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The
Silo and Silage

By A. J. Cook.

THE

SILO AND SILAGE

BY

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SUGAR AND THE SUGAR BUSH.

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PREFACE.

I write this primer: first, because I have been asked to do so; secondly, because, from my experience, I deem the silo a tremendous advantage to any farmer, and I wish to influence the farmers to do that which will aid them, in the struggle for success, more than any other one thing. My silo has been a surprising success, and in this little *brochure* I shall tell in a plain, simple way how I grow the corn, build my silo, fill and cover it, and feed the silage. I shall not pretend that this is surely the best method in every respect, but I shall urge that it will all pay, and prove a success; for I have tried it at an immense profit. There ought to be one thousand silos built in Michigan and ten thousand in the United States during the next year. I hope and trust that this little effort of mine may aid in bringing this about.

Agricultural College, Mich., Feb. 18, 1889.

THE SILO IN GENERAL.

A silo is simply an air-tight, water-tight box, in which green, succulent herbage may be placed and preserved as we preserve green fruit. It must not only preserve the contents from the air, but also protect against frost.

Silage—ensilage is a less acceptable term for the same substance—is the material that has been preserved in the silo.

IMPORTANCE OF THE SILO.

The great danger of American agriculture is the loss of fertility. Too much cropping, too little manure. Thus our soils become barren, our crops meager, and in the intense "struggle for existence" we go to the wall. What we most need—what we must have—is more fertilizers. The cheapest and by far the best fertilizer for the great majority of our farmers is barn-yard manure. He who secures the most of this will win in the race. To secure this barn-yard manure we must keep stock—cattle, sheep, hogs and horses—and the more the better. From my experience, I am free to say that with silage properly secured we can increase our stock one-half. Many say the stock can be doubled. If the silage can be made a safe and healthy ration the year through, as I think more than probable, thus superseding the wasteful system of pasturing, then surely the last estimate made above is entirely within limits. We thus score one—a tremendous one—for silage. Double the stock, double the manure; double the fertility; double the production.

Again, silage is a succulent food, and so, like the green pasture of June, is appetizing, digestible, and assimilable, just the food that suits the needs of the animal. This is why the agricultural chemists erred, at first, so surprisingly regarding this food. They could find no added elements, and so insisted that it could have no virtue beyond that of the dried plants. They did not stop to think that a dried, over-cooked steak of beef or mutton, though containing the same food elements of one juicy, tender, "done to a turn," was far less digestible. Silage is much more digestible than dried food, and thus the beef animal fed on it looks more sleek, and lays on fat faster; the milch cow gives more and better milk; all animals, cattle, horses, sheep, and hogs thrive upon it; and are more thrifty and healthy, because it ministers to their every need. Such men as F. D. Curtis, E. A. Powell, and J. S. Woodward, of New York; J. Gould, of Ohio; and H. Smith, of Wisconsin, dairymen of the highest intelligence, who know their business from A to Z, all unite in the assertion that it adds decidedly to both the quantity and quality of the milk. I recently saw in Secretary J. S. Woodward's barns, of Lockport, New York, a large herd of cattle, which had been carefully divided in the fall into two lots as uniform in condition as it was possible to make them. Each lot has been crowded to the utmost by free use of mixed grains. But one lot has had silage, and the other the best of clover hay, otherwise the treatment has been the same. This was a wonderful revelation. The cattle fed silage, in condition, both as to sleekness and fat were surprisingly superior to the others. I said if all were turned into a yard I believed I could select all of the silage-fed animals with hardly a mis-

take. The other gentlemen present, Colonel F. D. Curtis, Hon. Seth Fenner and Prof. E. F. Ladd, were as sanguine of the same ability as was I. Here, then, is our second score for silage. It serves the needs of the animal, and is far more digestible than is dry food, and so pushes growth, lays on fat, fosters health, and increases milk and butter as no dry food can do.

Again, if the silage is properly secured and preserved, as it easily may be, the cattle, horses, etc., prefer it to other feed. This preference is a pretty certain indication of suitability and excellence. After one of my cows had had silage for weeks and no hay, I tried giving her, at the usual feed time, some very nice, bright, green hay and silage side by side. She ignored the hay, and commenced upon the silage as if ravenous with hunger. The hay was then replaced with some ground oats and corn mixed; to our surprise the grain was left undisturbed till the silage was all gone. Another score for silage: The cattle like it; and the cattle know what is good for them.

THE BEST CROP FOR SILAGE.

