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THE
AMERICAN FARM REGISTER.

FOR ENTERING THE

RECORDS OF TITLE, DATES USEFUL FOR REFERENCE,

AND

THE STATISTICS OF PRODUCTION OF FARMS TILL THE YEAR 1900.

With an Introduction,

EXPLAINING THE USES OF THE SEVERAL BLANKS PROVIDED FOR ENTERING THE
ANNUAL RESULTS OF FARMING OPERATIONS, AND VARIOUS TABLES,
AND OTHER INFORMATION CONVENIENT FOR USE.

BY

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PHILADELPHIA:

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PREFACE.

A SYSTEMATIC record of farming operations will enable the owner of a farm to refer readily to the transactions of previous years, and afford, if well kept, a valuable means for determining the actual and comparative results of his experience in the various departments of his business that cannot fail of proving both interesting and profitable. It will give value to the farm, by enabling its owner to study the results of his labors, and to profit by his experience, avoiding for the future that which has proved unprofitable in the past, and seeking to enlarge those branches of his business which have proved from their returns that "*there is money in it.*" If the owner wishes to sell, such a record well kept would be invaluable, by showing what his farm *has done*. To the purchaser it would be not less important in proving what the farm *is capable of producing*. Nor would the value of such a record generally kept prove less important to the public than to private interests, because it would enable our farming class to report with precision upon the inquiries of the census, and thus enable all classes, as well producers as dealers and consumers, to base their calculations upon exact returns, instead of upon hasty and random estimates.

In the preparation of this work, blank spaces are arranged for entering the principal facts that would be desirable for reference in the management of a farm through a long series of years. Commencing with an abstract of title and a description of the farm itself, it embraces the dates of events that indicate the relative forwardness or lateness of the seasons, and the abundance or deficiency in crops. And from these, following through the operations of the year, it will enable the person keeping the record to enter the details concerning each crop, and each field, the improvements and changes on the farm, the principal facts concerning each class of domestic animals, and of each special branch of industry, and the final gain or loss in each of these and in the general aggregates from year to year through the whole period.

It too often happens that a man entering in early life upon the farming profession falls into a routine way of cultivation, from no other reason than because his father practised in this manner before him; and without attempting to reflect upon the causes that tend to influence results, or differences of soil, climate, or market demand, he goes on from year to year, scarcely gaining in estate, and quite frequently no more than "making the two ends of the year meet," at times when markets are dull, or when the seasons are unfavorable to his particular crops.

With such, the past throws but little light upon the future, and should the inquiry be made as to how the yield of a given year compares with another, or whether the production of one crop was growing more or less profitable with the ever-changing circumstances that influence the yield in kind and in value, the owner would be left to vague conjecture, and might often be misled by errors in memory as to dates and amounts, so that his conclusions would be as erroneous as his data were uncertain. Dates and quantities, unless committed to writing, soon slip from the memory, and are lost beyond recovery. Even written memoranda, unless systematically kept, tend to become scattered and lost, or are not readily found when wanted, and because not convenient for reference they are less frequently used. Yet the habit of noting down these data is easily acquired, and with a systematic arrangement provided for receiving such entries, and for finding them as wanted, it is believed that every intelligent farmer would find in this habitual noting down of facts and events a pleasant and profitable exercise. The chief value of such a record would evidently consist in the means it would afford for comparing the results of different years, and the tendencies to change which might appear. This careful study of the details of profit or loss, and a thoughtful inquiry into the causes that influence the result, are the surest means of gaining that success in life which is the natural object of every man's ambition, and the proper reward of industry, economy, and prudent forethought.

F. B. H.

INDEX.

	Page in Part I.	No. of Blank in Part II.		Page in Part I.	No. of Blank in Part II.		Page in Part I.	No. of Blank in Part II.
Absolute humidity explained.....	21		Calves, number of.....	56		Daffodils, dates of blossoming of.....	11	
in open fields, record of.....	22		butchered.....	56a		Dahlia, dates of blossoming of.....	11	
in woodlands, record of.....	22a		Canned fruit, entries of.....	56a, 51		Hairy products, entry of.....	26	159, 59a
Account of expenses.....	23		Capacity, metrical measures of.....	36	12	made of entering.....	26	
general statement.....	12		Cardinal flower, dates of blossoming of.....	40		homemade.....	59	59a
Acer rubrum, dates of blossoming of.....	37		Carrots, record of crop.....	35		factory.....	9	
Acer canadensis, dates of blossoming of.....	37		weight of a bushel (table).....	35		Days on which it rained or snowed.....	17	23
Ages of domestic animals.....	27		Castanea Americana, dates of blossoming of.....	12		assessed, highway labor.....	33	
Ametelichier canadensis, dates of blossoming of.....	12		Castor beans, weight of a bushel (table).....	33		Decimal system of weights and measures.....	9	1
Anemometers, construction and use of.....	15		Cattle, statistics of.....	56		Deduction of title.....	18	
Aneroid barometer.....	18		butchered.....	56a		Dew, absence of, an indication of rain.....	21	
Angular spaces, mode of representation by means of.....	11		pastured for others.....	29	73	Dew, indication of change in weather from.....	22	
Animal life, appearances in, that indicate changes of weather.....	22		Cautionary signals of signal weather service.....	30		Diagrams, construction of explained.....	9	
Apidary, statistics relating to.....	28	63, 63a	Cenitgrade thermometers.....	17		Dikes and embankments.....	31	82
Apples, dates of blossoming of.....	8		Cereal grains, weight of a bushel in the several States (table).....	34		Ditches, record of.....	29	78
dates of ripening of.....	8		Changes of weather, atmospheric indications of.....	22		Dogs, loss of sheep by.....	77	
weight of a bushel (table).....	34		of the farm.....	28	67, 67a	Dogwood, flowering, dates of blossoming of.....	12	
Apple-trees set out.....	72		Charcoal bushel, size of.....	32		Domestic animals, valuations.....	67a	
Arc, the unit of land measure, in metrical system.....	36		weight of a bushel (table).....	35		Drainage, record of.....	29	78
Area of fields, convenient mode of ascertaining.....	9		Cheese made at home.....	59		Dried fruit, entries of.....	56a, 51	
of squares, proportion of, how determined.....	13		made in factories.....	59a		Druths, dates of.....	17	
Asparagus, dates when first used.....	15		Cherries, black, dates of blossoming of.....	9		Dry measures, English converted into metrical measures.....	38	
Asses, period of gestation.....	27		dates of ripening of.....	10		Ducks, entries relating to.....	69	
Assessment of farm.....	67a		garden, dates of blossoming of.....	8		period of incubation.....	21	
Auroras, days on which seen.....	25		dates of ripening of.....	8		Earth thermometers.....	17	
Balance sheet for the year.....	86, 86a		weight of a bushel (table).....	31		Eggs, entries relating to.....	17	60
Barley, dates of seed-time.....	5		Chestnuts, dates of blossoming of.....	31	12	Elastic force of vapor explained.....	21	
record of crop.....	31		weight of a bushel (table).....	31		Embankments, of.....	31	82
weight of a bushel in the several States (table).....	35		Circles, mode of representation of quantities by.....	11		Enclosures, record of extent and cost of English weights and measures.....	32	
Barometre, construction of.....	18	21	Clay, etc., sold.....	28	61	Espy's theory of storms noticed.....	19	
Barrel as a measure for grain, etc.....	32		Cleaning of.....	67a		Evaporation from open water-surfaces, record of.....	23	24
Bars or lines, for showing a comparison of numbers.....	11		of stumps, boulders, etc.....	31	82	in woodlands.....	24a	
Beans, dates of seed-time.....	54		Clouds, indications of change in weather shown by.....	32		Events, dates of memorable.....	13	17
dates of harvest.....	60		Clover, cubic yards in a ton of.....	24		Ewes, period of gestation.....	27	
record of crop.....	31		seed, weight of a bushel (table).....	35		Expense account for the year.....	32	85, 85a
Bea-keeping, entries relating to.....	28	61	Coal, mineral, weight of a bushel.....	35		Experience, learning from.....	8	
Beer measure, gallon.....	12		Coal of sky indicating changes of weather.....	22		Experiments in fattening stock.....	27	
Beta, weight of a bushel (table).....	25		Colts, entries relating to.....	55		in feeding stock.....	26	
Berries, entry of statistics of.....	51		Columbine, wild, dates of blossoming of.....	12		Factory-made butter and cheese.....	59a	
Birds, dates of first appearance of in spring.....	13	13	Colums, solar and lunar, how caused, and their indications.....	22		Fair weather, indications of.....	22	
movement of, relative, change in weather.....	22		comparison of results, advantage in of results of the year.....	8	89a	Fall of leaf, dates of.....	9	16a
Blackberries, dates of blossoming of.....	9		Condensed milk, entries relating to.....	26		Farm, location and title of.....	28	67, 67a
dates of ripening of.....	10		Condition and changes of the farm.....	28	57, 57a	condition and changes of.....	31	82
weight of a bushel (table).....	34		Conversion tables, for English and metrical weights and measures.....	33, 36		stock, entries of.....	26	
Blackbirds, dates of first appearance of.....	13		metrical measures of capacity.....	38		Fattening of domestic animals.....	27	62
Blossoming of cultivated fruit-trees.....	13		of weights, English and metrical.....	38		Feathers, sale of.....	60	
of wild fruit-bearing plants.....	13		Cords changed to stiers.....	37		Feet changed to meters.....	36	
of cultivated ornamental plants.....	13		Corn, Indian, dates of seed-time.....	5		Fences, record of.....	29	76
of wild plants.....	13		dates of harvest.....	6		Fertilizers used, statistics of.....	25	48
Bluebirds, dates of first appearance.....	13		record of crop.....	15		best for fax and hemp.....	24	
Blue-grass seed, weight of a bushel (table).....	35		green, dates when first entered, or its shelled, only to be entered, or its equivalent.....	24		Field crops not specified.....	25	46
Bolobinks, dates of first appearance.....	34a		Cornus Florida, dates of blossoming of.....	12		Fields, convenient mode of ascertaining area of.....	9	
Bran, weight of a bushel (table).....	34		Corrections applied to barometer.....	18		record of cultivation of separate.....	31	84
Broad-corn seed, weight of a bushel (table).....	35		Cotton seed, weight of a bushel (table).....	35		Final balance for the year.....	11	86, 86a
weight of a bushel (table).....	35		Cows, number of.....	56	56a	Fire-flies, dates when first seen.....	11	
butchered.....	56a		period of gestation.....	27		Flies, injuries to fields from.....	17	
injuries to.....	25	47	Cranberries, weight of a bushel (table).....	34		Fishes, dates of first appearance of in spring.....	13	14
rotation of.....	31, 32		Crops, general statement concerning.....	23		Flax, dates of seed-time.....	5a	
not specified in printed holdings.....	37	45	entries of.....	23		dates of harvest.....	6	
Cubic measures, metrical system.....	37		injuries to.....	25	47	crop, entries of change in weather from.....	24	61
English changed to metrical measures.....	37		rotation of.....	31, 32		Flaxseed, weight of a bushel (table).....	35	
Cubic yards, and feet.....	37		Cubic measures, metrical system.....	37		Reeces shorn, entry of.....	57	
Cucumbers, dates when first used.....	15		English changed to metrical measures.....	37		Floods, dates of.....	17	
Cultivated fruits, dates of blossoming of.....	13		Cups, number of.....	37		Flour meal, etc., weight of a bushel (table).....	34	
dates of ripening of.....	13		Cuts, number of.....	37		Flowering almonds, dates of blossoming of.....	11	
Currants, dates of blossoming of.....	7		Cuts, number of.....	37		Fogs, indications of change in weather from.....	22	
dates of ripening of.....	8		Cuts, number of.....	37		Forest-tree planting, record of.....	29	79
weight of a bushel (table).....	34		Cuts, number of.....	37		Forests, utility of.....	29	
			Cuts, number of.....	37		entries relating to.....	26	69
			Cuts, number of.....	37		French metrical system of weights and measures.....	33	
			Cuts, number of.....	37		Frogs, dates when first heard.....	14	
			Cuts, number of.....	37		Frosts, unseasonable dates of.....	17	
			Cuts, number of.....	37		dates of first autumnal.....	16	
			Cuts, number of.....	37		injuries from.....	47	

	Page in Part I.	No. of Entries in Part II.		Page in Part I.	No. of Entries in Part II.
Fruit-culture, orchard.....	25		Ice, dates of disappearance of.....	16	
general results of.....	32		date of formation for crossing streams.....	16a	
Fruits, weight of a bushel (table).....	16		Implements, etc., purchased.....	31	81
Gales, velocity and pressure of winds in.....	16		Improvements made, and their cost.....	23	69
Garden products, dates of first use of.....	15	15	Inches changed to meters.....	25	
sold, entry of.....	25	31	Incubation of fowls, period of.....	25	
Geese, entries relating to.....	15	69	Indian corn, dates of seed-time.....	5	
period of incubation.....	13		dates of harvest.....	6	
will, dates of flying north.....	13a		record of crop.....	5	
dates of flying south.....	13a		Indian meal, weight of a bushel (table).....	31	35
Geldings, number of.....	5		Indian summer, dates of.....	5	16a
General character of season.....	25	26	Injuries to crop.....	25	17
expense-account for the year.....	25	25, 25a	Insects, dates of first appearance of in.....		
summaries of meteorological records.....	25		spring.....	13	11
Gestation, period of in certain domestic animals.....	27		Insurance upon property.....	28	79
Goats, period of gestation.....	27		georage total.....	28	79
Gouseberries, dates of blossoming of.....	7		Investments other than as specified.....	31	25a
dates of ripening of.....	7		"Isobars," "isobars," or "isobarometrie lines" explained.....	19	
weight of a bushel (table).....	31	8	Jacks, number kept.....	59	53
Grading, entry of, how entered.....	31	8	Kilograms changed to miles.....	59	53
Grafts set, record of.....	31	8	Kilometers changed to miles.....	59	53
Gram, the metrical unit of weight.....	31	8	Labor, hired, entry of.....	28	66
changed to ounces.....	31	8	general total hired.....	28	66
Grapes, dates of blossoming of.....	7		Lambie, entry of number.....	28	66
dates of ripening of.....	7		number sold.....	28	66
weight of a bushel (table).....	31	8	Land hired from others for pasturage.....	28	72
Graphic representations.....	10	1	hired from others for pasturage.....	28	72
Grasshoppers, dates when first seen.....	11		hired from others for use besides pasturage.....	28	72
dates of visitation of.....	11		hired to others for use besides pasturage.....	28	72
Grass seed, entry of.....	21	17	taken upon shares.....	28	72
Gravel, etc., sold.....	21	17	Land measure conversion table, English and metrical.....	28	72
Great lakes, effect of, upon storms.....	13		Land, entries relating to.....	28	72
Green corn, dates when first used.....	15		Latent heat, when absorbed and when given out.....	18	
Green peas, dates when first used.....	15		Leased buildings.....	28	72
Growth of domestic animals, period of.....	27	15	Leaves, dates of first appearance of.....	16	
Guano, record of use of.....	18		dates of fall of.....	16	
Guinea-pheas, period of incubation.....	27	15	Length, metrical table of.....	23	16
Habit of keeping records easily acquired.....	27	15	Lettings, dates when first used.....	27	15
Hailstorms, upward tendency of winds in.....	16		Life, term of with domestic animals.....	27	15
Hill, number of days on which it fell.....	25		Lices, dates of blossoming of.....	35	48
injuries from.....	25		Lime, record of use of for agricultural purposes.....	35	48
Hair for plastering, weight of a bushel (table).....	31	8	weight of a bushel (table).....	31	13
Hades, indications of changes in weather from.....	22	34	Lines, quantities changed by.....	13	
Hares, number of days on which seen.....	22	34	Liter, pounds of, how entered.....	11	
Harvest, dates of beginning of.....	1	6	liter measures, English, converted into metrical measures.....	28	66
Hay, weight of.....	21	17	Litter, the metrical unit of capacity.....	27	15
Heaped measure, cubic inches allowed for.....	32		Lobelia cardinalis, dates of blossoming of.....	12	
Hectares changed to acres.....	32		Local influences, effect of upon winds.....	18	20
Hectoliter, a grain measure in metrical system.....	37	11	Locusts, dates when first heard.....	18	
Heetolters changed into bushels, gallons, and quarts.....	28	77	Locust-trees, dates of blossoming of.....	11	
Hedges, record of.....	29	77	Long measure conversion table, English and metrical.....	28	66
Heifers, number of.....	56		Low areas of barometer.....	18	
batches.....	56		Machines and implements purchased.....	31	81
Hemp crop, entries of.....	21	12	Malt, weight of a bushel (table).....	31	
Hemp seed, weight of a bushel (table).....	31	35	Manure, weight of a bushel (table).....	31	
Hens, entries relating to.....	27	69	Map of farm.....	9	3
periods of incubation.....	27	69	Maple, red, dates of blossoming of.....	25	12
Hens grass seed, weight of a bushel (table).....	31	35	Maple sugar and syrup.....	25	12
Herring, dates when first caught.....	11		Mares, period of gestation.....	27	44
Hides, receipts from.....	13	56a	number of.....	27	44
High areas of barometer.....	18	20	Marsh fruits, entries relating to.....	28	41
Highway labor, assessment of.....	28	75	rice, sold.....	28	41
Hired buildings.....	28	75	Marshes reclaimed.....	28	41
labor, entry of.....	28	75	Martins, dates of first appearance.....	11	
lands, statistics of, how to be entered.....	21	25a	Materials for home manufacture, general total.....	28	66
pasturage.....	21	25a	Meadow larks, dates of first appearance of.....	13	
pasture.....	21	25a	Meal, weight of a bushel (table).....	31	35
Home industry, special advantages of.....	13	56a	Memorable events, dates of.....	18	17
Honey, entries relating to.....	24	63	Memoranda, need of system in the keeping of.....	8	
crop, entries of.....	24	63	Meteorological observations, general remarks concerning.....	25	
horses and mules, entries relating to.....	24	63	Meteors, number seen.....	25	
pastured for others.....	24	63	Meter (the unit of decimal measures).....	25	
Horse chestnuts, dates of blossoming of.....	11		Meters changed to toise, yards, fathoms, inches.....	25	
Hours for taking meteorological observations.....	11		Metrical system of weights and measures.....	25	
Humidity, general statements concerning.....	21	22	Miles changed to kilometers.....	25	
absolute (open field), record of.....	21	22	Milk, how sold.....	25	
in woodlands, record of.....	21	22	sold, entry of.....	25	
relative (open fields), record of.....	21	22	Millet seed, weight of a bushel (table).....	31	35
in woodlands, record of.....	21	22	Millet, a metrical measure of weight.....	31	35
Hungarian grass seed, weight of a bushel (table).....	31	35	Moisture, source of.....	17	
Hurricanes, velocity and pressure of winds in.....	16		in atmosphere, effect upon sound.....	18	
Insolvency, dates of operation of.....	21	5, 6	Money borrowed for farm.....	32	84
Hygrometer, indications of.....	21		Mountains, effect of upon rain.....	17	
			Muck, as a fertilizer.....	16	
			etc., sold.....	16	
			Mules, entries relating to.....	59	64
			Neat cattle, entries relating to.....	59	64
			pasturage hired for.....	59	64
			passed for to others.....	59	64
			New Mexico, Spanish weights and measures in.....	32	
			Number of plants when set in rows, etc., of.....	31	
			Oats, dates of seed-time.....	5	
			dates of harvest.....	6	
			record of crop.....	5	
			weight of a bushel (table).....	31	35
			Oceans, moisture supplied by.....	17	
			Oil seed, weight of a bushel (table).....	31	35
			Onions and onion-sets, weight of a bushel (table).....	31	35
			Operations of husbandry, dates of.....	13	5, 6
			Orchard fruit-culture, statistics of (apples).....	25	49
			Orchard grass seed, weight of a bushel (table).....	31	35
			Ornamental plants, dates of first sold.....	13	11
			Osage orange seed, weight of a bushel (table).....	31	35
			Onions changed to grams.....	25	
			Oxen work, entries of.....	59	66a
			fat, butchered.....	59	66a
			Parallelograms, planting in.....	30	
			Parhelia, indications of changes in weather from.....	12	
			Parsnips, weight of a bushel (table).....	31	35
			Pasturage hired from others.....	28	72
			hired to others.....	28	72
			Peaches, dates of blossoming of.....	35	48
			dates of ripening of.....	35	48
			weight of a bushel (table).....	31	35
			Peach-trees set out.....	35	48
			Peas, period of incubation.....	35	48
			Peanuts, weight of a bushel (table).....	31	35
			Pears, dates of blossoming of.....	35	48
			dates of ripening of.....	35	48
			weight of a bushel (table).....	31	35
			Peas-trees set out.....	35	48
			Pears, dates of seed-time.....	35	48
			dates of harvest.....	35	48
			record of crop.....	35	48
			weight of a bushel (table).....	31	35
			green, dates when first used.....	35	48
			Peat, etc., sold.....	11	12
			Percentages, conversion of.....	11	12
			Perch changed to cubic meters.....	27	
			Periodical events showing the progress of the seasons.....	13	5 to 17
			Personal estate, assessment and valuation of.....	27	65a
			Pigeons, period of incubation.....	27	65a
			Pigs, number of.....	27	65a
			Plan of arrangements explained.....	29	73, 80
			Planting forest-trees.....	29	73, 80
			modes of.....	29	73, 80
			Plants, number set in rows on a square, tables of.....	31	
			Plaster, record of use of.....	48	
			Plums, dates of blossoming of.....	10	7
			dates of ripening of.....	10	8
			Plum-trees set out.....	35	48
			Port, entries relating to.....	59	64
			posts for showing area of field.....	9	5a
			Potatoes, common, dates of seed-time.....	35	48
			date of harvest.....	35	48
			record of crop.....	35	48
			weight of a bushel (table).....	31	35
			sweet, dates of seed-time.....	35	48
			date of harvest.....	35	48
			record of crop.....	35	48
			Poultry, suggestion of form for keeping.....	59	60
			returns from.....	59	60
			Pregnancy of domestic animals, dates of duration.....	27	
			Pressure of winds of different velocities.....	19	
			Barometrical laws that govern.....	19	
			Private roads.....	31	82
			Profit from the keeping of systematic records.....	8	
			Proportional quantities, how best represented.....	11	85a
			Provisions for the family.....	21	85a
			Psychrometer explained.....	21	85a
			Quarts changed to liter, metrical measure.....	21	85a
			Quinces, weight of a bushel (table).....	31	35
			Quincunx order, plan in.....	20	15
			Railroads, dates when first used.....	16	19
			Rain and snow, depth of.....	16	19
			Rain-gauges, construction of.....	16	19
			Rain, indication of from atmospheric appearance.....	22	

