an *occator* to follow him for the purpose of covering any portion of the seed. The result of both modes of sowing was, that the corn came up in rows, separated by a considerable interval; so considerable, indeed, that it was not unusual to plough between them after the corn had grown to some height. Dickson and Tull differ as to the meaning of the word *occatio*, and as to the operation which it indicates. Probably they were acquainted with passages in which Varro and Verrius derive the word from *occœdere*, but neither of them seems to have been aware that a passage in the "De Senectute" completely settles the point—"quæ (sc. terra) semen oc-cœcatum" covered up—put out of sight "cohibet, ex quo *occatio* (quæ hoc efficit) nominata est." After this covering of the seed the land remained quiet till wheat had put out its fourth, and barley its fifth, blade. It then received its first hoeing (*sarritio*), which in dry land included what we should call earthing up; in moist land, where the corn was already on a ridge, the operation was simple hoeing. A second hoeing was given in the spring. These two hoeings were the universal practice, and a third and fourth are spoken of. Even the careful Cato is inclined to think that more than two hoeings may be given with advantage. Then followed hand-weeding (*runcatio*), which in the case of prickly plants was performed with a glove—"velatâ manu debet runcari." Pliny tells a curious story about

heavier rake was used for levelling ridges and for breaking clods than for giving a light covering to seed. It is doubtful whether the Romans ever used the harrow to cover seed.

the origin of the still further operation of ploughing between the rows of corn. In the course of a *razzia*, which seems to have taken place in spring or early summer, the Salassi easily destroyed the winter-sown crops of their enemies. But the panic and millet, which were only just coming up, were not susceptible of the same sort of injury. They were therefore ploughed in. As however the crops recovered, and proved unusually abundant, husbandmen adopted the practice of ploughing among their corn, either when the spike was just showing itself, or when it had put forth two or three leaves; probably about the stage which we call spindling.

The whole operation of growing a crop of wheat or barley was, as respects two-thirds of the crop, as follows:—A bare fallow extending from June (the time of harvest) to the September in the following year: four or more ploughings, and efficient breaking down by harrows and other implements; two or more hoeings and a hand-weeding. This is represented to have been ordinary practice, and the maxims are in conformity. “He,” says Columella, “appears to me to be the very worst of farmers who allows weeds to grow among his crops. The produce must be exceedingly diminished if weeding is neglected.” On this point we must let Dickson speak for himself. “When we consider how frequently in the ancient husbandry the land was fallowed, how frequently and at what seasons the fallow was ploughed, we are apt to imagine that there would be very little necessity for weeding; and yet the care of the Roman farmers in this article seems to exceed their care in every other thing.” Weeds, however, were not the only objects of the hoeings. The ancients considered that the growth of corn was much promoted by stirring the ground. One, or frequently two, of the four ploughings having been given to the bare portion of the fallow-break before winter, a larger proportion of the force of the farm could be devoted to the land which was sown with crops to be mown green for the cattle. Day by day

it was ploughed down as mown, a point on which the writers insist very strongly, and it appears to have received the same culture which we have described above. The fallow-break was called *vervactum*. In addition to these ordinary corn lands they had a small proportion which they called *restibilis*, as being capable of great endurance; land which had qualities analogous to those possessed by a horse which can go at a great pace and stay at it: or by a vocalist who can hold a note for an indefinite period. This land bore a crop every year. Pliny speaks of land which was so kindly that the crop smothered everything and required no weeding;* and Cato says, that as soon as the corn was cleared off, this land might be sown with vetches on a single furrow without manure, that it might be pastured down in December, and would still yield an undiminished crop in spring. Lands which had rested long, or were fresh brought into cultivation, were called *novalia*, and were subjected to a severer course of cropping than the old tilled land. Barley was considered to be a severer crop than any other. This epitome of grain-growing as practised by the Romans was applicable not only to Italy, but certainly to Sicily, to Spain, to the province which they called Africa, and probably to other southern provinces. Particular notices occur of parts of Syria and of Egypt, and Mesopotamia, where inundations made all the land *restibilis*. Practices to which we shall briefly refer are spoken of by Pliny as prevalent in Gaul and Britain, which are represented to have been grain-exporting provinces.

We must lump together in one sentence the various herbs which were cultivated by the Romans as green food for cattle; and we regret that we can give so little information respecting them. Cicer—pulse of some kind—*unde*

* Pliny's expression is "*omnia hæc*" (*i.e.* hoeing and weeding) "*supervacua facit indulgentia cæli.*" Columella says, "*cæli conditio et terræ bonitas ea est,*" &c. Columella says also, that on ordinary land lupines are the only crop which does not require weeding, because they smother all weeds.

Cicero—Ervum, often coupled with Cicer—Farrago, probably mixed corn to be mown green—Ocimum, of which all we know is, that Pliny says it was supposed to flourish most when sown with cursing and railing—Vicia, vetch—Cytisum—(remembering the word in Virgil's first Eclogue, we turned to the commentary and found this explanation): "Genus fruticis sive herbæ cujus species multiplex, et descriptio apud diversos diversissima:"—Lentils, lupines, fenu-greek, *pisum*, peas, *faba*. The Romans cultivated more than one sort of bean, and probably this *faba*, which was mown green for fodder, was the kidney bean. Cato leads the way with most minute directions for sowing these green meats, and is followed by the other authors. The first crop to be put in as soon as the corn is off the land: this will be ready for autumnal mowing; and two or three succession crops to last for the remainder of the year.

To the *Medica*—probably lucerne—Dickson devotes a chapter, and we must devote a sentence. Though Pliny says that it was brought into Greece "a Medis per bella Persarum, quæ Darius intulit," it appears to have been unknown to Cato and to Varro as an object of Roman culture. Virgil mentions it once as being sown at the vernal equinox, and as requiring very rich land. Columella, Pliny, and Palladius are full of its merits. The sum of their praises is—that one sowing lasts ten (Pliny says thirty) years; that it may be mown from four to six times annually; that it fattens lean, and cures sick cattle; that it enriches land; and that the produce of three-fifths of a statute acre will abundantly maintain three horses for a whole year. These statements appear to some modern agricultural writers marvellous or miraculous. We believe, however, that, bating the thirty years and the enriching land, they are constantly equalled now a-days in the fertile island of Jersey. Beans were considered a very valuable crop, and were subjected to very careful cultivation.

Hemp, flax, poppy, panic, and millet, were Roman crops; but we fancy only incidentally and in by-corners, and not

in any regular course of culture.* *Legum* or *legumen* did not imply a class of plants; but all crops which were pulled up by the root† instead of being cut by sickle or scythe. Hence, beans, peas, flax, hemp, &c., are spoken of as *legum* as well as turnip, rape, and radish. On turnips the later authors are diffuse, but we must be concise. Pliny declares that no crop is so valuable except grapes and corn; that they are most wholesome food for man, and excellent, dressed in a variety of ways; that they keep through the year, either pitted, or when mixed with mustard; that they are most valuable in ornamental cookery, as capable of receiving six colours besides their own, one of the colours being purple—a quality possessed by no other kind of food; that when boiled they will feed fowls, and that the leaves are good for cattle; and finally, that he has seen one 40 lbs. weight. Columella says that in Gaul the bulbs are used as winter food for cattle and sheep. As to culture, the Romans sowed the best sort of turnip after five ploughings on dry and free land, in rows well manured; thinned then to eight inches asunder; and, like us, were very much plagued by the fly (*culex*), which they combated with soot, steeped seed, and other remedies similar to our own, and probably about as effectual.

Many passages occur in the writers, which, taken singly, appear to indicate a strong opinion on their part, that whereas some crops exhausted, others improved the land. Probably, however, the majority of these passages have reference to a practice which was very prevalent in their agriculture, namely, sowing vetches, beans, and more especially lupines, for the purpose of ploughing them in

* Flax is universally condemned by the writers as an exhausting crop. Pliny, however, enters largely not only into its cultivation, but into the mode of steeping and dressing it, and into its manufacture into fine linen, sail-cloth, candle-wicks, fish-nets, and snares for wild boars. He says that each thread in a then extant breast-plate of Amasis, king of Egypt, consisted of 365 ply.

† Dickson, not adverting to this meaning, is surprised that Columella should reckon turnips among the pulse—*legumina*.

when they began to form seeds. By the writers generally more benefit is attributed to this practice than modern experience would appear to justify. It is true that in the Roman course of a crop and a fallow no time was lost by it. The opinion also that some crops, even when gathered, improved the land, did prevail—for Columella, who strongly advocates the ploughing-in system, thinks it necessary to combat it:—

“Some tell us that a crop of beans stand in the place of a manuring to the land—which opinion I would interpret thus; not that one can make the land richer by sowing them, but that this crop will exhaust it less than some others. For of this I am certain, that land which has had nothing on it will produce more corn than that which has borne these pulse in the preceding year.”

An opinion in which we cordially coincide.

Roman harvesting presents several variations from British practices. In some cases the ears of the standing corn were gathered by a sort of comb, cut off, and carried to the thrashing floor—the straw being cut by a subsequent operation. The mode in which this was done is accurately described by the writers, and is vividly portrayed in the drawings from the Egyptian tombs. This plan is said to have answered well in thin crops, but to have been troublesome when they were heavy; it would no doubt be still more so when they were laid and twisted. In other cases the corn was cut low, and having been gathered together, was passed through combs or hackles, which detained the ears. These being cut off, were carried away separately in wicker-baskets. Pliny remarks, that both these modes are favourable to straw which is to be used for thatching. About Rome the corn was cut in the middle by a sickle. Varro is of opinion that from this cutting in the middle, the word *mensis* was derived. The upper part of the straw was called *palea*, and was used for fodder; the butt ends, *stramentum*, were used as litter. In some countries they pulled up all their corn by the roots, and fancied, says Pliny, that the

disturbing the surface thereby was beneficial to the land. The reaping on Achilles' shield is similar to ours, except that it implies a greater division of labour than we usually carry out. In a previous passage, Homer declares the practice of rich men to have been, to start a gang of reapers at each end of a field of corn, and to their approach he likens that of the Grecian and Trojan hosts. Pliny, in a very obscure passage, and Palladius, in one which is more minute, describe a reaping-machine which was used in the large farms in Gaul. We do not think that Messrs. Ransome and Mr. Hornsby would take the words of either author, or both combined, as working directions for the construction of the implement. This much is evident, that the body of the machine was fixed on an axle which connected two wheels. To the axle were fixed a pair of shafts, into which a very steady working ox was harnessed, not in the usual manner, but, as a stable-boy would say, with his head where his tail should be. Consequently, when he walked on, instead of pulling by the shafts, he pushed by them, and drove the implement into the standing corn. By some machinery which we cannot undertake to describe, it collected ears of corn, cut them off, and dropped them into a receptacle—"in carpentum:" Pliny says "*vallum*." Palladius says, that this implement answered well in open and even land, and that some farmers in Gaul cut their whole harvest with it without employing any reapers.

Threshing presents as many varieties as reaping, and most of them must have been very old. Almost every one can be identified with some expression in the 27th and following verses of the 28th chapter of Isaiah. Threshing was generally performed immediately after harvest, and frequently in the fields; but Columella says, that where the ears only were cut off, they could be carried into the granary and threshed during the winter. The threshing was by flail, by treading out (for which horses are said to have been better than oxen), and latterly by a machine drawn by cattle, described sometimes as having teeth,

sometimes rollers, called *tribula*, *traha*, and *plostellum*, and which, whatever it might be, was adopted from Carthage. All the writers put forth their strength in describing the construction of the *area* or threshing-floor. Cato forms a concrete-like surface of heavily rolled and rammed earth (*cylindro aut paviculâ cœquato*), and saturated with the lees of oil (*amurca*). Varro follows his lead; Columella adds that the floor is improved if straw be introduced into the mixture. Pliny and Palladius macadamise flint, pound it, and roll it with the fragment of a column; but the latter mentions a floor "*saxo montis excisa*," we suppose flagged. Virgil, in a charming passage, which is as poetical as it is correct, constructs a threshing-floor. Two lines suffice to describe the handworking of the earth, the levelling it with a very heavy roll, "*ingenti cylindro*," and the covering with a solid surface of chalk: a third line points out that weeds and dust, which would spoil the grain, should be guarded against; while six more suffice to specify those peculiar habits of mice, moles, toads, weevils, and ants respectively, from which injury may be expected. Four words thrown in by way of &c. conjure up ideas of centipedes, earwigs, woodlice, and other disgusting inhabitants of cracks and chinks.

The Romans would not have incurred Mause Headrigg's reprobation by "impiously thwarting the will of Divine Providence, in raising wind for their ain particular use by human art." They were content for the most part to "dight the corn frae the chaff" by casting it with shovels in the teeth of a moderate wind. In cases, however, of protracted calm or other emergency, Columella recommends the use of a *vannus*. It is mentioned by Virgil among the "*duris agrestibus arma*," as "*mystica vannus Iacchi*;" and was no doubt a fan of some sort. The words are the same. They also used sieves to free the grain from dust. These are mentioned both in the Old and New Testament.

The modes of using straw were various, and the variations were local. Ordinarily the upper half was used as cattle

food, the lower as litter; but when the former failed, the latter was bruised on stones—a rude anticipation of our chaff-cutting—and sprinkled with salt to induce the cattle to eat it. Columella sets very little value even on the *palea*. He says that in many places cattle are fed on it from necessity, but “minus commode.” Varro directs that where the ears only of the corn have been reaped, the straw should be cut and gathered immediately after harvest; but that if the crop were thin and labour is scarce, it will not pay for this, and it should then be pastured with cattle as it stands. Thatching houses with straw is spoken of as a practice confined to particular localities. Cato is precise, that every spike of straw or stubble should be gathered for litter, and even that it should be eked out with leaves of ilex. Virgil says, that to burn the stubble on barren land is good practice. Pliny, noting that this is done “magno Virgilio præconio,” adds, that the principal benefit arises from the destruction of the seed of weeds. Both Isaiah and Obadiah allude to the practice of burning stubble. In classing straw as fodder, the writers all agree in the order of merit—millet, barley, wheat. The straw of pulse only was given to sheep.

As to manure, the directions of the prose men are rather precise than cleanly, and we shall not enter into the subject very largely. It is only Virgil, as Dryden says, who can “toss his dung about him with the air of a gentleman.” The value of every living creature on the farm as a manure-making machine is most minutely weighed up; and the separate sorts of manure are classed according to their respective values. The schedule presents some variations from modern opinion. The manure from water-fowl is said to be of no value, which contrasts strangely with our appreciation of guano. Columella puts manure from pigs at the bottom of the list, for which Pliny sneers at him. We stumbled somewhere on a passage interesting to modern farmers, which we cannot now refer to. The purport was, that part of the value of corn given to cattle is replaced in

the increased strength of the manure. A diligent collection of everything which can beneficially swell the bulk of the heap is prescribed—leaves, weeds, scrapings of highways, &c. He is a very idle farmer, says Columella, who does not get together some manure, even if he does not keep cattle. The only allusion to extraneous manure, purchased for the farm, is confined to that made in aviaries, which seems to have been sown by hand both on meadows and on corn. Cassius is quoted as a great authority on the respective values of manures. Cicero and Pliny enter into the early history of manuring. The former says that it is singular that the learned Hesiod, writing about agriculture, should not have said a single word about manuring, whereas Homer, who lived so many ages before him (*ut mihi videtur*), represents Laertes to have soothed the regret which he felt on account of his son, by cultivating and manuring his land. In the descriptions of Laertes's gardening, as it has come to us, there is not a syllable about manuring; whereas in the seventeenth book of the *Odyssey* there is a distinct notice of a manure heap, and of the agricultural purpose to which it was to be applied. Pliny asserts the antiquity of the practice, follows Cicero in the story about Laertes, and adds that King Augeas first discovered the advantage of manuring in Greece, and that Hercules published it in Italy: a statement which appears to negative the claim of King Stercutio to the invention for which he was immortalized and worshipped. Far be it from us "*tantas componere lites.*" The marvel would appear to be, not that a cultivator should make the discovery, but that any one should miss it.

Close on the heels of the directions for collecting and multiplying manure, follow those for its manipulation and management. Dickson revels in the middens. Skilful husbandmen, say Columella and Pliny, cover up their heaps, and suffer them neither to dry by the wind, nor to be parched by the rays of the sun. Hollow water-tight receptacles which retain the moisture are recommended.

Either oak leaves should be intermixed, or an oaken stake driven into the heap to prevent serpents from breeding there. Columella delicately observes that the treasure should not be piled up in front of the parlour (*prætorii*) windows. Cato and Varro say that manure, heaped, turned, and rotted down, is stronger than when green. From this opinion Columella and Palladius dissent, holding that the benefit of the turning and fermentation consists in their destroying the seeds of weeds, but that they weaken the manure; and they therefore prescribe that it should be applied quite fresh to grass land, where the weeds cannot so easily get root. Palladius thinks it necessary to wash seaweed in fresh water before it is used as manure. Manure was principally applied in spring and autumn. A little and often was considered to be the best practice. Wet land required more than dry. Dickson ascertains that 800 Winchester bushels of well-prepared manure to a statute acre was an average Roman dose. Pliny says that some persons think that land is best manured (*optime stercorari*) by having sheep, perhaps cattle (*pecora*), folded on it.

Theophrastus says, that mixing earths, "*ponderoso leve, levi ponderosum, macro pingue et contra,*" will often stand in the place of manure. Columella also records that his uncle, who was a most scientific and industrious farmer, improved his land by applying chalk to his sandy, and sand to his chalky and clay soils. Pliny, giving vent to the contempt for Columella which he is so little careful to conceal, says, "that is the practice of a madman. What can a man hope for who cultivates in this manner?"

