CHAPTER XII.

MAKING HAY.

Cutting and Curing Hay.—Within a few years we have given up the sickle for the scythe, and the scythe for the horse-mower. The hay-tedder takes the place of several weary boys in tossing the new mown grass; the horse-rake with a spring seat for the driver takes the place of the old hand rake. In some places the hay-loader is attached to the rear of the wagon and saves much heavy work. The large hay forks with a rope, a few pulleys, a horse, a boy and a little planning by the farmer, elevate the hay in large bunches to the top of the highest stack or the hay loft. This is all easy, if you have good tools and know how to manage, but no book can tell a beginner all about it. The operator must use his own judgment in deciding between that which is valuable and that which is not worthy of his attention.

Implements are all the time improving, and enterprising manufacturers see that the farmers know the fact. Instructions are freely given in reference to their use, hence little need here be said in reference to them.

Previous to haying the business farmer will put everything in good order. He has a few extra bolts, nuts, one or more extra sickle-bars and sections, and is prepared to meet slight accidents without delay. He has a good steady team and a careful driver who has some tact with tools. Before the grass had made much growth some pains was taken to remove stones, stumps or other obstructions, or to mark them so their location could be known when the grass had become tall.

For the prospects of fair, settled weather he no longer relies wholly on the almanac, the moon's phases or the weather

prophets, after the manner of his forefathers, but consults the "probabilities" of the signal service.—(Killebrew.)

If the grass is heavy, the dew should be nearly off before beginning. If the cutting bar is at one side the driver strikes out with the "off horse" next to the fence; he then turns about, driving over the swath last cut, and goes around as much as he chooses. Or if he use a Eureka or other mower where the machine follows the team immediately, he may go back and forth on one side or proceed in some other manner.

Before noon, and perhaps after noon also, the hay tedder stirs the grass once or more. Towards night it is raked and put into cocks. If there is much clover the tedder must not be used after the leaves have dried, as it crumbles and wastes the most valuable part of the hay. The leaves of clover will dry a long time before the stems.

If cut late in the afternoon, or in the evening, so it does not wilt, no harm will come if a heavy dew falls on the hay. If the day is a fair one it is not good practice to cut grass in the middle of the day and leave it partially cured exposed to dew or rain.

The finest hay is made in dry, sunless weather, with little dew, and as little handling over as possible. Burning too long in the hot sun renders the hay brittle, and some of it will be lost in handling.

As usually made, the best clover hay is only fairly wilted before it is put in the cock, where it remains from four to seven days. In the meantime the cocks are carefully opened once or more each into two or three piles for an hour or two, then put up again.

If not very well cured, hay will keep better in a close mow in the barn than in a loft or in a stack where it is much exposed to the air. The closer the barn the better for the hay.

The following was prepared by Prof. H. P. Armsby, of Wisconsin:

Effect of Drying.—"All the nutrients of dry, coarse fodder are digested and resorbed to the same extent as when it is fed green. This is only true when the fodder and the hay are otherwise of exactly the same quality, when both are cut at the same time and from the same field, and when none of the leaves or other tender and especially nutritious parts are lost during the preparation of hay. These considerations are never completely reached in practice.

"*The digestibility* of the organic constituents of a fodder is in no way altered by simply drying in the air, provided it is executed without loss of parts of the plants. The ordinary method of making hay involves a considerable loss of leaves, and the product suffers not only in its quality but in its digestibility as well.

"*Effect of Storing.*—The storing of fodder for a long time, even when all necessary preventions, such as a dry and airy location, etc., are observed, may decrease both its digestibility and palatability.

"*Period of Growth.*—Early cut forage is not only superior, other things being equal, to late cut, as regards its chemical composition, but it excels it also in digestibility. This fact is established by abundance of experimental evidence.

"Digestibility is not sensibly increased by steaming or ensilage. In practice, however, the palatability of a fodder may often be very considerably increased by suitable preparation, and the animals thus induced to eat larger quantities of fodder not perhaps agreeable to them in its natural state.

"*The Fertility of the Soil affects the Quality of Plant.*—The natural quality and fertility of a soil have a very considerable influence on the chemical composition of the crop. Still greater differences often show themselves when dark green 'rank' plants are compared with pale yellowish-green ones of the same kind, occurring in the same field, and of the same age.