	Page in Part I.	No. of Blank in Part II.		Page in Part I.	No. of Blank in Part II.		Page in Part I.	No. of Blank in Part II.
Rain, number of days on which it fell.....	17	75	Smoke, indications of changes of.....	22		Timber, planting of.....	29	72, 80
Rainy days.....	17	75	Snow-gauges, construction of.....	16		area planted with.....	29	72, 80
Rape seed, weight of a bushel (table).....	33	9	Snow, dates of appearance and disappearance.....	16	16	Timothy seed, weight of a bushel (table).....	35	76
Raspberries, red and black, dates of blossoming of.....	34	10	depth of, how recorded.....	16	19	Title, deduction of.....	9	1
dates of ripening of.....	34	10	do. of, how determined.....	16	19	Tolacoro, dates of seed-time.....	35	76
weight of a bushel (table).....	31	82	Snowy days.....	17	23	dates of harvest.....	35	76
Ravines, filling of.....	31	82	Soil, temperature of.....	17		record of crop.....	43	44
Real estate, assessment and valuation of.....	17	67	Solid or elastic material in metrical system.....	37	45	crop, entries of.....	25	44
Receipts other than from cultivation.....	28	64	Sorghum crop, entries of.....	33	35	Ton of hay, cubic yard in.....	24	
for year, general total.....	8	86, 86a	seed, weight of a bushel (table).....	33		Tonnage, a metrical measure of.....	39	
Records, utility of keeping.....	8		Spring beauty, dates of blossoming of.....	12		Tons changed to millers, metrical.....	39	
Rectangular diagrams for showing comparative quantities.....	11, 12		Spring wheat, record of crop.....	29		Tools, machines, etc., purchased.....	31	81
Reflexes of sky, indications of.....	22		Square measure, conversion table, English and metrical.....	36, 37		valuation of.....	31	81
Red top seed, weight of a bushel (table).....	35		Square meters changed to square rods, square feet, and inches.....	36		Tornadoes, movement of wind in.....	21	68a
Red birds, dates of first appearance.....	21	13a	Square— for showing comparative quantities.....	12		Tree-planting (forest), record of.....	29	79, 80
Relative humidity explained.....	21	27	planting in.....	30		Trees along margins of fields, for showing area.....	9	
in open fields, record of.....	21	27	Starks, weight of.....	21	55	apple, number of.....	49	
in woodlands, record of.....	21a		Stations, number of.....	30		fruit, other than apple, number of.....	50	
Rented lands, statistics of, how to be entered.....	23		States laws defining weights of the bushel (table).....	33		in leaf, date of.....	16	
how entered.....	23	74, 75	Steers, number of.....	36	56a	fall of leaves, dates of.....	16a	
Rents paid and received.....	28	71	Stock-breeding, general remarks concerning.....	37		set out, number of.....	32	
Repairs and improvements.....	28	69	Stock pastured off from farm.....	28	72	Triangles, planting in.....	30	
Reptiles, dates of first appearance of in spring.....	13	11	pastured for others on farm.....	29	73	Triangular order of planting, number of plants in.....	31	
Resultant of winds, mode of computing successive months.....	14, 15		Stone quarried.....	28	64	Turkeys, entries relating to.....	27	60
record of by years.....	8	18	Stone-wall fences, record of.....	29	76	period of incubation.....	27	
Results, importance of comparison of.....	13	8	Storm areas, eastward movement of.....	19, 20		Turnips, record of crop.....	29	79
Rice birds, dates of first appearance.....	8	13a	Storms, prediction of.....	14		weight of a bushel (table).....	35	76
Ripening of cultivated fruits.....	13	10	movement of.....	18		Valuation of farms.....	35	76
of wild fruits.....	13	10	law of movement of winds in.....	20		Veal, receipts from.....	56a	
Roads, private.....	31	82	thunder, usually local.....	19		Vehicles, etc., purchased.....	31	81
Robins, dates of first appearance.....	13	11	Strawberries, field, dates of blossoming of.....	9		Velocity of winds.....	16	
Robinson's anemometer.....	36		dates of ripening of.....	10		Violet, garden, dates of blossoming of.....	29	76
Roads changed to meters.....	24		weight of a bushel (table).....	34		Wall fence, record of.....	29	76
Root-crops, entries of.....	24		Sturgeon, dates when first caught.....	11		Water-courses, diversion of.....	31	82
weight of a bushel (table).....	35		Subdivisions of fields, convenient mode of finding.....	9		Watermelons, dates when first used.....	12	
Rotation of crops.....	31, 32		Sugar beets, weight of a bushel (table).....	26	54	Water-surfaces, drained.....	17	67a
lowed.....	8		maple, entry of.....	26	54	Water thermometers.....	17	
Rows, number of plants when set in.....	31		sorghum, entry of.....	40		Wax, entries relating to.....	28	63
Rust, injuries from.....	47		Superficial measure, conversion table, English and metrical.....	36, 37		Weaning of domestic animals.....	27	61
Rutabaga, weight of a bushel (table).....	33	5	Survey bill of farm.....	9		Weather, atmospheric indications of.....	21	
Rye, dates of seed-time.....	6		Swallows, dates of first appearance.....	13		importance of changes in to the farmer.....	14	
dates of harvest.....	6		Swamp muck as a fertilizer.....	25		Weight, metrical denominations.....	38	
record of crop.....	21	39	Swans, period of incubation.....	27		of bushel of different grains, etc.....	33	
weight of a bushel (table).....	34		Sweet potatoes, dates of seed-time.....	27	5a	Wells, digging of.....	31	82
Salt, weight of a bushel (table).....	35		dates of harvest.....	64		Wheat, dates of seed-time.....	5	
Land, etc., sold.....	28	64	record of crop.....	35	78	dates of harvest.....	6	
Scales of thermometer, rules for converting.....	17		weight of a bushel (table).....	35	78	spring, record of crop.....	29	
School taxes.....	85		Swine, entries relating to.....	27	58	winter, record of crop.....	28	
Seasons, events that mark the progress of.....	13	5 to 17	period of gestation.....	27	58	weight of a bushel (table).....	34	
general character.....	23	26	Syrup, maple, entry of.....	26	54	Wild fruits, dates of blossoming of.....	13	9
Seed-time, dates of beginning of.....	13	5	System, need of in the keeping of records.....	8		dates of ripening of.....	13	10
Separate fields, record of.....	31	83	Tallow, receipts from.....	28	5a	plants, dates of first blossoming of.....	13	12
Services, hired, entry of.....	28	66	Taxes, record of.....	20	85, 85a	Wind roses, construction of.....	15	
Shad, dates when first caught.....	11		Temperature of open air.....	17	29	Winds, indications of change in.....	22	
Shad-bush, dates of blossoming of.....	12		of woodlands.....	29	29a	law of movement in storms.....	11	18
Sheep husbandry, entries relating to.....	28	72	rates of decrease upward, and toward poles.....	16, 18		record of.....	17	
pastured by others.....	29	73	of planetary spaces.....	18		that bring rain.....	16	
Shore, privileges of.....	28	64	Tension of vapor explained.....	21		upward tendency of in land-storms.....	16	
Signal service, blanks furnished by.....	14		Thermometer, placing of.....	17		velocity of.....	16	
predictions of.....	19, 20		Thunder-shower, first date of.....	16		Wine measure gallon.....	32	
Silk raising, suggestion relating to.....	24					Winter wheat crop, record of.....	24	28
Sky, color of, indicating changes in weather.....	22	56a				Woodlands, rainfall in.....	17	16a
Slaughtered cattle, receipts from.....	16					temperature of.....	20a	
Sleighting, dates of ending of.....	16					absolute humidity in.....	22a	
dates of beginning of.....	16					relative humidity in.....	22a	
Small fruits, entry of statistics of.....	25	51				evaporation from open water-surfaces in.....	24a	
						planting of.....	29	79
						condition of.....	31	80
						Wool, entry of.....	37	
						disposition made of.....	37a	
						Working oxen, number of.....	36	
						Yards changed to meters.....	36	
						Yearly balance account.....	86, 86a	

PART I.

To aid in comprehending the design and use of this Register, the following explanations and suggestions are offered: The several tables and forms are designated by *numbers*, and not by *pages*, because it has been thought best to prepare the volume, in some cases, with particular reference to certain branches of business that are carried on more extensively, and which might therefore require more space than others; this will not, however, lessen the convenience of reference, as the numbers will be readily found by the index at the beginning of the volume.

(No. 1.) DEDUCTION OF TITLE.

The filling of the blank at the head of this page will need no explanation. It should show the owner's name, the extent of his farm when the record began, and its location. Space is given for designating the latter according to survey, where a part of the region is embraced in the public land surveys of the United States; but, if elsewhere, the town, county, and State only would be sufficient, or such other designation as local circumstances might suggest.

In preparing the abstract of title, it will sometimes be convenient to commence with the grant by the general or State government, or with the proprietors of the tract of which the farm is a part, and back to which it would be necessary to prove, if the right were questioned before a court. The first line would show the first owner, to whom he conveyed, the kind of conveyance, whether by deed, bequest, or otherwise, the time when, the amount paid, and a reference to the place where a record of the instrument may be found. The next transfer of title will occupy the next line, and so down to present owner. Such a deduction of title is always a desirable piece of information with respect to a farm, and may be readily prepared from the indexes to the records of public offices, with the help of such local information as the present owner may have. Where portions of land are subsequently added, an entry should be made in the table for showing the "condition and changes of the farm" (No. 67), and a separate deduction of title entered in this table as there may be occasion.

(No. 2.) SURVEY BILL OF THE FARM.

This is always given in the title deed, and should be recorded on this page, with such additional entry of additions as may be necessary by reason of new purchases, or a sale of part of the farm.

(No. 3.) MAP OF THE FARM.

The outline and subdivisions of the farm, upon any convenient scale, may be drawn upon this page, with such explanations and references as appear desirable. It should be neatly done and properly tinted.

For reference, it would be well to designate each field enclosed by a permanent fence or hedge, and of known area, by some number, letter, or other designation by which it may be distinguished from all others. But it will often happen that such a field may be cultivated in different crops, and these subdivisions or parts may often be of irregular form and of uncertain size, and changing from year to year. The extent of these

portions may be determined very conveniently without survey, by fixing once for all, certain points of reference, the position of which has been determined by measurement. Let A, B, C, D in the annexed diagram represent a permanent field one hundred and twelve rods long and sixty rods wide, containing forty-two acres of land. Along the line A, B, and the opposite line C, D, at distances of sixteen rods, set a locust or cedar post, that may be seen from the other side, or, what is better, *plant a tree*. If there is a row of trees set along these lines at more frequent intervals, those at the sixteen-rod points should be trimmed up so as to show a straight trunk considerably

higher than the intermediate trees, or they should be of a kind different and easily distinguishable from the rest. Along the lines A, D, and B, C, set posts, or plant trees in like manner, at measured intervals of *ten rods*. As a space ten rods wide and sixteen rods long forms an acre of land, it will be seen that lines sighted across from one side to the other by these permanent landmarks, would divide the large lot into forty-two rectangular spaces of one acre each, as shown by the diagram,—but without actual measurement, or the encumbrance of objects,

interfering with the cultivation. If in any year it was found desirable to cultivate a portion, as E, F, G, B, in any crop, it could be found, by simply getting the range of the permanent objects, that this part would contain nine whole acres and three halves, or ten and a half acres. Another part, C, G, F, H, might contain six acres, and the rest of the field would have twenty-five and one-half acres, or the difference between these two and the whole amount. These subdivisions may be determined in a few moments by simple observation, and may be changed from year to year with sufficient accuracy for all purposes without the least expense for surveys, and with but very little attention. It would generally be easy to refer to these lines in sowing different crops, so that their borders would be on the range of these objects, and the contents of the parcels, if desirable, an even number of acres without fractions.

(No. 4.) GRAPHIC REPRESENTATIONS.

It adds exceedingly to the interest of a series of numbers by showing the rise and fall of different years upon a diagram ruled into squares. Several of these are provided, printed in pale-blue lines, and these may be used in tracing *quantities* or *values*, as there may be occasion. To illustrate their construction, we will assume that through the period for which this record is provided the amount of corn, wheat, oats, and barley raised on a farm be as follows:

YEARS.	CORN.	WHEAT.	OATS.	BARLEY.	YEARS.	CORN.	WHEAT.	OATS.	BARLEY.
1878	210	610	25	100	1890	780	460	50	120
1879	275	700	42	140	1891	796	500	60	175
1880	350	624	60	160	1892	818	590	130	145
1881	418	500	70	212	1893	800	665	212	136
1882	450	456	100	240	1894	864	712	284	170
1883	480	425	120	216	1895	916	750	360	220
1884	600	375	120	160	1896	890	760	420	230
1885	630	410	120	225	1897	840	814	480	245
1886	640	350	100	160	1898	780	901	500	280
1887	700	360	75	120	1899	630	980	600	325
1888	740	358	50	130	1900	620	1000	575	440
1889	761	396	48	140					

To represent these numbers to the eye, we will draw a rectangular table, as in the accompanying figure:

It should be spaced off vertically into as many divisions as there are years in the period, and horizontally into

a convenient number of divisions, which, in this instance, is for a scale of one thousand. It is well to have the lines for even quantities, as for example, hundreds, a little heavier than the rest. In this drawing there are five spaces between the lines for hundreds, each representing twenty in amount. In the blank diagrams provided in the body of the work there are ten spaces between the heavy horizontal lines.

Having constructed this diagram by ruling horizontally and vertically, as above described, and by writing in on the upper margin the years, and on the left-hand margin the quantities to be used as a scale of reference, we take the quantities given in the above table, and point off the quantities for each year, measured from the bottom, and as shown by the scale. Then, by connecting these points by lines, we are able to show the *rise* or *fall* in quantities by the *ups* or *downs* of the line.

Usually there should be but one scale, and the natural place for this is the left-hand margin. But for some purposes we may place one scale for quantities on the left, and another for values on the right. It is best not to encumber a diagram with too many lines, and where the lines intersect one another, and where several series of quantities are to be shown, it is better to use several similar diagrams. It adds wonderfully to the clearness of effect if the lines representing the range of quantities or values are ruled in with different colors of ink, or if they are nicely shaded with water colors; but this could not be conveniently done in printing this volume, and we have, instead of this, adopted different kinds of plain and dotted lines.

