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SILOS AND SILAGE

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SILOS AND SILAGE.

The question of fodder-making from corn is intimately associated with that of silaging. If it can be shown that corn forage is equal in value to corn after siloing—that the fodder can be made and handled as cheaply and fed as economically as silage made from the like material — then it is futile to make further argument for the silo; for silaging is an expensive process, and one that goes naturally with intensive farming and accumulated capital in farming. It seems necessary, therefore, in the outset, to consider the question of

FODDER-MAKING

As preliminary to a statement of facts and experiments bearing on the question of silos and silage.

Every practical man familiar with the facts understands that corn fodder in Kansas is a very different thing from the article of the same name raised in New England and the Middle States. Here, the corn plant in all its parts reaches a development quite unknown in regions of shorter summers and poorer soils. Moreover, the proportion of leaves and blades (edible fodder) is doubtless much less with the Kansas corn than with the small-growing eastern sort, due to the habit of the plant in part, and to the whipping action of the blades in our prairie winds. Kansas corn–fields are weak in the fodder product for other reasons: the ripening period is a very brief one, allowing very little time in which to cut and shock the corn. The subse–quent tying and shocking of the bundles of fodder at the time of husking is always, except on "wet days," a difficult task, due to the nearly always dry and brittle condition of the stalks, and to their bulk. Even when all this has been done with the most pains-taking care, a very large proportion of the valuable corn-blades will be found to have been crushed and broken and scattered about the base of the shocks, from which it can scarcely be recovered. When we attempt to gather the remnant of our fodder, now literally "stalks," into shape such as to make it water-proof, either by close shocking, stacking, or hauling to the barn, we encounter difficulties, grow-ing out of the coarse, bulky character of the materials, that we have never been able to overcome.

For these reasons chiefly, and because of the cost of cutting up the corn and the added cost of husking from the shocks, we have ceased, upon the College farm, to attempt further to grow corn and fodder in the same field. The same facts have compelled us to look to the silo as a means of utilizing the wealth of vegetation which is otherwise largely wasted in our corn-fields.

WASTE OF FODDER IN FEEDING.

After we have cut our corn in the best possible state, shocking it care–fully and husking with equal care, there is still a very great waste in feed-ing it, that few farmers estimate. For three years we have, during a

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considerable portion of each "feeding" season, fed a number of cows, greater or less, upon corn fodder alone, and in various conditions, *i. e.*, chopped into different lengths and fed whole, and mixed with grain in various proportions. Below is given in tabular form our more recent experiments to test this question of the amount of corn fodder "wasted" or rejected by the animals before which it was placed.

The effort has been made to give results in whole numbers; to this end unimportant fractions have everywhere been discarded:

TABLE NO. 1.

Period covered by experiment.	No. of cows fed...	Daily feed of cow, lbs.....	Amount fed, lbs...	Total waste, lbs....	Length of cut of fodder, inches...	Per cent. of waste.....	Remarks.
1887.							
December 22–28,	4	20	480	134	¼	28	Fine fodder of excellent quality.
Dec. 28–Jan. 3..	4	20	480	124	½	26	Fine fodder of excellent quality.
1888.							
January 7–13...	4	20	480	125	1	26	Fine fodder of excellent quality.
February 1–7...	4	20	480	127	2	26	Fine fodder of excellent quality.
February 14–18,	4	19	300	121	*	40	Coarse fodder of good quality—wasted in handling.
February 18–21,	4	20	240	66	2	27½	Fodder of excellent quality.
February 21–24,	4	20	240	64	*	27	Fodder of excellent quality.
February 24–27,	4	18	220	59	1	27	Early-cut fodder, excellent quality.
Feb. 28–Mar. 2..	4	19	230	56	½	24	Early-cut fodder, excellent quality.
March 2–5.....	4	19	230	39	¼	17	Early-cut fodder, excellent quality.
March 6–9.....	4	16	192	24	¼	12½	Selected fodder—butts removed; fed mixed with corn-meal.
March 9–16.....	4	17	336	47	¼	14	Good fodder, fed with corn-meal.
March 16–19....	4	16	192	8	¼	4	Poor fodder—often mouldy.
1889.							
March 2–16.....	4	19	538	221	2	41	Fine fodder of excellent quality.
March 5–12.....	4	20	552	214	1	39	Fine fodder of excellent quality.
March 19–26....	4	17	484	113	½	23	Fine fodder of excellent quality.
Mar. 29–Apr. 5..	4	20	560	159	¼	28	Fine fodder of excellent quality.
March 16–23....	4	19	544	156	½	29	Fine fodder, same as above, except that it was *unhusked*.
Mar. 30–Apr. 2..	....	....	900	533	1	59	Ordinary coarse fodder.