Though lime was used agriculturally by the Romans only in their vineyards and orchards, we cannot wholly pass by the curious information which Dickson's chapter on the subject contains. Cato recommends its application to olives, and Pliny to vines, but more particularly to cherries. He says that cherries were unknown in Italy till Lucullus introduced them after his victory over Mithridates, A.U.C. 680, and that, within 120 years of their intro-

duction, they were dispersed by the Romans as far as Britain. We are very much inclined, however, to claim an indigenous origin for our bird-cherry, and for the Scotch gean. We learn from Palladius that builders and plasterers were as fastidious about lime in his day as in ours, each requiring the limestone and the sort and quantity of sand appropriate to their operations respectively. Cato describes most minutely the mode of building the kiln and of burning the lime. We may certainly consider it as a singular proof of his sagacity, that, for several years last past, the practice of lime-burning in England has tended to return to the principle which Cato prescribes, from one which had long been considered as a great improvement. Limeburners will understand us when we say, that Cato's principle was, close fires and a very obstructed supply of air, each kiln-full of lime being an independent burning. The modern practice among large limeburners has been, till recently, deep open-topped kilns, supplied with fuel and limestone on the surface, the fire being urged by a brisk draft of air from the bottom, which served also to cool the lime in its descent to the holes in the kiln-bottom, whence it was drawn in a continuous stream. We have some experience in the matter, and believe that, in point of economy, Cato is vindicated. He also describes a system of burning lime in partnership. The owner finds the stone, the kiln, and the fuel. The working partner quarries the stone, and finds all the remaining labour. They divide the spoil. The practice is not unknown now, nor do the proportions vary very materially; but our division is less favourable to the working partner, and ought to be, because our fuel is so much less cumbrous. Although Pliny limits the agricultural use of lime by the Romans to olives, vines, and cherries, he says that the Hedui and Pictones (the people of Autun and Poitiers) made their general land very productive by its application.

Varro reports, that when he led an army through Trans-

alpine Gaul as far as the Rhine, he passed through a country having neither olives, vines, nor apples,—where they manured the land “*candidâ fossiciâ cretâ*.” Pliny says that on wet cold land in Megara the Greeks, who tried everything, applied “*leucargillon*.” In Gaul and Britain, however, what we call marling appears to have been a staple practice in husbandry, and to it Pliny devotes several pages. He enumerates six different kinds of marl, called *marga*, *terra fullonia*, *glischromargon*, *eglecopala*, *capnomargos*, and other fine names. Some were clayey for light lands; some sandy for heavy lands; some rocky, and retaining that form, to the great hindrance of stubble-mowing, till several years of sun, rain, and frost reduced them. Some lasted 10 years, some 30, some 50. Some were got at the day; and one sort, which lasted 80 years, and which no man had ever been known to apply twice to the same land, was got in Britain by means of narrow pits 30 yards deep. The mode of working described by Pliny is similar to a sort of rude coal-getting, which is now sometimes practised, where the seam lies at no greater depth. We have seen superficial marl pits in the midland counties, in which grow the ruins of ancient oaks, acorns perhaps in the time of Pliny.

The general corn lands of the Romans were not enclosed or fenced, except occasionally against public highways. They were acquainted, however, with every species of fence which is now in use, and applied them to vineyards, gardens, orchards, cattle-folds, and parks in front of the villa in which wild animals were confined, “*ut possidentis oblectarent oculos*.” Palladius, the last of the writers, recommends that meadows should be enclosed. Quick fences—“*vivæ sepes*”—says Columella, are preferable to dead, because a mischievous fellow going by with a torch cannot set fire to them. They were raised from seed, with much preparation and culture, in which pea-meal and old ship ropes bear a conspicuous part. Directions may be found in one or other of these authors for raising every

sort of fence which now prevails in Great Britain or Ireland. Pliny particularly describes the frame by means of which such mud walls as are now seen in Buckinghamshire and adjoining counties were reared. He limits them to Africa and Spain.

Notwithstanding the ameliorations of climate which we are told to hope for from draining, we do not expect to see vines an object of the British farmer's culture, nor wine-making one of his household labours; we shall, therefore, merely intimate that any one who is anxious to learn "the ancient" practice in these matters, will find ample information in the agricultural writers. Beer comes home to our sympathies. Pliny says bluntly enough—"The western nations have their own way of getting drunk, by steeping barley. In Gaul and Britain the ladies use the yeast (*spuman*) as a cosmetic." This art, we fear, is lost; but if the patriotic Member for Derby will listen to the voice of antiquity, Bass's Kalydor may become as celebrated as his Pale Ale. The second use of yeast survives. These nations, says Pliny, used it for fermenting their bread: "*Quâ de causâ levior illis quam cæteris panis est.*" But the use of beer was not confined to the western nations. The Egyptian *zythus* was beer—Suidas says ἀπὸ κριθῶν γινόμενος made of barley—and Pelusium was the Burton-on-Trent of Egypt:—

"Ut Pelusiaci proritet pocula zythi."

Moreover, the Egyptians, being destitute of hops, flavoured their ale with the bitter lupine, and with an acrid wild carrot, of which Pliny says—"nemo tres siseres edendo continuaret." Wilkinson, most properly, devotes two or three pages to the Egyptian *zythus*. In Spain they made beer which would keep for several years. Tacitus speaks of German beer more scornfully than is consistent with its modern reputation. "*Potui humor ex hordeo aut fermento in quendam similitudinem vini corruptus.*"

Beer runs through all the classics. Athenæus says that

beery men dance, and sing, as merrily as those who are overtaken in more generous liquor. Aristotle states, with more discrimination, that the former, when helplessly overcome, lie on their backs, and the latter on their faces. Æschylus, Sophocles, Herodotus, Archilochus, Hecatæus, and Aretæus, all mention beer. Xenophon, during the retreat of the Ten Thousand, passed a convivial night with an Armenian sheik near to the sources of the river Phasis. The sheik's daughter, who had been married nine days, graced the feast with her presence. Her husband was not of the party, being off in the mountains coursing. On the floor of the subterranean dwelling stood a vessel filled with barley-bree, and furnished with hollow reeds of various sizes. Want of a common language did not prevent the observance of customary convivial compliments. The host, as his benevolence prompted, led some favoured guest to the beer-barrel, where the politer sort sucked the liquor through the reeds; but others, who had not learned manners, thrust in their noses like oxen. Xenophon says it was strong drink, but very pleasant when you were used to it. When the sun had risen on their revels, Xenophon, who commanded the rear-guard, took the sheik with him to the van of the army. There they found that General Cheirisophus, and his officers, had also met with good quarters, and were still protracting their festivities. They were crowned with rushes, and Armenian boys were ministering to them. To these boys they indicated by signs the form in which their services were required. Seven days were spent in these pastimes. On the eighth they took the sheik for their guide, and his son as hostage for his fidelity. The sheik led the army three days' march into the snow. Cheirisophus suspected treachery and struck the sheik, but neglected to fetter him. The sheik, resenting the indignity, levanted in the course of the night, leaving his son behind him. Then arose the only serious difference of the whole retreat between Xenophon and Cheirisophus, probably as to the fate of the boy. That

however, was settled by another general, Episthenes, who, having taken a fancy to the boy, carried him to Greece, and he proved, says Xenophon, very faithful.

In treating of fallows, we have spoken of the number of ploughings which the Romans gave to their land; but our description would be incomplete if we did not allude to the manner in which they were executed. On this point some passages are obscure, and Dickson is neither a very definite nor a very safe guide. He wishes to conclude from a single expression in Pliny, which appears as likely at least to refer to the width as to the depth of the furrow, that the ordinary Roman ploughings were nine inches deep. As we know that they were generally executed by two oxen, and that a jugerum, three-fifths of a statute acre, was a regular day's work, and was in free land considerably exceeded, a general depth of nine inches will not, to a practical farmer, appear very probable. They were not, however, very superficial, for Pliny will not allow a depth of four fingers—three inches—to be a ploughing; but calls it a scarification. As, moreover, one ploughing in the fallow course received a distinctive name, "proscindere," with respect to which Pliny says "*vi omni arato*," and as he states that it was not unusual to attach six or even eight oxen to one plough, it seems probable that once at least in the fallow course the land was stirred to a considerable depth. There are several maxims about going below the roots of all the weeds. We should bear in mind that the Roman plough was an implement which did not of necessity turn a furrow, though it was capable of doing so by a direction given to it by the man who presided at the stils. Our word furrow implies a slice of land turned over, whereas their word "*sulcus*" implies only a certain breadth disturbed and lightened up. The object of their fallow ploughings, and indeed of all their ploughings, except breaking up turf and the ridging which we have already described, was to stir all the land to an even depth. To effect this, they prescribed very narrow

and equal breadths and very straight lines. They had not the trouble which we experience, from the circumstance that the plough in going and returning turns the slice opposite ways. The Roman ploughman returned on his own traces, and one criterion of the perfection of his work was, that the surface should be left so even as to make it difficult to discern where the plough had gone. The overlooker is recommended to walk over the newly-ploughed field, and to thrust in repeatedly a pointed stick, by which he will discover whether any land has been left unmoved. In order to ensure perfect culture, their second ploughing was always across the first. And even when the declivity was so great that they could not in either case go directly up and down, they took two oblique directions across the hill which would intersect each other. The characteristic of Roman ploughing was precision. To move uneven breadths was called to plough "*sulco vario*," and was much condemned. Lumps of earth undisturbed were called "*scamna*," and were said to diminish the crop, and to bring a bad name on the land. He who ploughed crooked was said to prevaricate, "*prævaricare*;" whence, says Pliny, the phrase was imported into the law courts, and having been applied to those who went crooked in their ploughing, came to be applied to those who went crooked in their statements. The ridge on which corn was sown was called "*lira*" and "*porca*." "*Liras rustici vocant porcas*." With us Prince Albert and Mr. Pusey have superseded the ridge-backed sow. We were content to look no further than "*lira*" for the derivation of the word "*delirare*;" but Mr. Hoskyns insists that it should be "*de lineâ arare*," whence also delirious. We wish some skilful husbandman would import these Roman maxims into the midland counties, where nineteen ploughmen out of twenty either prevaricate or are delirious.

So great was the importance which the ancients attached to ploughing. "What," says Cato, "is the first point in good cultivation?" "*Bene arare*.—*Quid secundum? Arare*.

—*Quid tertium? Stercorare.*” Pliny declares the passage to be oracular, but muddles it in quoting. Theophrastus, who long preceded them both, says that no crop ought to be grown on the fallow-break unless it can be cleared off so soon as not to prevent the land from receiving all its summer ploughings. Cato forbids his bailiff to plough when it is wet, or to cart over it, or even to allow cattle to go upon it. He says that it will not recover itself for three years. Columella, Pliny, and Palladius say that if you meddle with land while it is wet, you will lose the whole season. Dickson is very elaborate in investigating the construction of ancient ploughs, and appears to be borne out in the following conclusions:—

“The ancients had all the different kinds of ploughs that we have at present in Europe, though perhaps not so exactly constructed. They had ploughs without mould-boards, and ploughs with mould-boards; they had ploughs without coulter, and ploughs with coulter; they had ploughs without wheels, and ploughs with wheels; they had broad-pointed shares and narrow-pointed shares; they even had, what I have not as yet met with amongst the moderns, shares not only with sharp sides and points, but also with high-raised cutting-tops. Were we well acquainted with the construction of all these, perhaps it would be found that the improvements made by the moderns in this article are not so great as many persons are apt to imagine.”

The Egyptian ploughs, as represented in the drawings, are mere mud-scratchers, drawn sometimes by oxen, sometimes by cows with their calves skipping by their sides; and Pliny says that, on flooded lands, he has seen a plough drawn by a donkey on one side, and an old woman on the other—“*vili asello, et a parte alterâ jugi anu vomerem trahente.*” Among the drawings from the Egyptian tombs, engraved for Sir G. Wilkinson, are several which represent ploughing, sowing, and other operations, and in one of these a roller drawn by two horses driven with reins is

introduced. The roller is hollow, supported by a framework inside, in diameter about two-thirds of the height of the horses, and the drawing would be no inaccurate representation of a modern agricultural iron roller. We are not aware that the use of such an implement in husbandry is mentioned by any of the ancient writers. If Columella had been acquainted with its use, he would not have recommended that land, laid down for meadow, should be smoothed by an instrument which, according to his own account, worked so clumsily as the *crates*. We have already seen, that, in compressing a threshing-floor, a piece of a broken column was pressed into the service as a makeshift roller. The Romans might have valued this implement as a breaker of clods, and as an assistant to fine tilth; but not a single passage intimates that they sympathised with our idea of the advantage of a firm bed for the roots of corn. Quite the contrary. Perhaps, in the climate of Italy, their crops were not so liable to be top-heavy as ours are. Perhaps the young plant was not so liable to be thrown out by frost.

When we come to sowing, the remarkable unanimity which, on moist points of practice, pervades the old authors, gives way to a diversity that sorely perplexes the minister of Whittingham. That candid judge expends much unsuccessful labour in attempts to reconcile their opinions; and, where this is hopeless, would fain make out that none of them can be convicted of heterodoxy. The directions given by them are very analogous to those which any gentleman would receive, if he were to enter an English county on one side, and ask the opinion of every farmer he met till he went out on the other. One would tell him to sow thin, because his land was poor, another because it was rich. A third would say, "Be liberal with your seed, because you are early in the season;" and a fourth would advise the same "because you are late." A fifth and sixth would differ as to whether wet land, or dry, required the most

seed.* This is the substance of what the ancients say in various passages—which we are not careful to harmonize, partly because their differences will dwindle when we mention the narrow limits between the thick and thin sowing. With few exceptions they recommend early sowing, and, as was their wont, enforce the practice by an epigrammatic maxim—"Early sowing sometimes deceives the husbandman; late sowing never—because the crop after it is always bad." Pliny will not have the joke, probably because he finds it in Columella, and gives the maxim—"Early sowing sometime disappoints the husbandman, late sowing always." Their mode of sowing was by hand, broadcast; or rather, according to the Egyptian drawings, overcast. A two-handed seedsman nowhere appears. We find in Theophrastus and Pliny an opinion which lingers still among seedsmen, where it has not been superseded by the drill. The same land was said to require varying quantities of seed in different years, and its taking much was "infausto augurio" for the crop. The land was supposed to be hungry, and to devour the seed. Theophrastus laughs at this as "fool's talk;" but Pliny says it is "religiosum augurium." Dickson explains the matter very naturally. In sowing, the step and hand go together. When the land is clammy the seedsman takes short steps, and gives the field more handfuls. A clammy seedness is generally followed by an unproductive harvest.

The next and last point of practice is the quantity of seed sown: and in our observations upon it we shall confine ourselves to wheat. We approach the matter with some anxiety, because on our accuracy respecting it hangs the only chance we have of ascertaining what was the productive return for all the laborious culture which we have described. We may state as a preliminary, that the

* Probably he would not meet a farmer who would tell him, with Pliny, that if seed barley remains long in the ground without vegetating, it will come up oats.

Romans were extremely particular in the choice of seed. They insisted on its being sound, plump, and well formed. They selected by hand from the ripened crop the boldest ears, rejecting all those which had any deaf husks. They were aware of the advantage of introducing seed from land which varied in soil or climate, and they represent that the produce of seed, taken indiscriminately, always degenerated in a few years. On the subject of quantity the writers are nearly unanimous, and very precise. There is, perhaps, a slight tendency in those who wrote last to increase the quantity of seed. The smallest quantity of seed-wheat named is rather less than two bushels to the statute acre—the largest exceeds two and a half by a small fraction. Cato is silent on the subject of quantity; but all the other Roman authors are unanimous in fixing on five modii to the jugerum, or less than two bushels and a quarter to the statute acre, as the standard quantity of seed-wheat. Both in the Scriptures, and in the old heathen authors, statements occur of the returns of one hundred, and one hundred and fifty, to one. These are, undoubtedly, meant to express very large crops; but how large, while the seed is an unknown quantity, it is impossible to ascertain. If we take two bushels of wheat as the seed for an acre, no practical farmer will be very apt to believe that any one ever reaped 300 bushels, or $37\frac{1}{2}$ quarters, of wheat from a single acre. By reducing seed, and by giving space and extra culture to each individual plant, an almost unlimited return, to one, may be obtained. That some such explanation must be given of these large statements is confirmed by the circumstance that, in the same passage in which Pliny makes them, he states also that an agent of Augustus sent him from Byzacium in Africa nearly 400 stalks (*germina*) from a single corn of wheat; and that Nero received from the same place 360 "*stipulas ex uno grano*." In our homely way, we saw last summer, a single bean producing 7 stems, 129 pods, and 519 beans, which any one so disposed might call a return of 519 for one. The return of

the field from which this root was taken was 33 for one. When the Romans measure and state their seed, their pretensions are much more moderate. Varro, using a little above two bushels of seed to the statute acre, claims a general return of 10 for one; and of 15 in land of extraordinary fertility. That is, about 21 and 32 bushels per acre respectively. He speaks of this rate of produce as a great falling off from what had been obtained in the time of his ancestors. Half a century later, Cicero (*in Verrem*) gives an account of the produce in the rich lands of Sicily. He claims $2\frac{1}{2}$ bushels of seed to the statute acre, and says, that well-cultivated land gives eight for one, or, “ut omnes Dii adjuvent . . . quod perraro evenit,” ten—equal to 20 and 25 bushels respectively. In another half century, Columella says that, over the larger part of Italy, the instances are few in which the return is more than four to one.* The increasing lamentations over diminished produce, as we descend in the series of authors, are quite consonant with these returns. They are confirmed also by unequivocal declarations in the later writers—that both the selling price and rent of land had declined, though the price of wheat had risen gradually from 3s. 6d. per quarter before, and 10s. in the time of Cato, to 60s. in the time of Pliny. The expense of agricultural labour had not, in the meantime, increased materially. Palladius, the latest author, states the price of an agricultural slave to be from 60*l.* to 66*l.* Cato is said to have paid for them 50*l.* each; but this is mentioned as being considerably below the market price, and is given as a specimen of his skill in purchasing.