Where it is desirable to show to the eye the proportion which several parts bear to the whole, there is nothing so effectual as angular space, or comparative areas. But in these we cannot take in the element of *time*, and are limited to the representation of *quantities* alone as they stood at different periods. The mode of representation by circles is probably in most cases preferable, and they are most easily drawn. Let us explain the mode of construction by this method: We will suppose that the production of a given year on a farm be \$250 from *Stock*, \$300 from *Grain*, \$180 from the *Dairy*, \$160 from *Fruits*, and \$110 from *Cordwood*. The sum of these is \$1000. We will reduce these quantities to *percentages*, by annexing two ciphers to each, and dividing by the sum. We shall find these percentages to be 25 for *Stock*, 30 for *Grain*, 18 for the *Dairy*, 16 for *Fruits*, and 11 for *Cordwood*. Then draw a circle: divide it into a hundred parts, by allowing 3.6 degrees to one hundredth, and space off the angular distances necessary. We shall find that they just close the circle, making the sum of the percentages 100; or, instead of this, we may multiply the percentages by 3.6, and we have the *degrees* due to each, their sum being 360.

Mode of Representation by Angular Spaces.

The same may be shown on a rectangular space, by taking a line of any convenient length, as in the following figure, and dividing one of the sides into 100 parts. Then taking of these parts as many as there are in the several percentages, we have the relative importance of these several items of production shown at one glance, by the comparative lengths of these several subdivisions.

STOCK.	GRAIN.	DAIRY.	FRUITS.	CORDWOOD.
\$250.00—25 per cent.	\$300.00—30 per cent.	\$180.00—18 per cent.	\$160.00—16 per cent.	\$110.00—11 per cent.

Mode of Representation by Proportional Division of a Bar or Line.

In both of these methods of graphic representation the quantities depend upon the length of the arc, if a circle,—or of the base line, if a rectangular figure, without reference to the breadth of the figure as measured on the radius of the former, or the side of the latter.

The rectangular diagram, although not quite as striking to the eye, has this advantage, that we may subdivide these belts, or zones, by dividing one side of each into 100 parts, and assigning to the different subjects of the subdivisions their proportional area.

For the purpose of illustrating this point, we will suppose that the values of production in *Stock*, *Grain*, *Dairy Products*, *Fruits*, and *Cordwood*, that are given in the foregoing examples, are subdivided into their elementary parts, as follows:

FARM PRODUCTS SOLD.		Number on Square Diagram.	Value of Each Item.	Per Cent. of Each to Total of its Class.	GENERAL SUM.	PER CENT. OF TOTAL.
Stock.....	Colts.....	1	\$60.00	24	}.....\$250.00	25
	Heifers.....	2	100.00	40		
	Sheep.....	3	60.00	24		
	Lambs.....	4	30.00	12		
Grain.....	Corn.. { Shelled....	5	80.00	67	}.....\$120.00	30
		6	40.00	33		
	Wheat { Spring....	7	45.00	50	}.....90.00	
		8	45.00	50		
	Rye.....	9	40.00	44.4	}.....90.00	
	Oats.....	10	30.00	33.3		
	Barley.....	11	20.00	22.2		
Dairy Products {	Butter.....	12	72.00	40	}.....\$180.00	18
	Cheese.....	13	90.00	50		
	Milk.....	14	18.00	10		
Fruit..... {	Apples.....	15	64.00	40	}.....\$160.00	16
	Pears.....	16	64.00	40		
	Small Fruits.....	17	32.00	20		
Firewood..... {	Maple.....	18	77.00	70	}.....\$110.00	11
	Oak.....	19	33.00	30		
Total,			\$1000.00		\$1000.00	100

In order to prepare these items for representation in a diagram, the subdivisions of each class must be reduced to percentages of the total sum of its class, which is done by annexing two ciphers and then dividing by this sum, as is shown in the column headed "Per Cent. of Each to Total of its Class." It will be seen that the sum of each of these groups of percentages is 100. Where many items help to make up a total, and we wish to obtain the percentage of each, it is sometimes more convenient to first ascertain the value of one per cent., and then using this as a multiplier, find by a series of multiplications the value of each; but if the number of items is small, their proportion may be found by a series of divisions.

Having computed these percentages, construct a square, and on one side lay off distances proportioned to the percentage of the principal classes. Thus, upon the side a , f , the division a , b is 25 per cent.; b , c , 30 per cent.; c , d , 18 per cent.; d , e , 16 per cent., and e , f , 11 per cent. The horizontal belt, containing the numbers 1 to 4, represents the receipts from *Stock*; that of 5 to 11, from *Grain*; that of 12 to 14, from the *Dairy*; that of 15 to 17, from *Fruits*, and that of 18 to 19, from *Firewood*. These spaces are then subdivided proportionally, so that the areas represent the relative amount of each subdivision, the relation it bears to its class, and its proportion to the whole. This class of diagrams has its effect heightened by tinting the subdivisions with shades of color. Where the data exist for constructing these for a series of years each year should have a separate square, which would be larger or smaller, according as the total production was more or less than that of other years.

In selecting the scale for such a series of squares, reference should be had to the requirements of the year showing the largest aggregates; and in fixing upon the sizes of those for other years, it should be remembered that the areas of similar figures are to each other as the *squares of similar lines*. If we would find the length of the sides of the squares that would be proportional in area to a given series, we should take the *square roots* of these numbers as the basis of our calculation.

We will suppose, for example, that the total production, in the course of five years, amounts to \$2500, \$3600, \$6400, \$8100, and \$10,000, and that we wish to construct squares that shall be proportional in area to these quantities. The square roots of these numbers are 50, 60, 80, 90, and 100. If a square, 6 inches on a side, be assumed to represent the largest of these, the sides of the others would be found by the rule of proportion to be 3, 3.6, 4.8, and 5.4 inches respectively. The same rule would apply to diameters, if we wish to represent the series by circular areas.

Had the successful farmer, with his ample estates (the fruit of many a year's labor), the data for presenting these details in a series of squares of this kind, the first ones small, with but few subdivisions, indicating the humble beginnings of a young man dependent upon his own industry for support, yet growing larger and more complex as his wealth increases and his resources became more ample and varied, what a record of a life would this series present!

In a succession of these squares, if colors are used, the same tints should be applied to the same object through the whole series.*

A simple mode of representing to the eye the relative amount of qualities is by means of lines of different length. These should be even at one end so as to show their differences more effectually at the other. The following illustration will explain itself:

This mode is applicable to all measures of time or distance, or of quantity other than those of superficial area or solid contents.

(Nos. 5 to 17.) PERIODICAL EVENTS SHOWING THE PROGRESS OF THE SEASONS.

We have frequent occasion to notice events that indicate the relative forwardness or lateness of the seasons. It is not unusual, in case of a remarkably late spring, or an uncommonly severe winter, or in any other incident out of the common course of events, to remark that the like was never known before, or that it was not within the memory of the "oldest inhabitant." This reliance upon memory and traditions is at least very unsatisfactory and is quite apt to mislead.

To afford a convenient and satisfactory means of reference, a series of tables, numbered from 5 to 17, has been provided, which may be classified as follows:

OPERATIONS OF HUSBANDRY.....	{ (5.) <i>Beginning of Seed-Time.</i>
	{ (6.) " <i>of Harvest.</i>
CULTIVATED FRUITS.....	{ (7.) <i>First Blossoms of Cultivated Fruit-Trees.</i>
	{ (8.) " <i>Ripening of Cultivated Fruits.</i>
WILD FRUITS.....	{ (9.) <i>First Blossoming of Wild Fruit-Bearing Plants.</i>
	{ (10.) " <i>Ripening of Wild Fruits.</i>
ORNAMENTAL AND WILD PLANTS.....	{ (11.) <i>First Blossoming of Cultivated Ornamental Plants.</i>
	{ (12.) " " <i>of Wild Plants.</i>
PERIODICAL APPEARANCE IN ANIMAL LIFE.....	{ (13.) <i>First Appearance of Birds in Spring.</i>
	{ (14.) " " <i>of Fishes, Reptiles, and Insects.</i>
OTHER PERIODICAL EVENTS.....	{ (15.) <i>First Use of Garden Products.</i>
	{ (16.) <i>Periodical Events dependent upon the Seasons.</i>
	{ (17.) <i>Memorable Events.</i>

* An elementary book of instructions for the preparation of diagrams for the graphic illustration of numbers is in course of preparation by the author of this volume. It may be followed by a more elaborate work upon this subject, in which the application of these methods will be shown as applied to scientific subjects and other purposes of study and illustration.

These dates should always be noted down at the time of their occurrence, leaving nothing to the memory or a more convenient time. In observing the blossoming and ripening of fruit-trees, the appearance and fall of leaves, etc., it is desirable that the observations should be made from year to year, so far as possible, on the same trees; and in like manner, the opening and closing of rivers or lakes should be upon the same waters, as differences due to local causes might otherwise impair their value for comparison. In tables 16 and 16 A, the names of the lakes or streams observed as to freezing or opening should be written in at the head of the column, in the dotted space provided for this purpose.

METEOROLOGICAL OBSERVATIONS.

The farmer, like the mariner, has much depending upon the seasons and the weather, and both may be largely benefited by a careful observation of the indications of coming change, as shown by the barometer, and other meteorological instruments. So carefully have these laws of change been studied, and so well is the movement of storms now known, that predictions are made with reasonable certainty many hours before any actual changes are visible in the sky, and sufficiently in advance to provide against many of the disasters that might otherwise happen.*

Pages are provided in this volume for entering the monthly results of meteorological observations, which, if carefully kept, would in time afford a most interesting and profitable subject for reference, and their value would increase from year to year. For common purposes, three observations might be made daily,—at the hours of 7 A.M., 2 P.M., and 9 P.M., which are those fixed by the blanks furnished to voluntary observers by the Signal Service.†

(No. 18.) WINDS.

The prevailing direction from which the winds blow in the forenoon and afternoon might be entered in two columns, and the sum of these halves, reduced to days, should be entered at the end of each month in this Register. Their sum would, of course (added to the days of calm), make the number of days in the year. If the number of days from different points were equal, both or all should be entered in the column of "Prevailing Winds."

The *resultant* is the mean direction that the winds have blown during a given period, and the relative amount of time they have blown in this direction. The mode of ascertaining this may be explained as follows: Let us suppose that during a month the number of days the wind has blown from the different points has been as follows:

North, 4.07 days.	East, 0.5 days.	Northeast, 1.50 days.	Southeast, 1.85 days.
South, 5.85 "	West, 6.32 "	Southwest, 3.88 "	Northwest, 7.48 "

By subtracting the opposite amounts, as here placed, and prefixing the names of the greater, the eight points are reduced to four, viz.: S., 1.78; W., 6.27; S. W., 2.38; and N. W., 5.63 days. The quantity 2.38 from the southwest may be considered as representing a certain distance *South* and *West*, as the line A, C, in the triangle here shown, represents a distance southward from A to B, and westward from B to C. These distances are readily found in a Traverse Table (each acute angle of this triangle being 45°), and will be found equivalent to S. 1.68, and W. 1.68. In like manner, analyze the distance N. W. 5.63, and it will be found to be N. 4.01, and W. 4.01. Again subtracting, as before, the principal opposite points,

S. 1.78,	W. 6.27,
S. 1.68,	W. 1.68,
N. 4.01,	W. 4.01 (and adding those with like letters pre-

fixed), and we have N. 0.55, and W. 11.96 as the result. These distances may be represented by the lines

* Blanks for recording meteorological observations are furnished upon application to the Chief Signal Officer of the United States Army (Division of Telegrams and Reports, for the benefit of Commerce and Agriculture), Washington, D. C. These blanks give instructions for their use. They may be easily constructed by ruling the pages of a blank book, of foolscap-paper size, and in this form are more convenient for reference than folded sheets.

† The blanks issued by the English meteorological office to stations of the second order are arranged for records made at 9 A.M. and 9 P.M. Whatever hours are adopted at the beginning of the record should be continued afterwards; otherwise the comparison between different years would be liable to mislead. The time of observation should be as near the regular hours as possible, and the reading of the instruments should be noted down in pencil at the time they are taken, so as not to be trusted to the memory until entered in the Register.

A, B, and B, C, of the annexed triangle, in which the length of the sides corresponds with these quantities, and the problem remaining is to ascertain the angle at B, and the length of the hypotenuse B, C. This angle will be the *average direction*, or *resultant*, of all the winds during the month, and the length of the line B, C will show the value or relative amount of this average expressed in days. It proves, in this case, to be N. 87° 22' W., and its *value* as 11.96 days. The problem is the same as if we were wishing to find the direction and distance of a ship from her starting point, if sailing with the wind, during a month. Unless the velocity of the wind is measured, we cannot determine the actual angle and value of the resultant, and practically, for purposes of comparison, the motion may be calculated as uniform, the result being in every instance but approximately exact.

The prevailing direction and general character of the winds may be shown to the eye by simple diagrams, usually called "Wind Roses." There are many ways of representing them, some of which are here shown.

Wind Roses.

by a line, and we have an irregular figure, elongated and enlarged, in the direction from which the prevailing winds blew. The construction of these figures requires no computation beyond the simple addition of the days.

By linking the resultants of different months together, one at the end of the other, we have a broken line which strikingly represents the direction of the winds in the different months of the year. The accompanying figure has twelve sections or links, corresponding with the twelve months, and might represent the prevailing course of the wind in these several months. In order to draw such a figure accurately,

Resultants of the Months of a Year.

the angles should be carefully laid down from a protractor, and the lengths of the sections by a scale. The line would seldom be as regular as here shown. Another mode of representation is by means of a polygon, which may be constructed as follows: Having found the number of days that the wind has blown from different points, lay off from a point, on a scale say of 10 days to an inch, a line vertically up, proportioned in length to the number of days that the wind has blown from the north. Then, from the end of that line, another to the northeast (the top of the drawing being considered as north), and so on, for each point of the compass to the northwest. The point where the drawing ends, by its direction and distance from the point of beginning, will show the direction and value of the resultant. These polygons will be elongated vertically if the station is in a valley running north and south, or horizontally if the valley runs east and west.

The effect of local influences in giving direction to the wind is always noticed, and where ranges of hills or valleys exist the surface current conforms to their direction. In wide, open plains, however, the course of the wind is generally that of the upper currents, as shown by the direction of the clouds.

The resultant of winds in different months or years may also be represented by arrows and other devices. At regular stations for meteorological observations, instruments called *Anemometers* are used for finding the velocity of the winds. The one most commonly employed is

Robinson's Anemometer, consisting of four hemispherical cups, attached by arms of equal length to an upright spindle. The cups have their hollow side open on the same side as regards the arms to which they are attached, so that the wind striking the hollow with more force than the convex surface of the cups, causes the instrument to revolve. A very slight breeze is sufficient to give it motion, and in a strong wind the motion is very rapid. An endless screw on the spindle gives motion to a series of wheels which indicate,

Winds at Utica, N. Y.

Winds at Kinderhook, N. Y.

and sometimes register, the velocity. Theoretically, the centre of each cup moves with one-third the velocity of the wind, whatever may be the length of the arms that support it; but in practice, some allowance must be made for friction, and the smaller instruments record less than the larger ones.

The velocity and pressure of the wind are sometimes represented by numbers, as follows, the force varying as the square of the velocity.

No.	CHARACTER.	Velocity in Miles per Hour.	Pressure in Pounds per Square Foot.	No.	CHARACTER.	Velocity in Miles per Hour.	Pressure in Pounds per Square Foot.
1	Just perceptible.....	2	0.02	6	Very high wind.....	45	10
2	Gently pleasant.....	4	0.08	7	Strong gale.....	60	18
3	Pleasant, brisk.....	12½	0.75	8	Violent gale.....	70	24
4	Very brisk.....	25	3.00	9	Hurricane.....	80	31
5	High wind.....	35	6.	10	Most violent hurricane....	100	49

The mean velocity of the wind through the year varies in different places, being from nine to fourteen miles per hour, and more in the winter than at other seasons. Taking the general average, it is least at sunrise and greatest at 2 P.M.

The surface winds often blow in a different direction from the upper currents, as shown by the motion of the clouds, and in changeable weather different currents may often be noticed in the region of the clouds. We shall have occasion to refer on a subsequent page to the indications of weather shown by the winds in respect to storms. The winds may have a strong upward direction, as in a hail-storm, by which drops of water and smaller hailstones in descending are caught and carried into a region of intense cold. This upward current is common in ordinary thunder-storms and local showers. The currents of air may have a descending course, as is supposed to be the case with the "norther's," which are cold and intensely chilling winds that occur at certain seasons of the year in Texas.

(No. 19.) DEPTH OF RAIN AND MELTED SNOW.

These are ascertained by means of gauges placed in situations not exposed to influences that might increase or diminish the amount of water received. Various forms of rain and snow-gauges have been used, the simplest being a cylinder with an arrangement for measuring the depth in inches, either by directly applying a scale, or by pouring the contents into a graduated measuring glass. The snow-gauge is always best made of the latter form, and should be of sufficient depth to hold any ordinary fall of snow. The contents may be pressed down from time to time, and, for ascertaining the amount, must be melted, and then measured in the same manner as rain-water. The measurements should be made as soon after the rain or snowfall is over as may be convenient, or if the fall be abundant or long continued two observations may be made, and their sum entered. The time of beginning and end of rain or snowfall should be entered in proper columns.

The amount of rain caught by a gauge depends much on the location, it being, as a rule, more at the earth's surface than on the roof of a building, and more on the latter than on a high tower. The best location is therefore in a box sunk in the ground, with the mouth of the gauge a little above the surface of the earth, and some rods distant from any roof, tree, or other object that could intercept the rain, increase the amount, or otherwise vary the quantity from that due to an open space. The area of the gauge is immaterial, one of small size being theoretically equal to a larger one; cylinders of common tinned iron, lacquered, a foot or more long, and about two inches in diameter, with slender graduated scales for direct measurement of depth, were formerly supplied by the Smithsonian Institution to its meteorological observers. They could be sent by mail, and answered a good purpose; but it would always be best to procure these instruments, with their proper means of measurements, as made by special manufacturers.

Besides measuring the amount of melted snow, it is desirable to record, as nearly as may be, the depth of the snow itself,—an observation not easy to make where it has drifted. It can, however, be found with some degree of accuracy by taking the average of several measurements in a place sheltered from the winds.

Unusual rain or snowfalls, floods, etc., may be entered in Table No. 17, as "Memorable Events," and the general character of the seasons as "wet," "dry," "deep snows," "open winter," etc., in Table No. 26. Similar

rain-gauges, observed with equal care, will sometimes show discrepancies within a distance of a mile or two that almost impair confidence; but the differences will be generally found due to passing showers, or other assignable causes.