Beyond question corn is the most profitable crop for silage. It is a very sure crop. It grows very rapidly. And we get a large yield per acre. From twelve to thirty tons are grown on an acre of land. As three tons of silage are worth one ton of the best hay, this is equal to from four to ten tons of hay per acre. Again this is the cheapest way to harvest corn, and puts it in a small barn space. Clover, millet and Hungarian grass can be more easily and cheaply harvested in the

usual way. From my experience I have reason to think corn (of course I mean corn stalks and all) as silage a pretty good food ration alone. If it is desired to add more albuminoids, bran and oil meal are easily obtainable. It is quite likely that it may pay to make silage of clover, and mix this with the corn silage in feeding. I have had no experience with this. We know that variety in any food ration is relished, and so we may believe is wise and desirable. My success with corn silage has been so marked and satisfactory that I believe it to be of first importance and highest value.

PREPARING THE CROP.

The kind of corn for silage is that which will mature the most corn, after which it is desirable to secure the most we can of stalks. The B. and W. or large Southern corn is not the corn for Michigan, as it does not mature. And we want the great yield of corn. Stalks are good but corn is better. As I look upon my silage I wish to see it thick with ears, or slices of ears as they were left by the cutter. I know that our largest, most prolific flint corn makes superb silage. If there is a variety of dent corn that produces as much grain, and more stalks, then it is better. If sweet corn furnishes the most grain and stalks, then it is best. This is to be said in favor of our flint and dent corn. We can save our own seed, and so can be certain that it will germinate and grow vigorously from the start.

I quote from the Bulletin (No. 1) of the New Hampshire Experimental Station: "*Tons per acre, regardless of feeding value per ton, were formerly regarded as the best indication. This is wrong, and to-day the most experienced users are*

finding that immature watery varieties, though standing high in the scale of *tons per acre*, are really lower in the true scale, of *feeding value* in the manger.”

HOW SHALL WE PLANT?

A short, easy rule is this: Plant, cultivate, and care for just as you would to secure the most field corn, just as you did before silos and silage were heard of. Of course, methods will vary some with locality, soil, and the person who grows the crop. I prefer to plant on plowed sod, which has been generously covered early the preceding winter with fresh barnyard manure. As soon as our oats are in—this work, oat seeding, is hastened by using that par-excellent implement the Clark cut-away harrow in lieu of a plow. After the sod is plowed the cut-away harrow is used to mellow it. I desire a deep, mellow seed bed. We aim to have our ground in readiness by May 20. It does not pay to hasten planting too much. When planted, the corn should commence at once to germinate, and should push up rapidly and vigorously, which is only possible with warmth and sunshine.

It is also a wise precaution that should never be forgotten, to test our seed before planting time arrives. This is especially important in case we purchase our seed. If we save our own seed, which is always wise, selecting the best, and hanging it in a *warm, dry room*, so that it will dry out early and thoroughly, then we may be pretty sure that every kernel will germinate; but even then testing makes “assurance doubly sure.” This testing is a very simple matter. We have only to put a certain number of kernels in a box of

moist earth about as we would plant them, and keep the box in a warm room. If all or nearly all send up the sprout, then we know our seed is good, and need have no solicitude in planting it.

I find I can grow the most corn with the least labor to plant in drills. I have no special corn drill—I doubt if the average farmer can afford to purchase one—so I use my grain drill. All but the two outside feeders are stopped up with wooden plugs. This makes the rows four and one-half feet apart. In this way we put on about ten or twelve quarts of corn to the acre. Pretty thick, do you say? Yes, but corn is cheap; and if planted so thick the cut worms can take some and yet do little harm, and we can drag up some and yet have enough for a first-class crop of corn. In thus drilling, we space every other row with the eye. With care this can be done so as to please the most fastidious. We must also watch the hose, lest they clog with some sod or clod, and we drop no corn. In this way it is possible to plant ten acres in a half day. I like this method. It requires no machinery not already on the farm, it is a cheap and easy way to plant, and best of all, it has given magnificent crops of corn. Nearly or quite as soon as the corn is all planted, especially if we have rains to compact the soil, I put a fine tooth harrow to work. This may be very large, so as to harrow a wide space in once crossing the field. The teeth are small and slant back. By use of this the soil is mellowed, and the ever present weeds just peering through the ground are uprooted and destroyed. This harrowing is continued till the corn is three or four inches above the ground, and the

stalks so thinned that a maximum yield of corn is insured. As a result the weeds are largely vanquished, the corn is pushed to a most vigorous growth, so that it only remains to cultivate the crop with a good spring tooth cultivator till it becomes too large to work. Thus all hand labor is avoided, weeds are very scarce, even in the rows, and a mammoth crop almost always rejoices the heart of the one who planted and tilled. We must be sure to so thin our corn as to secure a maximum yield of grain. This will also add to the value of the stalks.