* Uncut.

SUMMARY.

Condition of fodder.	Amount fed, lbs.	Total waste, lbs.	Per cent. of waste.
Fodder uncut	540	185	34
Fodder cut in two (2) inch lengths	1,258	414	32
Fodder cut in one (1) inch lengths	2,152	931	43
Fodder cut in one-half (½) inch lengths	1,738	449	26
Fodder cut in one-fourth (¼) inch lengths	1,462	340	23
Fodder cut in one-fourth (¼) inch lengths and fed with meal	528	71	13
Total fodder of all lengths	7,678	2,390	31

This table is interesting and instructive, albeit to some extent misleading, because of the impossibility of stating the exact quality and condition of the fodder.

The table seems to show that the shorter the lengths into which fodder is chopped, the smaller the proportion rejected by the animals; and this, I believe, is generally true of fine fodder of the first quality. That it is not true of all classes of fodder is shown by many of the feeding periods of the table, in which the fodder cut in shortest lengths shows the largest proportion of waste. Moreover, in an experiment made in 1886 we demonstrated that the finer the fodder was cut up the larger the proportion of waste; but in this case the fodder used was coarse and uniformly poor. I am abundantly satisfied from accurate experiments made to test the point, and from a large general experience, that the chief, almost only, value of cutting fodder is found in the fact that such chopped fodder can be placed in the manger and generally handled much more conveniently than the unchopped.

The addition of meal to the cut fodder diminished the waste greatly without a doubt, although it may well be questionable whether cattle are benefited by consuming a large amount of indigestible, woody fiber to which they have been tempted by a very small amount of adhering meal.

The striking fact is that even with the very excellent fodder used in this experiment, and fed as it was in a tight manger, the cattle rejected thirty-one (31) per cent. of all placed before them. Consider for a moment what would likely — certainly, I may say—be the case with ordinary, coarse fodder fed on the ground in the field or yard and often necessarily in the mud !

THE LOSS OF CORN IN FODDER–MAKING.

There is yet another phase of the fodder question that must not be lost sight of. If we make fodder of any real value the corn must be cut up while it is yet green. At what stage of ripeness the corn plant yields the best and largest amount of fodder has not yet been definitely determined,

but all agree that the corn plant must be "green" at the time of cutting. Now the experiments of last season, made at this station,* seem to show as conclusively as one trial can show anything, that the loss of corn when cut even slightly green is very great.

It was distinctly shown that in *nearly every case* adjacent rows, cut at intervals of seven to twenty days, gave variations, with only two or three exceptions in seventy-odd cases, almost exactly proportionate to the difference in the time of cutting; the largest yield of the best quality of corn, going with the row cut latest. Indeed, we are plainly taught here that corn continues to improve in weight until the very last—after the blades of the plant have been dried up, and quite likely blown away, and seemingly until the juices of the stalks have been completely sucked up. It is hard to resist the conviction that this cannot be a mere coincidence; that, in short, these figures point to a real principle in the growth of the crop which the farmer cannot afford to ignore. . . . Considering then all the facts—the great labor of husking corn from the shock as compared with "picking" it from the standing stalks, the great difficulty in tying, hauling and stacking or otherwise securing the fodder crop, and the great waste of fodder in the field and ultimate loss in feeding (which we have demonstrated time and again to amount to twenty to sixty per cent. of the stalks) — it is perfectly clear to me that we must raise corn for corn, with no thought of fodder, and corn again which has no higher purpose than the production of fodder. We must, in short, have two corn-fields on every farm, receiving radically different treatment, to correspond with the different purposes for which they are cultivated.