The number of rainy or snowy days, or days on which rain or snow fell in sufficient quantity for measurement, is an interesting item, and a column for this is given on Table No. 25. At some stations the direction of the winds that bring rain are recorded. Winds from the sea, and continuing several hours, generally bring rain, especially in winter. It is now generally conceded that most of our rains come from moisture evaporated from oceans, and brought over the land by winds. In certain regions the winds are deprived of their moisture by being carried over mountains, and a district entirely rainless may occur on one side of a chain of mountains while the other side has abundant rains.

Rainfall in Woodlands.—The effect of woodlands upon the rainfall, temperature, and evaporation is now being carefully studied in several places in Europe. Where opportunities occur, the observer may add to the existing fund of knowledge upon this subject by establishing a comparative series of observations. A report upon Forestry, made by the author of these pages under authority of Congress, and published in 1878, will be found to afford all the information necessary for the placing and care of instruments. It will be sufficient here to say, that such observations should be made in a place wholly within the influence of the woods, and selected as affording the average amount of shelter and shade. The place should be enclosed by a fence to prevent intrusion or injury. In all cases there should be for comparison a similar series of observations made in the open fields at some distance from the forest, so as not to be affected by it. In European stations for this study, self-recording instruments are employed, and the readings are made twice a day.

(No. 20.) TEMPERATURE OF THE OPEN AIR.

The thermometer observed should be placed in the open air, sheltered by a little roof, and protected from the direct or reflected heat of the sun. Extreme cold can only be measured by a spirit thermometer, and greatest heat and cold only by a self-recording thermometer. In measuring the temperature of the soil at different depths, a square box is placed in the ground to the desired depth, and into this a wooden block is fitted which carries a thermometer, sunk into one side so as not to be exposed to injury. This is drawn out for observation, and then returned to its place. To prevent the effect of changes during the reading, the bulb should be enclosed in a thick glass covering, which, being a slow conductor of heat, would not allow the temperature to be changed perceptibly when taken up for observation. The thermometers commonly used in this country and England have the *Fahrenheit* scale, in which the zero point is 32° below freezing, and the boiling point of water is at 212°. It is highly important that the minus sign (—) should not be omitted in recording temperatures below zero. The *Centigrade* or *Celsius* scale is much more convenient for scientific determinations, and, if once accustomed to it, would be found best for common use. Some thermometers have both scales attached. The zero of this scale is at the freezing point, and 100 at the point where water boils. In Germany and Russia the *Reaumur* thermometer was formerly much used, in which the zero is at the freezing and 80° at the boiling point of water.* The boiling point becomes less as we ascend above sea level, and the temperature of boiling water becomes a rude means of determining the altitude of mountains.

Water Thermometers are small thermometers inclosed in a cylindrical case of metal, with a valve at the bottom opening upward. When sunk in a river or lake the water passes through, and when drawn up the valve closes, bringing up water of the temperature at the lowest depth to which the instrument has been sunk. We are thus able to obtain the temperature of waters at different depths.

The temperature of the atmosphere diminishes as we pass from the equator towards the poles, and with much greater rapidity as we rise above the surface, so that at elevations of a mile or two in summer, in temperate

* Tables for changing each one of these scales into the other are given in works upon Meteorology. The following rules will serve in their absence:

1. To change *Fahrenheit* to *Centigrade*: subtract 32, and multiply remainder by $\frac{5}{9}$.
2. To change *Fahrenheit* to *Reaumur*: subtract 32, and multiply remainder by $\frac{4}{5}$.
3. To change *Centigrade* to *Fahrenheit*: multiply by $\frac{9}{5}$, and add 32.
4. To change *Reaumur* to *Fahrenheit*: multiply by $\frac{9}{4}$, and add 32.
5. To change *Centigrade* to *Reaumur*: multiply by $\frac{4}{5}$.
6. To change *Reaumur* to *Centigrade*: multiply by $\frac{5}{4}$.

climates, we would reach the freezing point. The regions of interplanetary space are doubtless intensely cold*. The range of temperature at a given place is usually, within the northern States, from 100° to 140° in the year. In more southern latitudes it is less. In dry regions, as on the western plains, the daily range is very much greater than in humid valleys. It is found that a moist atmosphere prevents the cooling of the earth by night, and the formation of dew. This explains the reason of a remark often made, that a still clear night in summer, without dew, is an indication of rain. A moist atmosphere is a good conductor of sound, and hence the reason why sounds are sometimes heard at great distances before a rain.

The temperature of the air is affected by congelation and by the melting of ice and snow, in the former a certain amount of latent heat being given out, and in the latter absorbed. In like manner the condensation of vapor into rain or snow, and evaporation, have opposite tendencies; the former evolving and the latter absorbing latent heat. The temperature varies much less over cloudy than over clear districts, and less in valleys than on hills and plains. It is warmer on one side of an area of low or high pressure than the other, and *generally warmer in advance of a storm-centre, and colder in the rear.*

As an illustration of the relation of temperature over extensive regions to barometric pressure at distant points, it is stated that severe frosts and cold have frequently been experienced in Great Britain and Western Europe, traceable directly to an abnormally high pressure of the atmosphere over Iceland, precipitating a powerful polar current of air towards the southeast continuously for periods of two or three weeks.†

(No. 21.) BAROMETER.

This instrument shows the pressure of the atmosphere, and, more than any other, is relied upon by meteorologists for indications of the approach of storms. It is in very general use on board of ships at sea, and should come much more into use among farmers. There are two forms of this instrument depending upon different principles,—the mercurial barometer (sometimes carrying a dial-plate for indicating changes by an index), and the aneroid barometer, which is made entirely of metal, may be easily carried without derangement, and is sometimes made in form for pocket use. For careful observations the mercurial barometer, with means for adjusting the mercury in the cistern to a fixed level, and an inclosed thermometer for showing its temperature, should be used. For comparisons between different stations, and for scientific purposes, corrections should be applied for temperature and altitude, so as to reduce the record to what would be observed at sea-level. Tables and rules for applying these corrections have been published, and may be obtained from the Smithsonian Institution, at Washington. Taking the average of observations upon the barometer, after applying corrections for temperature and altitude, we find the pressure, one year with another, about 29.927 inches at the equator. It increases as we go north to about 32° of latitude, where the mean is 30.21 inches, and it then diminishes to 64° ; and beyond that it again increases as far northward as observations have been made. In going south from the equator, we notice a similar but much less distinct increase, and beyond 25° of latitude a very considerable falling off, so that at 70° south latitude it is only 28.88 inches. These inequalities are due to the prevailing winds in different regions of the earth.

The monthly means of pressure in middle latitudes do not vary much, being generally less in summer than in winter. There is also a daily range, the greatest pressure on the general average occurring between 9 and 10 A.M., and the least between 3 and 5 P.M. There is also a less rise about 10 P.M., and a less fall at 4 A.M. This diurnal oscillation is greatest at the equator, where it is a little over a tenth of an inch, and it diminishes towards the poles, so that in high latitudes it is barely perceptible. These daily changes are due to the action of the sun's heat, and to changes in the amount of vapor present in the atmosphere, with a slight fluctuation due to the moon's attraction.

* The decrease of temperature upward is much greater near the surface than at a higher elevation, and is more in a clear sky than in cloudy weather. The rate varies with the latitude, the season of the year, and the hour of the day; being more rapid in warm than in cold climates, and in summer than in winter, and by day than by night. It is also found to depend closely upon the pressure of the atmosphere as shown by the barometer, and, after ascending a mile or so, the rise and fall of the barometer and thermometer very nearly coincide, a change of one inch in the former corresponding with two and a half degrees of the latter. Any influence that causes a depression of the barometer is accompanied by a cooling of the atmosphere, and tends to the formation of clouds.

† It has been calculated that the temperature of space, beyond the vicinity of planetary bodies, is from -60° to -80° of the Fahrenheit scale. Were it not for our atmosphere the temperature at the earth's surface would be alternately intensely hot or intensely cold, according as the place was exposed to the sun or shaded from it. This condition must exist on the moon's surface, there being no perceptible atmosphere around that body.

† Practical Use of Meteorological Reports and Weather Maps.—Circular of Chief Signal Officer, p. 23.

If we compare the indications of the barometer as they exist simultaneously over wide areas of country (as is done three times daily, from telegraphic reports, by the Signal Service), it will be found that there are certain areas of high, and other areas of low pressure of the barometer. Lines drawn through points of equal pressure are called "Isobarometric Lines," or simply "Isobaries" or "Isobars." The areas that these lines inclose may vary from a few miles in diameter, as in tornadoes, to several hundred miles, as in general and widely extending storms. Usually areas of low pressure are much less in extent and more regular in form than those of high pressure. If we could obtain instantaneous reports from the whole surface of the earth, we would always find several of these areas of low pressure surrounded by those of high pressure, and one or more of them are constantly seen with more or less distinctness upon the weather-maps published thrice daily by the Signal Service office.

Taking the mean results of months and years, we find that in certain great regions the mean annual atmospheric pressure is habitually lower than in others, as is shown by the following map:

Areas of low pressure are usually areas of cloudy and stormy weather, if the moisture of the atmosphere be sufficient. They vary in extent according to the prevailing conditions of temperature and moisture of the regions over which they pass, becoming smaller where the air is dryer. It does not follow that every area of low pressure is a storm, or even an area of cloudy weather; but it may be safely said that no extensive storm occurs except within such areas.

North of 30° north latitude these areas of high and low pressure, as well as of extreme depressions of the temperature, move eastward, but south of 30° their course in summer is usually westward. Originating on the western borders of the continent, or coming from beyond, they move at a rate which may amount to fifty miles an hour, but which is usually less than thirty miles, and, travelling with great regularity, they pass off upon the Atlantic, and may even reach Europe in some cases.

A storm-area coming from the Pacific, may afford abundant rains at certain seasons on passing over the Sierra Nevadas and the Rocky Mountains. It may pass over the plains without rain, but on coming over the comparatively moist air of the Mississippi Valley condensation may again begin, and if there be considerable moisture, heavy rains may attend its course.

The Great Lakes appear to attract these areas of low pressure northeastward; they hang tenaciously over them, and move slowly away from them. This northeasterly tendency is greatest in early autumn, while in winter it is eastward.

The approach of a storm appears to be preceded by an increase of temperature in the upper regions, due apparently to the evolution of latent heat by condensation. It is followed by the formation of cirrus clouds, which precede by some hours the formation of rain-clouds. Around the borders of an area of low pressure, thunder-showers and other local disturbances are frequently observed. The lowest pressure of a storm-area is felt after the rain has begun to fall. Strong winds in autumn on the lakes and in northwestern States, with little or no rain, are caused by disturbances moving southeastward from British North America, and in midwinter there is sometimes seen a storm travelling from north to south; but these are rare. They are characterized by continuous snow, succeeded by cold, dry weather.

Thunder-storms are usually local in extent, and the winds may gyrate either to the right or left, according to the local influences. They may generally be explained by Professor Espy's theory of storms, as caused by

ISOBAROMETRIC LINES SHOWING IN INCHES THE MEAN ANNUAL ATMOSPHERIC PRESSURE OF THE UNITED STATES.

ascending currents of heated air, occasioned by unequal exposure to the sun's heat on particular parts of the earth's surface.

By turning over the pages of daily charts published by the Signal Service, it will be seen that the area of low or of high pressure of one day may be generally recognized further eastward the next, until they have passed off upon the Atlantic, to be succeeded by others from the west.

It is from the knowledge obtained by telegraph, from many widely distributed points, by means of carefully placed instruments in charge of trained observers, as to the approach, extent, direction, and character of these areas of low pressure, that the Signal Service is able to announce, sometimes many hours in advance, and in more than nine cases in ten with correctness, the path of an approaching storm, and the probable character of the weather for the coming day. From these intimations of a storm of large area that may be passing over the region beyond the Mississippi, it is able to display cautionary signals at all the posts and stations that may require it on the Great Lakes and along the Atlantic Coast, so that vessels may take heed and be prepared for rough weather, and it has been proposed to establish such signals throughout the country for the benefit of farmers generally.

As a general rule the tendency of winds is *inward* towards the centre of *low areas* of the barometer, and *outward* from *high areas*. But the motion of the earth upon its axis gives in both cases, in north latitudes, a tendency *towards the right* from the radial line. These tendencies are shown in the accompanying diagrams by arrows; but practically the direction of the wind is towards some point between these, generally 30° to 40° , or, in severe storms and cyclones, at times 80° of angle from the radial line.

The changes of the wind on the approach of an area of low pressure, will vary according as it passes centrally or marginally over a given place. The following table represents these changes as they are generally observed in a passing storm-area, unless influenced by local irregularities of surface.*

DIRECTION OF WINDS IN A PASSING STORM.

PLACE OF OBSERVER, WITH RESPECT TO AREAS OF LOW OR HIGH PRESSURE.	PREVAILING WINDS, LOW PRESSURE AREA.	PREVAILING WINDS, HIGH PRESSURE AREA.
On the N. Side.	N. and E.	S. and W.
On the N. W. Side.	N. W. and N. E.	S. E. and S. W.
On the W. Side.	W. and N.	E. and S.
On the S. W. Side.	S. W. and N. W.	N. E. and S. E.
On the S. Side.	S. and W.	N. and E.
On the S. E. Side.	S. E. and S. W.	N. W. and N. E.
On the E. Side.	E. and S.	W. and N.
On the N. E. Side.	N. E. and S. E.	S. W. and N. W.

The laws that regulate the winds and their relation to barometric pressure are therefore extremely important. In a region of mountains and valleys the inequalities of surface may often give a local direction along their course, although the prevailing direction of the clouds may show a general direction across them. These general winds are usually dependent upon the position of high and low areas of the barometer. Besides

* The friction of the earth's surface has a greater influence upon strong than upon feeble winds, and this does more to retard the tangential than the centripetal motion in the neighborhood of an area of low pressure. Hence, in severe land-storms the winds blow more directly towards the centre of low area than on the sea. The velocity of the winds at some hundreds of feet above the surface is often very much greater than at the surface, as shown by the shadows of passing clouds.

these local and general winds, there are great currents encircling the earth and extending over whole continents, that are largely influenced, if not entirely dependent upon the rotation of the earth upon its axis, which also gives direction to the motion in whirlwinds and storms.

The winds may blow in an ascending or descending direction as well as horizontally, and in fact such winds form a prominent feature in tornadoes and waterspouts, the currents in the centre of such violent movements being upward at the centre, and downward at the outer edge.

HUMIDITY.

Perhaps no class of observations has more direct value in the study of climate, than that relating to humidity; but this inquiry has been very frequently omitted from records that were otherwise carefully made. For rude approximations, the *Hygrometer*, depending for its indications upon the expansion or contraction of animal or vegetable substances as they become moist or dry, has long been employed; but the instrument now generally used depends upon other principles, and affords data much more complete and reliable. This is the *Psychrometer*, consisting of a pair of thermometers, as nearly alike as they can be made, and placed side by side in a case exposed freely to the air, but sheltered from the weather. One of these has its bulb covered with muslin cloth. A few minutes before the observation is made this cloth-covered bulb is wet with water, when the evaporation from the surface will generally cool it down to a certain degree where the cooling will stop. The difference between the two thermometers read at that time, which is little or nothing in damp weather, but considerable in dry weather, will afford, by the aid of tables calculated for the purpose, two important elements, viz., the *absolute* and the *relative* humidity of the air at the time of observation. A few words of explanation will be given with respect to these terms.

(No. 22.) ABSOLUTE HUMIDITY.

The absolute humidity of the atmosphere—sometimes called the “tension,” or the “elastic force” of the aqueous vapor—is always observable, because the atmosphere is never absolutely dry. Above the boiling point of water this elastic force becomes, in the form of steam, a mechanical power of great utility and very general use. At lower temperatures it is perceptible only by its effects, as shown by the psychrometer. The laws which govern the pressure of aqueous vapor have been carefully studied, and tables are computed for showing its amount at all temperatures ever observed in the open air, and for all differences ever occurring between the wet and dry bulb thermometers. The absolute moisture is represented by the height of a column of mercury which it would support, measured in *English inches*, or in *millimeters*, according as the tables are calculated. Both classes of tables are published, and can be easily obtained from the Smithsonian Institution, at Washington. The height of column representing this element of calculation varies between 0.009 inch at 30°, and nearly two inches (1.988) at 101.2° Fahr. It is much greater in the summer months than in winter, and in warm than in cold climates, because the rate increases rapidly as the temperature is raised.

(No. 23.) RELATIVE HUMIDITY.

Air that is absolutely dry (a condition not actually known in common observations), is represented by 0. Air saturated with moisture (as during a rain, or in a damp fog), is marked 100. The intermediate degrees vary according to the conditions of the atmosphere, the percentage being higher in winter than in summer, although the absolute moisture is greater in the latter than in the former. At stations in or very near woodlands both the absolute and the relative moisture are greater than in the open fields, and the relative difference is very considerably more in the summer time, and during the season of active vegetation, than at other seasons of the year. This is partly due to the evaporation then going on from the foliage (which at the same time adds to the amount of moisture, and by the cooling process of evaporation reduces the capacity of the air for moisture), and partly to the greater shelter from sun and winds which woodlands in full leaf afford.

The “dew point,” is the temperature at which dew begins to form on the outside of a bright metallic vessel when water is placed in it and cooled down. The “complement of the dew point” is the difference between the temperature of the air and the dew point. This ranges usually from 10° to 15°, occasionally amounting to 25° and 30°, and in India it has been known to rise to 61°, and elsewhere even to 78°. This latter difference represents but 6 per cent. of relative humidity. Besides changing with the seasons, the relative humidity fluctuates

during the diurnal period, being least about an hour before sunrise, after a part of the vapors have been precipitated as dew in the cool of the night, and greatest a little before sunset, when the air has been exposed many hours to the sun's heat. The mean diurnal variation of relative humidity varies in different places according to local influences, and at Philadelphia it amounts to an eighth part of the average amount of vapor in the atmosphere.

Besides the instrumental observations above mentioned, designed to indicate the condition and approaching changes of the weather, there are others less definite as to their character, but scarcely less certain, which are due to the amount of moisture present in the atmosphere, the temperature, and direction of wind in the region of the clouds, and other circumstances that deserve attention. They can best be learned from habitual observation, and may vary in different countries according as the prevailing winds pass over the sea or the land, or whether they pass over high mountains or level plains before reaching the place of observation, and as other influences of a general or local nature may affect the weather.