We have thus brought to a close our long digest of ancient agricultural practice and produce. In renewing

* Some attempts have been made to explain away or to discredit this passage in Columella, but apparently without any reason. His “cum quarto responderint” is exactly analogous to Cicero’s “efficit cum octavo”—“cum decumo extulisset,” and to the “cum decimo redeat” of Varro. In short, this is the only way in which the ancients express the amount of produce.

our acknowledgments to Dickson for the assistance which he has given us, we are bound to say that, for many of our statements, he is not answerable. Some things which he either missed, or purposely passed by, we have brought forward from the men of old; and in several cases in which he has appeared to us to misconceive their meaning, we have, after due consideration, followed our own opinion, without making the difference between us matter of controversy. His translations we have generally discarded. Several matters on which he dwells largely, but which did not seem to have much connection with British agriculture, we have omitted altogether. Equally, we have omitted the constantly-recurring directions of the ancients to govern ourselves, in sowing various seeds, or in eradicating particular weeds, by certain lunar and sidereal influences; and another class of directions, as a sample of which we may give, that a seed hopper ought to be lined with the skin of an hyena. Our reverend author is scandalised that some modern sceptics should have treated these maxims as superstitious, and is at much pains to prove that they are, or may be, consistent with sound reason. We by no means sneer at them, calling to mind that the best house-keeper we ever knew would never allow a pig to be killed when the moon was waning, because bacon cured under those influences would not, to use her own phrase, "swell in the pot."

-We are quite aware how many unexpected matters may turn up when we come to reduce a system of agriculture, which is depicted on paper, to the rough realities of practice. But the Roman authors appear to us to have this peculiarity, that they never look forward, but always backward. Their anxiety is not to promote progress, but to guard against declension. It is enough for Columella and Palladius to cultivate as Cato and Varro directed, and Cato and Varro are satisfied to appeal to the Greek writers and Mago. No one of them, as far as we recollect, claims any improvement as of recent discovery. We have eras

in our agriculture, but they appear to have had none. We can point to the period when the value of our sands was doubled or trebled by the introduction of turnip husbandry, and the consequent intimate union of the fleece and the plough. We can tell that, through general enclosures, the exhausted clays of our open fields were allowed to recover their fertility by long rests in grass. Sowing corn by the drill, threshing by horse power and by steam, permanent under-drainage, the new Leicester sheep and the improved short-horn, all attest our progress. They had nothing of the sort. They describe a very advanced and refined system of tillage, but they treat agriculture as an art whereof the origin is veiled in the mists of antiquity, which they do not seek to penetrate; which had descended to them in a state of perfection, beyond which they scarcely ventured to look; and which they must be careful not to deteriorate. Dickson's abiding faith is, that they were better farmers than the moderns, and, on almost every point where ancient and modern practice differ, he gives the preference to the former. Nor is he alone in these opinions. The very latest historian of the Papal States says, "Agricultural science has not been carried as high in Scotland as it was carried more than two thousand years ago by the Romans, as any one who has ever *studied* the *Scriptores Rei Rusticæ* will readily admit" (vol. iii. p. 637). Whether the Rev. John Miley, D.D., himself has ever *studied* them, though he puts the word in *italics*, we are somewhat doubtful; but, at any rate, from these judgments we appeal to the results. No one, we believe, doubts or denies, that the agriculture of Scotland, if imperfect, and the still less perfect agriculture of England, have resulted in constantly-increasing produce, and enabling those countries to supply not only an increasing population, but a population whose scale of maintenance—with the exception, alas! of the class of mere agricultural labourers—has been constantly improving. Confessedly the reverse was the case in Roman agriculture. The successive writers speak

of the same districts, the same soils, and constantly deplore diminished produce. And yet they do not say that the land received fewer ploughings, or hoeings, or weeding; that manure was less carefully husbanded; or that a less scientific course of cropping was adopted.

This falling off, having reached its crisis in the time of the later writers, evidently puzzled them sorely. Columella commences his treatise with it, and says that the fault cannot be in the earth. She must have the same principles of fertility as heretofore—so he has recourse to absenteeism and luxury, and such other explanations as pass muster with us in settling an Irish or West Indian difficulty now-a-days. Pliny only discusses the mystery—"Quænam ergo tantæ ubertatis causa erat?" It was either, he says, that the earth was then cultivated by the hands of great generals, and rejoiced—"ut fas est credere"—in a plough crowned with laurel, guided by a ploughman who had received a triumph; or that these men planned their course of crops with as much judgment as their campaigns, and laid out their fields with the same diligence as their camps. One reason is about as good as the other. The latter might be applicable to the four acres of Cincinnatus or Attilius Regulus, but we are slow to believe that nature produces a generation of men who are all giants in mind, body, or spirit; and we have no doubt that the age of Cincinnatus produced the usual proportion of husbandmen of only ordinary intelligence and energy. We believe that failure was inherent in the system. Roman agriculture was founded on the assumption that culture alone would enable land to export corn continually for an indefinite period. They acted tenderly on the assumption, and said, *every other year*, "alternis annis." A constantly-diminishing produce—diminishing probably in proportion to the length of time during which the assumption had been put to the test—proclaimed its failure. On this assumption, Tull attempted to base a system; but it did not survive him. Mr. Huxtable enunciates it as a principle, and founds calcula-

tions upon it; but no farmer who ever lived, ancient or modern, has relied on it so little in practice. His boxed bullocks, shedded sheep, and pampered pigs, are a standing contradiction to his claim of a continuous yield of 16 bushels per acre. This, according to Roman husbandry, would be 32 bushels per acre in alternate years; with the addition (which we cannot stop to calculate, but the data for the calculation are given in Mr. Huxtable's pamphlet) due to a manuring once in six years. To Mr. Huxtable's assumption we oppose Roman results. He cannot cultivate better than they did; and between the time of Varro, and that of Columella, they reduced the yield from 23 bushes per acre to about 12! What shall we say to Mr. Mechi? Nine hundred to a thousand quarters of corn *bought* annually for consumption on a farm of 170 acres.* Does not the shade of old Cato haunt his dreams? "*Patrem familias vendacem non emacem esse oportet.*" When we descend to instances which are less controverted, we find that the practice of Mr. Hutley in Essex, Mr. Hudson of Castleacre, and, in short, of every successful arable farmer in Norfolk, Lincolnshire, or the Lothians, is founded on conviction that land which exports corn continuously is not self-sustaining. Such of our agricultural readers as have the misfortune or the advantage of forty years' recollection, will confirm our statement that the great bulk of the English common fields—more particularly those which ran the rain off their surface—were, on the eve of enclosure, reduced to the state, described by Columella, of a return of about four for one. In fact, the common-field system, which was one of a continuous carrying off of corn with no other aid but fallowing, and a little light adventitious manure, soot, and so forth, had worn itself out.

And here we remark the great distinction between Roman agriculture and ours. Theirs was correct, precise, regular, persevering, careful, but altogether unelastic. Ours, coarse,

* We speak on the authority of the "Times" Agricultural Commissioner.

without system, inaccurate, often wasteful, but full of resource. They saw their produce dwindle, and their country become more and more dependent on importation for daily bread; and, with every temptation in price, found no remedy. When our clays struck work, we resorted to a general system of enclosures, which enabled us to give them rest without entire abandonment; and we applied all our energy to obtain the wheat and beans, which they had furnished to us, from a description of land which every previous generation had considered to be wholly unsuited to such produce. We ransacked earth and sea, home and abroad, for adventitious manures. No doubt we have had great advantages. Any one who casts his eye over the list of British imports and exports, will recognise at once an enormous balance remaining with us of matters resolvable ultimately into manure. Indeed the account is almost all one way. In our hardwares and crockery we export no elements of fertility, and our exports of textile fabrics are but a small fraction in weight of the raw material which we had previously imported. We have to look far back for the period when we regularly exported grain, and when our imports of wool failed to balance, or nearly so, our exports of manufactured woollens. To set against all this there is great waste; but even the sea makes us some compensation, in the shape of fish and wrack, for the filthy contributions which our rivers pour continually into its bosom. The emerald fringe, which surrounds all our towns and most of our villages, attests the general balance and its application. The suburban lands, which are brought to the acme of fertility, as far as that can be attained by extra-manuring, form a very appreciable portion of the surface of England; besides which, lands lying at distances, varying with the facilities of carriage or back-carriage, assist in sweeping off the fertilizing matters which accumulate in our great towns. There is no evidence in the ancient writers of any such process. There can be no doubt that, after the conquest of Carthage, Italy imported largely,

and that a large portion of her imports came as tribute, without much return. Probably the want of easy means of transport prevented the agricultural use of the manures which might have been economised in the towns. In the absence of such aid the constant repetition of corn crops, aggravated, in many cases, by a systematic robbery of the arable field for the sake of the more profitable vineyard, produced the state of exhaustion to which the progressive diminution of return so fully testifies.

No point in agriculture is better established than that long rest (what the Romans called "*longa desidia*") in grass gives to land renewed, or increased, powers of producing crops when it is again restored to culture. No fact is so entirely unexplained. None so palpably contradicts all our maxims. Here is no tillage, no stirring up, no exposure to light or air, no succession of crops. What becomes of the doctrine that the roots of plants exude something which is noxious to their own species? A field is laid down in grass, and every year it exports something; beef, mutton, wool, milk—or bone, sinew, and muscle, in the shape of store cattle.* Coexistent with a continuous export is the anomalous fact of increased productive power. Of this remedy for exhaustion we have availed ourselves largely. Our extensive pastures are our storehouses of grain—our safeguard against protracted dearth. Serious alarm would soon cover them with grain again. Our history teems with protests and futile laws against the increase of pasture. The process was inevitable: agriculture was rebelling against exhaustion, and was adopting the only remedy which difficulties of transport then permitted; a remedy of which

* We have no inclination to discredit the statement that a marked declension of cheese produce occurred in the old dairy lands of Cheshire, and was arrested by the application of bone manure, nor to throw any doubt on the chemical explanations which have been given of those circumstances. We may mention, however, that in the great midland cheese-making district, to which parts of five counties contribute, and in which the generality of the cow pastures have been from time immemorial unviolated by the plough, we never heard of any such declension or remedy.

the moistness of our climate diminished the sacrifice, and perhaps also increased the efficacy. In addition to this *remedy*, we now possess a *preventive*. We prevent the exhaustion of our lands by the application of adventitious manures. But the remedy, whatever its deficiencies, is not attended by outlay. It is simply a pro tempore abandonment of cultivation. On the other hand, the preventive, to which we have given the fanciful name of *high farming*, is altogether dependent upon outlay. An outcry for the application of increased capital to farming is evidence that a state of exhaustion has been reached, or is in immediate prospect. When Sir R. Peel tells his tenants that an average produce of about 2 to $2\frac{1}{2}$ quarters of wheat per acre cannot pay, he indicates that their lands have approached the state which Columella describes to have been reached in Italy.* To this result of their agriculture the Romans never systematically adopted a preventive, nor did they contrive any specific remedy. Their business was to conquer and rob the world: their provinces bore an overwhelming proportion to their domestic limits. So it is in our case: but our connection with our outlying dependencies was never framed on Roman principles, and their wide compass will not absolve us from the necessity of turning our attention, with painful intensity, on our internal resources.

Though the Romans never practised the resting system, any description of modern agriculture which should pass it by would be incomplete. In a new country a settler subdues a piece of land, flogs it to death and abandons the carcase, and then repeats the operation on a new subject. That is the agricultural system in large portions of the United States. A great part of Russian Finland consists of low irregular hills, which yield a spontaneous growth of fir-wood. When the trees in this puny forest have attained the size of a fence-rail, the cultivator sets it on fire,

* From a printed circular letter of Sir Robert Peel's to his tenants Drayton Manor, Dec. 24, 1849.

and following the burning with one or more ponies harnessed to a tool which cannot accurately be called either plough, hoe, or spud, but which in his hand jumps about with the agility of an opera-dancer, he scratches the wood-ashes into the little deposits of soil which exist between the protruding rocks and stumps, and with them some seed-rye; repeating this crop for two or three years, according to the staple of his soil; and then resigning his exhausted victim in order to renew the operation on the piece of forest which is next in succession. It would be difficult to improve his agriculture. A somewhat analogous occupation of various poor wastes was, within a century, known in England. In many of the enclosed counties, particularly in the Midland, Northern, and Western, whole districts are described by the appellation of up and down land. The agricultural principle was, to call on mysterious nature to renew the exhausted soil. The system was frugal, but slow. It might consist with pack-horses, perhaps with stage-waggons, but it was scouted by post-coaches, and exploded by railroads. It was not suited to a country fully occupied, and which had an increasing population. The gross produce was necessarily small, and could support neither high rents nor heavy payments. Every new agricultural device proposed to get rid of it.

We can remember when it was treason to agricultural science to doubt that the four-course shift, with turnips consumed by sheep where they grew, was self-sustaining. Sufficient virtue was supposed to exist in the feet of the sheep to set at nought a principle which had been sanctioned by experience in every age and every clime. The answer to the statement that land stimulated by culture could not, permanently, export its produce without exhaustion was—rotation of crops and the four-course shift. Sane men assured the agricultural world, that a farm divided into four equal parallelograms, to be occupied successively by turnips, barley, clover, and wheat, would go on for ever on its own resources with increasing fertility.

But these flattering prospects were destined to be materially abated. Turnips missed, land was clover-sick: in short, Nature had not changed, and land, severely cropped, was exhausted. Now rotations are at a discount, and the jargon about improving crops—which Columella despised eighteen hundred years ago—has ceased; and high manuring, in one form or other, possesses the agricultural mind. No instructor has a chance of a hearing unless he professes to teach the farmer how he can restore to the earth the nitrogen, or ammonia, or some mysterious element which every one admits to have been carried off to the mill, the malt-house, and the shambles. Why all this outcry about draining? Mainly because draining is a necessary preliminary to successful manuring. When land is surcharged with water, and runs the rain off its surface, one portion of the manure which is applied to it is rendered effete by wet and cold, and another portion is swum away; but if land be porous by nature, or is rendered porous by art, every particle and every element of the manure is available for reproduction. The counties of Norfolk and Lincoln produce tenant farmers who manure, not like the Romans, once in six years, but for every crop. Every schemer in agriculture professes to have a plan by which we shall drive foreigners from our markets by the mere exuberance of our domestic production. Some of all this may be absurd, some exaggerated, but it shows the bent of the national mind. Whenever the history of British agriculture is faithfully written, it will tell, not of a tame acquiescence in diminishing produce, not of the helpless iteration of a worn-out course, but of constant improvement. It may be truly said of the Roman agriculturist, that he farmed as his fathers did before him; but of no class of men could it be said less truly than of the British. Who among us would found his practice on an authority fifty years old?

It would be very easy—nay, it is daily practice—to write a description of British agriculture founded on undoubted

facts, but which shall be a caricature. From the backward arable practice of grazing and dairying districts—from the wayside cows of arable districts—from wheat-fields sacrificed to hop-gardens—from desolate lands, the improvement of which has been impeded by difficulties of tenure and mixed and imperfect ownership—from some sacrifices to the picturesque—and from more to the cherished feelings, prejudices, if you will, of resident proprietors, which forbid the absolute introduction of the rectangular system which scientific precision would dictate—any critic, viewing the country from the window of a railway carriage, might select a group of agricultural deformities. They would bear the same relation to our general husbandry which reports from the felon's dock and the police office would bear to our general morality. A discerning "commissioner" finds, in every district of Britain, some farming practice carried to considerable perfection, or some agricultural improvement urged to a considerable extent. The British farmer has acquired a sort of prescriptive right to be called pudding-headed, and beef-witted, and would hardly know himself by any other description. He adopts it with perfect good humour; and yet, when he comes to be looked into, he stands out as the man who, under some disadvantages of climate and some of tenure, has urged a limited area, of no exuberant natural fertility, to an amount of produce hitherto unparalleled in the world's history—and is urging it onward still. There is talk, indeed, of throwing land out of cultivation, but action is all the other way. Never was the indomitable energy of the British agriculturist more conspicuous than at this moment. A fall in the value of every article of farming produce—which his experience gave him no reason to anticipate—has dealt him a blow under which he staggers. When abundantly-stocked markets have reduced the price of goods below the cost of production, the cotton-spinner takes to short time, the iron-master blows out furnaces, and the collier shuts up his pits for three days in the week. Under

similar circumstances—guided, we hope, by a sure instinct, which we blindly follow without comprehending it—the agriculturists make an universal rush to produce more. Everybody is determined to confute Malthus, and to prove to him that he misplaced the ratios—that the agricultural ratio of increase will double the produce of a rural district much sooner than the procreative ratio will double the population. Sir Robert Peel tells his tenants that 2 or 2½ quarters per acre cannot pay. No doubt that is so. A gross produce of 4*l.* or 5*l.* per acre from the golden crop of the series cannot sustain a landlord, a tenant, a rector, police, bridges, gaols, churches, lunatic asylums, union workhouses, labourers, and a chancellor of the exchequer. We must have 2 or 3 quarters per acre more. Mr. Huxtable, Mr. Hudson, and all of us, are solving, or endeavouring to solve, the problem how to buy them (for buy them we must) for less than they will fetch in the market. We are trying to confute the Roman maxim—“bene colere necessarium est, optime damnosum.” Our faith, if we have any, is in the power of consumption. We trust that the stomachs of all Her Majesty’s subjects are in a course of progressive dilation. “Produce more,” say statesmen authoritatively, philosophers dogmatically, protectionists dolefully, free-traders fiercely. If we were to suggest “produce cheaper,” we hardly know whether we should meet with a seconder. This indeed would involve many severe struggles which we would fain be spared. Visions of the disruption of ancient connections—of the extinction of some deserving classes—of the application of the rule and square to the face of the country—flit painfully before our eyes. Having seen the domestic spindle and loom swept into the unsightly factory—almost every independent brook-side producer, in every class, absorbed into some leviathan steam-driven establishment—Her Majesty’s mail-coach, and Mr. Newman’s neat post-chaise attached to the Rail—we can hardly hope that agriculture alone will be able to maintain its old relations, and to resist the economical pressure.