This seems to me to state with sufficient fullness the argument against the attempt to get grain and fodder from the same field. The great Kansas staples, corn and sorghum, are unsurpassed fodder plants when grown and harvested with the single object of making "hay," I have come to think, after three years of careful experiment with the silo upon the College farm, that it is a necessary part of the machinery of the corn-field. The argument for this view is given in what follows.

SPECIAL VALUE OF THE SILO TO KANSAS.

Corn and sorghum are, and are likely to remain to Kansas farmers, the principle sources of stock food. With either of these crops cultivated for the sole purpose of fodder-making, and considering them from the standpoint of bulk or quality, two or three times as much stock food can be produced as from an equal area of timothy, clover, orchard grass, or millet. That bulky foods like corn and sorghum may be harvested easiest, cured best and with least loss, and handled with the least waste, when their destination is the silo, and when there are stored in the smallest space, are facts that go without argument with me. Moreover, a crop of rich corn fodder

* See page 42, *et seq.*, First Annual Report Kansas Experiment Station.

or sorghum is always a possibility in Kansas. In 1874 a magnificent crop of fodder corn bearing ten bushels of nubbins to the acre was consumed by grasshoppers because we had no silo in which to store it. In the drouth year of 1887 our crop of sorghum was an excellent one. Last season (1888) we grew a good crop of fodder bearing thirty-five (35) bushels of corn to the acre, the seed of which was planted on July 6th. In this section of the State, an excellent crop of fodder may be grown after the wheat crop has been harvested, where the seed has been listed in upon wheat-stubble ground.

THE EXPENSIVENESS OF ENSILAGE as compared with the common method of fodder-making in the field is often urged by those unfamiliar with it. A comparison of the successive steps necessary in both methods does not, however, show a heavy balance of labor against the silo. In both methods the corn must be cut up and hauled to the barn or feeding-place, and the cutting into half-inch lengths is as necessary to one process as to the other. The silaging, too, saves the expensive process of husking from the shock, and the subsequent hauling, shelling and grinding of the corn. In the single item of husking, the silo saves to its owner much more than the increased cost of hauling the green fodder. The overwhelming argument for the silo, in Kansas, is that it furnishes the means by which the greatest of all forage plants, corn and sorghum, may be cut up, cured, and fed in such time and manner as give to the farmer all of value that there is in them. Of course other crops, the grasses, clovers, alfalfa, the non-saccharine sorghums, millet and forages in general, may be used as silage material, but in Kansas corn and sorghum are, and are likely to remain, well-nigh the only silage materials.

THE SILO.

The silo is simply a more or less completely air-tight and cold-proof room or compartment of any nature. It will be made large or small, according to the size of the herd to be fed from it. A large silo is more economically constructed than a small one, and other things being equal, a smaller proportion of spoiled silage will be taken from a large silo than from a small one. Nevertheless I should on no account advise the erection of very large silos, simply because an accident to a large silo means a very large loss in its contents, and besides, a large surface of silage exposed to the atmosphere will in this climate, unless fed out promptly, mould and spoil, often considerably. However large the herd, I should not care to make the silo larger in superficial area than say 35x15 feet. If larger than this, I should certainly divide the silo by one or more cross-partitions. A few figures giving results obtained at the Station during the last year may prove suggestively useful to the farmer who is thinking of his first silo. However, we give fair warning that such figures, if taken literally, are most delusive. For example, our herd would quite likely have eaten very much more silage than they did had the season been a cold one, or the grain ration less, or had the cattle been larger or less comfortably housed.

DAILY CONSUMPTION OF SILAGE.