The following indications are mentioned as worthy of notice. They are partly derived from the publications of the meteorological office of the English Board of Trade:

Something may be judged of the weather from the color of a clear sky. The purer the air, the deeper is its azure tint. The sky is bluer after a rain, and a pale blue tint betokens a coming rain. The sky is bluer in equatorial regions than towards the poles, and increases as we ascend till it becomes almost black. The redness of the evening sky is caused by the condensation of vapor and the absorption of the violet rays of light, while the red rays, being not absorbed, are transmitted to the observer. It is usually regarded, whether the sky is clear or cloudy, as a promise of fair weather; but the presence of a red sky in the morning indicates an excess of moisture, and is a presage of wind and rain. A whitish yellow tint in the west after sunset, extending high up, is an indication of rain. A purple tint of the sky at sunset, with a bright blue in the zenith, is followed by fine weather. A high dawn foretells wind; a low dawn, fair weather. Soft-looking or delicate clouds foretell fine weather, with moderate or light breezes; hard-edged, oily looking clouds, wind. A dark, gloomy blue sky is windy, but a light blue sky indicates fine weather. Generally, the softer clouds look, the less wind, (but perhaps more rain) may be expected, and the harder, more rolled, tufted, or ragged, the stronger the coming wind will prove. A bright yellow sky at sunset presages wind; a pale yellow, wet. Small inky clouds foretell rain; light scud clouds, driving across heavy masses, show wind and rain; but, if alone, may indicate wind only.

High upper clouds crossing the sun, moon, or stars in a direction different from that of the lower clouds, or the wind when felt below, foretell in middle latitudes a change of wind.

After fine, clear weather, the first signs in the sky of a coming change are usually light streaks, curls, wisps, or mottled patches of white, distant clouds, which increase, and are followed by an overcasting of murky vapor that grows into cloudiness. This appearance, more or less oily or watery as wind and rain will prevail, is an infallible sign. Usually the higher and more distant such clouds seem to be, the more gradual but general the coming change of weather will prove.

Light, delicate, quiet tints or colors, with soft, undefined forms of clouds, indicate and accompany fine weather; but gaudy or unusual hues, with hard, definitely outlined clouds, foretell rain, and probably wind. Misty clouds forming or hanging on heights show wind and rain coming, if they remain, increase, or descend; if they rise or disperse, the weather will improve or become fine.

Birds and animals appear to have by instinct some consciousness in approaching changes. When sea-birds fly out early and far seaward, moderate wind and fair weather; if they hang about the land stormy weather may be expected. Swallows and other birds of long flight will hang about home and fly low before a rain, and animals will sometimes seek shelter-places before other indications of a storm are seen. The smoke of chimneys spreading out or falling indicates an unfavorable change. Morning dews or fogs are indications of a fair day.

Halos, or circles around the sun or moon, and *Parhela*, or bright spots on each side, or above or below the sun, are generally regarded as indications of a storm. These luminous appearances are caused by the action of the light upon crystals of ice in the air. If *colored*, the light is *refracted*, as in rain-drops causing the rainbow; if *white*, the light is *reflected* from the outside of the crystals. Sometimes several of these circles or arcs may be seen together, having the sun or the zenith as their centres. Columns of light passing vertically through the sun or moon are caused by the reflection of light from the flat surfaces of snow crystals in the air. Light, fleecy clouds near the sun in summer will sometimes show beautiful rainbow tints. These are seldom seen except in fair, settled weather.

(No. 24.) EVAPORATION FROM WATER SURFACES.

This may be determined by exposing a cylindrical vessel of any size, filled with a measured depth of water, and ascertaining from time to time the loss by evaporation. If freely exposed to the sun, rains, and winds, it would probably represent, with reasonable accuracy (first deducting the amount received from rain-fall), the amount of water evaporated within the time observed. Such an evaporation should be measured at least once a week, and it should be replenished from time to time. It should be covered with an open wire screen to prevent interference from birds or animals.

More delicate instruments have been constructed for measuring by a scale. The graduated measures belonging to the rain-gauge may be used to measure by pouring out the contents of the evaporator from time to time. The amount of evaporation is much less in a woodland than in the open fields, a circumstance doubtless partly due to the protection from the winds afforded by the foliage. A table for this record is also given.

(No. 25.) GENERAL SUMMARIES.

The use of this table is obvious. If rain or snow fall in quantity sufficient for measurement, however small, the day should be counted. Descriptions of remarkable haloes, meteors, and auroras should be entered in the blank used in recording the daily observations.

(No. 26.) GENERAL CHARACTER OF THE SEASONS.

The entries may be in general terms, such as "early," "late," "very warm," "very cold," "wet," "dry," etc., according to the facts of the case.

STATISTICS OF PARTICULAR FIELD CROPS.

It is intended that each page of this portion should show the total results of the year in the cultivation of each class of products mentioned in the headings for the entire farm, including that raised upon land hired from others, or worked upon shares, but not that raised upon the farm if the land is rented to others for cultivation.

If the land is rented to others upon shares, these details belong properly to the business of the cultivator and not to the owner. It would be sufficient in such a case to simply enter the receipts in kind in the column of remarks. The amount of land hired from others for cultivation has a place on blank B, and its production should form a part of the totals of grain, etc., in tables 27 to 52 inclusive, wherever it embraces items mentioned in these tables.

The proper time for filling these tables is at the close of the year, when the results of the several crops are known, and the suspension of labors in the field affords leisure for review of the operations of the season.

In computing the receipts from a given crop, or other commodity, the prices *paid on the farm* should be entered, and not the price *paid at a distant market*. If sold at the latter, the cost of transportation should be deducted from the amount received at such place.

In order to possess the data for filling this Register with the annual results of the year, with respect to different crops and particular fields, it would be convenient to provide a common blank book, say of three or four quires of paper, in which should be entered, from day to day, such items of production, purchase, use, and sale as there might be occasion for from time to time. The simplest form of entering these facts would be to devote a page to each subject. One page, for example, might relate to wheat, another to rye, and so on through the list of grains and other products of which memoranda are to be preserved for final entry in this Register. Being thus already together, the items can be readily consolidated as the occasion may require.

(No. 27.) HAY CROP.

The headings of this table need no particular explanation, as farmers who feed their hay on the farm seldom weigh it; the amount must be estimated. Its quantity may be known approximately by measurement, but the differences between different kinds of hay, and between the same hay at different periods after being placed in the mow or stack, and at different heights of pile, are too uncertain for satisfactory determination except by

weight. Of fresh hay 10 cubic yards will average a ton. When well settled it may be reduced to half this space in some cases. Old hay when taken from well settled stacks will measure, it is said, about 8 cubic yards to the ton.* Clover is much lighter, 11 to 12 yards being required for a ton.

In noting the amount of grass-seed produced, it would be proper to include the amount screened from grain as well as that reserved in the meadow for seed. Where the cultivation of any particular kind of grass-seed or the seed of other forage plants is made a special object, one of the pages numbered "46" should be ruled to suit the wants of the occasion. The "Total Receipts from Hay Crop" would only include the benefits received from hay or from grass-seed sold, and not the incidental profits from these articles that might be fed upon the farm. If stock is kept for others the facts may be entered in the column of "Remarks." The term "hay" will be understood to include all kinds of grass, clover, lucern, or other plants mowed when green, dried in the sun, and gathered and stacked or stowed for feeding stock in winter. If hay is sold pressed or for pressing the amount should be entered in the column of "Remarks;" and if this be a regular branch of business, requiring entry every year, a part of this column might be ruled and used for a separate record of quantity of hay pressed or sold for pressing, according to the wants of the occasion.

(No. 28.) WINTER WHEAT CROP.

As the harvest of one year, is with this crop, the yield from seed sown the year before, care should be taken, when determining the average yield per acre, to use as the divisor, the number of acres sown that year, and entered in the horizontal line *above* that which shows the number of acres harvested. If the "acres sowed" in one year is greater than the number of "acres harvested," it would show that a part of the crop had been lost, and its cause should be entered in the column of "Remarks."

On the Pacific Coast, grain will sometimes reproduce itself by self-seeding. These crops are called "volunteer crops," and would be sufficiently entered by omitting to enter in the columns headed "Acres Sowed in Autumn" and "Bushels Sowed in Autumn." The fact might be further explained under the column of "Remarks." Among other items of information proper for this column would be a note of price paid for threshing, names of purchasers of crop, market at which sold, or any other fact of interest concerning it.

(Nos. 29 to 36.) FIELD CROPS OF VARIOUS KINDS OF GRAIN.

It is presumed that none of these tables require remark in this place, the headings being specific, and in some degree similar. The *rye crop* is understood to mean "winter rye," this being most generally cultivated. If spring rye is made a special crop, a table may be ruled to receive it. In entering bushels of corn raised, *shelled corn* only should be entered, or, if sold in the ear, only the equivalent reduced to proportion of the corn when shelled.

(Nos. 37 to 40.) VARIOUS ROOT CROPS.

The same remark applies to these as to grains. It is to be observed that custom, and in some States law, has fixed the weight of these per bushel, as stated in a table on a subsequent page. When measured they are heaped. Sugar beets and other root crops should have a separate page ruled, if there be occasion.

(No. 41.) FLAX CROP.

The finer qualities of flax are obtained by pulling the plant just as the stems begin to turn yellow, and before the seed ripens. If left till the seed is fully ripe, this crop is quite exhausting to the soil. The best fertilizers for securing a good yield of seed are bone-earth, guano, and other manures rich in phosphates. For fibre, gypsum and ashes are more suitable. The water in which flax is steeped in preparing it for manufacture becomes a rich manure for the crop.

(No. 42.) HEMP CROP.

Hemp, like the finer qualities of flax, must be cut before the seed ripens, the proper time for cutting being when the leaves of the staminate or male plants turn yellow and fall. Especial care must be taken in drying and storing the seed, as it loses its vitality very easily. Lime is beneficial to this plant, and the best crops are grown on a limestone soil.

* In Dakota Territory the law defines a ton of hay as 343 cubic feet [12.7 cubic yards], after settling thirty days, or such other time as may be agreed upon. This is the only instance in which an attempt has been made in the United States to define the weight of hay by measurement.

(No. 43.) TOBACCO CROP.

This table needs no suggestion. The column for "Remarks" will afford sufficient room for entering any facts concerning the crop not otherwise provided for.

(No. 44.) HOP CROP.

Hops are often cultivated with corn the first year, and land thus occupied would be entered twice. Hop-roots are usually sold by the bushel, the prices ranging between wide extremes, according to amount of supply and demand. The rate paid for picking is commonly at a given sum per *box*, the contents of which is in some States regulated by law, and in others by custom only.

(No. 45.) SORGHUM CROP.

Besides the items of information provided for in this table, others, such as price of seed, cost of manufacture, etc., might be deemed worthy of entry.

(No. 46.) FIELD CROPS NOT SPECIFIED.

A sufficient number of pages, indefinite as to subject, are allowed for special crops not otherwise provided for. These may become convenient for use in recording the crops raised in market- or seed-gardens, and the like, and in the cultivation of particular fruits.

(No. 47.) INJURIES TO CROPS.

The years in this table are left blank, as some of them might pass without occasion for entry, and in other years, several entries might require a place. In case the injury extended through several days or weeks, such as drouth, fires, etc., the time of beginning and end should both be entered. In regions liable to injuries from the potato-bug, grasshoppers, etc., a public service would be rendered by keeping a record of all circumstances noticed, and especially of such influences and conditions as are found to increase or diminish their numbers.

(No. 48.) STATISTICS OF FERTILIZERS USED.

In case the fertilizers mentioned are produced on the farm, such as ashes, lime, muck, marl, etc., the quantities only need be mentioned. Space is allowed for entering special fertilizers, which are too varied in number for satisfactory designation in the printed headings of these tables. In experimenting to ascertain the particular kinds of fertilizers best suited to the crops on a given soil, it is best to provide a separate register, ruled to show the area of land, the crop, the amount applied, the time and mode of application, the cost, and the result. Swamp muck is a material abundant on many farms, and may be made highly valuable as a fertilizer by suitable preparation. By mixing with quick-lime, when newly dug, and before it is dry, and afterwards with animal matter, such as urine or dung, this substance becomes an excellent fertilizer; or it may be slowly mixed with marl or clay, allowing it to remain exposed to the air for a considerable time, turning it occasionally. This substance is most useful when applied to soils containing much lime, and is better upon clay than upon sandy soils.

(Nos. 49, 50.) STATISTICS OF ORCHARD FRUIT CULTURE.

The first of these tables of statistics of fruit culture is prepared for apples; the succeeding are left in blank to suit the varied wants of different farms. They are intended to show the capacity of production and changes in the plantation, the yield of fresh fruit, the dried or prepared fruits, a comparison of expenses and receipts, and such remarks as may be thought necessary.

(No. 51.) STATISTICS OF BERRIES AND OTHER SMALL FRUITS RAISED FOR MARKET.

In case the raising of berries for market, whether sold fresh, dried, or canned, the quantities raised and the prices may be entered on these pages. In the blank space across the heading enter the name of the crop, and in the blank spaces for quantities the words "bushels," "quarts," "pounds," or other unit of measure employed. The figures in the column for years are omitted from this table, so as to admit of several entries being made in a single year for as many different kinds of berries or fruits as there might be occasion to enter,

the name of each fruit being entered on its appropriate line in the column for "remarks." This practice would be convenient where these crops were only cultivated occasionally, while in other years there would be no occasion for an entry.

(No. 52.) **STATISTICS OF FRUIT CULTURE: GENERAL RESULTS OF THE YEAR.**

The design of this page is to present a summary of the total operations in fruit culture for the year. It will be seen that blanks are left for entering kinds not specified. The columns for receipts and expenses of all fruits, whether raised in the orchard, field, or garden, should be summarized for this table.

(No. 53.) **STATISTICS OF GARDEN PRODUCTS SOLD.**

The headings of this table are left blank, and are to be filled with the names of such products as may be made a special subject of cultivation for market sale.

(No. 54.) **MAPLE SUGAR AND SYRUP.**

In the northern States and in Canada, these become important objects of industry during the thirty or forty days in the early spring months, when alone their production is possible in a remunerative degree. In the New England States the amount of maple sugar that reaches the market is much greater than that of syrup, while in the northwestern States the latter is relatively greater in amount. The maple tree will yield sap on any warm day during the winter months, but it is not until the approach of spring, when warm days alternate with freezing nights, that the amount obtained is sufficient for profitable manufacture.

(Nos. 55 to 58.) **FARM STOCK.**

The design of these tables is to afford an opportunity of entering a statement of the number of each class of domestic animals on the farm at the beginning of the season, the changes during the year, receipts from sales, and (with respect to sheep and swine) the quantity and value of products. Except the table for horses, mules, etc., the headings extend across opposite pages, affording ample opportunity for entering the details.

In case of experiments in soiling cattle, feeding steamed food, or other improved methods, a separate record should be kept for ascertaining the advantages and the comparative expense; but these are too varied in their character to be anticipated in this volume.

(No. 59.) **DAIRY PRODUCTS.**

The manufacture of butter or cheese, but more especially the latter, has become of late years, and in regions favorably situated, a distinct branch of industry, the milk from a convenient distance around being brought once or twice daily to a factory for manufacture on a large scale. At such establishments an account is necessarily kept with each patron, the milk being generally weighed. An account of sales, detailed statement of cost, and a calculation of the interest of each patron requires full records to be kept, and books have been prepared for these special uses. The object in preparing the tables of this volume has been to provide a place for the entry of the results at the close of the season, and separate pages have been prepared for home and factory products.

In a few localities *condensed milk* is made a special branch of business; but as in these cases the milk is usually sold to the manufacturer, the dairyman will have no occasion to follow it further than the entry of "milk sold to the factory," and "total receipts." There are many details in butter and cheese-making, such as the amount of salt and other articles used, cost of boxes, tubs, and the like, of which every intelligent farmer should take account in his business; but these are too varied for arrangement in our tables.

(No. 60.) **POULTRY.**

This table is chiefly intended for use in cases where the sale of poultry and eggs is made a leading business with the farmer, as is done in some cases where favorably located with respect to markets. A special hatching record has been recommended to poultry breeders in the following form:

No. of Nest.	Date when Eggs were placed.	Number of Eggs.	Kinds or Varieties.	Date when Hen is to come off.	No. of Chickens Hatched.	REMARKS.
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STOCK-BREEDING.

Persons engaged in stock-breeding would find it convenient to provide a table, by ruling blank pages, for entering the dates of beginning of gestation, so as to better know when to expect its termination. Three columns would be sufficient for this purpose, of which the first would be the name or description of the subject of record, and the other columns, the first and last, dates. The period of gestation, proper age, and duration of powers of reproduction are given for different animals by approved authors as follows:

KINDS.	Proper Age for Reproduction.	Period in Years that Power of Reproduction Lasts.	Shortest Period. Days.	Mean Period. Days.	Longest Period. Days.
Mares.....	4 years.	10 to 12	322	347	419
Cows.....	3 "	10 to 14	240	283	321
Ewes.....	2 "	6	146	154	161
Swine.....	1 "	6	109	115	143
Goats.....	2 "	6	150	156	163
Asses.....	4 "	10 to 12	365	380	391
Buffaloes.....		8	281	308	335
Dogs.....	2 "	8 to 9	55	60	63
Cats.....	1 "	5 to 6	48	50	56
Rabbits.....	6 months.	5 to 6	20	28	35

The period of incubation of domestic fowls is given as follows in days:

KINDS.	Shortest Period.	Mean Period.	Longest Period.	KINDS.	Shortest Period.	Mean Period.	Longest Period.
Hens.....	19	21	24	Pigeons.....	16	18	20
Turkeys.....	24	26	30	Pea-Hens.....	25	28	30
Ducks.....	28	30	32	Guinea-Hens.....	20	23	25
Geese.....	27	30	33	Swans.....	40	42	45

The time that animals continue to grow, and the age to which, under favorable circumstances, they may live is as follows:

Camel grows 8 years, lives 40 years.	Dog grows 2 years, lives 12 to 14 years
Horse " 5 " " 25 "	Cat " 1½ " " 9 to 10 "
Ox " 4 " " 15 to 20 "	Hare " 1 " " 8 "
Lion " 4 " " 20 "	Guinea-Pig " 7 months, " 6 to 7 "

(No. 61.) WEANING OF THE YOUNG OF DOMESTIC ANIMALS.

This record is in cases of some of the more valuable kinds of stock a matter of sufficient interest for record, but generally not. There are other records in the life of animals, especially in respect to males not kept for reproduction, that might be useful, but these are omitted from this volume as not of general interest.