LOCATION OF THE SILO.

As already intimated, when space and convenience permit, there is no better place for the silo than in the barn. This makes it convenient to feed and saves expense, as no roof is required. It has been estimated (see Bulletin No. 1, N. H. Ex. Station, p. 1) that such a silo can be built for \$1.00 per ton of capacity. Thus a silo holding seventy tons would cost \$70.00. Mine cost me nearly double this amount, yet in the end mine may be the cheapest. It should be remembered that the silo will surely increase the stock of the farm, as this might influence us in locating the silo. If the barn is a basement barn, so much the better. The silo may extend from the floor of the basement to the plates of the barn. This enables us to cut our filling on the floor above the basement, and saves elevating to so great a height. If we build outside, we must locate with reference to ease and convenience of feeding all our stock, horses, cattle and sheep; as we shall wish to feed silage to all. It should be remembered that feeding is semi-daily work, and no care should be

neglected in our planning to bring the door or doors of our silos as near as possible to the mangers that are to be filled with the silage. If a few hours' thought, study and planning save years of regret, it will be very well employed.

BUILDING A SILO.

We now have the corn rapidly nearing maturity, and we must hasten to prepare the silo, that it may be in readiness by the time the corn is in condition to cut up; the usual time for cutting field corn that is to be husked.

As already stated, the silo is an air-tight, nearly frost-proof room. To make it air-tight and warm it must be double walled. Unless it is made right in the barn, which is usually the best and cheapest plan, it must have a good roof, just under which arrangements should be made for ventilation.

SIZE OF THE SILO.

This must vary greatly, depending upon size of farm and position of silo. I can only give some general hints. The usual mistake is to make the silo too small, so that with the succeeding year a second silo must be built. This of course adds to the expense. My silo is twenty feet high, and I should like to have added five feet, but could not, as I built it in my barn, and so the height was limited. As the carriers to our present feed cutters carry the cut stalks to almost any height, I would prefer the silo to be twenty or twenty-five feet high when this is practicable.

To aid in determining the size of the silo, let me say that estimating forty lbs. to the cubic foot—I have known it to weigh fifty-six lbs.—which is near enough for our purpose, a

silo ten feet square and twenty feet high will hold forty tons of silage, and one fifteen feet square and twenty feet high will hold ninety tons. If we raise fifteen tons to the acre—many report twenty and twenty-five—which we may surely hope and expect to do, it will take not quite three acres to fill the first silo; and about six to fill the second. Again, if we count sixty lbs. a ration for a cow or horse, which, with the addition of some bran, oat meal, or oil meal will keep a cow or horse in thriving condition, then the first silo would feed eight cattle for nearly six months, and the second would feed seventeen for the same time. These figures look large; but experience proves them reliable. Prof. E. M. Shelton says usually by the middle of January he takes an inventory of his stock and feed, and trembles as he contemplates the shortage in spring. Now, as he sees what his silo is doing, and can do, he thinks he will not need to save any feed in 1889, as he has enough to last till May, 1890. I quote from memory. Yet Prof. S. feeds sixty cattle and has, I believe, only ten or twelve acres of corn and sorghum in his silo. Mr. Jaques, of New York, objects to the silo on this ground: Usually he has had to buy 100 tons of hay to feed his great flock of sheep and herd of cattle. This winter with his silo he will have to buy none, and so will lose all that manure. With the above figures, each person, after studying his farm, his barn, and circumstances can decide upon the size of his silo. Let me caution, however, not to build too small. With a good silo we can sell most of our hay at a large profit, and yet keep our farms in fine condition by buying manure and taking a large load of this home each time a load of hay

is taken to market. We shall keep our farms increasing in fertility if we pursue such a course, and at the same time add vastly to our income.

THE FOUNDATION.

I would have the bottom of the silo eighteen inches below ground, that the stone wall on which the silo rests should have the earth to sustain it on the outside. I would dig a trench for the stone wall two feet below the bottom of the silo. This is to be filled for a foot with small stones, and, if necessary, thoroughly drained. *The bottom of the silo must be dry.* The remainder of the foundation wall should be laid in cement. This wall should be eighteen inches thick below the bottom of the silo. From the bottom of the silo to the top of the ground it is only eight inches thick. That is, only the outside of the wall is carried to the top. Thus the inside ten inches of the wall only extend upward to the bottom of the silo—eighteen inches below the surrounding earth. On this rest sills made of three two by ten inch plank, which lap at the corners and are firmly spiked, thus tying the sides firmly together. It will be seen that, as these plank lap at the corners, they lie not on each other but two inches apart. In large silos, where the sills are long, several pieces of plank must be placed between these long plank, so that the upper ones shall not sag from the weight of the building. The studding or uprights, which should be made of two inch plank ten inches wide, and as long as the silo is high—in my silo they are twenty feet—rest on the sill to which they are toe-nailed by use of spikes. These are sixteen inches apart. We see that the lower end of these studs push against an