We are unwilling to close this long article without a word or two more on some conclusions respecting our Gallic and British ancestors, at which we have arrived from a perusal of the agricultural writers of Rome. When her professed historians passed the boundaries of Italy, they occupied themselves little with any matters which had not immediate bearing on the career of Roman conquest. The nations to their north and west were unknown to history, were classed under the general appellation of barbarians, and nothing respecting them appeared worthy to be recorded except the degree of resistance which they were able to offer to the Roman arms. Of what Mr. Hoskyns appropriately calls their "inner life" we learn nothing. Even when Tacitus writes a treatise "On the Manners of the Germans," he gives an account of them which nothing but our respect for a great name prevents our calling childish and absurd. The people he professed to describe were a great nation, who repeatedly foiled the Roman generals, and destroyed their armies, and who, though harassed on their frontiers, were in fact never conquered. In epigrammatic and antithetical sentences he sets before us a state of orderly but very democratic freedom. Men inspired by romantic virtue, and restrained by puritanical morality; women chaste, constant, and devoted, as became the wives and daughters of such heroes. If the nation had a fault, it was a somewhat too great proneness to convivial hospitality. That their dwellings were covered neither with tile nor thatch, that the men wore a robe pinned on with a thorn, and that the semi-nudity of the females was only redeemed from indecency by their perfect innocence, is all that we learn about their lodging and clothing. A statement that they made an intoxicating liquor from grain; and three sentences, which are rather negative than descriptive, dispatch the whole subject of their agriculture. The conclusion of the treatise declines, with a prudent reserve, to pass any opinion on the apparently prevalent report that the remoter tribes combined the visages of men

with the bodies of beasts. From such history, and from the statements and silence of Cæsar and Livy, we appeal to numerous, but incidental and entirely unsuspecting circumstances, which meet us in the agricultural writers. They appear to us to warrant the inference, that a settled condition of society, and considerable progress in the useful arts, existed in Gaul and Britain before those countries were known to the Romans. Indeed, we doubt whether civilization was not rather repressed than advanced by their classic invaders. Nor is this opinion inconsistent with the fact that they were conquered. That they fell before armies to whose equipment and training the accumulated science of centuries had been applied, is analogous to the case of the village hero, who, though he has by activity and pluck thrashed all his rural competitors, finds himself powerless in the hands of a professional prize-fighter.

The Romans found Gaul a country of large farms (*latifundia*), in which various agricultural appliances quite unknown to themselves were habitually practised. The Romans were ignorant of the general use of lime in agriculture—they learned it in Gaul. They found chalk beneficially applied to corn-growing, both in Gaul and in Britain. In both countries various marls were applied to various descriptions of soil with scientific discrimination. In Britain, a particular description of marl, which was used as a top-dressing to land, was got by pits 10 yards deep. This circumstance is very significant. Every one conversant with underground work will be aware that it implies some power of freeing the works from water, and some scientific mode of ventilating them. The heavy expense of such an improvement is justified by the statement that the benefit endured for eighty years, and was only repeated after the expiration of that period. That circumstance, again, implies a settled state of society and great security of property. A Roman writer is not likely to have invented these matters, and we attach much more weight to inferences justly deducible from them, than we do to Cæsar's vague

statement, that no family ties existed in Britain, and that the connubial arrangements were analogous to those of the poultry-yard and sheep-fold. The case of agricultural implements is still stronger. Pliny states that the Romans, ignorant themselves of any other mode of separating flour from bran than a common sieve, found in Gaul a dressing-machine on the modern principle of a brush working in the inside of a porous bag, and brought it into use in Italy. We have already named the machine for reaping corn, which was so effective that, on many farms in Gaul, it superseded every other mode of reaping. We must recall to our readers what this machine performed. With no other aid than that of being kept in motion by a bullock, it collected the ears of the standing corn, cut them off, and dropped them into a chest which was part of the machine. Nothing of the sort is shown to have existed in civilized Egypt. In that country, as well as in Italy, the system of reaping the ears only, leaving the straw to be mowed by a subsequent operation, was in great favour ; but the work was performed by hand. We believe that modern mechanists have failed in every attempt to make a satisfactory reaping-machine ; and among the vast and almost speculative variety of implements which grace our agricultural shows, we are not aware that one which has professed to accomplish this operation has of late found a place.* The single fact, that the north-western nations made fermented liquor from grain, may not indicate any high degree of civilization ; but the statement, that, by the skilful application of one product of their brewing in the hindred art of baking, they enjoyed lighter bread than was known to the luxurious Romans, is not without significance.

In these cursory remarks we have confined ourselves

* This was practically true in 1850, the date of the author's statement ; but in 1852 reaping-machines of good promise, though still imperfect, were introduced from America, and some English ones were revived which bid fair to become permanent implements.—EDITOR.

strictly to deductions from the incidental statements of the agricultural writers. We are quite aware that this is a very narrow corner of a great field, which abler husbandmen than ourselves are occupying with resources which we do not pretend to command. We have the satisfaction, however, of knowing that our partial conclusions point in the same direction as their more extensive and elaborate researches.

HIGH FARMING.

AN UNPUBLISHED FRAGMENT.

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HIGH FARMING.*

"IF good farming will not pay, certainly bad will not," said Lord Stanley (Derby), or at least so his Lordship is reported to have said, at an agricultural meeting at Bury. The phrase was sufficiently expressive, but appears to us not to have been logically accurate; because, in our estimation, paying is the criterion of goodness in farming. If no sort of farming will pay, there is no good farming. "*Cadit questio*." Then hurrah! for the wilderness. Let us with-

* 1. "The Improvement of Farming. What ought Landlords and Farmers to do?" By Ph. Pusey, M.P. for Berkshire. London, 1851.

2. "The Present Prices." By Rev. H. Huxtable, A.M., Rector of Sutton Waldron, Dorset. Seventh Edition. Blandford and London, 1850.

3. "High Farming, under liberal Covenants, the best Substitute for Protection." By James Caird, Farmer, Baldoon. Seventh Edition. Edinburgh and London, 1850.

4. "Report of a Visit to the Farms of Mr. Rigden, Sussex, Rev. Mr. Huxtable, Dorset, and Mr. Morton, Gloucestershire." By David Milne, Esq., of Milnegraden. Berwick-on-Tweed, Edinburgh, and London, 1850.

5. "Copy of a Paper on the Subject of British Agriculture read before the Society of Arts, November 27th, 1850." By Mr. J. J. Mechi. London, 1850.

6. "Free Farming to meet Free Trade." By Hugh Smith, Surveyor. London, 1850.

7. "Mr. Huxtable and his Pigs." By Porcius. Edinburgh and London, 1850.

8. "A Letter on Agricultural Education." By Charles Lawrence, Esq. London, 1850.

9. "On the Construction of Farm Buildings in Ireland." Dublin, Liverpool, and London, 1850.

draw from the gentle slopes and softened vales which we occupy so unprofitably, and restore them to our predecessors, the elk and buffalo, the wild boar and stately stag, who at least did not weary heaven and earth with their complaints. We are not unreasonable. We admit any farming, which pays the rate of profit due, on a comparison with other trades, to its pleasantness, to its salubrity, and to the even tenor of its way, without deteriorating the freehold, to be positively good. If it pays a higher rate, or if it improves a freehold, it is comparatively better. If it does both, it is good in the superlative degree. When we speak on behalf of the agricultural interest, we can enter into no compromise with farming which does not pay. Without claiming to be eloquent, we think that we could get up a fine sentence, and assure the farmer that it is his high destiny to provide sustenance for the race whose ancestor God formed in his own image; and that when he makes two ears of wheat grow where one grew before, he may glory in being the benefactor of mankind. But we are afraid that the self-importance which we might conjure up would fade away before a distress for rent and taxes, and that the sight of two stacks of wheat where only one stood before, would fail to cheer the heart of the bold peasant—"his country's pride," or to dry the eyes of the mother of his children, when they had once been placed in the schedule of the bailiff. No! The object of farming is gain. Whether an agriculturist grows bread to strengthen man, wine to gladden his heart, oil to make him of a cheerful countenance, or opium to poison him; whether his barley be made into wholesome ale or deleterious gin, he has but one concern—does the cultivation pay? The landlord manufactures and brings to market corn and beef; the cotton-lord muslin and calico. Incidentally, the one class of products feeds mankind, and the other clothes them. But the price, not the application, concerns the producer. That is the commercial principle; and the closer either party sticks to it the more probable

will be his success. We therefore, with some reluctance, but on conviction, lay aside all sentiment, and approach the subject of agriculture in the driest economical spirit.

Having thus strictly limited the sense in which only we can consent to use the phrase good farming, we come next to another phrase of modern origin, but which now constantly occupies the mouths or pens of all agricultural disputants. We like the phrase because it is so very definite and so very unassuming. "High farming" is simply a higher, or more than average, expenditure of money on land, in order to make its agricultural produce greater. Extra expenditure in labour, in manure, or in machinery, is its essence. It passes by the subject of profit and loss. Agricultural journals have been content to record that Lord A., Sir J. B., or Squire C., have, by high farming, extracted thirty tons of swedes per acre from land whose previous produce was only fifteen. The record of the fact has not been accompanied by a balance-sheet. These individuals were spirited agriculturists—an epithet which may have been correct, but which sounds rather queer in connection with the most plodding occupation under the sun. When the grumblings of the agricultural classes rose higher than the recognised standard, and began to be somewhat of a nuisance to their non-agricultural fellow-citizens, the thirty tons of these spirited individuals were cast in the teeth of their more cowardly brethren, and they were bid to go and do likewise. They demurred to the mandate. The demurrer was, in substance, that high farming is not good farming, in the sense to which we have limited the latter phrase. The case is now on for argument at the tribunal of agricultural opinion; and at the head of this article we have placed before our readers a list of the arguments hitherto brought forward by the most eminent counsel in the cause.

We must assume two data, in both of which we believe that the conviction of our experienced readers will go along with us. 1st. That the natural produce of average land

may be increased by manuring. 2nd. That with respect to all land which is not pestered with furrows, water-grips, ditches, and such abominations, and which consequently, either by nature or by artificial aid, absorbs all the rain which falls upon it, something approaching to a definite ratio has been established by experience between ingesta and egesta—between the quantity of manure applied and the increase of produce. If water runs off the surface of land, it is impossible to say how much this ratio may be disturbed. The manure applied may go to fertilize an alluvial meadow indefinitely distant, or to assist in forming a rich mudbank in the ocean.*

We will illustrate these data by the simplest case which is within our own experience, and will state the results. When on a portion of a field of meadow-land, which, in its natural state, would yield one ton and a half of hay per acre, we sow four cwt. of Peruvian guano, we find that the produce is in the first year increased to two tons per acre, and that in the second year an effect of a few cwt. per acre, certainly under five, remains. The outlay in guano, including cost, carriage, pounding, sifting, and sowing, is quite 45s. per acre. The result is, that we have bought hay at 3*l.* per ton, having some increase of aftermath to set against the harvesting of fifteen cwt. of hay. This suits us, because we are habitual buyers of hay; and this mode of purchase is ready, saves marketing and other interruptions. But were we haysellers, we are convinced that we should be losers, because in ordinary seasons the transaction would be about evenhanded, and once and again in a series of years comes a dry May and June, in which guano has little or no effect. This, then, is not good farming, because there is no profit. It is not very bad

* Few persons, except those who have both observed and thought accurately, are aware how much furrows impede the beneficial effects of draining. They entice the water to the place which has been last and most trodden by the horses, and last and most glazed by the plough, and where it has consequently most difficulty of ingress.

farming, because there is no loss. It is a favourable specimen of amateur farming, because the amusement costs nothing. This is an instance founded on existing prices; and the circumstance that it turns out about a drawn game renders it, perhaps, the more suited to our purpose, because it places in the simplest form before our readers the only elements on which success depends—the cost of the operation and the value of the increased produce. If Peruvian guano should fall fifty per cent. (the market value of hay remaining constant), then, buying hay at a little above 30s. per ton, and selling it at 60s., we should enjoy a profitable trade. If guano should rise fifty per cent., buying at 90s. and selling it at 60s., we should be speedily ruined. And, on the other hand, guano remaining constant, variations in the market value of hay would produce corresponding results. If all the operations of high farming could be reduced to this simple form, there would be, no doubt, no dispute. The oracle from Auchness would have been silent; the *Times* would not have commissioned; Huxtable would not have preached; Porcius would not have grunted; Milne would not have reported; Pusey would not have moderated; and we should not have written this article. But unfortunately, the complications of high farming are very numerous and very difficult to define. We will only state two instances. Every agriculturist knows that a Dr. and Cr. account of all the stall-fed cattle in Great Britain would exhibit a large balance of loss. It is possible, though not very easy to determine, that the money which is lost on the bullock is received back with usury in the barley; but in the case of a progressive farm there will always be abundant scope for difference of opinion on the question, whether the balance which is lost at the banker's can be found in the land? Any man who undertakes to make a balance-sheet on either a progressive or on a retrogressive farm will find himself frequently at fault. The question of capital and revenue will constantly occur. He will find that it is as

difficult to close the capital account of a farm as of a railway, and that the results of farming accounts, even if kept on the most improved models, may be very misleading guides, and require to be acted on with much caution and discrimination. Mr. Huxtable has given to us a pamphlet which has gone through many editions, and which we therefore suppose to have taken considerable hold of the public mind. He undertakes, *inter alia*, to show to British agriculturists how they may grow wheat with profit at 5s. per imperial bushel. Pressed by the difficulty of account of which we have spoken, he endeavours to present a simple case of buying manure and selling wheat attended by a satisfactory result:—

“I shall proceed now to apply the principles A and B to answer the question, ‘Can wheat be grown profitably for 5s. per bushel?’

“In the first instance I shall take the most unfavourable case—that of growing wheat successively year after year upon the same field, the manure, ammonia, being all purchased. Here the problem will be, At what cost can a crop of thirty-two bushels per acre be raised on the average of seasons?

	Bushels.
Natural produce of the soil	16
The straw, containing $\frac{1}{2}$ per cent. of nitrogen of previous crop of 32 bushels, weighing 3200 lbs., will furnish by its decomposition in the soil 19lbs of ammonia, or	3 $\frac{1}{2}$
$12\frac{1}{2} \times 5 = 63$ lbs. of ammonia will produce	12 $\frac{1}{2}$
Total	32

“The present price of ammonia, whether in guano or sulphate of ammonia, is 6d. per lb.

“The field being free from couch, will require only one ploughing. The threshing is supposed to be performed by steam, at a cost of 1 $\frac{1}{2}$ d. per bushel. The horse-labour has been charged at the cost for which it can be done by-hired horses in this neighbourhood.

“ With these data, the cost of an acre of wheat will be as follows :—

	£	s.	d.
Rent, 1 <i>l.</i> ; tithes, 5 <i>s.</i> ; rates, 2 <i>s.</i> 6 <i>d.</i> ; way-rate, 10 <i>d.</i>	1	8	4
Ploughing, harrowing, drilling, crushing	1	0	0
Tradesmen's bills	0	5	0
Bird-keeping and hoeing	0	5	0
Reaping, 10 <i>s.</i> ; harvesting, 3 <i>s.</i> 1 <i>d.</i>	0	13	1
Taking in rick for threshing and marketing	0	4	10
Threshing 32 bushels at 1½ <i>d.</i> per bushel	0	4	0
Seed, 2 bushels	0	10	0
62½ lbs. of ammonia, at 6 <i>d.</i>	1	11	3
Total	6	1	6

	£	s.	d.
The produce, 32 bushels, at 5 <i>s.</i>	8	0	0
Expense of crop	6	1	6
For the interest on capital and profit	1	18	6 per acre.

“ This particular case has been adduced, not certainly as an instance of good husbandry, for it is the very reverse, but as an illustration of the manner in which the true principles of agriculture should be applied.”—*Present Prices, Seventh edition*, pp. 22, 23.

We neither admit nor deny that 16 bushels per acre is rightly taken as the “natural produce of the soil.” We neither admit nor deny that 5 lbs. of ammonia will produce 1 bushel of wheat. We assume these points in order that we may investigate with Mr. Huxtable other matters connected with his account. We know no way in which a farmer can derive advantage from a didactic example except by applying it to his own case and trying how it will work. We will proceed to do so. We have come recently into the occupation of 100 acres of arable land, situated in a midland county. On 20 acres of it we should be very thankful to grow wheat profitably for 5*s.* per bushel. But in order to do so we must comply with Mr. Huxtable's conditions—“the field being free from couch.” In this district we include under the name of twitch or quitch the whole class of perennial weeds whose roots do

not descend below the depth of an ordinary ploughing. Well! on the 1st October, 1851, we will deliver to Mr. Huxtable this 20-acre field. He shall pay 28s. 4d. per acre (his own price) for rent, rates, and taxes; and on the 1st October, 1852, we will pay to him 6l. per acre if the field is "free from couch," and fit to receive seed-wheat on one ploughing, harrowing, drilling, and crushing. But we have other and even worse enemies than couch—coltsfoot, thistles, sow-thistles, bindweed, and other deep-rooted plants, penetrating far below the track of an ordinary plough, and far more difficult to *eradicate* than couch. We will cheerfully give Mr. Huxtable an additional 2l. per acre if he will restore our land to us free from these. We have a third enemy, and particularly to wheat—water. Our land is undrained, and lies on an impervious subsoil. Nothing less than drains 4 feet 6 inches deep and 12 yards apart (or something quite equivalent in cost), laid with pipes and collars, will effectually subdue this enemy. We will give Mr. Huxtable 4l. per acre to execute this work, and he will lose money by it. The land being so re-delivered to us freed from weeds and water, on October 1st, 1852, we think it not improbable that what Mr. Huxtable calls the natural produce of the land, that is, the quantity of wheat produced without the application of any manure, might be 16 bushels per acre, and we have Mr. Huxtable's ammonia and word for the other 16. So that, in the year from October, 1852, to October, 1853, we shall, according to Mr. Huxtable's data, have laid out 6l. 1s. 6d., and shall have received 8l., and be consequently 1l. 18s. 6d. in pocket. What have we to set against this? First, 12l. for clearing and draining, on which we will charge 4 per cent., amounting to 9s. 6d. Then we must have capital, horses, ploughs, drills, carts, crushers, harrows, &c., a threshing-machine, and a steam-engine. We will not ask for the 16l. 5s. per acre which is employed by Mr. Rigden. We will not even require the 6l. per acre which, at present prices, Mr. Pusey thinks sufficient. We will be content,

under the mode of cultivation assumed by Mr. Huxtable, with a modest 4*l.* per acre. In our own agricultural calculations we always charge 20 per cent. annually on horses, implements, and machinery, for interest, repair, and replacement. We see that at p. 31 of his pamphlet Mr. Huxtable allows 20 per cent. on horses and 15 per cent. on implements and machinery. We will adopt his lowest charge. Then what shall we say about management and overlooking, either by ourselves or by a paid substitute, on 100 acres of arable land? can we say less than 50*l.* per annum, or 10*s.* per acre? The account will therefore stand as follows:—