(No. 62.) FATTENING OF DOMESTIC ANIMALS.

This record is convenient for current use and after reference, but in special cases one much more extended would be useful, especially in experiments upon the use of different kinds of food in fattening stock, or in the mode of preparing and feeding it. These, like experiments in soiling cattle and the like, are too varied for a general series of tables, and are mentioned here only in a suggestive way. The entries may be made collectively for each class of animals fattened, and in the column of remarks reference might be made to any special records that might be kept.

According to the results of many experiments, a bushel of corn will produce 8·4 pounds of pork net, or 15 per cent. of its weight; or conversely, 1 pound of pork requires 6⅔ pounds of corn. These data afford the means of estimating the cost of fattening swine, the price of corn being known. The amount of food required will, of course, vary according to the breed of the animal, variety of food, temperature, and other circumstances.

As a general rule in feeding, oily food is best calculated to increase fat, and glutinous food (grains) for draft animals. Fattening food should be ground and steamed.

(No. 63.) BEE-KEEPING: HONEY AND WAX.

These pages are intended for use where bee-keeping forms a leading business. The successful management of bees requires careful attention, and when the business is conducted with intelligence it may often result in large profits. With such, a more detailed record might be used.

There may be occasionally other farm industries that require record, but these are so exceptional that it has been thought best to leave them for entry on blank pages of the record, as occasion may arise. Among these may be mentioned silk-raising and the cultivation of special fruits, roots, or seeds, and field-crops, too varied for a general record. It is designed to prepare a special edition suited for the wants of Southern agriculturists, as there may be occasion.

(No. 64.) RECEIPTS FROM THE FARM OTHER THAN FROM CULTIVATION.

The quarrying of stone, or getting out of clay, sand, gravel, marl, or peat, and other revenues from privileges, as of shore and the like, may, in exceptional cases, become a source of income from lease, sale, or working by the owner. They are too varied for specification, and too variable from year to year to be presented otherwise than in the indefinite manner adopted by means of blank headings suited for such subdivisions and uses as exceptional wants may require.

(No. 65.) SPECIAL OBJECTS OF HOME INDUSTRY.

These, like the objects last named, are too varied for specification. They may include such manufactures for sale as may be produced by household labor or in winter season when field labors are suspended.

(No. 66.) HIRED LABOR.

This is intended as a memorandum for dates, rates of wages, and remarks with regard to labor upon the farm or for household service.

(No. 67.) CONDITION AND CHANGES OF THE FARM.

These pages should show the extent of the farm, the changes in its area, assessed valuation of property of the owner, and estimated value of different classes of farm property. A comparison of results through a series of years, and a careful study of the points wherein these changes have occurred, would prove a most useful subject of attention.

(No. 68.) BUILDINGS ERECTED.

The years in this table are left blank because some might pass without occasion for entry, while in others there might be several entries required. It would be well to enter at the beginning the buildings already on the farm when the record began, so far as the facts concerning them are known.

(No. 69.) REPAIRS OF BUILDINGS.

In this table, as in the last, the years are left blank, and for a similar reason. The specification of the nature of the repairs or changes may be general or particular, according to circumstances.

(No. 70.) INSURANCE UPON PROPERTY.

This table explains itself. It will apply to all forms of insurance upon buildings, furniture, stock, or other property.

(No. 71.) BUILDINGS HIRED OR LEASED.

This table will readily serve for all purposes of entering memoranda of buildings hired of others, or leased to others from time to time. The uses for which the lease was made can be entered in the same column as that of the description of the building, as "barn for hay," "house for farm laborer," etc.

(No. 72.) HIRED PASTURAGE, AND STOCK PASTURAGE ON LAND NOT BELONGING TO THE FARM.

This table applies to cases in which a farmer, wishing to extend his stock operations beyond the capacity of his land, hires pasturage, either by leasing land, or by hiring his cattle kept by others.

(No. 73.) PASTURAGE HIRED TO OTHERS, AND STOCK TAKEN IN FOR PASTURAGE.

This table is the converse of the preceding, and applies to cases in which a person, having more pasturage than stock, either rents land to others, or takes in the stock of others for pasturage. The use of these tables will be obvious without further explanation.

(Nos. 74 and 75.) LAND HIRED FROM OTHERS, OR TO OTHERS, FOR USE OTHER THAN FOR PASTURAGE.

These two tables, like those numbered 71 and 72, apply to land hired from others, or to others, for cultivation, whether upon a fixed rent or upon shares.

(No. 76.) FENCES EXISTING AT BEGINNING OF RECORD, AND MADE ANNUALLY AFTERWARDS.

There is perhaps no item of farm-interest in which there is greater room for economy than in fences. Except in cases where stone is abundant, they have, in the older sections of the country, been usually made of wood, and are maintained at an expense that becomes annually greater as wood becomes scarce. Among the important lessons that remain to be learned by our farming community is the fact that much of this expense may be avoided either by fencing stock *within* their proper range, or by the improved methods of feeding known as *soiling*, *i.e.*, keeping them in stables or yards, and carrying fresh food to them that is cut for the purpose from day to day.

(No. 77.) HEDGES.—(No. 78.) DITCHES AND OTHER DRAINAGE.

These tables are designed to record the extent of hedges and of ditches, and other artificial drainage existing on the farm at the beginning of the record, and the extent made annually afterwards. A proper attention to both of these subjects is highly important. Hedges, besides serving as a fence, will, when allowed to grow high, serve as wind-breaks, and as a shelter to stock,—a service much needed in the prairie States. The nesting places which they afford to birds that feed upon insects is worthy of notice and encouragement among farmers.

(No. 79.) FOREST-TREE PLANTING.

In many sections of the country the scarcity of timber for farm uses, manufactures, building, and fuel is seriously felt, and its want is among the first that the settlers experience in the prairie regions of the Western States. In the older States, where the primitive growth of forests was abundant, little care has been taken to reserve a sufficient proportion for future use, and already a scarcity is felt in regions once thought to afford inexhaustible supplies. There are incidental advantages afforded by woodlands in the influence they exert upon climate, by preventing the drying effect of winds, affording protection to birds useful to farmers, maintaining humidity, and tempering the extremes of heat, that commend the subject of tree-planting to the notice of every owner of land. These should lead him to provide on his own farm at least enough for his own use. It is found in Europe that the best results in agriculture are obtained when at least one-fourth of the area is covered with woodlands. The pastures interspersed among groves are less liable to drouth, and crops bear more uniformly a good yield, than where the protection afforded by growing trees has been taken away. This service is especially felt in fruit-culture; partly by the obstructions afforded by forests against drying winds,—in some degree by the moisture and shelter they afford,—and to a considerable extent by the retarding of vegetation in the spring by preventing the early melting of snows. In this they have an effect like that known to be produced by large bodies of water, which render the spring months cool, and prevent fruit-trees from blossoming until summer is fairly confirmed, and the danger from late spring frosts is passed.

The table affords the opportunity for entering the number of acres, and, by count or estimation, the numbers of trees of different kinds set during each year.

We may present, in this connection, some suggestions relative to

MODES OF PLANTATION.

In regular plantation, the trees or plants may be arranged in rectangular or oblique order. In the former the rows may be equidistant each way, and they may be cultivated equally well either way. Lines drawn through the objects planted would form a series of squares, as shown by the annexed drawing.

Plantation in Squares.

If the lines are nearer together one way than another, as in common nursery rows, the figures obtained by drawing lines through the trees or plants thus placed, form a series of parallelograms. In planting by this mode we may get space between, in one direction, wide enough for driving a horse or team, and may space the objects apart in the rows to suit convenience. In forest-planting the alternate trees in the rows should be taken out as the growth becomes dense, and in some instances the alternate rows entirely.

Plantation in Parallelograms.

A third method consists in placing the plants in oblique rows, so that each plant (except on the margin) shall be equally distant in six directions from its neighbors. If a plantation of this kind be connected by lines, it will produce a series of *equilateral triangles*, and by joining six of these together, *hexagons*, as in the annexed drawing.

Plantation in Equilateral Triangles.

A fourth method consists in planting in oblique lines at right angles with each other, so that when connected by lines passing through the objects planted, the resulting diagram will be a series of squares and right-angled triangles. This is called the *quincunx* order, and for orchard and forest-tree planting is to be preferred to all others, where the object is to secure all the air and light possible on a given area.

Diagonal Plantation on Quincunx Order.

This plantation gives rows more conspicuously in line when viewed diagonally than in lines parallel or at right-angles with the side of the field, because in these the plants or trees are as much nearer together, as the side of an isosceles right-angled triangle is less than its hypotenuse. Land may be marked for this kind of plantation by tracing twice as many lines each way, at right-angles to each other, as there are places to be planted on these sides. In planting, only every alternate point of intersection is used, as shown in the annexed drawing.

Mode of Marking for Quincunx Planting.

The following table will be found convenient for use in ascertaining the number of plants required for covering a given area of land. The distances apart, as shown in the heading and left-hand margin, are *metres*, and the numbers in the body of the table are those on a *hectare* (2.47 acres); but without any change it will show the number for *rods*, *yards*, *feet*, or any other unit of measure, on a square having 100 of such units on a side.

Number of Plants set in Rows on a Square of 100 on a Side, at Intervals, in the Heading and Left-hand Margin.

Distance between Plants in the Rows.	DISTANCE BETWEEN ROWS.										EQUIDISTANT PLANTING EACH WAY.	
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	In Squares.	In Triangular Order.
0.5	20,000	13,333	10,000	8,000	6,667	5,714	5,000	4,444	4,000	3,636	40,000	46,188
1.0	10,000	6,667	5,000	4,000	3,333	2,857	2,500	2,222	2,000	1,818	10,000	11,547
1.5	6,667	4,444	3,333	2,667	2,222	1,905	1,667	1,481	1,333	1,212	4,444	5,132
2.0	5,000	3,333	2,500	2,000	1,667	1,429	1,250	1,111	1,000	909	2,500	2,887
2.5	4,000	2,667	2,000	1,600	1,333	1,143	1,000	889	800	727	1,600	1,848
3.0	3,333	2,222	1,667	1,333	1,111	952	833	741	667	606	1,111	1,283
3.5	2,857	1,905	1,429	1,143	952	816	714	635	571	519	816	943
4.0	2,500	1,667	1,250	1,000	833	714	625	556	500	455	625	722
4.5	2,222	1,481	1,111	889	741	635	556	494	444	404	494	570
5.0	2,000	1,333	1,000	800	667	571	500	444	400	364	400	462
5.5	1,818	1,212	909	727	606	519	455	404	364	331	331	382
6.0	1,667	1,111	833	667	556	476	417	370	333	303	278	321
6.5	1,538	1,026	769	615	513	440	385	342	308	280	237	273
7.0	1,429	952	714	571	476	408	357	317	286	260	204	236
7.5	1,333	889	667	533	444	381	333	296	267	242	178	205
8.0	1,250	833	625	500	417	357	313	278	250	227	156	180
8.5	1,176	784	588	471	392	336	294	261	235	214	138	160
9.0	1,111	741	556	444	370	317	278	247	222	202	123	143
10.0	1,000	667	500	400	333	286	250	222	200	100	100	115

In using this table, if the intervals be assumed as measured by *yards*, for example, the number on a tract 100 yards square would be, at half a yard apart in the rows, and at $3\frac{1}{2}$ yards between the rows, 5714; at 7 yards between, the rows, each way, 204, if set in squares, or 236 in triangles, and so of all other numbers in the table. Its application for larger or smaller areas, by multiplication or division, will be obvious without further specification. The advantage of diagonal planting over that in squares, will be seen by comparing the last two columns of the table, where the same areas of land and the same intervals between the trees give quite different results.

(No. 80.) CONDITION OF WOODLANDS AND FOREST PLANTATIONS AT THE END OF EACH YEAR.

This table may be regarded as a kind of supplement to No. 79. It affords an opportunity for studying the causes of failure, if observed in plantations, and shows the gaining or diminishing extent of natural and artificial plantations upon the farm.

(No. 81.) VEHICLES, TOOLS, MACHINES, AND IMPLEMENTS PURCHASED.

The cost of farming implements, more especially of the expensive kinds, is an item of much importance. This table will enable the farmer to notice their durability and relative expense of maintenance in working order.

(No. 82.) OTHER INVESTMENTS.

There may occur expenses not elsewhere provided for, such as the opening of private roads, building of farm bridges, clearing off of stumps or boulders, grading, dikes and embankments, works to prevent the erosion of streams, filling up of ravines, digging of wells, diversion of water-courses, and the like, that when done, add to the value of the premises, and come properly under the head of investments. They are too varied for specification, but may all come properly into this table, as matters of useful record and for future reference. Under the heading of "amount invested" should be entered the value of team-work and labor, as well as money expended.

(No. 83.) RECORD OF CULTIVATION OF SEPARATE FIELDS.

The principal advantage of this record will be to keep a journal for reference in the rotation of crops. It has long been known that the same crop cannot generally be cultivated with advantage upon the same ground through a series of years, but that certain changes are desirable, and even necessary, in order to secure the best results. The rules to be followed in this rotation of crops differ greatly, according to the nature and strength of the soil, and other circumstances; but it may be stated, as a general rule, that where the productive powers

of the soil have been exhausted by cultivation, and carried away in a crop, this should be followed by another that tends to restore fertility, either from its own decay or by affording nourishment to stock, the offal from which is returned to the soil. The cereal grains, the fibre-plants (when allowed to ripen their seed), hops, tobacco, etc., are exhausting, while leguminous plants and root-crops, when returned directly or indirectly to the soil, tend to restore fertility. The following successions have been found successful in Pennsylvania:

1, Wheat; 2, Rye; 3, Clover; 4, Wheat; 5, Corn; 6, Oats; 7, Wheat; 8, Clover.

There has been established no regular system of rotation in the United States, although in some countries the principles involved have been made a subject of careful study, and reference should be had to approved treatises upon agriculture for a statement of the principles involved, and the rules that should be observed.

(No. 84.) MONEY BORROWED FOR USE IN FARM PURPOSES.

This table is designed to afford a convenient place for a memorandum of money borrowed and a reminder of the time when due. The date when the loans are paid, or any other note of reference or information, may be entered in the column of remarks.

(No. 85.) GENERAL EXPENSE ACCOUNT FOR THE YEAR.

(No. 86.) GENERAL RECEIPTS OF THE YEAR, AND FINAL BALANCE.

These pages are designed to present a general statement of expenses and receipts, and the balance of accounts for the year.

STATUTE WEIGHT OF A BUSHEL OF GRAIN AND OTHER COMMODITIES.

The *Bushel* is adopted in the United States from the English custom, as the standard of dry measure, and contains 543391.89 standard Troy grains (or 77.6274 pounds avoirdupois) of distilled water at temperature of greatest density, the barometer being at 30 inches.

No law has hitherto been passed by Congress exactly defining weights and measures except with regard to the Troy pound used in the Mint.* Exact copies of the English standards of weights and measures have however been prepared and furnished to all the States and Territories,† and these have been declared the standards of these States and Territories by their statute laws. In some acquired portions, the Spanish measures of length, weight, and capacity have been also sanctioned.‡

As all English weights and measures are arbitrary, and have no exact unit of reference in nature, or any true origin but in usage subsequently legalized, differences were found to exist in different sections of the country at the time when scientific inquiries and comparisons began to be made. There had accordingly occurred some discrepancies in these units of weights and measures, as adopted and confirmed in the several States, prior to the distribution of standards by the general government, and these still exist on their statute books.§

In Louisiana, the barrel of $3\frac{1}{2}$ bushels, dry measure, and its half and quarter, are legal measures for grain and coal. In Maryland, the corn-barrel is a measure 21 inches in diameter at the bottom (clear of the staves) and 23 at the top, and deep enough to hold 5 struck bushels of corn.

The *Standard Gallon*, in liquid measure, contains 58372.2 grains Troy (or 8.3389 pounds avoirdupois) of distilled water at greatest density. In some States, as in New Hampshire and Minnesota, milk is sold by *beer measure* (282 cubic inches to the gallon), while in others, as in Connecticut, Massachusetts, Rhode Island, and Vermont, it is sold by *wine measure* (231 cubic inches to the gallon).

The weight of grain differs in a given kind, according to its variety, and the soil, and other circumstances in which it has grown. But in most of the States the weight of a bushel has been fixed by law, and in some markets the quantity is determined by weighing instead of measuring. There exists considerable difference among the several States and Territories in these legal weights of grain, and they have in some instances been

* Act of May 19, 1828. † Act of June 14, 1836. ‡ In New Mexico, the Spanish measures recognized by law are: The *Cuartilla*=1 pint U. S. measure. The *Almond*=1.6 of a *Half Fanega*=412.7+ cubic inches. The *Half Fanega*=2,476.25 cubic inches.

§ In Arkansas and Indiana, the half bushel contains 1075.2 cubic inches; in Nebraska, it is 1075; and in New York and California, 1071.25. In the States of New York and California, the half bushel must be 15½ inches across, and the bushel 19½ inches. In New Hampshire and Minnesota, the former is 13½ inches, and the latter 18½ inches.

The heaped measure, in Connecticut and Kansas, contains 1282 cubic inches in the half bushel. In Minnesota, the bushel of charcoal is 2419 inches; in Colorado, 2500; in Pennsylvania, 2571; and in Missouri, 2680.

changed, so that, in the same State, differences occur in comparing the bushel of different periods. As an example, it may be stated that 1000 bushels of barley, taken from Kansas to New Orleans, would become 1500 bushels according to the laws of Louisiana, the bushel being 48 pounds in the former and 32 in the latter. In the case of rye, the difference is enormous, being from 56 to 32, so that 1000 bushels of rye, taken from Kansas to New Orleans, would fill an order for 1750 bushels, the purchase and sale being in both cases by legal weight.

The importance of this subject has led us to construct a table from existing State laws, and this is here given as complete up to the time when prepared. It is liable to change from time to time, and will be found to differ from similar tables found in other books; but it can be shown that this difference, if found, would be due to the fact that these other tables have been copied from older ones, or compiled from older statutes. We have used no authorities but the recent statute laws, and have compared them with the finished work to avoid errors in copying. The only effectual way to avoid misunderstanding would be the introduction of a custom, sanctioned by Congress, and therefore applicable to every part of the country, by which grain and other measured commodities should be bought and sold by *weight only*. The most convenient unit would be the *cental*, or 100 pounds, and this, if once adopted, would soon regulate prices upon this basis, beyond liability to confusion or misunderstanding.