Our silo No. 2 is, inside, 18¼ feet by 13¼ feet, and 22 feet high. It was filled-eight days having been occupied in the process—with 80 tons of corn silage, omitting a small fraction here as elsewhere. Two days after the filling it had settled two feet. The average weight of each cubic foot of the contents of this silo at that time was a small fraction under 34 pounds. Our herd to which silage was fed numbered 56 head, all females, of four breeds, and ranging from yearling to aged cows. The average daily feed to these cattle, most of which had a small daily grain ration, was nearly 34 pounds, or almost exactly a cubic foot of silage as it rested in the silo shortly after filling.

Prof. Samuel Johnson, in the April bulletin of the Michigan Station, estimates that cows of 1,000 pounds will consume a daily ration of 60 pounds of silage. This is considerably more than we have been able to feed. With us only large cows, and those of which extra service at the pail, or in suckling calves, was demanded, consumed a daily feed of 60 pounds of silage and an added grain ration. From outside sources of information, the discussions had at farmers' institutes and the like, as well as from our own experiments, I am inclined to think that the estimate of the consumption of silage per head of cattle, here given at one cubic foot per day, is, with a good quality of silage, and considering herds made up of large and small animals, a very safe basis for an estimate of the size of the proposed silo.

LOCATION OF SILO.

If in the possession of a barn of suitable size, I should prefer a silo erected inside this building to an independent structure, by reasons of cheapness in construction and its usual convenience to the animals to be fed from it. Where the silo occupies a portion of the barn, it should be made to extend the full height of it—from the floor of the basement or cellar to the purline plates. A silo located in a dry bank or bluff-side, such that a portion of its height greater or less was beneath the ground, would be most advantageously situated, provided the silage could be withdrawn at the lowest point of the silo. Such a silo would have very decided advantages over one built wholly above ground; it would admit of easier filling, and at a moderate height above ground would give great depth to the silo, which is always an advantage. A silo having a cellar from which the silage must necessarily be hoisted, is wholly inadmissible. The "cellar" portion of the building will ordinarily be constructed of masonry. This should, however, be given a thick coat of cement or plaster, so that the silage is nowhere brought in contact with the stone or brick of the wall.

Our experience with a stone silo has been most disastrous. During the two years we used a silo of exposed stone masonry, our loss of silage must have been nearly or quite fifty per cent. of its contents. Even where this stone work was brushed over with a thick paste of cement and lime, there

was found six inches to a foot thick of rotted silage in contact with the masonry. Afterwards the stone work was sheathed over with inch stuff, leaving a two-inch air-space between the sheathing and wall. The same silo since has preserved its contents without loss.

Great care should be taken that the location of the silo is such that feeding from it may be done with the least possible outlay of labor. If located in the barn, the silo should be placed as near as possible to the cattle stalls; if outside, it should be given a position adjoining the feed-yard or shed, as the case may be. Where the herd is fed in shed or barn, the stalls are likely to be arranged in double tiers, the tiers separated by an alley toward which the cattle are headed. In this case, the silo should be placed adjoining the end of the shed in such manner that the door of the silo will open into this common alley.

CONSTRUCTION OF THE SILO.

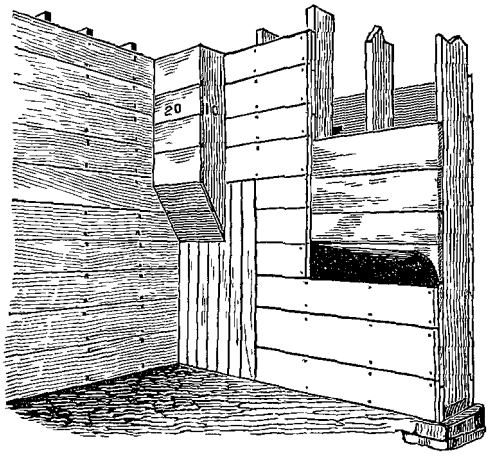
The foundation of the silo walls may be a wooden sill slightly imbedded in the ground, but for obvious reasons such a foundation will rarely be used. In making silos as in many other cases the cheapest method is often a very dear one in the end. I advise farmers generally to be extremely shy of the cheap and easy methods of making silage which I see occasionally recommended by amateurs. *A nearly air-tight and cold-proof room* must be had, and any silo that comes short of this is sure to give the owner a large annual crop of mouldy, spoiled silage.