It is questionable whether very high manuring really gives more nutritious fodder than can be got from soil of good fertility.

"*Method of Curing.*—All methods and appliances which diminish the amount of handling which the hay must receive, especially when it is nearly dry, tend to improve the quality of the product by avoiding mechanical losses. So, too, it is desirable to dry the grass as little as is consistent with the object of curing, sufficient to ensure the keeping of the fodder, since the dryer and more brittle it becomes the greater is the loss by handling. In the process of 'ensilage' these losses are largely avoided, but the process of fermentation causes a loss. Recent results obtained at the New York Experiment Station, and at Houghton Farm, seem to show that corn-ensilage suffers very little loss from fermentation.

"*Damage by Rain.*—Both analysis and digestion experiments confirm the common observation that hay which has been wet is diminished in value.

"*Early or Late Cutting.*—Young plants while rapidly growing contain relatively more protein and less fibre than more mature ones, consequently early cut fodder must be of better quality than that cut late. It is more digestible.

"Three elements enter into the problem of selecting the best time for cutting, viz: the quality of the fodder, its quantity, and the amount of labor expended upon it. While any grass is ripening a large part of the protein and starch passes from the leaves and stem to the seeds, which are so small that they are seldom masticated or digested. Moreover, they are easily lost in curing. The hay made from fully ripe grass is essentially straw.

"If only one crop is to be obtained, probably the best time for cutting is usually when the plants are just beginning to blossom. At this time a larger crop is obtained than if cut earlier, while the digestibility is not seriously impaired.

"If cut early there is a great advantage to the second crop, as shown by an experiment at Hohenheim:

	Percentage of Protein.	Total pounds of Protein.	Total dry matter, pounds.
One cut	16.3	434	2,662
Two cuts	24.4	668	3,274

"The following table, taken from *Chemistry of the Farm*, shows the percentage composition of meadow grass cut at three different dates in the same field. The first cutting will represent pasture grass fed off in the green state by stock; the second cutting is good ordinary hay; the third cutting is an over-ripe hay, somewhat coarse and stemmy, but well harvested.

Date of Cutting.	Albuminoids.	Fat.	Soluble Carbo-hydrates.	Fiber.	Ash.
May 14	17.65	3.19	40.86	22.97	15.33
June 9	11.16	2.74	43.27	34.88	7.95
June 26	8.46	2.71	43.34	38.15	7.34

"These numbers speak most decidedly in favor of early cutting. When the fodder was cut twice, not only was the quality far better, as shown by the percentage of protein, but the absolute quantity both of protein and of dry matter per acre was nearly one-half greater. When we take into account the greater digestibility of the young hay, the gain becomes still greater. Experiments indicate that the richest fodder and the largest yield of digestible matters per acre may be obtained by cutting two or more crops of comparatively young grass in a season, rather than one crop of over-ripe vegetation.

"In practice, however, the fertility of the soil, the length of the season, the kind of grass, the cost of labor, etc., have to be con-

sidered. Rowen is more liable to injury from wet than coarser hay. It may often be cheaper to get one large crop of hay, even of poorer quality, and supplement it with concentrated fodders.

"The only direct feeding trials that have been made on this point, so far as I know, are those made by Professor Sanborn, of Missouri. So far as they go they indicate that the value of early-cut hay may have been over-rated.

"*Legumes.*—The legumes are characterized by the large proportion of protein contained in the plant as a whole, and in the seeds. As fodders, when properly cut and cured, they are very rich, but have the disadvantage of being rather bulky, and of being easily subject to deterioration by mechanical losses. As a general rule clover is richer in nitrogenous matters than grass. Compared with meadow hay, which is made from the true grasses, its protein is about equally digestible, its crude fibre decidedly less digestible."

In trying to decide which is the proper stage of growth for cutting grass for hay we should not forget that a late growth of the plants nearly to seeding impairs their strength. In case of red clover, it greatly interferes with the crop of seed which is obtained from the second cutting.