eight inch wall, and this against solid earth. Thus we secure against any possible pushing out of the walls of the silo, which is a very important matter. It will be seen that the silo is mostly above ground. It would be just as well for the silage to dig deeper into the earth, providing the pit was thoroughly drained, so as to protect against water; but it is harder to feed where the silage has to be lifted up and where work is to be done frequently—once or twice daily—it pays to make it as easy as possible. We should force gravity to aid not to hinder us in our work. In case we build outside a basement barn, it is often wise to dig down and bring the floor of the silo on a level with the floor of the basement of the barn.

THE WALLS.

The studding, as just stated, should be two inches thick and ten inches wide. The ends of these planks of course extend crosswise of the wall. They should be from sixteen to twenty inches apart. Mine are sixteen inches. I think twenty would answer, though I know of several silos where the walls have been thrust out by the pressure of the silage. It is wise to make the walls secure against any possible lateral thrust that may be brought against them. The walls of my silo are firmly held by beams, eight feet from the bottom, and again at the top. When there is no such support, it may be necessary in case the silo is very large and twenty or twenty-five feet high to tie the walls with iron rods or put our studs one foot apart. We must in building insure against any displacement, as the heavy weight is placed in the silo. I emphasize this point, as many have built with too

little care in this direction, and their silos have not "gone back" but out on them. Some of our builders or physicists should tell us just how we should build our silos to be sure that they are sufficiently strong and yet save all unnecessary expense. As yet I know of no such data. In building we better err on the side of strength. We now tack onto the outside of this studding good, thick, firm, building paper, lapping it well at the edges. Outside of this we seal tight either with matched or shiplap lumber. The object is to secure an air tight sealing. If out doors, or cheaper, Hiram Smith's advice may be followed: first ceil with cheap lumber, then put on the building paper and shingle outside with cheap shingles, with a six inch exposure. My outer wall is made of paper and matched siding. We next seal on the inside with common lumber, and lath inside of that; or use, as I did, grooved siding, now so much used instead of lath to plaster on, and then plaster the whole inside with water lime, or cement, just as we plaster a cistern. This not only makes our silo water tight, but we also form an air-tight or dead-air space of one foot all around the silo. This makes it practically frost proof. In purchasing the cement for our plaster we must be sure it is of first quality. I have known such plastered walls to crumble because of poor cement.

It is true that such plastered walls cost more than walls wholly of wood. But they last, and like the laws of the Medes and Persians change not. Were we sure that by use of oil, pitch, or hot coal tar and resin, we could so coat our wooden walls as to certainly make them water proof, then, owing to greater cheapness, wood would be preferable; but

after seeing such walls not more than one or two years old, that were badly warped and swollen, and that I could pick to pieces with my finger nails, they were so water soaked, I am suspicious of them and am glad I have not the very expensive, but very durable plastered walls. I believe in the end no one will regret the small extra expense of plastering the inside of the silo with the cement. It costs here nineteen cents per yard to plaster. If we do all the labor and only buy the cement and hire the mason it only costs ten cents per yard; or for a silo fifteen feet square and twenty feet high only thirteen dollars. Then we have a safe, sure and lasting structure.

It will be observed that I say nothing of stone, brick, or concrete walls for the silo. They cost more than wooden walls and are not as good. It is found that silage does not keep as well next to such walls, and that the frost is almost sure to creep through them. I know of several who have silos with stone walls, that intend to seal inside with wood. I am sure that such silos will never give perfect satisfaction. The door to the silo should be on the side and in the position most convenient for feeding. It should be at least two and one-half feet wide, and if desired may be three. It should extend from the ground to within two feet of the top of the silo. This two feet serves to tie the walls of the silo together as do the plank below the door, and insure against spreading. As the silo is filled the door is closed by use of six-inch boards and building paper, which are added as needed. The point to be secured is to make all air tight. I also use similar boards and paper outside, which are nailed firmly in place. This also secures against spreading. Thus I have the dead air space at the door as well as elsewhere.