MR. HUXTABLE'S Plan of Growing Wheat at 5 <i>s.</i> per bushel, and per Contra.				Cr.	
Dr.	£	s.	d.	£	s. d.
To interest on 12 <i>l.</i> , at 4 per cent.	0	9	6	Surplus received in 1st year	1 18 6
To interest on 4 <i>l.</i> , at 15 per cent.	0	12	0		
To Management	0	10	0		
To Balance	0	7	0		
Total	1	18	6	Total	1 18 6
By surplus					0 7 0

Mr. Huxtable gives no reason why any subsequent year should be better than the first. We will give several why they should be much worse. We find therefore that, altogether setting aside profit, it will require thirty-four years to replace the 12*l.* which we have expended. We have adopted all Mr. Huxtable's data without believing in them; we have applied his illustration on his own terms to our case, and we are sorry to be obliged to inform him, with much respect, that he is of no use to us at all; he has not taught us to grow wheat with profit at 5*s.* per bushel. If any of our agricultural readers are fascinated with Mr. Huxtable's statement, we advise them to try our plan of applying his illustration fairly to their own case. We must go further. We must prove to Mr. Huxtable, if he

be reasonable, which we have no reason to doubt, that should he attempt to act on his own illustration, it will break down under him. He shall be a fortunate youth just popped into the occupation of land at 28s. 4d. per acre rent and taxes, free from couch, the natural produce of which is 16 bushels of wheat per acre. We will not inquire into the previous history of the land. Mr. Huxtable shall occupy it as he proposes, and at the end of the first year, when he has paid 10s. for management, and 12s. for interest, repairs, and replacement of implements, horses, and machinery, which payments he cannot escape, he will remain with 16s. 6d. in hand, and there we advise him to keep it, for it will soon be required. Does he think, that when for four or five years in succession he has grown a wheat crop with one ploughing, given as a seed-furrow in the months of October or November, with as much money expended in hoeing as it can claim from the charge "birdcatching and hoeing 5s." (for we are not told on what terms these two items associate), his land will still remain free from couch? How much of his precious ammonia will, after the first year, have been occupied in growing weeds and not wheat? To what amount will 32 bushels per acre have dwindled? Will the land in five years be anything but a mat of weeds? Will anything less than the accumulated sixteen-and-sixes restore it to its former state of purity? We really thought that growing successive corn crops had gone out of fashion even as an illustration. We hope that Mr. Huxtable will not think that we trespass on his province when we remind him—"Thorns also and thistles shall it bring forth to thee." "In the sweat of thy face shalt thou eat bread." He appears to us to propose to eat bread without the sweat of his face. He says this is "not certainly an instance of good husbandry." Certainly not, for it will not pay. But it is not even a good illustration, for it will not work. The land under this management will not produce permanently 32 bushels. After five years it might graze

a donkey, but it would not grow wheat. We are bound, however, to admit that if, *in every-day farming*, 5 lbs. of ammonia, costing 2s. 6d., will produce a bushel of wheat,* worth at the present moment 4s. 9d., the fact is of great importance to agriculturists, and Mr. Huxtable has done well to bring it prominently before them by his widely-extended publication. Still we could not consider that, or any similar discovery, as a permanent source of more than average profit to a wheat-grower, because the general recognition of such a ratio would very shortly be followed either by a rise in the price of ammonia, or by a fall in the price of wheat.

Before we can apply Mr. Huxtable's illustrative account to another purpose which we contemplate, we must state the theory of manures which he, as do Mr. Pusey and others to some extent, recognises as established:—

1st. Nitrogen is the base of ammonia, into which, under ordinary farming circumstances, it converts itself by imbibing one-fourth of its own weight of hydrogen.

2nd. Ammonia is the *only* manure of *any* value in the growth of cereals.

Proved as follows:—

Fourteen tons of ordinary farm-yard and stable manure have been shown by analysis to contain two cwt. of ammonia.

Three contiguous pieces of land, in all respects similar, having been sown with wheat—No. 1, without manure; No. 2, fourteen tons farm-yard and stable dung; No. 3, two cwt. ammonia—the quantity of wheat produced by No. 2 and No. 3 was exactly equal, as were, of course, also their respective excesses over the produce of No. 1.

Therefore the carbonic and phosphoric contents of the fourteen tons of dung were of no value whatever in growing wheat, which, as far as phosphates are concerned, is

* We are sorry to observe, that in the experiment stated by Mr. Pusey, p. 6, 8 lbs. of ammonia were required to produce a bushel of wheat—a woful inroad on our anticipated profits.

strongly confirmed by the experiments given by Mr. Pusey at p. 5 of his pamphlet.

Neither are the mineral contents of the dung of any value; confirmed also by the experiment of burning fourteen tons of dung, and applying the ashes to wheat growing, with a slight *prejudicial* effect.—*Pusey*, p. 5.

The bushel of wheat which refuses to be produced without the application of five lbs. of ammonia to the soil, and will receive no substitute, contains in itself and in its straw only two lbs. of ammonia, and is therefore a very "wasteful," "extravagant," "costly" plant, as are barley and oats.—*Huxtable*, pp. 19 and 28.

In the case of turnips. "The simple phosphorus, which did nothing for wheat, nearly equals the dung for turnips." "Ammonia single does harm."—*Pusey*, pp. 6 and 7. "The mineral theory equally fails," "the application of potash diminished the size of the bulbs" (p. 6); and so doubtful is the case of carbon, that Mr. Pusey, after speaking with much hesitation, sums up as follows:—"At present, however, we can only say that the three leading principles of manure are, 1st, ammonia; 2nd, phosphorus; and probably, 3rd, carbon."—p. 8.

But turnips, which refuse to be fed by ammonia, are "thrifty plants;" they, "from their own resources, add to the amount." One ton of swedes contains more than five lbs., and one ton of tops more than twelve lbs. of ammonia.—*Huxtable*, p. 35.

We know not how our readers feel, but we are in such a whirl, that, when we consider where we are and where we have been, we are doubtful whether we are not involving ourselves in a labyrinth instead of assisting others in finding their way out. Let us look back one moment. Few years have elapsed since all who held the established faith believed that carbon was the main essence of manure, that a supply of carbon to the soil was the secret of agricultural success. Then arose a great prophet—a really great man, in spite of one failure—who paraded before us

the mineral contents of vegetables, and assured us, that if we supplied the soil with those mineral elements, the vegetables would find their organic elements for themselves. We all ran after him. But his doctrine came to a natural end, not by experiment, but by experience. The mineral elements of wheat were supplied to the soil, and the return in wheat was—nil. And so the mineral theory is gone. Now have arisen a marvellous flight of philosophers, Lawes, Gilbert, Way, Boussingault, Playfair, and others, who agree wonderfully in the main, and teach us, that ammonia is absolutely the *only* manure for cereals; that phosphorus is probably the only manure for turnips, and perhaps for the other legumina (but of this we are not certain); and that it is doubtful whether carbon be a manure at all. We cannot help remembering the old farmer, who broke into a momentary pause in an animated dissertation on alkalies, and carbonates, and silicates, with the blunt exclamation, “I’ my opinion there’s nought like muck.” And though we are by no means inclined to dispute, or even to doubt, that these philosophers have rightly established the singularly-varying appetites and antipathies of our cereals and legumina, we cannot forget, that, either by a wonderful chance or by a special providence, the refuse of these vegetables taken almost indiscriminately, and the excrements of animals, taken in the same manner, form a compound in which every object of culture finds the elements necessary for its vigorous growth and perfection. And so universal—we had almost said, so equal—is the benefit, that, after thousands of years of experience, practical farmers are not even yet agreed to what crop their home-made manure is most beneficially applied; and whereas one man bestows it on his wheat, another on his beans, and a third on his turnips; the fourth man lays it on his mowing land, to be, if we are to believe our modern instructors, exhausted by the sun, dissipated by the wind, and drenched by the rain. Strange as the statement may

sound to some of our readers, we do not hesitate to oppose experience to philosophy and reason, and to declare our belief, that in no way is manure applied more effectually than in the manner last stated; by which we mean, that if the same quantity of manure which would increase a crop of wheat 50 per cent. be bestowed on the surface of a piece of upland meadow, it will increase the crop of hay in more than the same ratio. Well, then, and wisely, has Mr. Pusey summed up this part of his subject in the following sentence:—

“The mineral theory hastily adopted by Liebig has broken down; no other has taken place. Our best authority, Mr. Lawes, has established certainly so much, that, of the two active principles in manure, ammonia is specially suited to corn, phosphorus to turnips, and that turnips are probably benefited by the woody matter of straw. But vegetable chemistry, having no fixed truths of her own as to the sources from which plants derive their food, or the mode in which they appropriate it, is not advanced enough to lay down laws for farming, or sit in judgment on its established practices. Except Liebig’s suggestion for dissolving bones, and Sir Robert Kane’s for using flax-water as manure, I know no agricultural process arising out of chemical discovery. The more we value the labours of agricultural chemists, the more warmly we look forward, as I do, to their future progress, through the patient examination of existing practice, which is itself the accumulated and varied science of ages, the more we should discourage undue expectations of immediate advantage. It is a great mistake to suppose that men can be made farmers by teaching them doubtful chemistry. But are we, therefore, to abandon agricultural chemistry because it is yet doubtful, and has not yet brought forth more fruit? Rather let those who are able cultivate it the more diligently by careful experiments, that, step by step, we may reach more certain knowledge hereafter. No one, mean-

while, can doubt the high value of Mr. Lawes's experiments in the field, or Mr. Way's researches in the laboratory."—*Pusey*, p. 14.

Perhaps, however, a ray of philosophic light, to which Mr. Pusey has adverted, breaks through the mist with which we are environed, and enables us to assign a reason for the faith in alternate husbandry which experience has engrafted in our minds. When manure is applied to a crop of turnips, they appropriate the phosphorus which it contains, but, for some unaccountable reason, refuse to touch the ammonia. (We use the word unaccountable, because, according to Mr. Huxtable, a crop of 32 bushels of wheat contains only in grain and straw 96 lbs. of ammonia, whereas 20 tons of turnips and tops, which he seems to consider to be an equivalent crop, contain 174 lbs.—p. 35.) The ammonia, therefore, remains in the soil ready to nourish the cereal crop which will so appropriately follow. If, *vice versâ*, the manure be applied to the wheat, that grain will appropriate or "waste" (*Huxtable*) the ammonia which it contains, leaving the phosphorus untouched and ready to nourish the succeeding crop of turnips.

Mr. Huxtable, however, feels none of the doubt and hesitation which so much perplex Mr. Pusey. He weighs out his equivalents; 5 lbs of ammonia on the one hand, and a bushel of wheat on the other, with exactly the same confidence with which he would put a sovereign into one scale and two half sovereigns into the other. In the illustrative account on which we have commented, Mr. Huxtable bought his ammonia from the drysalter, but he says that he can manufacture it cheaper. The digestive organs of animals, principally pigs, are his laboratory. Here we find ourselves unwillingly, but, in order to avoid constant explanations, compelled to adopt a new term—nitrogen; and we must beg our readers to bear in mind, that, in all the operations of which we are about to speak, nitrogen, without any act of man, converts itself into ammonia, adding to itself at the same time one-fourth of its previous

weight : so that, when we speak of manure, four of nitrogen is five of ammonia. Mr. Huxtable lays down this proposition—that, if you give to an animal food containing nitrogen, one-fourth of that substance will be appropriated to his carcass, and the other three-fourths will pass away in his excrements (pp. 19, 20): he, however, suggests at p. 23 that the quantity appropriated to carcass is a constant quantity (3lbs. in 100 lbs. of flesh), and by no means dependent on the amount of nitrogen in the food : and we deduce from his figures, that, if a pig be fed wholly on barley meal, he will appropriate a third of the nitrogen which it contains to carcass, leaving only two-thirds in the manure ; whereas, if he is fed on beans and lentils, he will appropriate to carcass hardly more than one-sixth, leaving nearly five-sixths in the manure. This is a most important variation, as we shall see by-and-by ; and, indeed, Mr. Huxtable himself is of opinion, that, by neglecting this difference, he lost 20*l.* in one porcine transaction of only 211*l.* 0*s.* We must, however, let this hare sit for the present, having first given our readers a specimen of the fearless way in which our author draws his conclusions :—

“Therefore, if we know how much nitrogen there is in the food given to a beast, and know how much he has increased in live weight upon that food, then, as each 100 lbs. of live weight contains 3 lbs. of the nitrogen, we can estimate how much nitrogen, and, therefore, how much ammonia is contained in the manure : in other words, we can pronounce how many bushels of wheat that manure will grow.”—*Seventh edition*, p. 20.

There is no waste here.

We must now pass to another, but ancillary, class of Mr. Huxtable's statements. He gives us (p. 26) a detailed account of an experiment in manufacturing pork, which was of sufficient extent as well as duration to be entitled to much weight. We do not perceive in it the elements of uncertainty which have been suspected by others. We

believe the proportion between dead weight and live weight, which he assumes, to be well established, and not to be stated too high. The important result is, that $5\frac{1}{3}$ lbs. of dry food, being about four-fifths mixed meals, and one-fifth bran and pollard, will make one pound of swine's flesh. We believe that, on an average of English markets, the value of this $5\frac{1}{3}$ lbs. of food would be $4d.$, and that, on a like average, the value of a bacon hog is $4d.$ per lb. It is somewhat singular, that, in the case of an ox stated at p. 20, if we reckon his food at the present market price, he will have cost $4\frac{1}{2}d.$ per lb., which would be about his value in an average English market. In both these transactions, therefore, the feeder must seek in the manure, interest of capital, risk or insurance, attendance, expenses of marketing, and profit. If this be so, how important the manure is, and how important it is to use nitrogenous food, and how important it would be to discover a breed of animals generous enough not to appropriate any nitrogen, which, after all, is but 3 per cent. of their live weight! That is the great desideratum in agriculture. "Thus, in the preceding experiment, if the *meal*, instead of being half barley, had consisted wholly of beans or lentils, of which the nitrogen is about 4 per cent., the manure would have contained 500 lbs. more of ammonia: or, according to the rate of ammonia in our estimate, have supplied the essential materials for 100 more bushels of wheat." Assuming, therefore, that the food and the pork balance one another, a more favourable result than we could exhibit on the average of 20 years of pig-feeding, a summary of the account framed on Mr. Huxtable's data will stand thus:—from 1704 lbs. nitrogen given in food, deduct 434 lbs. sold to the butcher: there remain 1270 lbs. = 1524 lbs. ammonia = 305 bushels of wheat; to which add 100 bushels lost by the error of using barley *vice* beans, and the grand total is 405 bushels of wheat created by feeding an average of 80 pigs for about six months. Mr. Huxtable arrives within 5 bushels of the same conclusion by a less

simple process. But we own that he is too fast for us. We cannot follow him. His calculations are all made *in vacuo*, without any allowance for resistance of the air or for friction. And yet he tells us that Ammonia, the object of his fond admiration, is the most volatile creature alive—that she will elope with anybody, and is sorely in need of protection (p. 21). He talks a great deal about fixing her, but he leaves us quite behind. We have no idea what he proposes to do to her, or how she would act if she were fixed. We are much consoled by finding (*Pusey*, pp. 8-10) that the accomplished editor of the “Royal Agricultural Journal” is as much perplexed as ourselves.

We must now bring back our readers to the point from which we started, and must remind them that Mr. Huxtable has stated that ammonia is too dear at 6*d.* per lb., and that he can manufacture it for less. We are examining whether he has done so. We have been obliged, by the state of the markets, to cut down the price of his pork from 5*d.* and 4½*d.* to 4*d.*, because, neither in this year, nor in the last, has the price of bacon hogs been more than 4*d.* per lb. in the average markets of England. This, by his own statement, leaves his pork just evenhanded with his food. Though we accept with perfect confidence Mr. Huxtable's statements, we do not, as our readers will have perceived, confide in his deductions; but, for the purposes of this investigation, we accept them all. Mr. Huxtable, having bought his pigs and sold them, having paid interest on the money employed, and insurance on the pigs, having *lodged* never less than 70, and sometimes 90, having *cooked* for them, having cleaned them, we suppose rung them; having tended them in sickness and in health,—having done all this for more than six months, has, at the end of that time, by his own showing, received, for doing it all, 1524 lbs. of ammonia, worth, at 6*d.* per lb., 38*l.* 2*s.* Has his ammonia cost him less than 6*d.* per lb.? We believe, that, on any fair charge for the particulars which we have stated, on any fair return on the buildings and apparatus necessary for

lodging and feeding from 70 to 90 pigs, it has cost him more ; and that even the additional 500 lbs. which he says that he ought to have got, but which he did not get, would fail to bring down the ammonia to the price at which he buys it from the drysalter. Having, therefore, before shown that he cannot, by buying ammonia, grow wheat to profit at 5s. per bushel, we have now shown that neither can he do so by manufacturing it.

We need not follow Mr. Huxtable into his calculations of the feeding value of his turnips. Mr. Curwen, Mr. Boxwell, and Mr. Howden, may be quite right when they estimate that a certain weight of clover and turnips will produce so much live weight in an animal, but we apprehend that Mr. Huxtable is quite wrong when he reduces that live weight into beef by the tables, and reckons that beef at the highest market price. Beef varies at this moment in Smithfield market from $3\frac{1}{2}d.$ to $5\frac{1}{4}d.$ per lb. ; and we apprehend that twelve pounds of beef, made by a ton of yellow turnips, would be estimated there at the former figure, which would sadly derange Mr. Huxtable's calculations. This, however, we may remark, though it is worth but a passing sentence, that if it is bad to farm with our instructor on the plan of either buying or manufacturing ammonia, it is worse to farm with him without doing either ; for in the latter case we must deduct from the debtor account the price of $62\frac{1}{2}$ lbs. of ammonia, and perhaps 5s. from threshing and harvesting ; and from the creditor $12\frac{1}{2}$ bushels of wheat, leaving the balance in hand 12s. 3d. (or, if the wheat be reckoned at the present price of 4s. 9d. per bushel, 7s. $4\frac{1}{2}d.$) to pay interest of capital and profit on an acre of wheat grown on land free from couch, and ready to receive the seed on a single ploughing. Never before were we conducted by an agricultural instructor to so complete a *reductio ad absurdum*.