Our practice has been to build a light stone foundation-wall, one about ten (10) inches in the ground, rising no higher than the surface, and about twelve (12) inches thick at the top. At intervals of about eight (8) feet a bolt of half or three-eighths-inch iron, threaded at the top and provided with a burr, is built in the masonry. This bolt is made to project above or out of the foundation-wall about three inches. A foot-wide, two-inch plank which has been previously tarred and bored to match the projecting bolts, is satisfactory as a sill. This is driven down over the bolts to the top of the wall, the corners are halved together and strongly spiked, the burrs are turned down, and the foundation of our silo is laid.

With a silo twelve (12) feet high, joists 2"x8" set upright every sixteen (16) inches are heavy enough; with a higher wall than this I should use 2x10 joists in every case. The walls of the silo must be made strong enough to bear without deflection the great pressure put upon them. If the Wall yields to the pressure, the silo takes air, and the result is a mass of spoiled silage, greater or less according to the amount exposed. With the joists erected and securely “toe-nailed” to the sill, and secured by a strong plate at the top, the work of finishing the silo is of the simplest character.

The cut represents a part of the interior and cross-section of one of the walls of the College silo No. 3, recently finished. In this silo the exterior wall-shell is composed of shiplap; the inner is made up of two thicknesses

of stock-boards, with one thickness of tarred paper intervening. In selecting materials for the silo wall, care should be taken to avoid pieces with knotholes, and those much warped or twisted. In boarding up the inner wall-shell we have found it cheapest in the end to bring the stock-boards to a straight edge with the plane before attempting to nail them up. The tarred paper we put up in horizontal strips, allowing the strips to lap three inches. We have used ten-penny wire nails in sheathing the silo-wall, although quite likely 8s would answer the purpose. The two courses of boards should be made to break joints much more completely than is shown in the cut. The top of the silo, to prevent spreading, ought always to be stayed by a number of cross-ties of plank or wire cable, extending from one plate to the other. The roof of the silo may be made of any materials that will exclude the rain.



THE SILO FLOOR.

Do not attempt to floor the silo with boards or plank. The best and cheapest material for the floor of the silo is common clay, which after having been evenly spread to the depth of three inches should be moistened and worked (puddled) and smoothed with the hoe. One of our silos has a cement floor, the other is floored with clay. For aught that is appreciable to the senses the clay floor is fully equal to the much more expensive one made of cement.

THE COST OF THE SILO.

Will of course largely depend upon local values of the labor and materials employed in its construction. I am abundantly satisfied that it will be unsafe to calculate the cost of the silo in Kansas upon a lower basis than $2 to the ton of its contents.

SILAGE MATERIALS.

Any material of value in the condition of hay or fodder is probably suitable for silage. Clover, timothy, alfalfa, millet, Hungarian, cow-peas and many other forages have been tested and found satisfactory in the condition of silage. Nevertheless, for reasons stated before, the coarse-growing fodder plants, like corn and sorghum, are sure, in Kansas and generally throughout the West, to be the principal if not the only silage crops.

GROWING THE SILAGE CROP.

So far as the corn crop is concerned the tendency in recent years has been strongly in the direction of thinner planting for silage. By many it is maintained that ensilage corn should be planted precisely as though the object was to procure the largest yield of grain of the best quality. I am inclined to think that a like rule holds with ensilage sorghum, and that it should be planted in such a manner as to insure the maximum development of sugar and seed. We plant ensilage corn in drills three and one-half feet apart, with plants occupying in the rows eight to twelve inches of space. The corn is cultivated and kept clean, precisely as corn is ordinarily managed during the growing period. With sorghum designed for the silo we should plant in drills three and one-half feet apart, and grow individual plants in the rows at intervals of six to ten inches. Upon good soil and with fair treatment, corn raised as above will yield twelve to sixteen tons of silage per acre, while the yield of sorghum will often reach twenty tons.