The object of this door extending to the top is for ease and convenience in feeding. We commence to feed from the top, raking or forking off each day as much silage as is needed. Of course we remove the six-inch door boards as we come to them, each in succession. In this way there is no mold or heating of the silage as we feed it out, but all is fresh continually. If the door is at the bottom, we must cut the silage down, which adds to the labor, and the exposed surface heats and spoils, especially if the weather is warm. The bottom of the silo, if the earth is clay and perfectly dry—it must be dry—is all right with no preparation. Otherwise a cement floor should be laid. As before stated, if the silo is out doors, a good roof must be added. The space between the top of the silo and the roof should be ventilated, else the damp air will cause the wood work to decay prematurely.

We thus have our silo complete except to close the dead air spaces at the top. Here we also use the paper and nail boards over this. In case the building is out doors, these boards may be two inch planks like the studs, which shall serve as plates. Of course the rafters will rest upon these. By spiking long plank to opposite rafters near the bottom, the building will be prevented from spreading. If desired iron rods may be used to tie with. Similar stringers may tie the end plates to the rafters. My silo is in my barn and the beams of the barn hold the sides, so that no spreading is possible. In building our silos we must be cautious that all is so firmly stayed that no displacement will be possible. In large silos it is usually customary to separate the silo into two apartments by use of a partition. I should never put a par-

tition in a silo unless the silo were so large that I would not feed fast enough—taking silage from the whole top—to prevent some injury from mold. By keeping some straw above the silage it will not freeze. The straw is easily pushed one side as we rake off our silage. From my experience and observation I think I should make a pretty large silo before I should add the partition. It costs money, is in the way, and unless needed as suggested above, better be omitted altogether. The partition is not needed for filling, as we had best use corn or second growth clover to form silage; and all these can be put in at once. Even if the silo is partly filled in July, and the work completed in September, there will be no difficulty, as will appear when we discuss filling. If a partition is decided upon it should be built as are the walls of the silo, except that the dead air space need not be more than six inches wide, and both sides are covered by the grooved sheeting and plaster. Of course this partition must be strong enough to sustain the silage on one side after the other side is emptied. It must also be thick enough to prevent freezing of the silage on one side, after that on the other side has been fed out. Of course, there must either be a door in the partition, or else one in each apartment of the silo, as will be most convenient for feeding. Even in the face of the opinion of such an authority as Mr. E. A. Powell, of Syracuse, New York, I advise all to study the matter well before the awkward partition is added to the silo.

FILLING THE SILO.

Now that our silo is ready, and the ears of corn mostly glazed, we must hasten to fill the silo before a frost comes to

lessen the value of the crop. If frosted corn, however, is put at once into the silo, the damage from the frost is much less than when we are to husk and feed the stalks dry—another score in favor of the silo. Two points can not be too much emphasized. *Never*, except that an untimely frost forces us to it, *fill the silo until the corn is beginning to glaze*, or mature enough to cut, were we to cut up and husk in the old way; *and never put any crop into the silo while at all wet with rain or dew*. If either of these rules are disregarded, the silage will be less nutritive, and more sour. I have observed both these rules in preparing my silage, and it has ever been sweet to the taste and almost without the sour odor so common about the older silos. I have visited silos where the silage was sour, both from too early filling, and from filling while the stalks were wet. Just here is explained why the early silos and silage gained an unsavory reputation. The corn was put in, at a great loss, while not more than half mature, and the silage was sour and *unwholesome*. Dr. Peter Collier, while chemist of the Agricultural Department, showed that the increase in nutritious elements in corn was exceedingly rapid towards the period of maturity. Prof. I. P. Roberts shows the same thing in Bulletin No. 4, of Cornell University. And we all know that nature rarely shows her power to work wonders in vegetable transformations more vividly than in the corn field. How wondrous the growth and increase from first to last! Yet just at the close, when roots, stalks, leaves and all are united in pushing growth and development to the utmost, often forming three great ears to a single stalk, and

that in just a few weeks, this wondrous metamorphosis from the crude to the organized, from the inorganic to the nutritious, reaches the climax. Surely it were unwisdom to cut short this beneficent work, the free gift of bounteous nature. Nature at the close dries off her product, and coats it with a shell-like cover, merely to protect and to preserve it, to fence out the disintegrating forces that are ever present to remove succulent material, both animal and vegetable, from the earth. Thus nature must change the juicy, digestible and nutritious, into the dry and less valuable products. It rests with us, armed with the silo, to step in and prevent this last unprofitable drying-off process of nature.