METRICAL SYSTEM OF WEIGHTS AND MEASURES.

The metrical or decimal system of weights and measures was first adopted in France in 1795, and has since been legalized and brought into use in many other countries, in some cases permissively, and in others exclusively, superseding altogether those formerly in use.

Besides its decimal subdivisions and multiples, by which one denomination may be changed into another by removing the decimal point without calculation, this system has the great advantage of presenting a common basis for the measurement of *length, area, solid contents, capacity, and weight*.

This unit is the *METER*, intended to be the ten-millionth part of the distance from the pole to the equator, measured on a meridian on the earth's surface. It is very nearly 39.37 inches in length, and is subdivided into *tenths, hundredths, and thousandths*, and multiplied by 10, 100, and 1000. The names of the subdivisions have prefixes derived from the *Latin* language, while the names of the multiples are distinguished by prefixes from the *Greek* language. In some countries, where the metrical measures come very near those previously in use, the old names, with or without some modifications, have been retained, but the amounts when written in figures are strictly coincident with those of the metrical system.

By an act of Congress, approved July 28, 1866, the use of this decimal system of weights and measures is sanctioned, but not enforced. It was also legalized in like manner in the Dominion of Canada, by an act assented to April 14, 1871; and it is to be hoped that ere long it may come into general use in common business transactions, as it already has, to a considerable extent, in scientific determinations. The growing importance of this subject leads us to insert a series of tables for converting English into metrical and metrical into English measures.

MEASURES OF LENGTH.

Metrical Denominations.	Length in Meters.	Length as Specified in Act of Congress.	VARIOUS EQUIVALENT MEASURES.
Myriameter	10,000.	62137 miles.	{ =3280.899 feet=0.62138242 miles. This is the common itinerary measure used in countries where the metrical measures are adopted.
Kilometer.....	1,000.	3280 ft. 10 in.	
Hectometer	100.	328 ft. 1 in.	
Decameter	10.	393.7 inches.	{ Used in measuring land, as the chain is used in English measure. =39.370432 inches, by most approved authorities, although 39.37079 by authorities more frequently cited, and in the act of Congress of 1866 =3.2808868 feet=1.093623 yards.
METER.....	1.	39.37 in.	
Decimeter	0.1	3.937 in.	{ Used for the exact determination of small distances, and in barometrical observations, and other scientific measurements.
Centimeter.....	0.01	0.3937 in.	
Millimeter.....	0.001	0.0394 in.	

WEIGHT OF A BUSHEL OF VARIOUS COMMODITIES.

STATES AND TERRITORIES.	CEREAL GRAINS.										LEGUMINOUS AND OTHER GRAINS.					FLOUR, MEAL, Etc.										FRUITS.									
	Barley.	Shelled.	Indian Corn. In the Ear.	Oats.	Rye.	Wheat.	Beans.	Buckwheat.	Peas.	Peanuts.	Brn.	Ground Peas.	Hominy; Cracked Corn.	Indian Meal.	Malt.	Meal.	Rye Meal.	Fresh.				Dried.			Small Fruits.										
																		Apples.	Cherries.	Peaches.	Pears.	Quinces.	Apples.	Peaches.	Plums.	Blackberries.	Cranberries.	Currants.	Gosberries.	Grapes.	Raspberries.	Strawberries.	Chestnuts.		
Arizona.....	45	54		32	56	60	60 ¹																												
California.....	50	52		32	54	60		40																											
Colorado.....	48	56	70	32	56	60	60	52						50																					
Connecticut.....	48	56		32	56	60	60 ²	48	60					50			50																		
Dakota.....	48	56	70	32	56	60	60	42	60		20																								
Delaware.....						60								44 ⁴																					
Illinois.....	48	56	70	32	56	60	60 ²	52		20				48	38								24	33											
Indiana.....	48	56	68		56	60	60	50						50									25	33											
Iowa.....	48	56	70	33	56	60	60	32		20							48	40	48		48	24	33		32		40	40	40	32	32				
Kansas.....	50	56	70	32	56	60	60	50		20				50	32								24	33											
Kentucky.....	47	56	70	32	56	60	60 ²	56	60		20	24		50									24	39											
Louisiana.....	32	56		32	32																														
Maine.....	48	56		30		60	64	48	60					50			50	44																	
Maryland.....	47	56		26	56	60		48																											
Massachusetts.....	48	56		32	56	60		48					50	50	50 ²¹	50																			
Michigan.....	48	56	70	32	56	60	60	48	60					50									22	28	28		40								
Minnesota.....	48	56		32	56	60		42															28	28											
Missouri.....	48	56		32	56	60	60	52		20													24	33											
Montana.....	48	56		35	56	60	60	52						50																					
Nebraska.....	48	56	70	34	56	60	60 ²	52	60		20			50	30								24	33											
New Hampshire.....		56		30	56	60	60		60					50			50																		
New Jersey.....	48	56		30	56	60	60	50	60														25	33											
New York.....	48	58		32	56	60	62	48	60																										
Ohio.....	48	56	70	32	56	60	60	50	60				60 ⁹		34								22	33											
Oregon.....	46	56		36	56	60		42										45		45			28	28											
Pennsylvania.....	47	56		30	56	60		48																											
Rhode Island.....	48	56		32	56									50			50										32 ¹⁵								
Vermont.....	48	56		32	56	60	60	46	60									46																	
Virginia.....	48	56	70	32	56	60	60 ²	52	60 ¹⁶	22				50	38								28	40 ¹⁷										57	
Washington.....	45	56		35	56	60	60	42										45		45			28	28											
West Virginia.....	48	56		32	56	60	60	52															25	33											
Wisconsin.....	48	56	70	32	56	60	60	50										47					28	28											
United States ¹⁸	48	56		32	56	60		42	60																										
Dom'n of Canada.....	48	56		34	56	60	60	48	60						36								22	33											

¹ Small white beans, 60; other beans, 55.² White beans.³ Common English turnips.⁴ Sifted meal, 44; unsifted meal, 48.⁵ Turnip beets, 60.⁶ Michigan salt.⁷ Stone lime.⁸ Bushel of 2680 cubic inches.⁹ Hominy.¹⁰ Coal sold by ton of 2240 pounds; at Pittsburg by the bushel, 76 pounds; at Greensburg, 75 pounds.¹¹ Foreign ground salt.¹² Fine foreign salt.¹³ Coarse foreign salt.¹⁴ Onions, 50; all root-crops, except onions, 60.¹⁵ All other berries, 32.¹⁶ Black-eyed peas.¹⁷ Dried peaches, peeled, 40; unpeeled, 32.

The weights here given are those fixed for determining the quantity of grain imported from foreign countries. In furnishing army supplies, peas, beans, and potatoes must weigh 60 pounds to the bushel.

¹⁹ Charcoal to be measured in baskets not less than 20 inches in average diameter, and to hold 18 gallons level measure; this to be considered as two bushels, or one strike.

²⁰ In Vermont, the bushel of charcoal is one bushel and three-fourths of a peck.

²¹ All other meal, except oat meal, 50 pounds.

²² 80 pounds for bituminous, and 70 pounds for cannel-coals.

In measuring *distances*, where *miles*, etc., have been commonly used, the term *kilometer* is generally employed as the unit. In measurements where the *rod*, *yard*, or *foot* has been used, the term *meter* is employed, and for delicate measurements, the *millimeter* is used.

The following little multiplication table will facilitate the conversion of our measures of length into metrical measures, and the reverse :

Conversion Table and Multiples to 9 :—LONG MEASURE.

	VALUE OF METERS EXPRESSED IN ENGLISH MEASURES.					VALUE OF ENGLISH MEASURES EXPRESSED IN METERS.				
	Kilometers into Miles.	Meters into Rods.	Meters into Yards.	Meters into Feet.	Meters into Inches.	Miles into Kilometers.	Rods into Meters.	Yards into Meters.	Feet into Meters.	Inches into Meters.
1	0.621	0.199	1.094	3.281	39.37	1.609	5.025	0.914	0.305	0.0254
2	1.243	0.398	2.187	6.562	78.74	3.219	10.050	1.828	0.610	0.0508
3	1.864	0.597	3.281	9.843	118.11	4.824	15.075	2.742	0.915	0.0762
4	2.485	0.796	4.375	13.124	157.48	6.437	20.100	3.656	1.220	0.1016
5	3.107	0.995	5.468	16.404	196.85	8.047	25.125	4.570	1.525	0.1270
6	3.728	1.194	6.562	19.685	236.22	9.656	30.150	5.484	1.830	0.1524
7	4.350	1.393	7.656	22.966	275.59	11.265	35.175	6.398	2.135	0.1778
8	4.971	1.592	8.749	26.247	314.96	12.875	40.200	7.312	2.440	0.2032
9	5.592	1.791	9.843	29.528	354.33	14.484	45.225	8.226	2.745	0.2286

The use of this table may be illustrated by two examples :

1. Supposing that we wish to change 87,437 *meters* into *yards*. We take from the column headed "meters into yards" the quantity set opposite 7 (on the left-hand margin); then that opposite 3, carrying the whole one place to the left, and so of the rest, and then add. If ciphers occur in the multiplier, we are simply to allow for the mby removing the next partial product one place for each. Observe to place the decimal point properly in the *first line entered* (but not in the other lines) and at a corresponding place in the sum.

7.656
3281
4375
7656
8749

95623.966 *yards*.

2. Required to change 11,402 *feet* into *meters*. In this case the second line is carried *two places* to the left, because the second figure of the multiplier was 0. We are careful to retain the ciphers on the right hand of the numbers found in the table, on account of their local value, but those on the left may in this case be omitted.

.610
1220
305
305

3477.610 *meters*.

The *meter* is defined in the Canadian act of 1871 as = 1.093944 *yards* = 3.28133 *feet* = 4.97247 *links*.

SUPERFICIAL OR SQUARE MEASURE.

The unit of square measure is the *are*, which is an area ten meters on a side, or 100 square meters. Where great areas, such as those of countries, are mentioned, it is customary to use the *square kilometer* (0.0359 sq. mile) as a unit; in common land measure, the *hectare* (2.471 acres), or sometimes, in speaking of small plats, the *are*, or proper unit; and in cloth measure and the like, the *square meter*. In delicate measurements of small areas, the *square millimeter* is occasionally used as the unit.

The multiples and subdivisions of metrical square measure, as recognized by act of Congress, are given in the following table :

Metrical Denominations.	Square Meters.	Area as Specified in Act of Congress.	
Hectare.....	10,000	2.471 acres.	{ = 11967.1444 square yards = 247255.047 sq. links = 0.386116112 square miles. = 0.024711431 acres. = 10.76430 sq. feet = 1.19603 sq. yards.
ARE.....	100	119.6 square yards.	
Centare.....	1	1550 square inches.	

1 square league = 4.8276447 square kilometers.
1 square kilometer = 0.20712747 square leagues.

1 square inch = 6.4513668 square centimeters.
1 square centimeter = 0.15500591 square inches.

Conversion Table and Multiples to 9:—SQUARE MEASURE.

VALUE OF SQUARE METERS, ETC., EXPRESSED IN ENGLISH SQUARE MEASURE.								VALUE OF ENGLISH SQUARE MEASURE EXPRESSED IN SQUARE METERS, ETC.							
Sq. Kilometers into Sq. Miles.	Hectares into Acres.	Ares into—		Square Meters into—				Sq. Miles into Sq. Kilometers.	Acres into Hectares.	Square Rods into—		Sq. Yards into Sq. Meters.	Sq. Feet into Sq. Meters.	Sq. Inches into Sq. Meters.	
		Square Rods.	Square Yards.	Square Rods.	Square Yards.	Square Feet.	Square Inches.			Ares.	Square Meters.				
1	0.0359	2.471	3.954	128.492	0.039	1.196	10.764	472.583	27.855	0.405	0.253	25.641	0.836	0.093	.000645
2	0.0717	4.912	7.908	256.984	0.079	2.392	21.528	945.168	55.710	0.809	0.506	51.282	1.672	0.186	.001290
3	0.1076	7.413	11.861	385.476	0.119	3.588	32.293	1417.751	83.565	1.214	0.759	76.923	2.508	0.279	.001935
4	0.1435	9.884	15.814	513.968	0.158	4.784	43.057	1890.335	111.426	1.619	1.012	102.564	3.344	0.372	.002580
5	0.1793	12.355	19.769	642.460	0.198	5.980	53.821	2362.919	139.275	2.024	1.265	128.205	4.180	0.461	.003225
6	0.2152	14.826	23.723	780.952	0.237	7.176	64.585	2835.503	167.131	2.428	1.517	153.846	5.016	0.557	.003870
7	0.2511	17.297	27.676	899.444	0.277	8.372	75.350	3308.087	194.986	2.833	1.770	179.487	5.852	0.650	.004515
8	0.2870	19.768	31.631	1027.936	0.316	9.568	96.114	3780.670	222.841	3.238	2.023	205.128	6.688	0.743	.005160
9	0.3228	22.239	35.584	1156.428	0.356	10.764	107.678	4253.254	250.696	4.047	2.276	230.769	7.525	0.836	.005805

SOLID OR CUBIC MEASURE.

The unit of solid or cubic measure is the *cubic meter* or *stère*. It is applied to the measurement of timber, firewood, stone, earth, masonry, and the like, in cases where the cubic yard, cubic foot, cord, or perch are commonly used in English measures. The *cubic meter* has the same capacity as the *stère*, but differs from it in use, the former being employed in measurements where there are no interstices, as in hewn timber, and the latter applies to commodities that are piled, like firewood, with more or less of intervals between.

Conversion Table and Multiples to 9:—CUBIC MEASURE.

	Stères into Cords.	CUBIC METERS INTO—			Cords into Stères.	Perch (16½ ft.) into Cubic Meters.	Cubic Yards into Cubic Meters.	Cubic Feet into Cubic Meters.
		Perch (16½ cubic ft.)	Cubic Yards.	Cubic Feet.				
1	0.276	2.140	1.308	35.316	3.616	0.467	0.764	0.028
2	0.552	4.281	2.616	70.633	7.232	0.934	1.529	0.057
3	0.828	6.421	3.924	105.949	10.848	1.401	2.293	0.085
4	1.104	8.561	5.232	141.266	14.464	1.868	3.058	0.113
5	1.380	10.701	6.540	176.582	18.080	2.336	3.822	0.142
6	1.656	12.842	7.848	211.899	21.696	2.803	4.587	0.170
7	1.932	14.982	9.156	247.216	25.312	3.270	5.352	0.198
8	2.208	17.122	10.464	282.532	28.928	3.737	6.116	0.226
9	2.484	19.263	11.772	317.849	32.544	4.204	6.881	0.255

1 cubic inch = 16.386175 cubic centimeters = 0.0000163 cubic meters.

1 cubic meter = 61026.048 cubic inches.
= 2.2072863 cord-feet.
= 0.88291457 tons round timber.
= 0.70633166 tons hewn timber.
= 0.84087104 shipping tons.

1 cord-foot = 0.45304497 cubic meters.

MEASURES OF CAPACITY.

The unit of measure of capacity or contents is the LITER, which is a *cubic decimeter*, and is the same for all dry and liquid articles that are sold by measure. For grain measure, the *hectoliter* (2 bushels 3.35 pecks) is commonly used.

The denominations of this measure, with their equivalents, are as follows :

Metrical Denominations.	Capacity in Liters.	Relation to the Cubic Meter.	Equivalent in Dry Measure, etc.	Equivalent in Liquid or Wine Measure.
Kiloliter.....	1000.	1. cubic meter.	1.308 cubic yards.	264.17 gallons.
Hectoliter.....	100.	0.1 " "	2 bushels, 3.35 pecks.	26.417 gallons.
Decaliter.....	10.	10 cubic decimeters.	9.08 quarts.	2.6417 gallons.
LITER.....	1.	1 " decimeter.	0.908 quarts.	1.0567 quarts.
Deciliter.....	0.1	0.1 " "	6.1022 cubic inches.	0.845 gills.
Centiliter.....	0.01	0.01 " "	0.6102 " "	0.338 fluid-ounces.
Milliliter.....	0.001	0.001 " "	0.06102 " "	0.27 fluid-drachms.

Conversion Table and Multiples to 9 :—MEASURE OF CAPACITY.

HECTOLITERS INTO		LITERS INTO		DRY MEASURE.		LIQUID MEASURE.		
Bushels.	Gallons. (Liq'd Meas.)	Quarts. (Dry Meas.)	Quarts. (Liq'd Meas.)	Bushels into Hectoliters.	Quarts into Liters.	Gallons into Hectoliters.	Quarts into Liters.	
1	2.837	26.417	0.908	1.056	0.352	1.101	0.038	0.946
2	5.675	52.834	1.816	2.113	0.705	2.202	0.076	1.893
3	8.512	79.251	2.724	3.170	1.057	3.303	0.113	2.839
4	11.350	105.668	3.632	4.227	1.410	4.405	0.151	3.785
5	14.187	132.085	4.540	5.283	1.762	5.506	0.189	4.731
6	17.025	158.502	5.448	6.340	2.114	6.607	0.227	5.678
7	19.862	184.919	6.356	7.397	2.467	7.708	0.265	6.624
8	22.700	211.336	7.264	8.453	2.819	8.809	0.303	7.570
9	25.537	237.753	8.172	9.510	3.172	9.910	0.341	8.517

1 imperial bushel = 36.3233 liters.

1 hectoliter = 3.53145 cubic feet.

1 barrel (U. S. wine measure) = 1.19259 hectoliters.

1 barrel (imperial measure) = 1.63564 hectoliters.

1 barrel (beer measure) = 1.66232 hectoliters.

MEASURES OF WEIGHT.

The unit of weight in the metrical system is the GRAM, which is the weight of a cubic volume of water, one centimeter on a side, at the temperature of greatest density. In heavy weights, where the ton has been usually employed, the *millier* or *tonneau* (2204.6 pounds avoirdupois) may be conveniently used. In the common weighing of merchandise, the *kilogram* (2.2046 pounds) is generally employed, and in delicate weights, the *gram* and its decimal parts.