Even if our investigation of Mr. Huxtable's accounts had been more favourable to his views, we must have protested altogether against the basis on which they are

founded. He starts with an ideal farm, a farm the whole of which is free from couch, and ready to bear wheat with one ploughing, and yet the occupier has no capital *in* the land. The previous history of the farm is considered to have nothing to do with the matter. Our objection is, that such farms do not exist. No man can take such an one ; and to an occupier who has brought one into that state, a notice to quit without compensation would be a sentence of ruin.

Though we have examined Mr. Huxtable's estimates strictly, and have differed from him freely, we must not allow him to suppose that we are insensible to the services which he has rendered to agriculture. His mind is full of knowledge, and his style of writing is clear and lively. Almost every page in his book conveys information, or suggests useful reflection. The manner in which, at p. 31, he systematises the general cost of cultivation, under the three heads of motive power, manual labour, and rent and charges, is the best which we have ever met with. The severest sentence which we should be justified in passing on his present performance is, that the cheerful and ardent spirit in which he pursues useful and benevolent objects, is not unlikely to involve those who accompany him in a somewhat dangerous fascination. We have much pleasure in bringing before our readers the testimony which Mr. Milne, one of his fellow-labourers in the field of agricultural literature, bears to his worth :—

“ Mr. Huxtable is clergyman of the parish in which his farms are situated. I do not believe that there are many clergymen in the English Church, or in any Church, more devoted to their professional duties, or more successful in the discharge of them, than he is. In proof of this remark, it need only be mentioned, that, shortly after his appointment as rector of the parish, finding that the parish church was in a very dilapidated condition, and that it was difficult or impossible, from the state of the law, to get it properly repaired or replaced by another, he erected a new parish church entirely at his own expense. Moreover, by

the handsome style of architecture adopted, and in the neatness of the interior fittings and furnishings, he still further indicated the homage which he wished to render to the Master in whose service he labours. He has established Sabbath-schools, to which, besides preaching twice every Sunday, he assiduously attends. Among the adult population of his parish, who, in their younger days, had not the benefit of the schools since established, he endeavours to supply the deficiencies of education by pecuniary rewards; for the Dorsetshire labourers are excessively ignorant, not one in twelve, as I learned from a well-informed proprietor in that county, being able to read. It was from the same benevolence which dictated these efforts and sacrifices, that Mr. Huxtable was led to think of, and take up the business of farming, that he might have the means of giving regular employment and good wages to the able-bodied labourers of his parish.

“From what has been said as to Mr. Huxtable's many parochial duties, it will at once be inferred that he does not superintend or direct the operations on his farms, as one would do who has nothing else to attend to. Days frequently elapse without his being on either of them, and hence the expense of management is necessarily greater than usual, especially on farms so small in extent.”—Pp. 36, 37.

Mr. Milne's very interesting pamphlet contains an account of his visit to the farms of Mr. Rigden (Sussex), Mr. Huxtable (Dorset), and Mr. Morton (Gloucester). An abstract worthy of the publication would be very instructive, but we cannot attempt it, partly because space forbids, and partly because it deals rather with the practices than with the pecuniary results of high farming. Some of the particulars, however, with which we are made acquainted are intimately connected with the latter subject. Many of our readers will be surprised to learn that these farms occupy a capital of 16*l.* 5*s.*, 16*l.*, and 12*l.* per acre respectively.

With respect to Mr. Rigden's farm, we learn that on the side of expenditure the acreable charge amounted at Martinmas, 1849, within small fractions, to the following sums:—rent and taxes, 2*l.*; tradesmen's bills, 9*s.* 6*d.*; insurance, losses, and sundries, 2*s.* 6*d.*; wages, 2*l.* 8*d.*; purchased manures (including an allowance on purchased food), 1*l.*, and seeds 3*s.* 9*d.*: the whole amounting to 4529*l.* “The value of the total produce, on an average of the last two or three years, Mr. Rigden estimates at 9*l.* per acre,”—amounting to 6660*l.* (now of course considerably reduced by a further fall of prices), and leaving a balance of 2131*l.* From this gross produce the following items must be deducted:—1st, the value of the portion consumed in the business of the farm; and, 2nd, the interest of 12,000*l.*, a considerable portion of which being invested in farm-horses, implements, furniture, &c., ought, for interest, repair, and replacement, to give a return of from 15 to 20 per cent. We have worked out this sum by the aid of the best agricultural accounts which we know to have been published, and of our own experience. We could not give the particulars without defending them by more minute explanations than would be suited to these pages; but we can assure our readers that they do not present a gaudy result. The impression produced on our mind is, that in no other business, with which we are acquainted, would Mr. Rigden's great intelligence and enterprise, and large capital, have met with a less adequate reward. Mr. Rigden is a very high farmer. His practice is, of course, in some degree modified by his contiguity to a large town. Having seen a portion of his farm last year, we are now confirmed by Mr. Milne's account in the impression which was then produced on our minds—that nothing which can conduce to success is either omitted or misapplied. In this case the extra manure is for the most part purchased, not manufactured on the farm. Mr. Rigden has the advantage of getting quite 25 per cent. more than the ordinary rural price for the milk of 21 cows, and

of selling 50 acres (one-fifteenth of the extent of his farm) of potatoes on the ground. He has this further advantage to an arable farmer, that, except against a railway, he has not a fence on his farm. He had one hedge, but he grubbed it up.

We now come to the much-controverted case of Auchness, in the county of Wigton. It lies in a nutshell: 240 acres—rent under 22s. per acre; as far as appears in the account, subject to no charge for tithe or tax. *If this be so*, Auchness, transported into the parish of Sutton Waldron, and subjected to Mr. Huxtable's charge of 8s. 6d. per acre for tithe and tax, would yield a landlord's rent of 13s. 6d. per acre, of which it appears that 7s. 6d. is interest of money laid out in draining and extra building. This poor farm has been forced by admirable management to the extraordinary gross produce of 2518l. 15s. annually, or about 10l. 9s. per acre.

Gross produce	£2518	15
Debited with rent	£262	
„ labour	417	
Purchased food and manures	526	
	1205 0	

It leaves a balance of . . . £1313 15

to pay for the portion of the produce consumed in the operations of the farm, tradesmen's bills, interest of money, incidental expenses, and profit. The gross produce approaches very nearly to ten rents. Though the labour is 8s. per acre less than Mr. Rigden's (the difference perhaps arising from the rate of wages, which are very high near Brighton), the farming at Auchness is in many respects higher than at Hove. At the former place the purchased manures and cattle food amount to nearly 44s. 6d. per acre, whereas at the latter they are only 21s. 6d. The gross produce at Auchness exceeds that at Hove by 29s. per acre, being 6s. per acre more than the excess of purchased manure and food. The peculiar advantages of the farm at Auchness appear to be, that it lies at a low elevation, near a good shipping port, has water-power, ample and con-

venient buildings, a climate singularly suited to green crops, an unlimited supply of peat, and 500 cart-loads annually of sea-weed for the manufacture of manure. The surprising produce appears to result mainly from management of cattle and manure, very superior to what is ordinary, but anywhere attainable by the combined efforts of landlord and tenant, and from the devotion of nearly one-fourth of the farm to the potato crop. We lay little stress on the latter circumstance. A man as enterprising and as intelligent as Mr. McCulloch will always find some crop particularly suited to his locality and tenure. It may be potatoes, or carrots, or parsnips, or chicory, or woad, or teasles, or flax. We once knew a man who, on a very high and poor farm, made money by growing chamomile. The man, not the place, produces such results. Mr. Caird gives us no statement of the capital employed by the tenant of Auchness, nor any figures which enable us to come nearer to a balance than the account which we have laid before our readers: but we see no reason to doubt that Auchness is an instance of good farming—that it pays well. Our decided opinion is, that if all the landlords in Great Britain were like Colonel M'Douall of Logan; if they had farms having the advantages of Auchness, tythe and tax free, which they were willing to let at 14s. per acre; and if, moreover, they were willing and prepared to lay out eight or nine rents on the farm, receiving 4 per cent. return; their tenants, as skilful and as highly qualified in all respects as Mr. David McCulloch, might farm high with much confidence, even at present prices, and find high farming *good*. We cannot expect this to take place at once, but in the meanwhile there is a great deal in Mr. Caird's description of Auchness well worthy the attention and imitation both of landlords and tenants.

We fear that our readers will not consider that our account of High Farming is on the whole very cheerful; but our account of ordinary arable farming will be still less so. Before, however, we come to the latter subject,

we must hear what the editor of the "Royal Agricultural Journal" says on the former.

Mr. Pusey's pamphlet is a most valuable contribution to agricultural literature. It is also most timely, and every way worthy of the position and character of the editor of the leading agricultural journal of the empire. Assuming the existing difficulties of agriculture without dilating on them, glancing fairly and candidly at the alleviating circumstances by which a large fall in the price of produce has been accompanied, he applies his main efforts to bringing pointedly before owners and occupiers of land the remedies which are offered to them by science and by experience, and which are consequently quite within their own power. These remedies he ranges systematically under a number of heads, of which some, having reference to permanent improvements, are addressed more particularly to owners, and others, which relate to recurring culture, to occupiers of land. He is a great master of condensation. Forty lines of what he calls introductory remarks explain and vindicate his whole purpose and plan; and already, in the second page, he is deep in the mysteries of vegetable chemistry. Into these we have been led incidentally, in treating of Mr. Huxtable's propositions. Animal chemistry is discussed in three pages singularly lucid and comprehensive. Probably some of the following propositions may be new to our readers. Vegetable nutrition is darker than animal, because "vegetables have the task of transmuting dead elements into living matter," and the "hidden powers" by which they work are yet undiscovered; but animals find their "substance ready made in the vegetables which they consume," their "stomachs do not compound their flesh from the ingredients of their food, but, finding that flesh ready formed in the corn or hay, merely select and appropriate it." Gluten, albumen, fibrine, flesh, muscle, blood, are "exactly the same body," "never vary in composition," "quite identical." When an animal eats food containing gluten and carbon, he burns the carbon to keep himself warm,

and builds up the gluten into "flesh without change, just as a house is built up with stones from a quarry." All animals desire food containing carbon in cold weather, and reject it in warm, "as we light our fires at Michaelmas, and leave our grates empty in May." So far there is a delightful concord among all the authorities, and by these rules we may proceed to build up lean meat with great confidence. But when we come to fat, Liebig, Playfair, and Boussingault have each a theory of his own. We shall imitate Mr. Pusey's prudent reserve in expressing no opinion on their differences. We certainly have been startled by the proposition that mangold-wurzel contains very little fat or milk, which substances are contained more abundantly in straw; and, as our own cattle have always fed faster and milked better on mangold-wurzel than on any other vegetable food, we cordially agree in Boussingault's candid admission, that "practice has got the start of theory; and I own, with perfect humility, that I think its conclusions are in general greatly to be preferred."

Passing from chemical to mechanical science, Mr. Pusey lingers, somewhat incongruously, with meteorology by the way, and declares his belief that the climate of England is the best in the world for farming. The only important deductions, however, which he draws from a considerable array of meteorological facts, and from an isothermal map of the world, are, that though draining pipes of one inch diameter may be sufficient in a country where the annual fall of rain is only 25 inches, they may be quite inadequate in another where the fall is 50 inches; and that manure may be much less injured by rain in an open fold-yard in the former county than in the latter; in both which conclusions we have no doubt that our candid readers will cordially concur.

Mr. Pusey puts forth his full strength when he impresses upon farmers the immense advantages which mechanics have conferred upon agriculture, and he accuses them, temperately but firmly, of having been slow to avail themselves of

those advantages. He estimates a saving in motive power, as represented by horses, "putting the expense of each horse at only 10*l.* a year," of 750,000*l.* annually since 1840; and this arising from the only partial adoption of the improved implements which agricultural shows have brought under every one's observation. In the case of carriages he proves that the economy in capital is even greater than the economy in operation, for, whereas on a farm of 200 acres they would cost under *the old* system 161*l.*, they are amply furnished under the new for 57*l.* 10*s.* "To use them" (the old carriages) "still, is like running a stage-coach in these days between London and Bath." He next adverts to the increased use of agricultural steam-engines, and to their greatly-diminished consumption of fuel. He calculates the saving by the employment of the best threshing-machines, as compared with threshing by hand, to be 7*s.* per acre on wheat; and states that they will perform double the work of ordinary machines which are still in general use; "a difference which could not exist two years at Manchester,"—a very apt illustration, for we have heard it said that every successful cotton-spinner of old standing has broken up or burnt his machinery two or three times in the course of his career. Mr. Pusey says that he will never incur the expense of burning another rick before threshing it, and hints at dispensing with barns altogether. We do not know whether he means to risk rain when threshing. He lives in the driest county in England. We should not be disposed to be so adventurous, but we are inclined to think that barns are not unlikely to be in some measure superseded by covered stack-yards, built on pillars, and covered perhaps with corrugated iron. In a small pamphlet, entitled "On the Construction of Farm-Buildings in Ireland" (W. S. Orr and Co., London and Liverpool), this plan is advocated, and detailed estimates are given of the expense. The writer justly says:—

"The use of the covered stack-yard is not only a shelter to the produce, but a considerable saving in the expense of

stacking and thatching. These operations have to be carried on in the busiest season of the year, when labour is dearest; and the after expense of pulling the hay-rick is a waste of material and loss of money. In the covered stack-yard these objections do not exist; the ricks are formed as fast as the carts can be unloaded, and a cloudy sky or a threatening horizon does not frighten or injure the farmer in the middle of his stacking operations."

From threshing, the transition is easy to cutting up the "loose straw into chaff," for which operation Mr. Pusey was wont to pay 2*d.* per six-bushel basket. He now, by means of Mr. Corne's chaff-cutter, performs the same amount of work for one farthing, "one-eighth only, therefore, of the cost incurred here twelve years ago." Mr. Pusey may be sanguine in his calculation of these savings, but we quite agree with him that mechanical science has conferred greater advantages on agriculture than chemical. It may be doubtful whether the latter has materially increased the amount, but there can be no doubt that the former has very materially diminished the cost of production. "But," says Mr. Pusey, "farmers have been, to say the least, rather slow." The cost of motive power,—the cumbrous wagon and slow horses, always favourites with the wagoner because they allow him to be slow also,—the ill-constructed plough, a favourite with the ploughman because it lightens his labour a little by increasing that of his horses a great deal,—are year by year pulling down the old-fashioned arable farmers of the midland and western counties. Nothing can save a man who goes slow when all the rest of the world is going fast.

Hitherto Mr. Pusey has addressed himself to occupiers of land. He now introduces his advice to owners, with the following observations:—

"Ten years since nothing struck me so much as the varied means possessed by the owners of land in England for raising, permanently, the productiveness of their estates. In no country are those means so various. Scotland and

Flanders are monotonous in contrast with England. In none has so much been effected. And, after ten years' labour, the same thing still strikes me as forcibly. It is on these recognised practical improvements that our dependence, I firmly believe, must be now placed. Not only, too, have we these *varied* means, but most of them are very *cheap* means. They would average three or four pounds an acre, and the crops are increased by them, be it remembered, without increase of the tenant's outlay. I know no other safe investment in which moderate expense produces so large a result of *profit* as in many of these permanent improvements of land. At the present time, however, the landlord's anxiety is, to avoid permanent *loss* of income. He should, therefore, raise the productive power of each farm, and there are very few farms on which the owner, consulting with the tenant, may not find some effective and cheap improvements to make."—*Pusey*, pp. 22, 23.

The improvement of land is then ranged under twelve heads, of which some are of general, some of local, and two or three, we think, of rather questionable application. Draining stands first in the list, and we are far from questioning the propriety of its precedence. But, before we proceed further, we must make a professional appeal to the editor of the "Royal Agricultural Journal." We do so because, in the matter to which we refer, he has more power than any other person; and though we shall interrupt the current of our ideas, and the thread of our discourse, we cannot consent to hide our appeal in the obscurity of a note. We seldom read a paper in the Journal, or in any other agricultural publication, without encountering some local term or phrase with which we are wholly unacquainted. We entreat the editor to reform the vocabulary of agriculture, first by his own practice, and then by his influence. We appeal from Mr. Pusey to the editor. Mr. Pusey states the depth of his drains in feet and inches, and the intervals in yards and feet, but he states the length in poles. Why this should be, unless it has some sly re-

ference to the difficulty of ascertaining the longitude, we cannot conceive. We have no idea what a pole is. Perhaps the length of Mr. Pusey's walking stick, or some personal measure. Perhaps *he* does not know that a rood of draining in Leicestershire and Derbyshire is seven yards, and in Staffordshire eight; and that if you leave out one of the *o*'s in this measure, you cut down the length to five yards and a half. With respect to the words "inch," "foot," and "yard," there is no such uncertainty of interpretation. They convey to the minds of every one of Her Majesty's British subjects a definite and an unvarying meaning. Again Mr. Pusey talks of bushels and quarters of lime. We believe that we are the largest lime-burners in England, but we do not know what quantities these terms indicate. We occasionally burn lumps of lime which would not go into a bushel. Though cwts. and tons do, unfortunately, in respect to a few articles and in a few localities, refuse to conform to the definite meaning to which they are confined by Act of Parliament; and though we admit that, in the north-western provinces, lime is one of the articles which, in passing from what mercantile men call first hands, declines to be cut down from 120 lbs. to 112, yet we believe that the use of the words tons. and cwts. would, even with respect to it, convey much more general and more definite information than quarters and bushels.