Before we had the silo, nature, that always does her work well, did the best for us, now she overdoes the matter, and it only rests with us to step in just at the dawn of this indurating process. Then we get all the nutritious elements developed to the maximum, and prevent all the changes that make the crop less digestible, and so less valuable. I am no chemist, and so it is not for me to say why corn or clover put into the silo wet does not make first-class silage; but the fact is patent. Dr. Manly Miles, than whom there is no more thorough student of scientific agriculture in the United States, was the first, I think, to claim and prove that heating to a high temperature to kill the germs of fermentation was required to secure first-class silage. It is easy to see how wet material would retard this heating, and so fermentation would not be held in check. Whatever the scientific explanation, the fact is beyond dispute, and is practically very important. If the cutting of the corn can be done with a reaper,

it would save much hard work and much valuable time. I have not been able to accomplish this part as yet. Others have; which shows that it is practical if one has the right kind of a machine. As yet, we have cut with a hand cutter and laid the stalks in bunches on the ground. For drawing, nothing equals the low platform wagons, which are so handy on the farm for many kinds of work. With these, one man on the wagon and two on the ground will load the corn very rapidly. With a common wagon and rack, the same method of loading works very well. Two men can cut and hand up two acres, or thirty tons, in a day. Some, however, in this case change the wheels, putting the small wheels on the hind axle, and then incline a long plank from this or from the hind end of the rack to the ground. Then the stalks are carried up and laid on the wagon. I have found the other method the most satisfactory. Mr. Geo. F. Powell, of Ghent, New York, recommends a rack made as follows: The reach to the wagon is replaced by two long poles with front ends together, which are fastened to the front axle by means of the king bolt, as was the reach. The back ends of these poles are fastened firmly to the under side of the hind axle, one on each side, close to the hind wheels. A cross bar is fastened upon these poles just back of the front wheels; and on this and other cross-bars, arranged at pleasure, a platform is made. This is broad and low and I should think it would work well, as Mr. Powell says it does.

CUTTING THE CORN.

I think that science and practice unite in urging the cutting by the use of a feed cutter of both corn and clover,

especially the former, before putting it into the silo. The objection is, that the machinery for cutting costs more than does a good silo. This is true. My silo, fifteen feet square and twenty feet high, cost less than one hundred and thirty dollars; while my tread power costs, at retail, more than one hundred, and my No. 14 Smalley feed cutter, with an eighteen food carrier, also costs more than one hundred dollars. But the same tread power enables me to cut all my dry cornstalks at a great saving, and to grind all my oats and corn at a slight expense, with one of the excellent Morton grinders, while the cutter is also used as just indicated. It is certainly true, that good silage has been secured by placing the material, even corn, into the silo whole. So this is practical. Yet many have failed, and by so doing have lost all their silage. The material in a silo must be so thoroughly trodden or pressed down as practically to exclude the air. This of course, if the filling is not cut fine, will be difficult and will demand great care. It is probable that the difference in placing and compacting explains, for the most part, the varied experiences that are reported as to the condition of silage from uncut corn. It is possible, too, that the corn in some cases was cut too green, and that it may have been put into the silo while wet. It only remains to be said, that if whole corn or clover is to be put into the silo, it *must be near maturity*, should certainly be dry when put in, and that every pains must be taken to lay it straight, so that as it is pressed down the air may be wholly excluded. I have not tried the above method, nor do I wish to. For safety and convenience in feeding I prefer to run all the corn through a cutter. I

believe that silos will soon be so common that engines and cutters will go from farm to farm, as threshers do now; then even the small farmers may cut the material for the silo, and yet not need to own the expensive machinery.

THE POWER.

I have never regretted that I secured a two-horse tread-power for cutting and grinding feed. This works well, is kept housed in a small space, is very easily and quickly moved from one spot to another, furnishes good exercise for horses and colts in winter; can be worked in cold, stormy, blustering weather, as well as at other times; and best of all, these are now so governed that they are perfectly safe. The sweep horse-powers cannot be housed, cannot be worked in an ordinary barn, and so are useless on stormy days; and with the same number of horses are only about half as effective as a good tread power. I have the two-horse Morton tread-power, which is portable, safe and durable, and gives most perfect satisfaction. I doubt not that powers made by other firms may be as good as the one I have. I do not see how they can work any better. In case of very large silos, holding hundreds of tons, I presume it might pay to secure an engine to cut the corn; but for eight or ten acres of corn, and silos to hold a hundred tons of silage, I think the tread-power will prove entirely satisfactory.

THE CUTTER.

I have tried five different cutters, and those with knives on the cylinder and on the fly wheel, and I have found the Smalley No. 14 not only to be by far the best, but also to be all that I could wish. It costs, with carrier, a little more than

\$100. This mill not only cuts very rapidly, but the elevator works to my entire satisfaction. It should be stated, however, that with my two-horse tread-power, I cannot cut the stalks finer than one inch and work as fast as I desire. I think, however, that this is fine enough. The silage keeps well, and the cattle and other stock eat it all up. I do not see what we would gain by cutting it any finer. Very likely other cutters are as good as the Smalley, but I have not used any such. I am sure that no one can make any mistake in buying this machine.