The following on this question is by Prof. W. H. Jordan, taken from the *Philadelphia Press:*

"What if sorghum does have more saccharose and less glucose when the seeds are formed or are ripe? Is it more nutritious? We have no reason for thinking so. Starch and the various sugars and other carbohydrates have just the same office, and, so far as we can judge, nearly the same value in animal nutrition, so how does a change from glucose to saccharose, or from starch to sugar, very materially affect the nutritive value of a plant? In the processes of digestion starch is changed to glucose, and in that form passes into the blood. Sugar in the blood requires somewhat less work for its preparation for use by the animal

body, and is, undoubtedly, somewhat more completely utilized than is the case with starch. But the final form and office is the same with both starch and the sugars or foods.

"It is, therefore, difficult to see how a change from glucose to saccharose in sorghum can effect the intrinsic value. But why compare sorghum and Timothy anyway? One is a sugar-bearing plant, the other is not.

"Because sorghum, a sugar-producing plant, is worth most for making sugar when the seeds are ripe, why should it follow that Timothy, a plant containing in advanced age a very small quantity of sugar, is most nutritious when the seeds are formed? We cannot determine the effect that age has upon the nutritive value of any known fodder plant by the increase or decrease of a single compound. Plant substance is complex, is made up of many compounds, and we must measure nutritive value by the total quantity of digestible nutrients, taking into account also their form and relative quantities.

"Our knowledge of changes occurring in Timothy grass through age is, briefly, as follows:

"(1.) The nitrogenous compounds decrease and the carbohydrates (starch, sugar, etc.) increase in relative amounts.

"(2.) There is no conclusive evidence that the nitrogenous compounds assume more valuable forms in the later stages of growth than when the plant is in bloom.

"(3.) With the carbohydrates there is a change of material into the form of crude fibre. Crude fibre is in part digestible, and to that extent is as valuable as digestible starch.

"(4.) The nutrients in young grass are more largely digestible than in old.

"(5.) This decrease in percentage of digestibility may be in part or even wholly compensated by the greater acreage production in the case of mature grass. Whether this is so, undoubtedly, depends largely upon the locality and season.

"Purely chemical facts favor very strongly the idea that a pound of dry substance, as existing in Timothy when in bloom, is more valuable than a pound of dry substance at any later period, in much the same way (but in a less degree) that a pound of dry substance in young pasture grass is more valuable than the same quantity of material in the mature plant."

The following opinion, based on experiments, by Prof. J. W. Sanborn, of Missouri, differs from the above: He recommends cutting grass, mostly Timothy, as soon as one-fourth part of the heads were in bloom, and other lots ten days later, when out of bloom, and after the seed had begun to mature. After repeated trials in feeding steers, and cows giving milk, he says the results indicate, not only that the amount of hay gathered from a given area are much larger when cut after bloom than when cut in bloom, but the late-cut hay was more nutritious. He believes that Timothy or clover hay, particularly the former, is worth more per pound, and for Timothy thirty-five to forty per cent. more per acre, for cutting when sufficiently out of bloom in preference to cutting in bloom or before blooming. From some experience he concludes that this is also true of corn fodder, and he is inclined to believe it is true of most vegetation.

The writer thinks it very doubtful whether it is best to cut all forage plants at the same stage of advancement.

Most farmers, as a rule, prefer to cut clover when a few of the first heads begin to turn brown.

If the grass has made a pretty good growth, and the bottom is not wet from damp weather, it is the safest plan to begin haying early. Something will very likely interrupt so that the grass last cut will be older than it should be for good hay.

Unless the weather is favorable it is difficult to cure well a thick growth of very young, succulent grass.

When the growth is thick, some of the lower leaves begin to decay, while those at the top are gaining. To save all the leaves

grass must be cut when young. Very much will depend on the condition of the weather. If the sun is obscured by clouds and rain descends every few hours, the grass intended for hay must be left standing even though it be going to seed. For making hay we need dry weather, but we can fill a silo rain or shine.

Another reason for cutting early must not be overlooked. It will be noticed while reading the chapter on *Insects Injurious to Grasses and Clovers,* that in many cases early cutting is recommended as an effectual remedy.

It will be seen that it is by no means an easy matter to select the best time for cutting or the best process of curing grasses and clovers, or to tell just how much it is safe to rely on chemical analyses to help determine these questions; and when we come to the test of feeding the difficulties are still increased on account of a changing climate, differences in the animals selected, and other things only thought of by men who have carefully experimented in feeding domestic animals.