Metrical Denominations.	Number of Grams.	Weight of what Quantity of Water at Max. Density.	Equivalent in Avoirdupois Weight.	Equivalent in Troy Weight.
Millier or Tonneau.	1,000,000.	1 cubic meter.	2204.6 pounds.	2679.2273 pounds.
Quintal.....	100,000.	1 hectoliter.	220.46 pounds.	267.92273 pounds.
Myriagram.....	10,000.	10 liters.	22.046 pounds.	26.792273 pounds.
Kilogram or Kilo..	1000.	1 liter.	2.2046 pounds.	2.6792273 pounds.
Hectogram.....	100.	1 deciliter.	3.5274 ounces.	3.2150737 ounces.
Decagram.....	10.	10 cubic centimeters.	0.3527 ounces.	0.32150737 ounces.
GRAM.....	1.	1 cubic centimeter.	15.432 grains.	15.43235 grains.
Decigram.....	0.1	$\frac{1}{10}$ of a cubic centimeter.	1.5432 grains.	1.54323 grains.
Centigram.....	0.01	10 cubic millimeters.	0.1543 grains.	0.15432 grains.
Milligram.....	0.001	1 cubic millimeter.	0.0154 grains.	0.01543 grains.

Conversion Table and Multiples to 9:—WEIGHTS.

	METRICAL WEIGHTS INTO AVOIRDUPOIS.			AVOIRDUPOIS INTO METRICAL WEIGHTS.		
	Milliers or Ton- neau into Tons of 2000 pounds.	Kilograms into Pounds.	Grams into Ounces.	Tons of 2000 lbs. into Milliers or Tonneau.	Pounds into Kilograms.	Ounces into Grams.
1	1.102	2.205	0.035	0.907	0.454	28.349
2	2.205	4.409	0.070	1.814	0.907	56.699
3	3.307	6.614	0.106	2.722	1.361	85.048
4	4.409	8.818	0.141	3.629	1.814	113.398
5	5.511	11.023	0.176	4.536	2.268	141.748
6	6.614	13.228	0.212	5.443	2.722	170.097
7	7.716	15.432	0.247	6.350	3.175	198.447
8	8.818	17.637	0.282	7.257	3.629	226.796
9	9.921	19.842	0.317	8.165	4.082	251.459

1 millier = 0.98420595 tons of 2240 pounds.

1 ton of 2240 pounds = 1.0160475 milliers.

Troy Weight.	{	1 grain = 64.798949 milligrams.	1 gram = 15.43235 grains.
		1 pennyweight = 1.5551747 grams.	= 0.64301457 pennyweights.
		1 ounce = 31.103495 grams.	1 hectogram = 3.2150737 ounces.
Apothecary Weight.	{	1 pound = 0.37324194 kilograms.	1 kilogram = 2.6792273 pounds.
		1 scruple = 1.2959789 grams.	1 gram = 0.7716175 scruples.
		1 drachm = 3.8879369 grams.	= 0.25720582 drachms.

PECIMEN OF A FARM PLAT INTENDED FOR THIS WORK.

(No. 1.)

(No. 2.)

SURVEY BILL OF THE FARM.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1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for John

DATES OF THE BEGINNING OF SEED-TIME.

YEARS.	Winter Wheat.	Spring Wheat.	Barley.	Winter Rye.	Spring Rye.	Oats.	Indian Corn.	Buckwheat.
1878								
1879								
1880								
1881								
1882								
1883								
1884								
1885								
1886								
1887								
1888								
1889								
1890								
1891								
1892								
1893								
1894								
1895								
1896								
1897								
1898								
1899								
1900								

DATES OF THE BEGINNING OF SEED-TIME.—*Continued.*

YEARS.	Peas.	Beans.	Common Potatoes.	Sweet Potatoes.	Tobacco.	Turnips.	Flax.
1878							
1879							
1880							
1881							
1882							
1883							
1884							
1885							
1886							
1887							
1888							
1889							
1890							
1891							
1892							
1893							
1894							
1895							
1896							
1897							
1898							
1899							
1900							

DATES OF THE BEGINNING OF HARVEST.

YEARS.	Winter Wheat.	Spring Wheat.	Barley.	Winter Rye.	Spring Rye.	Oats.	Indian Corn.	Buckwheat.
1878								
1879								
1880								
1881								
1882								
1883								
1884								
1885								
1886								
1887								
1888								
1889								
1890								
1891								
1892								
1893								
1894								
1895								
1896								
1897								
1898								
1899								
1900								

DATES OF THE BEGINNING OF HARVEST.—*Continued.*

YEARS.	Peas.	Beans.	Common Potatoes.	Sweet Potatoes.	Tobacco.	Turnips.	Flax.
1878							
1879							
1880							
1881							
1882							
1883							
1884							
1885							
1886							
1887							
1888							
1889							
1890							
1891							
1892							
1893							
1894							
1895							
1896							
1897							
1898							
1899							
1900							

DATES OF FIRST BLOSSOMING OF CULTIVATED FRUIT-TREES, SHRUBS, AND VINES.

YEARS.	Apples.	Pears.	Peaches.	Plums.	Garden Cherries.	Red Currants.	Gooseberries.	Grapes.
1878								
1879								
1880								
1881								
1882								
1883								
1884								
1885								
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DATES OF FIRST RIPENING OF CULTIVATED FRUITS.

YEARS.	Apples.	Pears.	Peaches.	Plums.	Garden Cherries.	Red Currants.	Gooseberries.	Grapes.
1878								
1879								
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DATES OF FIRST BLOSSOMING OF WILD FRUIT-BEARING PLANTS.

YEARS.	Field Strawberries.	Red Raspberries.	Black Raspberries.	High Blackberries.	Black Cherries.			
1878								
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DATES OF FIRST RIPENING OF WILD FRUITS.

YEARS.	Field Strawberries.	Red Raspberries.	Black Raspberries.	High Blackberries.	Black Cherries.			
1878								
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DATES OF FIRST BLOSSOMING OF COMMON CULTIVATED ORNAMENTAL PLANTS.

YEARS.	Daffodils.	Garden Violets.	Flowering Almonds.	Lilacs.	Horse Chestnuts.	Common Locust Trees.	Dahlias.
1875							
1879							
1880							
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DATES OF FIRST BLOSSOMING OF WILD PLANTS.

YEARS.	Shad Bush. (<i>Amelanchier Can-</i> <i>adensis.</i>)	Red Maple. (<i>Acer Rubrum.</i>)	Spring Beauty. (<i>Claytonia Vir-</i> <i>ginica.</i>)	Wild Columbine. (<i>Aquilegia Cana-</i> <i>densis.</i>)	Flowering Dog- wood. (<i>Cornus Florida.</i>)	Chestnut. (<i>Castanea Ameri-</i> <i>cana.</i>)	Cardinal Flower. (<i>Lobelia Cordi-</i> <i>nalis.</i>)
1878							
1879							
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1881							
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DATES OF FIRST APPEARANCE OF BIRDS IN SPRING.

YEARS.	Blue Birds.	Robins.	Wild Geese flying North.	Crow Blackbirds.	Red-Wing Blackbirds.	Martins.	Barn Swallows.	Eave Swallows.
1878								
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DATES OF FIRST APPEARANCE OF BIRDS.—*Continued.*

YEARS.	BOB-O-LINKS. (Reed Birds.) (Rice Birds.)	Meadow Larks.					Wild Geese flying South.
1878							
1879							
1880							
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DATES OF FIRST APPEARANCE OF FISHES, REPTILES, AND INSECTS.

YEARS.	Shad first caught.	Herring first caught.	Sturgeon first caught.	Frogs first heard.	Fire-Flies first seen.	Locusts first heard.	Grasshoppers first seen.
1878							
1879							
1880							
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DATES OF FIRST USE OF GARDEN PRODUCTS GROWN IN THE OPEN AIR, AND NOT IN HOT-BEDS.

YEARS.	Lettuce.	Asparagus.	Radishes.	Green Peas.	Cucumbers.	Green Corn.	Watermelons.
1878							
1879							
1880							
1881							
1882							
1883							
1884							
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DATES OF PERIODICAL EVENTS DEPENDENT UPON THE SEASONS.

YEARS.	Sleighing ended.	Ice gone from the.....	Snow gone.	First Thunder Shower.	Trees in Leaf Generally.	First Autumnal Frost.	First Killing Frost.	First Autumnal Snow.
1878								
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DATES OF PERIODICAL EVENTS DEPENDENT UPON THE SEASONS.—*Continued.*

YEARS.	Indian Summer.	Trees Mostly Stripped of Leaves.	Sleighting Began.	Solid Ice for Crossing the ...
1878				
1879				
1880				
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MEMORABLE EVENTS.

DATE.			Heavy Floods and Snows ; Frost out of Season ; Drouths ; Visitation of Grasshoppers, and Memorable Events generally.
YEARS.	Months.	Days.	
1878			
1879			
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1882			
1883			
1884			
1885			
1886			
1887			
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MEMORABLE EVENTS.

DATE.			Heavy Floods and Snows ; Frost out of Season ; Drouths ; Visitation of Grasshoppers, and Memorable Events generally.
YEARS.	Months.	Days.	
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MEMORABLE EVENTS.

YEARS.	DATE.		Heavy Floods and Snows; Frost out of Season; Drouths; Visitation of Grasshoppers, and Memorable Events generally.
	Months.	Days.	
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1900			

MEMORABLE EVENTS.

YEARS.	DATE.		Heavy Floods and Snows ; Frost out of Season ; Drouths ; Visitation of Grasshoppers, and Memorable Events generally.
	Months.	Days.	
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MEMORABLE EVENTS.

DATE.			Heavy Floods and Snows; Frost out of Season; Drouths; Visitation of Grasshoppers, and Memorable Events generally.
YEARS.	Months.	Days.	
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(No. 24.)

METEOROLOGICAL OBSERVATIONS—EVAPORATION FROM OPEN WATER SURFACES.

[illegible]

[illegible]

METEOROLOGICAL OBSERVATIONS—GENERAL SUMMARIES.

YEARS.	No. OF DAYS IN EACH YEAR.					No. of Meteors Seen.	DAYS ON WHICH AURORAS WERE SEEN.
	Rained.	Snowed.	Hailed.	Solar Halos.	Lunar Halos.		
1878							
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METEOROLOGICAL OBSERVATIONS—GENERAL CHARACTER OF THE SEASONS.

YEARS.

SPRING.

SUMMER.

AUTUMN.

WINTER.

1878

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HAY CROP.

[illegible]

[illegible]

[illegible]

[illegible]

YEARS	Acres Planted.	Bushels.		Average Yield per Acre in Bushels.	Disposition of the Crop.		Acres Sowed for Forage.	Average Price of Sales.		Total Receipts.	REMARKS.
		Planted.	Harvested.		Bushels Used.	Bushels Sold.		Shelled Corn.	Corn in the Ear.		
1878								\$			
1879								\$			
1880								\$			
1881								\$			
1882								\$			
1883								\$			
1884								\$			
1885								\$			
1886								\$			
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1893								\$			
1894								\$			
1895								\$			
1896								\$			
1897								\$			
1898								\$			
1899								\$			
1900								\$			

[illegible]

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BEAN CROP.

[illegible]

[illegible]

SWEET POTATO CROP.

YEARS.	Acres Planted.	Bushels Harvested.	Average Yield per Acre.	Disposition of the Crop.		Average Price per Bushel Sold.	Total Receipts.	REMARKS.
				Bushels Used.	Bushels Sold.			
					<i>cts</i>	<i>\$</i>		
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1879								
1880								
1881								
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[illegible]

HEMP CROP.

TOBACCO CROP.

YEARS.	Acres Planted.	Pounds of Tobacco Harvested.	Average Yield per Acre (Pounds).	Average Price per Pound.	Total Receipts.	REMARKS.
				\$	\$	
1878						
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SORGHUM CROP.

YEARS.	Acres Planted.	Bushels of Seed Planted.	Gallons of Syrup Made.	Pounds of Sugar Made.	Average Price per Gallon of Syrup Sold.	Total Receipts.	REMARKS.
					Cts. \$		
1878							
1879							
1880							
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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF...

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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RESULTS OF THE CROP OF

YEARS.

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INJURIES TO CROPS.

Date.			Extent of Injury.	Nature of the Injuries, as Hail, Frost, Rust, Drouth, Winds, Running Fires, etc., specifying the crops injured, and such remarks as appear proper.
Year.	Month.	Day.		

STATISTICS OF FERTILIZERS USED.

[illegible]

STATISTICS OF FERTILIZERS USED.—*Continued.*

Other Fertilizers Used.

YEARS.

1878

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[illegible]

[illegible]

STATISTICS OF FRUIT CULTURE: GENERAL RESULTS OF THE YEAR.

[illegible]

1900

[illegible]

[illegible]

[illegible]

SHEEP HUSBANDRY.

[illegible]

SHEEP HUSBANDRY.—*Continued.*

YEARS.	Disposition of the Wool.			Total Receipts.		REMARKS.
	Pounds Used in Family.	Pounds Sold.	Average Weight per Fleece.	Sheep and Lambs Sold.	Wool Sold.	
				\$	\$	
1878						
1879						
1880						
1881						
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SWINE.

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[illegible]

DAIRY PRODUCTS (HOME).

[illegible]

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POULTRY.

[illegible]

WEANING OF THE YOUNG OF DOMESTIC ANIMALS.

NAME OR DESCRIPTION OF ANIMALS.	BEGAN.			NAME OR DESCRIPTION OF ANIMALS.	BEGAN.		
	Year.	Month.	Day.		Year.	Month.	Day.

WEANING OF THE YOUNG OF DOMESTIC ANIMALS.

NAME OR DESCRIPTION OF ANIMALS.	BEGAN.			NAME OR DESCRIPTION OF ANIMALS.	BEGAN.		
	Year.	Month.	Day.		Year.	Month.	Day.

WEANING OF THE YOUNG OF DOMESTIC ANIMALS.

NAME OR DESCRIPTION OF ANIMALS.	BEGAN.			NAME OR DESCRIPTION OF ANIMALS.	BEGAN.		
	Year.	Month.	Day.		Year.	Month.	Day.

FATTENING OF DOMESTIC ANIMALS.

[illegible]

[illegible]

RECEIPTS FROM THE FARM OTHER THAN FROM CULTIVATION.

YEARS.	FROM WHAT SOURCES.	Expenses	Total Receipts.
		Incurred.	
		\$	\$
1878			
1879			
1880			
1881			
1882			
1883			
1884			
1885			
1886			
1887			
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1890			
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SPECIAL OBJECTS OF HOME INDUSTRY.

YEARS.	OBJECT.	Expenses on Ac- count of Ob'ect.	Total Receipts.
		\$	\$
1878			
1879			
1880			
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HIRED LABOR.

[illegible]

BUILDINGS ERECTED.

YEARS.	Kind or Description.	Material.	Size on the Ground in Feet	Date of Completion.	Cost.		REMARKS.
						\$	
1878							
1879							
1880							
1881							
1882							
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1885							
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REPAIRS OF BUILDINGS:—IMPROVEMENTS.

YEARS.	NATURE OF THE REPAIR, CHANGE, OR IMPROVEMENT.	Date of Completion.	Cost.	REMARKS.
			\$	
1878				
1879				
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[illegible]

BUILDINGS HIRED OR LEASED.

YEARS.	Buildings Hired or Leased, and for what Uses.	Names of Persons from whom or to whom Leased.	Amount Paid in Rents.	Amount Received from Rents.
			\$	\$
1878				
1879				
1880				
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[illegible]

LAND HIRED OUT TO OTHERS FOR USE OTHER THAN AS PASTURAGE.

YEARS.	Hired out for Fixed Rent.		Let to Work upon Shares.		Uses to which Land was Applied by those Hiring.			
	Acres.	Rent Received. \$	Acres.	Value Received \$	Meadow. (Acres.)			
1878								
1879								
1880								
1881								
1882								
1883								
1884								
1885								
1886								
1887								
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1899								
1900								

At Beginning
of Record.

At Beginning
of Record.

DITCHES AND OTHER DRAINAGE.

YEARS.	Open Drains.		Stone Drains.		Tile Drains.		Total Cost.	REMARKS.
	Rods.	Cost per Rod.	Rods.	Cost per Rod.	Rods.	Cost per Rod.		
	\$		\$		\$		\$	

At Beginning
of Record.

FOREST-TREE PLANTING.

[illegible]

VEHICLES, TOOLS, MACHINES, AND IMPLEMENTS PURCHASED.

Kind or Description.	From whom Bought.	Date of Purchase.	First Cost.	Cost of Repairs.	REMARKS.
			\$	\$	

OTHER INVESTMENTS.

DESCRIPTION OR KIND.

Date.

Amount Invested.

1/2

OTHER INVESTMENTS.

DESCRIPTION OR KIND.	Date.	Amount Invested.
		\$

OTHER INVESTMENTS.

DESCRIPTION OR KIND.	Date.	Amount Invested.
		S

RECORD OF CULTIVATION OF THE FIELD KNOWN AS CONTAINING.....ACRES.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.	
			Sowed or Planted	Harvested.				
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RECORD OF CULTIVATION OF THE FIELD KNOWN AS CONTAINING ACRES.

Bushels.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.
			Sowed or Planted.	Harvested.			
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RECORD OF CULTIVATION OF THE FIELD KNOWN AS CONTAINING.....ACRES.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.
			Sowed or Planted	Harvested.			
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RECORD OF CULTIVATION OF THE FIELD KNOWN AS CONTAINING.....ACRES.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.
			Sowed or Planted.	Harvested.			
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RECORD OF CULTIVATION OF THE FIELD KNOWN AS
CONTAINING ACRES.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.
			Sowed or Planted	Harvested.			
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RECORD OF CULTIVATION OF THE FIELD KNOWN AS
CONTAINING.....ACRES.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.
			Sowed or Planted.	Harvested.			
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RECORD OF CULTIVATION OF THE FIELD KNOWN AS CONTAINING.....ACRES.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.
			Sowed or Planted.	Harvested.			
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RECORD OF CULTIVATION OF THE FIELD KNOWN AS CONTAINING.....ACRES.

Bushels.

YEARS.	Crops Raised.	Character of the Yield.	Bushels.		When Ploughed.	When Sowed or Planted.	When Harvested.
			Sowed or Planted.	Harvested.			
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MONEY BORROWED FOR USE IN FARM PURPOSES.

FROM WHOM BORROWED.	Amount Borrowed.	Rate of Interest.	Date when Borrowed.	Date when Due.	REMARKS.
	\$				

MONEY BORROWED FOR USE IN FARM PURPOSES.

FROM WHOM BORROWED.	Amount Borrowed,	Rate of Interest.	Date when Borrowed,	Date when Due,	REMARKS.
	\$				

GENERAL EXPENSE ACCOUNT.—*Continued.*

YEARS.	Provisions for the Family.		Other Family Expenses.	Materials for Home Manufacture.	Hired Labor.	Insurance.	Interest on the Investment.	Total Expenses.
	Products of the Farm.	Purchased.						
	\$	\$	\$	\$	\$	\$	\$	\$
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