HOW THE WORK IS DONE.

We set our cutter so that the carrier drops as nearly over the center of the silo as possible, and so we can draw the material to be cut right beside the cutter. When all is ready, we rush the work until the silo is full, only stopping for night and rain. We have proved now for two years that the old rule—to cut and fill one day and rest the next, that the silage may heat and destroy the germs of fermentation, and thus fill only on alternate days—is not necessary. When we commence we push the work to the utmost till it is completed, and our silage is admirable. I advise filling rapidly, as I know that it is safe and excellent in its results. There is no doubt but that filling leisurely, as suggested above, will give just as good results, as many have proved this to be true; hence, if more convenient, the filling may go forward only on alternate days. I find it best when the help is ready to rush the work till the silo is full. By covering with a foot of cut straw, we may leave the silo partly filled for weeks, then complete the filling.

I have six men; two to cut and help load in the field, two men, each with a team, to help load, draw and hand to the man at the feed cutter, one man at the feed cutter and one in the silo to tread the material about the walls, and especially in the corners. In case the field is near the barn, the man in the silo may be omitted. The horses on the tread need to rest, and the man who feeds and the drivers can tread the silage.

Mr. E. A. Powell, of Syracuse, urges rounded corners, that this compacting may be better done. I find no trouble in this regard, only I wish my best man in the silo. No lazy shirk will do there. Thorough treading at the edges will alone insure perfect silage clear to the walls and corners. That I know *will do it*, for I have tried it. Each morning it is well to throw the silage away down from the edge for a few inches and fill in with that that is heated from the center. Of course, no treading is necessary except at the border. The weight of the green material will press that in the center sufficiently, so the man in the silo will only need to see that at the edge is firmly trodden. Of course, this same person adjusts the boards and paper at the door, as the silo is being filled. After the silo is filled to the top it should be allowed to settle a day or two and then filled to the top again, which should be twice repeated. At the last, a foot or two of cut straw should be put on top, and this weighted by a few boards to hold it down. We have thrown on these a load of seasoned wood. The old way of weighting with tons of stone, earth, etc., is shown by ample experience, other than mine, to be utterly useless; it is labor thrown away.

G. H. Mitcher, director New Hampshire experimental station, estimates the cost of putting corn into the silo at \$1 per ton. It costs me less than one-half that amount. It has been estimated that the entire cost of raising crop and making it into silage is from \$2 to \$2.50 per ton. I think this estimate is also quite too large.

It will be seen by the above that the ears of corn, as well as the stalks, are cut and run into the silo. We often see it recommended to pick off the corn. I see no reason for this. The corn makes the silage very much more valuable. There is no other way that the corn can be harvested so easily and so cheaply. In the silo the corn is softened so that no grinding is required, for even cattle will digest thoroughly this softened corn in the silage. After my experience in feeding silage full of rings of corn as it came from the cutter, I am thoroughly pleased with this way of treating and feeding this most valuable grain for feeding that we raise.

FEEDING SILAGE.

The silo can be opened, and its contents fed out at once if desired; or it may remain closed, as will usually be the method practiced until cold weather sets in. It answers well as the main food ration for all kinds of stock at any season of the year. Indeed, as I and others have proved, it serves well, if we may judge by the appearance of the animals fed, as an exclusive ration; yet chemical analysis shows that it is lacking in the nitrogenous or albuminoid elements, and is doubtless improved by adding bran, oat, linseed, or cotton seed meal. For the benefit of those that are chemically inclined I give the following analyses:

Ensilage Bulletin No. 14, Geneva, N. Y. Station. Water, 59.29; ash 1.72, albuminoids 3.62, crude fiber 8.11, nitrogen—free extract, 24.80, fat 2.56. We see that according to the nutritive ratio of the German tables we have here twice as much fat as is desired, and also a large excess of the carbohydrates. The same authority gives bran as follows: Water 13.71, ash 5.53, albuminoids 14.56, crude fiber 10.83, nitrogen—free extract—52.56, fat 3.11. Here we have albuminoids in excess. So we see that chemistry will be suited if we combine these two kinds of feed, and from my limited trials I believe the cattle, horses, etc., will not give the lie to science in actual feeding. By use of a little more oil meal—30 per cent. albuminoids—or even the more nitrogenous cotton-seed meal—40 per cent. albuminoids—we can arrive still nearer the nutritive ratio of the German tables.