Mais revenons. We wish we could consider draining to be one of "the very *cheap* means" of improvement which Mr. Pusey indicates. We have never found it so. He gives us a table of the prices which he pays for draining. We cannot estimate the price of labour per yard, because we do not know the length of Mr. Pusey's pole; but a cost per acre of only 2*l.* 5*s.* 7*d.* for five-foot drains and 11 $\frac{2}{3}$ -yard intervals, is by us perfectly inexplicable. Nor can we understand how five-foot depths with these intervals should cost only 3*s.* 4*d.* per statute acre more than four-foot depths. The cost of 17*s.* 3*d.* per acre for pipes is only explicable on the supposition that they are small and used without collars,

a mode of draining which we would hardly thank any one to execute for us gratis. With extended experience we adhere to a statement which we made two years ago in this Journal:—"We do not think that we ever saw so favourable a combination of circumstances, that efficient thorough-draining of retentive land could be executed at from four to five feet deep under 4*l.* per acre. We have seen few or no cases in which it might not be executed for 5*l.*" We cordially agree with Mr. Pusey, that, "instead of saying that a whole farm," or a whole field, should be drained at a stated interval, you should "unfold your plan as you proceed." We agree, with the same cordiality, that to prescribe the same depths and the same intervals for all lands, is perfectly empirical. But when Mr. Pusey says—"a line of wetness may be found on a hill-side where the springs are thrown out, oozing through" (we should have thought, running over) "the field below—draw your drain deeply along this line"—we differ from him entirely. We never saw an instance in which such a case was encountered most cheaply or most effectually in the manner prescribed. We dissent, for the following reasons. The cause of the line of wetness is, that a porous stratum reposes on a retentive, and the water which has sunk through the former, being unable to sink through the latter, bursts out to the day at their line of junction, or at some parts of it. But Nature is not studious to level her surfaces very accurately before she brings them into opposition, and therefore their various points of contact are seldom found to be exactly in the same plane. In order that the drain in the line of wetness may be effectual, it must pass below all the points of contact of the porous and retentive strata; it must in its whole length cut into the retentive stratum. If, therefore, on any given line, the average depth of the points of contact of the two surfaces being six feet, there is one place in which the depth is ten feet, the drain must be ten feet deep in its whole length. If it be not, the water passing, and at that lowest point with most freedom, under the drain, will

appear at the surface on the land below. Add to this, the external line of junction between the two strata is seldom so straight or of so even curvature as to afford a desirable line for a drain. If, on the other hand, an experienced drainer examines the surface, he will always be able to discover the lowest point or points of contact between the two strata; we mean lowest with respect to the slope of the hill. If into that lowest point or points he drives, up the line of steepest descent, an adequate drain or drains, he will so lower the level of the water which stands in the porous stratum, that it will cease to flow over the edge of the retentive, which is the evil to be remedied. If a stream of water enters into a barrel with an open top, it will flow over the rim or over some one or more low places in it. But if you bore into the barrel, a foot below the rim, a hole or holes of sufficient capacity, the water will then cease to flow over, and the barrel for a foot below the rim will become dry. We have been diffuse on this point, because we have seen many instances of well-executed drains, drawn along the line of wetness, which have been ineffectual, and because we know no theory, deserving to be exploded, which lingers more pertinaciously than that of the line between wet and dry. Mr. Pusey mentions an instance in which by a ditch which cost 20*l.* he drained forty acres of land. We have seen a case of "line of wetness" in which one drain, driven in the steepest slope four feet deep increased to seven in the last twenty yards, effectually stopped a flow of water over nine acres of land, four of which did not belong to the person who executed the drain. We quite admit, though we do not know from what source Mr. Pusey derives the maxim, that "one drain well laid to suit the circumstances will often save a dozen by rule," and generally that it is much more satisfactory to drain by force of head than by force of money.

Still, whenever Mr. Pusey writes on draining, we desiderate the recognition of what appears to us to be one great if not indeed the main object—the preparation of the land

to receive and *admit* all the rain which may fall upon it. On well-drained land this preparation is always in progress, or at least effectually progresses until it has been effectually attained. Nature has only two ways of drying the surface of retentive lands—one, the great atmospheric drain, evaporation—the other, the drain by vegetation. In winter both these are in abeyance; and the consequence is, that when such lands at that season become saturated with water, they continue so till those natural drains begin to act again. When rain falls on land in this saturated state there is no admittance; the house is full, the inmates are three in a bed already; the vagrant must pass on to some other asylum, and he always takes anything which he can carry away with him. But when such land is well drained, every drop of water which runs out of the drain leaves room for a drop to enter at the surface; every hour of fair weather prepares for an hour of rain. The vital difference between four-foot drains and two-foot is, that the constant tendency of the former is to have nearly four feet of soil prepared for the reception of rain, whereas the latter can only prepare something less than two feet. Every one knows that the effect of open ditches and of straightened watercourses has been to increase the rapidity with which our floods rise, and to limit their duration, with the concomitant result, that the streams carry down much more mud with them. The effect of general under-draining would be to reverse both these results. Rain falling on soil ready to receive it, and filtered through, would pass off much more equably, and would carry away with it no impurities. With us, the last fortnight of January and the first of February passed without downfall. Our drains, on retentive lands, ceased to run. Then came a heavy fall of rain. The ditches of our neighbours on undrained lands ran full and very muddy: our drains ran equably and quite clear water. After four days of light frost our neighbours' ditches ceased to run, but our drains continued for a fortnight, and were running

gently when more rain came. These matters are worth observation.

Having appealed to the editor of the "Royal Agricultural Journal" on one subject, we will now take the liberty of appealing to its correspondents on another. We have no doubt that some one or more of them are quite competent to furnish information which would be of great value to drainers. We want a table which will show at one glance the water-passing power of pipes at various degrees of inclination—something of the following sort:—

Fall in 10 yds.	Size of pipe.	Water passed per minute.
1 inch .	. 3 inches .	. x gallons.
2 " .	. " .	. n "
3 " .	. " .	. m "

and so for every size of pipe commonly used up to the sharpest fall, say four or five inches in a yard, which is likely to occur in agricultural drainage. There is no use in providing for extreme cases. The table might be so arranged as to indicate at what respective inclinations the various-sized pipes become equal to one another in water-passing power. We shall feel an additional obligation, if the gentleman who is so kind as to undertake this will abstain from using any learned phrases, such as "subtending angles," and so forth. We know nothing which is usually determined more by a random guess than the size of pipes in a receiving drain. To say so many acres to so many inches is nothing, unless we know the inclination.

We spare the admirers of the soft beauties of agricultural England the pain which they would experience in reading Mr. Pusey's denunciations of hedges and hedge-row timber. We hardly know whether this ruthless reformer would leave a hedge or a tree standing between John of Groat's and the Land's End. They are doomed. This is certainly a cheap improvement, for, when you have eradicated them, you are quite sure that the hedge cannot

be there again for one ten years, nor the tree for a century. On this subject we will not trust ourselves, but will hand over Mr. Pusey to the tender mercies of William Johnston, barrister-at-law, who, in two volumes full of varied and useful information, has undertaken to hand down to posterity "England as it is in the Middle of the Nineteenth Century:"—

"One great charm in the general tone of the English landscape arises from the abundance of timber all over the face of the cultivated land. From one end of the civilized world to the other, the hedge-rows and hedge-row timber of England have been, and are, the admiration of the traveller. A great destruction of this timber is, however, now in progress, and it appears likely to increase. In order successfully to compete with foreign farmers, who are now as free to bring their produce into English markets as English farmers are, scientific agriculturists declare that it is expedient to make our fields larger and more open to sun and rain, by removing hedges and fences; that the shade of trees is injurious to the ripening of grain, and therefore that they should be removed; that timber-smothered land is a reproach to scientific and economical farming; that to keep pace with the advancement of agricultural knowledge, and to meet the activity and competition of the age, the hedge-rows, which have heretofore been considered the beauty of England, must, from considerations of utility, be abandoned; that land must be looked on as nothing else than a manufactory of agricultural produce; and that farmers who think of anything else than profit are little better than fools. Such are the theories of those who bring the wisdom of city counting-houses or scientific lecture-rooms to bear upon rural affairs."

But the case is more hopeless than even Mr. Johnston states it to be. The heartless wisdom which calculates that the hedges in one parish in Devonshire would have reached "from London to Edinburgh," and exults that

they are now so much reduced that they would "stretch little further than York"—which says, "The utter extinction of the land overshadowed by trees would be gladly submitted to by every farmer, provided the trees were to be annihilated, and that without any diminution of rent,"—comes not from a scientific lecture-room, nor from a city counting-house, but from the Conservative M.P. for Berkshire and editor of the "Royal Agricultural Journal;" and the man who boasts that it is now a very long time since his own internal fences have been removed entirely, is the same individual.

Four-footed game are doomed also—another cheap improvement; but we are thankful to Mr. Pusey for tolerating pheasants and partridges. He reckons burning clay, claying, liming, boning, and chalking among cheap "landlords' improvements." No one of these operations is of general application. Perhaps situations may be found in which each of them may produce an improvement having somewhat of permanence. Nothing but local experience is a safe guide. Of lime, Mr. Pusey says, "it is considered indispensable on the west side of England, and is generally found utterly useless elsewhere." Of burning clay, we beg to state, that though he cites eight witnesses who all testify strongly in its favour, and though we do not at all doubt their testimony, our experience tells us that this practice also is only of local advantage. We have burnt clay in Staffordshire and Derbyshire, we have seen it burnt for several successive years on a large scale and at *vast* cost in the former county, and we never saw an instance in which it was followed by any apparent advantage, and we have seen several, where the surface of the land was burnt, in which the result was manifest deterioration. We state this, not to dissuade persons from proving the effect, but to caution them against practising on a large scale before they have proved it. We need not go far to find a gentleman whom the clay-burning papers in the "Agricultural Journal" have cost hundreds of pounds,

which he might just as well have thrown into the Bay of Biscay.

Our great agricultural authority rivals Cato in his advocacy of water-meadows, but this with a limitation which will at once exclude half England, for he insists that the water shall be soft. We shall be obliged to him if he will reconcile the following statements, which we find at pp. 10 and 33 of his pamphlet:—"If you pour a solution of ammonia on loamy soil, the water, when it escapes below, will be free from ammonia." "Putrid urine, sewer-water, passing through loam, as Mr. Huxtable found, become pure as well as clear" (p. 10). "Our own pure and warm springs, issuing from the depths of the earth, fertilize our meadows by bringing with them ammonia, the result, perhaps, partly of ancient volcanic action, partly acquired by filtration through the upper soil, for in soil, too, even uncultivated soil, modern chemistry has recently detected ammonia" (p. 33). How is this? You pass water charged with ammonia through soil, in order that it may leave its ammonia; and it does leave it—it comes out free. You take other water which has passed through soil, because it has picked up ammonia in its passage, and you pass it through other soil, in order that it may leave this ammonia behind. Why should it leave on its second passage that which it has picked up on its first? There is some confusion here.

On the subject of farm-buildings Mr. Pusey speaks with his usual good sense and moderation. He is of opinion that the farmer should be as well lodged as the parson. But of the buildings he says, "A man with 3000*l.* set apart for the purpose might well be uncertain what plan to adopt. Notwithstanding the really excellent plans of farm-buildings we have recently published, for one I should certainly be puzzled; because farm steadings, like certain countries, are really in a state of revolution;" and always will be. We are about to erect buildings on an arable farm, and with a sparing use of bricks (now, however,

much cheapened), we shall, with great care as to arrangement, use in the main larch poles and slabs. These will last twenty or thirty years, and at the time of their erection we shall plant a waste acre with larch or fir, which will come in for repairs, or for renewal, if, in the meantime, a better arrangement has been discovered. Moreover, we can now have a brickyard, without being troubled by the visits of the exciseman, and in it we can make our own draining-tiles and pan-tiles for covering, if we find it expedient. By these means, instead of the 10*l.* which is often required, we expect to execute the work for 2*l.*, or at most, 3*l.* per acre. It seems to us, that, in our present state of knowledge as to the management of manure, whenever a farmer can command abundance of litter, or dried peat, or any other substitute, boxes for the feeding of cattle and lodging of horse, cheaply erected, and dispensing with liquid manure tanks and water-carts, or other arrangements for its distribution, afford the best and most economical plan; for we are quite of opinion with Mr. Pusey, that "liquid manure is a pretty toy, but solid dung is for farming in earnest." On half the farms with which we are acquainted, want of extent and permanence in the building is not the evil, but an arrangement which forbids economy and the prevention of waste; and we know many in which a fire once in half a century, if it had burnt the buildings only, would have been a benefit to the property. And this state of things is not peculiar to agriculture. What manufactory is there in England to which buildings erected half a century ago are not a nuisance, and an impediment to the successful prosecution of the concern? We are much too apt to attempt to impose our wisdom on succeeding generations. We see plans for making farm-buildings fire-proof. What can be more absurd than any considerable expense incurred for that object, when you must have such inflammable articles as straw and hay on the premises, and when a wheat-stack containing 100 quarters is, even at present prices, of more value than a

barn or a stable? Low prices must, among other expedients, be met by an economy of dead capital.

The rest of Mr. Pusey's excellent treatise is devoted to what he calls "the practice of farming," and comes therefore only collaterally within our present scope. But, several pages on, "The Foulness of Land" has so intimate a connection with the expenses of cultivation, and Mr. Pusey's statements are so utterly opposed to our own experience, and to everything which we have ever seen stated by any other agricultural writer except Mr. Huxtable, that we cannot pass them by without notice. Mr. Pusey quotes from "Bayldon," a standard work, "the absolute expense" of fallowing an acre, "and his charge is estimated, be it observed, not for a field casually foul, but as a regular ingredient of the cost of the entire turnip crop of a farm every year." The absolute expense amounts to 2*l.* 9*s.* 6*d.* per acre. If to this be added the 28*s.* 6*d.* per acre for rent, tithe, and taxes, included in our proposal to Mr. Huxtable, the amount will be 3*l.* 18*s.* per acre. Our field is casually foul, fouler probably than the average land of England, when its turn comes to be fallowed. On the other hand, we are sure that land which has for a series of years been periodically subjected to Mr. Bayldon's fallow would be much less foul than the average. We do not, therefore, after having seen Mr. Bayldon's detailed estimate, repent of our charge of 6*l.* per acre for making a field, casually foul, "free from couch;" nor do we think that the additional 2*l.* for eradicating the deep-rooted weeds, whose existence Mr. Pusey completely ignores, is excessive. Every farmer knows that when a field is casually foul, or even of average midland and western county foulness, both these enemies cannot be destroyed by the fallow of one average summer. But Mr. Pusey proposes to strike out the whole of Mr. Bayldon's bill, except 8*s.*, adding 1*s.* per acre on the following authority:—Mr. Hudson, of Castleacre, forks the couch out of his wheat stubbles at the expense of 1*s.* per acre, and sows his turnips

with one ploughing, for which the above-named 8s. is allowed by Mr. Pusey. This is marvellous enough; but in farming, when any statement comes to us well authenticated, we accept it *as far as the instance in which it has occurred is concerned*. We know, however, that if this forking of couch were attempted on our wheat stubbles, or on the bulk of those over which our eye passes, the hardened surface would come up in lumps, and the couch, instead of being presented on the surface in the handsome form in which Mr. Pusey has presented it to us by a drawing, would be broken into short lengths, each imbedded in a hard lump of soil, and ready to sprout with the first rains of autumn, and could only be destroyed by "the ploughing, harrowing, rolling, raking, and burning, 'very likely' repeated a third time," which he so much deprecates. We know, further, that if we should attempt to grow turnips on one ploughing from a wheat stubble, we should never get a sufficiently tender tilth to ensure a plant. Oh! that Mr. Hudson and Mr. Bond could be our godfathers, and that, leaving 8s. for ploughing and 1s. for forking, we could "strike out at once the remainder of Mr. Bayldon's long bill, which will give a saving of 2l. per acre upon the turnip crop, that is, on one quarter of an arable farm; and as 1l. is the average rent of land in England, a saving of one-half the rent. Let no one hereafter speak of clean farming as expensive farming. What high farming may be remains to be seen. At all events, according to Mr. Bayldon, we have saved *two pounds* per acre to pay for artificial manure on our turnip crop, which we must hope will suffice."—*Pusey*, p. 47.

On his own farm Mr. Pusey allows only one pair of horses to one hundred acres of land—a lower estimate than we have seen elsewhere. He says, "I had a farm full of couch, and having now made it clean—" Happy man! But we long intensely to know at what cost of money and of *time* he made it clean. What capital of cleanness has he invested in the farm? What sum does

it owe him annually for permanent interest on cleanness, or for gradual replacement of money? We want to know "what landlords and farmers ought to do," not on clean farms, but on average farms. Will he tell us what sum of money must be invested to make all the farms in England as clean as his own? He, a provident man, got landed in good times. We are still struggling in the slough, and want him to tell us how we are to get out. We admit, however, freely, though we differ with him sometimes, that he has done more to help us out than any man we know.

Passing on to other points of practice, Mr. Pusey takes frequent occasions of showing that the idle, the ignorant, and often even the parsimonious farmer is the "real spendthrift." He treats both of increase of produce and of reduction of expenses, and perhaps, on the whole, gives rather the greater prominence to the latter topic. This is at least an useful corrective to other agricultural publications, which have dwelt almost entirely on the former. We beg leave to convey to Mr. Pusey, with much respect, our sincere obligations. He opposed the late legislative changes which affected his order, and probably retains on that subject his old opinions; but he writes with admirable candour; and the unrepining and even hopeful spirit in which he treats of the prospects of agriculture, indicates the influence of a temper and of principles which it must be a happiness to any man to possess.