Partially cured hay may be pressed into very solid bales, and not injure by heating. It keeps much like *ensilage* in a *silo.*

If the hay in the cocks is too damp, before drawing it should be opened an hour or two. No fixed rule can be laid down to guide the farmer. Remember that dew and rain wash out much of the best portion of grass after it has been cured, or partially cured.

A few minutes of an expert will show a beginner how to put hay into neat cocks of 75 to 200 lbs. or more each. The hay at the top should spread and hang down the sides to help carry off rain, should any occur. General W. G. LeDuc, of Minnesota, has the following on this topic:

"There is an art in cocking the clover hay so that it will shed rain, and the best hay makers in this locality claim to have acquired the difficult art of thatching the clover cocks by dexterity in handling the fork and laying the hay. They insist on taking

up small forkfuls of the windrow, placing one on top of another until they have a miniature cock, then taking it up on a four-tined fork and turning it skillfully so that the center of the forkful comes down, inverted upon the center of the forming cock. The cocks must be small and tall—such as will stand securely until the sunshine of the morrow."

Making Clover Hay in One Day.—By Hon. L. N. Bonham, Oxford, Ohio:

"For several years I put up clover hay as did my father and other Jersey farmers. I have long since abandoned their method and now put my clover hay in the mow the same day it is cut. The hay is far better, and the labor and risk in making it are far less. I select a bright day and start the mower as soon as the dew is off.

"By 11 o'clock I have cut as much as can be hauled in between 1 and 5 o'clock. The clover is then all turned and shaken up loose before we go to dinner. By 1 o'clock it is dry enough to rake into windrows if the day is an average hay day. No time is lost now in getting it into the mow. The hay is warm and free from external moisture. The warmer it is the less moisture is left on it. By 5 o'clock we have it all in the mow, if we can. If not all in then we prefer to leave it in the windrow until near noon the next day. After we stop hauling, at 5 P. M., the mower is started to cut what we can haul in the next day. The clover cut so late in the day is not wet with dew, and will not wilt enough to be blackened by the dew. It will be ready to shake up and spread out before 10 o'clock the next day, and by 1 o'clock we can begin to haul it into the mow.

"The clover hay thus made goes into the mow bright and with every leaf and head left on it. The secret of the whole business is, it is free from external moisture, while the warmth of the hay when it goes into the mow hastens the approach of the temperature of the mass up to 122, when the germs which cause in-

creased fermentation are destroyed, and the hay keeps bright and sweet, and comes out fragrant clover, with all the heads and leaves of good color.

"My mow is 28x28, and as tight as good siding and strips painted can make it. There are no windows in the sides to let in air. The clover is put in as compactly as we can get it, to save room, and kept level, to have the heat uniform.

"Sometimes we sprinkle a half gallon of salt to the load when putting into the mow, but this is of doubtful value.

"'To exclude the air' from the top of my clover mow, I often cover with straw. But this does not pack closely. I find it better when hauling in wheat to fill up over the clover with wheat. This excludes air, and packs the clover so that it keeps bright to the very top.

"The old theory that the mow must be open and the clover thrown in loose, and treated to 'plenty of salt,' which may mean much or little, is exploded. Green clover will keep green in the silo if well packed and the air is excluded. Clover hay, put into the mow warm and dry, the day it is cut, will keep brighter and purer and sweeter than if cured longer in the field.

"The trouble, however, in farmers adopting the method I have successfully used, is they do not attach enough importance to the fact that the conditions named must be followed.

"It will not do to cut clover in the morning and haul it in after sun-down. It will surely mould or come out brown or fire fanged, simply because dew falls at 5 o'clock.

"Nor can we cut clover and put in the mow the same day without favorable conditions of sun and air. In neither case will the hay go in free from external moisture."

The above account was clipped from the *Farmer's Review.*

Hay caps are sometimes used, and we never heard of a farmer who threw them aside after he had once used them. They will sometimes save their cost in a single season. They are about six

feet square and made of good common unbleached muslin. At each corner is an eyelet for pegs to run through into the sides of the hay cock, or stout cords may be fastened to the corners and long enough to reach to the pegs which stick in the ground. In fair weather the caps need not be used, but when rain threatens a man will sleep better with his hay covered, unless perchance, as is related in the *Country Gentleman*, some stranger wakes him up to tell him there are a lot of white cows in his meadow.