It seems more than probable that silage is going to make it easy and possible to do away with the great expense of pasturing. True, soiling may replace pasturing, but we cannot soil early in the season, and as already shown, a soiling crop has not got the best from earth, air, and moisture when fed. Silage will be ready at the earliest date, and is the most economic of all known food for stock. It gets the most from the soil and elements, and is *very digestible*. I am persuaded that pasturing is a very expensive part of our common farm economy. It is also wasteful of manure, as the droppings in the pastures are not in such form and distribution as to give the best returns. I hope we have in silage a valuable substitute for this wasteful system. I do not see how it can be otherwise. I hope and expect to know soon, by actual experi-

ence, that in summer feeding of ensilage we shall find our next great advance in practical agriculture.

In feeding, as before suggested, we commence at the top and rake or fork off from the whole upper surface what we require to feed all our stock. This is quick and easy, as no cutting is required, and by this process the silage is all kept constantly fresh and there is no mold or mildew even in the hottest weather. In cold weather a little straw above the silage prevents freezing, and is quickly pushed aside as we rake or pitch off the silage. A bushel of the loose silage, which weighs about twenty-five or thirty pounds, is enough for a single feed for a full-size horse or cow, or for ten sheep. For young stock it takes less. They may be given what they will eat clean. For young growing stock bran, linseed meal or oatmeal may be added to the silage. If we are fattening our animals we may add liberally of cornmeal or cornmeal mixed with bran or oatmeal, if full digestion requires. I have found silage specially valuable to feed mares suckling fall colts, cows suckling calves, and for sheep. Mr. Woodward finds it superb for his ewes that are suckling lambs that are to be sold in winter and spring. The lambs also quickly learn that silage is good, and thus get a double benefit from it. In feeding lambs or cows and mares that are suckling young, we should not feed full rations at first; indeed, it is safest with all animals to feed sparingly at the beginning for a few days. Mr. Woodward, with many others, finds that it increases the milk of the cows, and thus increases the butter yield. Good silage is no injury to milk, cream or butter. The old cry that silage spoils the milk and butter is proved

false daily on thousands of American farms. The testimony of such eminent dairymen as Hiram Smith, of Wisconsin, John Gould, of Ohio, and Messrs. E. A. Powell and Colonel F. D. Curtis, of New York, upon this point is all conclusive and leaves no foothold even for doubt.

It has been suggested by even men of high scientific attainments that silage is pre-eminently the food for cattle and not for other farm stock. This is certainly a mistake. If we raise fall colts, which I find very profitable, then silage is just what we need, and will enable us to produce colts as excellent as though dropped in the spring. This gives us our brood mares in first-class trim for the hard summer's work. I find silage just as good for young colts and other horses. Of course if horses are worked hard it might be well to give one feed a day of good hay, and add grain to feed the wasting tissues that are so rapidly consumed by hard muscular effort. I also find that my sheep never did so well as since I have given them silage. Not only do they thrive in winter but they drop their lambs without trouble, and the lambs are more strong, vigorous and hearty. Mr. Woodward, of New York, speaks emphatically to this same effect, and his experience with hundreds of sheep and scores of winter lambs is most valuable and conclusive. I have had no experience with hogs, but Col. F. D. Curtis, the great American authority on the swine industry, states that silage is also valuable to add to the winter rations of our swine.

CONCLUSION.

This is a time of severe and unceasing competition in all industries. The "struggle for existence" is fierce in all de-

partments of industry. Combinations and excessive division of labor can not come to the relief of the farmer as they do to those of other pursuits, yet here, as elsewhere, the "fittest alone survive." It, therefore, behooves the farmer to cast about and lay hold of any and every lever that shall aid him in becoming master of the situation. In this quest for improved methods, no single thing, I am sure, will stand so prominent as a grand practical aid, as does the silo. As suggested, it will multiply the herds and the products secured from them; it will increase the manure, add to the fertility of the soil and consequent productiveness, making "two blades of grass to grow where but one grew before." All of this will help to make prosperity smile upon the farmer's home and life, and so lessen the care and labor of the great army of husbandmen that is the hope and stay of our country. If the silo, in addition, will keep our stock in summer in good, thriving condition, as we have every reason to expect, and thus banish those two most expensive necessities of the farm under the old regime, pasturing and the fence, then it will earn a still greater meed of praise. We now know and recognize the gift of the silo to be a benefaction. If our just and reasonable hopes for its future are realized it will be almost revolutionary in its grand accomplishments.

As I stated in the beginning of this primer, Michigan ought to build a thousand silos the coming summer. That silos may spread till they become as numerous as are the farms and farmers of the country "is a consummation devoutly to be wished;" that this little primer may speed the work is the wish of its author.

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