Mr. Pusey says that farming estimates of the expenses of cultivation are fanciful things; and often they are so. But there must be expenses, or there must be limits within which they can be estimated. We are sure that we could form an estimate which no man could prove to be excessive, but which would show that where an arable farmer grows only twenty bushels of wheat, thirty of barley, and forty of oats (gross produce at present prices about 4*l.* 4*s.* per acre)—and in this category would be included more than half the arable farmers in England—he must draw in

many cases for the whole, and in all for a large portion of his rent, tithe, and taxes, either on his own capital or on the staple of his farm. Neither of these funds is likely to answer his drafts long. What then must be done? He can only improve his position in one of two ways; either by producing more at his present cost, or by producing his present quantity at less cost—or partly by the one and partly by the other. Produce can only be increased either by enabling your crops to avail themselves more fully of resources already existing in the soil—which is improved culture; or by adding resources to the soil—which is extra manuring; or partly by one and partly by the other. Improved culture is a leech, and tends to exhaustion. You have a horse going four miles an hour; you flog him, and he goes eight; but the next time you flog him he will only go six, and so every time in a diminishing ratio, till at last he will not go at all. If your whip is only sharp enough to increase his pace from four to six in the first instance, he will probably go a little longer, but will only traverse the same ground in the end. To this general rule there is, in practical husbandry, one important exception. To the extent to which the improved culture effects the extirpation of weeds, the cultivation crop may be increased without producing increased exhaustion. (We will have a word with Jethro Tull's new-fangled disciples, the spade-husbandry men, by-and-by.) Even if this view of the case be wrong, still the advantage of improved culture must be estimated by a balance between increased cost and increased produce. Extra manuring may be effected from two sources, either by purchasing manure directly, or by purchasing it circuitously, *i. e.* manufacturing it by the agency of cattle. In the latter case the manure is equally purchased, whether the cattle consume food expressly bought for them, or whether they consume what would otherwise have been sold. Which is the cheaper way of providing extra manure? That may be a question difficult to answer, because the cost in one case is fixed, and in the

other variable. Our impression, rather than our opinion, is, that where a farmer is a *good buyer and a good seller*, where he has such an arrangement of buildings and such an apparatus as enable him to reduce the cost of preparation of food and of attendance on his cattle to a minimum, he will manufacture manure cheaper than he can buy it; but the contrary where one or more of these elements of success are wanting. We think, however, that the manufacturer plays on the whole the surer game; 1st, because he can be certain of the quality of his article; and, 2ndly, because we do not think that it is established beyond doubt that the light concentrated manure, on which he must mainly rely if he is a purchaser, will for a series of years maintain a farm at the same point of fertility as those which are manufactured by the old-fashioned organs of digestion. But the improvement of a farmer's position, either by purchasing manure or by manufacturing it, depends wholly on the balance between the cost of the manure and the value of the increased produce. He may make his position better, or he may make it worse. Fourpence per pound for ammonia may raise him; sixpence may depress him. Mr. Pusey, relying on the Rothamsted experiments, says that 18s. worth of guano will produce 40s. worth of wheat. We never found it so, or saw it so, in actual farming. We think it very unlikely that it should be so. It would be better than California. It would be impossible to keep it secret. Any blockhead could find it out. Any blockhead could practise it. There is no science, no skill, hardly any exertion. It is very little more than putting 18s. into a banker's hand to receive 40s. in six months. There would be a guano mania, and a guano king. Perhaps our own experience is a little nearer the mark. In the summer of 1849 we thoroughly drained and fallowed well twenty acres of poor land. In February, 1850, we sowed it with barley, and sowed at the same time 4 cwt. of guano per acre. The cost of the guano when sowed was 45s. per acre. We are morally certain, judging from previous experience, that the

crop of barley on this land, grown after a year's fallow without manure, would not have been less than three quarters per acre. The actual crop varied only a few bushels in the whole field from five quarters per acre. We cannot state to half a bushel per acre, because we do not know exactly what allowance to make for a few trees which stand in the field. The barley was not of first quality, worth 22s. or 23s. per quarter. In short, the extra barley just paid for the guano. Still we think that we had an advantage in the transaction. The increased crop kept down annual weeds. We expect to find an advantage, perhaps 5 cwt. of clover-hay per acre, this year. Independent of the pleasure of seeing a good crop on poor land, we should be just willing, on mercantile grounds, to repeat the transaction, and we believe that a similar description would be very applicable to average cases of buying guano and selling produce. When we come to the second means of improving a farmer's position—producing the same quantity at less cost, there is no doubt, no balance; the account is pure gain. Be it much or be it little, he has improved his position by the whole. If it has cost him 4*d.* to thresh a bushel of wheat, and by a new method he threshes it for 2*d.*, on a crop of twenty bushels he has improved his position by 3*s.* 4*d.* per acre. If it has cost him 8*s.* per acre to plough his land, and by an improved implement and method he ploughs an acre in the time which three-fourths occupied before, he has improved his position by 2*s.* per acre on every ploughing. If by the removal of fences and trees he adds one productive acre to every ten (*Pusey*, p. 26), he has improved his position by 2*s.* per acre, supposing the rent to be 20*s.* How we are getting on! We should soon put a rent between the farm where these things are well done, and where they are ill done. But we give these merely as the simplest and unexaggerated examples. And let there be no mistake: read Mr. Pusey's pamphlet. Improved and efficient implements do not cost more than the unimproved and inefficient—frequently less.

You need not read anything to tell you that a square field costs less to cultivate than a three-cornered. An owner who will not put his fields into the shape in which they can be cultivated at least cost, does not deserve rent. Increase your produce by increased culture wherever the increased produce will pay for the increased culture. Increase your produce by extra manure whenever the extra produce will pay for the extra manure. But under all circumstances, and in all states of markets, use your utmost endeavours to raise the same amount of produce at diminished cost.

Now a word with the spade-husbandry men; and we shall treat them very curtly, because, among the many humbugs which benevolent individuals have run after, we believe this to be the rankest of all. They found themselves on Jethro Tull, and say that he discovered that culture would supply the place of manure. He discovered nothing but a mare's-nest. The discovery of which they speak would have been the greatest ever made in agriculture, and such discoveries never die. But Tull's no-discovery has been dead these hundred years. Ancient or modern, there is not a single evidence in its favour except his own. But, they say, garden culture and garden produce. See how a gardener digs, and chops, and trenches. Did they ever know a gardener who would cultivate without manure? Ours is ravenous, insatiable; we dread to see him near our manure-heaps. We know something of this matter, because we grow potatoes every year by the plough, harrow, and horse-hoe, and others, where we cannot plough, by the spade, rake, and hand-hoe. The former always beat the latter, because the former set of implements are more efficient than the latter. On two-thirds of the cultivated land in England nothing can be less efficient than a spade and rake. They cannot deal with cloddy land at all. Pray do not overwhelm us with instances, because we can prove your case *ad nauseam* by adopting the well-established plan of stating one side. We know two instances, in each of

which a benevolent gentleman has devoted a field of the finest old turf to labourers' gardens. The produce has been enormous, the admiration of every one, has gone the round of the papers. It would have been just the same with the plough, but gentlemen vigilantly guard their very fine old turf from the plough. We know several instances in which ordinary land, devoted to labourers' gardens, has diminished year by year in produce, and in which the number of deserted plots has year by year increased. We do not at all deny or doubt that the occupation of a piece of spade-husbandry land is an alleviation to a man who cannot get work ; nor do we deny or doubt that an inducement to pick and scrape the roads very often prevents waste. We have seen instances in which a labouring man has been tolerated in taking possession of twenty or thirty perches of a very poor waste, and by picking and scraping has manured it up to a very considerable produce ; perhaps, if a value were placed on his own time and on his children's, at considerable cost. But the sight is gratifying : a man has acquired an object endeared to him by honest industry, and has taken a step on the road to independence. When moral good has been created, we do not strictly scrutinize the economical results. But all this is very different from employing spade-husbandry as a remedy for agricultural pressure. Spade-husbandry created the Irish paupers, but it very soon left us to maintain them.

In a work to which we have already alluded, Mr. Johnston, whose general tone and reflections will, we have no doubt, receive the sympathetic approval of a large body of readers, intimates that, recently, in the *Quarterly Review*, we have spoken with unbecoming coolness of the future prospects of agriculture. The coolness must have been of manner ; it could not have been of feeling, for it would be difficult to find a person more completely bound up with agriculture, by habit, by taste, and by interest, than ourselves. We might have expressed regrets which would have been sincere, but which would also have been

expressed in vain. We did, in the passage to which Mr. Johnston excepts, anticipate for agriculture a revolution to be occasioned by economical pressure; and we still fear that our anticipation was correct, and that the revolution is in progress. All the merely arable farmers, below the first class, whom we see or know, have employed for the last two years less labour, have purchased less manure, and are wearing out their farms and themselves. Our observation, indeed, though not confined to the midland counties, lies principally in them, and there the practice of arable farming is at a very low ebb. Many of the farmers depend mainly on other modes of occupying their land, and every operation connected with crops raised by the plough is performed at much greater cost and in a much more imperfect manner than in the southern or eastern counties. We do not think that on farms where the principal dependence is on dairying, grazing, or sheep-breeding, the pressure is very severe. Grass farms have been less affected than arable, partly because there has been a less percentage of fall in the price of their produce than in cereals, but principally because the cost of production has not hitherto fallen in the same ratio as the price of produce, and on grass farms, as compared with arable, the cost of production is a very immaterial item. Gloomy, however, as is the view which we take of the present state of arable farming, if we are asked whether it will again prosper in England? limiting our ideas to the degree of pecuniary prosperity which is due to a very engaging, a very salubrious, and a tolerably certain employment, we answer without hesitation, that we believe that it will; but not till after a revolution. We feel strongly the pain of a revolution, and we are quite aware, that no business, partly from the habits of those who carry it on, but much more from real natural impediments, from its fixtures we may say, and from its tenures, submits so slowly and so unwillingly to a revolution as agriculture in England. Still the revolution must and will be effected, and those will have the best chance of pros-

perity who get through it before they are subjected to the full force of domestic as well as of foreign competition. When the revolution is effected, we cannot be blind to the following considerations :—Mr. Pusey says that England has the best climate in the world for farming; and perhaps, if we couple green crops with cereals, this opinion is correct. England affords the best market in the world; has (in our own hemisphere) the most concentrated population, and the best communications; furnishes the best and cheapest implements and machinery. Money is habitually cheaper in England than in any other country. In works of labour and of skill Englishmen challenge the world for efficiency. The existing laws are oppressive to agriculture, but we have a right to expect that justice will prevail, and that agriculture will be relieved. These are surely elements of prospective prosperity. Still, looking to unlimited competition, and bearing strongly in mind how difficult it will be to subject husbandry, which cannot shift the venue, and which must be more or less tied to existing institutions, to the purely-economical regulations which would be adopted in a newly-established manufacture, we would rather express our opinion of prospective arable prosperity negatively than positively.

1st. We believe that no arable farm will prosper which has not, at the least possible outlay of dead capital, buildings which, in extent and arrangement, and position, will facilitate the greatest economy of labour.

2nd. That no arable farm will prosper on which, from want of concentration or of good roads, the internal communications are inconvenient and expensive.

3rd. That no arable farm will prosper which is not of sufficient size to employ economically the most efficient implements suited to its texture, the best machinery, and probably steam-power.

4th. That no arable farm will prosper which does not give facilities for the economical production and good management of manure—when such facilities have been discovered ;

5th. Which is not dry by nature or thoroughly drained, and entirely emancipated from all sacrifices to taste, fancy, or prejudice.

We assume capital and skill in the occupier. We believe that, under any circumstances which we can anticipate, men of capital and skill will be ready to take farms complying with these conditions ; that they will pay an annual sum to cover rent, tithe, and tax ; and that on an average of years they will make a competent profit. They will farm higher or lower (but never so as to diminish the fertility of their lands), in conformity with the principles which have been developed in this article.

The conditions here stated are novel in British agriculture, but they are not unreasonable. *Mutatis mutandis*, they would not be considered stringent if applied to any manufacture ; indeed, no manufacture could prosper which did not comply with them.

In speaking of the farm of Auchness we made allusion to the advantages which some farmers have derived from paying attention to crops which either do not occur or occur on a more limited scale in the ordinary routine. Probably new objects of culture may be introduced, because pressure is near enough akin to be also the mother of invention. We look forward also to a different appreciation of the present objects of culture. Fine wheat appears to us to be in Great Britain a forced production, and very ungrateful for the sedulous care which we bestow upon it. We select seed with the utmost attention, we create and import varieties, we invent implements expressly for the culture of wheat, we write more on the culture of wheat than on that of any other grain ; and when we have done all, the random cultivation of Poland and of *many other countries* leaves us far in the rear in quality. The *Times*, containing a return dated "Corn Exchange, Monday, March 17, 1851," is now before us, and it presents the following results:—The highest price of *any* British wheat is 45*s.* per quarter. The highest price of Dantzic is 48*s.* The highest price of Lincolnshire

and Yorkshire wheat is 38s.; of Rostock and Wismar, 45s.; of Pomeranian, 43s.; of Ubermark, 42s.; of Silesian, 40s.; of Hamburg, Bremen, Holstein, and Lower Rhine, 40s.; of Brabant and Louvain, 40s.; of Flemish and Zealand, 42s.; of French, red, 40s., white 42s.;—a sufficiently discouraging result. And be it remembered, that the highest-priced Lincolnshire and Yorkshire wheat is probably fresh threshed, whereas all these foreign wheats have probably been some time in warehouse, and have certainly been subjected to a much longer sea-voyage than the English, and are necessarily more stale and in inferior condition. Flour tells the same tale. Both the French and the American deluge us with flour of finer quality than any which can be produced by British millers from British grain. Any one who has seen the white breads of the Continent, of Paris, of Turin, and of Florence, and the macaroni of Naples, must be aware that it would be vain to expect such products from British flour; and when he compares the cultivation of those countries with that of England, he may well be surprised at such results. The fact is, that the *quality* of wheat depends much more on climate than on culture. When we look to barley, we find exactly opposite results. We quote from the same document. The finest British barley 28s. per quarter; the finest Saal, 25s.; Danish, 21s.; Baltic, small, 18s.; Baltic, large, 21s.; and the only foreign barleys which are quoted as of malting quality are the Saal and some Danish chevalier. The case of oats is similar to that of barley. The finest British oats, 21s. per quarter; the finest foreign, 18s. Thus in barley and oats we distance our competitors as much as they distance us in wheat. If you are disposed to experiment in high farming, no grain is so hazardous as wheat. The least extra manuring, or in a moist season even an ordinary manuring, will throw it down. No grain falls so early, is so slow in rising again, or receives so much injury when down. You may bestow manure on barley with much greater confidence of a beneficial result.

If you see a man pass from growing wheat to growing barley, depend upon it he has either improved his culture or his land has been drained or otherwise substantially benefited. All the least and worst arable farmers in England below the hills grow what they call their "bit of wheat," but barley is quite above them. Many of our neighbours on undrained lands tell us that it is of no use to sow barley, explaining, by true farmer's logic, first, that there would be none, and, secondly, that what there was would be fit only for the pigs. But we have exploded that idea. Three of our neighbours, who have thoroughly-drained and highly-manured land of weak staple, not very free, and lying on a retentive bottom, have grown in each of the last three years between 50 and 60 bushels per acre of barley, weighing 55 lbs. per bushel, and of a quality acceptable to the brewers of Burton-on-Trent. This year, for the first time, we have done it ourselves. Thorough draining will make any land barley-land, unless elevation forbids. The case, therefore, stands thus:—Barley is the grain which is most grateful for high farming—barley is the grain, the production of which, *of fine quality*, we have the greatest power to extend—barley is the grain as to which we have least reason to dread the number or the power of our foreign competitors—barley is the grain, the consumption of which is limited by a tax amounting at the present time to cent. per cent.—and barley is the grain which is not allowed to be drunk on the producer's premises for the purpose of reproduction unless he pays the tax. We had almost said, indeed, if the editor does not think that it savours of political intimidation, we shall be obliged to him if he will allow us to say, that we will never vote for a county member who does not vote for the repeal of the Malt Tax.

Many persons have expressed an apprehension that the owners of landed property in Great Britain are in danger of being permanently degraded. We do not believe that this can be the case in a country constantly increasing in

population and wealth, which is constantly consuming land by buildings, pleasure-grounds, roads, railways, docks, and cemeteries, and in which the possession of land is a pride and a passion. Nor do we believe that the revenue derived from real property can be permanently diminished. The British landowner never felt himself to be a rich man, as compared to a person deriving an equal income from other sources, because, whatever might be his personal frugality, he has always been subject to the temptation of expending his savings on his property, and it has been quite as often on blunders and fancies as on improvements which added to his revenue. It may be that for a period, now commenced or at hand, he may have to season the pride of his position with somewhat of increased pressure, because he is always in debt. He has been the shuttlecock of those legislatures who have sported with the currency; struck up to a giddy height from 1797 to 1815, from which height he has been let down by successive subsidences to his present depressed condition. Mr. Johnston, in "England as it is," reckons the "indebtedness" of real property in England at one-half of its absolute value, and the annual charge of such indebtedness at one-half of its revenue. But for the circumstance that this debt, both as to principal and interest, is a "*fixed amount of money*," the statement would amount to no more than this—that the apparent owners of the real property in question only own one-half of it, and that somebody else owns the other half. "But," as Mr. Johnston justly observes, "when we take into account debts or fixed engagements of any kind, a change in the currency must disturb the balance of justice; and when the change is such as to increase the value of money, it is a severe measure of oppression upon the weaker and indebted class, while an undue advantage is given to those who are least in need of it." Under this oppression the present race of landowners are struggling; and, on the whole, manfully. A certain amount of change in the ownership of land is always in progress, and is no

doubt salutary to the body politic; but the tenacity of landowners has, under all difficulties, opposed a successful resistance to a sweeping revolution. Any one who looks into Fuller's Worthies, or Sir William Dugdale's Catalogues of Commissioners, or into the indexes attached to Plott's and other county histories, will find the old names attached to the old places to a considerable extent. Our hope and belief is, that, notwithstanding present difficulties, the hereditary owners of land will, by a continued exertion of the energy and prudence which carried those from whom they inherit their possessions through all changes, continue to maintain their social position.

The reproach of British agriculture, that she had no literature, is fast passing away. The works which we have placed at the head of this article would be creditable to any science and to any age. We are not acquainted with the agricultural publications north of Tweed, but we have been told that they have great merit. We constantly see with wonder and admiration the variety and spirit by which the Royal Agricultural Journal is sustained. The Agricultural Gazette, attached to the Gardener's Chronicle, contains almost weekly some practical article of sterling value. The letters of the *Times*' Commissioner have ably supplied a deficiency which has existed ever since the time of Arthur Young's agricultural tour. They have informed the general body of agriculturists of the varieties of practice which have obtained a permanent footing in various districts, causing each to contribute its quota of knowledge and experience to the general stock of information. In offering our humble mite, we are, indeed, proud of our fellow-labourers.