Drying by Hot Air from a Furnace or the Use of a Fan.—W. A. Gibbs, of Essex, England, has patented a contrivance for driving hot air from a furnace among the half-made hay as it is tossed by revolving forks in a long trough. This is sometimes valuable in Great Britain and Ireland, where they are subject to rains, especially for curing aftermath when the sun is low and the days short.

Morton's Crops of the Farm gives another plan which seems likely to come into more general use. It consists in providing a horizontal shaft, either under the ground on which the rick is built, or, by means of suitable boarding, within the lower layer of the rick itself, and connecting with it, one or more upright shafts into the body of the rick. A fan is used at the outer end of the main shaft, and draws the air through the whole body of the hay with sufficient rapidity at once to keep the temperature within safe limits. In this way partially cured hay can be finished before stacking.

Stacking Hay.—It is almost impossible to give rules in writing which shall be of much use. The best way for a person to learn is to become a pupil of a good stacker.

The foundation should be made on boards or some timbers to keep the hay from absorbing moisture from the ground. The middle should always be kept highest; it should be evenly trod down on all sides; the hay should be pitched onto the stack

from different sides, or near the center of the stack, to prevent packing the hay on one side more than on the other. The top should be finished with long, straight, coarse grass or sedges. In the old country stacks are thatched.

Fermentation of New-Made Hay.—Concerning this point, the following is from the pen of Prof. F. H. Storer in the *Rural New Yorker:*

"There are several facts, long familiar to practical men, which show clearly that the process of hay-making is something more than a mere drying-out of moisture from the grass. New hay will 'sweat' somewhat in the mow or stack, no matter how dry it seemed to be at the moment of storing; and many horse-keepers believe it is not fit for food for horses until after this sweating fermentation has thoroughly run its course.

"Even at the ordinary temperature of the air a good deal of carbonic acid, with traces of hydrogen and hydrocarbons, are given off during fermentation.

"In the beginning of an experiment, the oxygen of the air was rapidly absorbed and changed to carbonic acid. But even after the oxygen had been completely removed in this way from the confined volume of air employed in the experiment there was still evolution of carbonic acid from the hay, the oxygen for which must have come from the grass. The atmosphere surrounding the grass had but little influence on the volume or the composition of the grasses produced. The evolution of carbonic acid took place about as rapidly in the artificial atmosphere as it did in air. It was more rapid at a temperature of 97 degrees than at 60 degrees. Where corrosive sublimate was used in the hay, or where the tube containing the hay was exposed to steam-heat for several hours and then left to itself, no gases at all were evolved; hence the conclusion that the fermentation and the evolution of gas must be dependent upon the presence in the hay or grass of low forms of organic life. In confirmation of this

view the microscope always revealed numerous bacteria in the water taken from tubes in which the grass had fermented.

"It is commonly held to be quite improper to bale new-made hay, no matter how dry the hay may be. The waste of nitrogen from hay by long-continued keeping has repeatedly been noticed before by agricultural chemists. It follows that although the popular belief that the new hay is bad for animals may be true enough, old hay is not necessarily good hay."

Saving Seeds.—Instead of placing all the notes on this topic under this heading the reader will consult what is said on saving seeds of orchard grass, tall oat-grass, June grass, and red clover.

CHAPTER XIII.

LOOK THE WORLD OVER FOR BETTER GRASSES AND IMPROVE THOSE WE NOW HAVE.

Some Requisites for Success in a Grass.—J. J. Thomas, in the New York Agricultural Report for 1843, says:

"Some of the essentials to the success of grasses are—1st. They should produce seed in sufficient abundance, which may be collected without difficulty. 2d. Where used in mixtures they should not exclude others, as is the case with *Poa pratensis*. 3d. They should not be so tenacious of life as to become troublesome weeds in rotation, as *Triticum repens*. 4th. Some are valuable for close pasturage, which become too hard and wiry for meadows, as the hard fescue grass. 5th. Some are chiefly adapted to moist land, as red-top and ribbon grass; some for strong soils, as Timothy; some for growing in the shade, as *Poa nemoralis*, and in experiments these specific qualities should not be forgotten."

As Dr. Bessey, of Nebraska, puts it: "The qualities which