HARVESTING THE CROP.

The tendency has in recent years been markedly towards harvesting corn designed for the silo at an advanced stage of ripeness.

In Kansas it will not be safe to follow eastern practices in this respect. Here the intense heats and other special climatic influences push the corn crop, when once on the down grade towards ripeness, at a constantly accelerating speed; so that often only a few hours separates the grain which is only “glazed” and that which is ripe to flintiness, and dead and dry in leaf, stem, and seed. Moreover, after the corn plant begins to dry up and “fire,” the winds act upon the blades and tender parts of the plant most wastefully. For these reasons, and considering the accidents and hindrances likely to arise after the work of filling the silo has fairly begun, this work ought not to be much delayed after the corn is in the early “dough” state.

The simplest and, on most accounts, best method of harvesting corn for the silo is the common plan of cutting the corn with the corn-knife and gathering it in armfuls, carrying each armful as fast as cut directly to the wagon-rack.

It is often necessary to cut the corn and leave it in bunches on the ground hours or even days before hauling. The sweetest and best sample of silage that I have yet seen was made from rather green sorghum which had been cut and left in hundred-pound heaps on the ground during three to five very hot days, before hauling to the silo.

FILLING THE SILO.

Whether the silo should be filled at a continuous operation, or by periods allowing one or two days of rest to follow each day's work of filling, is one of the mooted questions in silage-making. It is argued that the method of slow filling permits free access of air to all parts of the mass of silage, and

consequent rapid oxidation and great increase of temperature. This high temperature (140° Fahr. and upwards) destroys the germs of acetic fermentation, it is claimed, and thus we have as a result of the slow filling, "sweet ensilage." By others, this theory, and the facts on which it is based, are disputed, and the claim is put forward that sweet ensilage is due to the condition in which the corn crop is harvested for the silo — well-ripened fodder giving the sweet article of silage, while the green, watery and succulent corn develops a high degree of acidity. In our experience with both plans of filling, the slow method has given what seemed the sweeter silage. I admit, however, that our experience on this point is far from conclusive. It certainly ought not to be a difficult matter for those who have made a study of bacteriology to determine whether a temperature of 140° Fahr —beyond which we have never known the temperature of the silo to rise —is really destructive of vinegar germs.

For practical men this fact remains: we may fill the silo rapidly, or by the slow method, as suits our convenience, with the assurance that no great harm will result in either case. We have used in filling our silo a "13-A" Ross feed-cutter having a twenty-four (24) foot elevator. This machine is operated by a ten (10) horse-power engine, which is greatly more power than is really needed. We have usually cut our silage into half-inch lengths, although for aught I know results have been just as satisfactory when the cut was made at one inch, except that the silage cut into inch lengths would not pack quite as closely in the silo as when the materials were cut in smaller pieces.

We have tried treading and packing the silage as the filling progressed, afterward weighting the mass heavily with rocks, and we have filled the same silo without treading, or subsequent pressure of any kind. In the latter case, the silage kept as well and came from the silo, it seemed to me, in much better order than that which had been thoroughly tramped and weighed. In filling, the stream of silage should fall at as nearly as possible the center of the silo, and it is wise to level the mass frequently, treading down the sides and corners, that settling may go on evenly.. After the silo is full it may be covered with almost any material that will tend to exclude the air. We have found nothing better than a layer of tarred paper, covered about eighteen (18) inches deep with green, fine grass, like the aftergrowth of orchard grass, or prairie grass. This caution deserves the attention of every owner of a silo: do not, on any account, after the silo has been sealed up, disturb this covering or the inclosed silage until you wish to feed it. I have had occasion in a number of cases to break the natural seal of the silo, and always have lost heavily, as a result, in spoiled silage.

EMPTYING THE SILO.

The operation of feeding from the silo is usually performed from the door, as shown in the cut. In feeding it is well to remember that if a silage sur-

face is left exposed to the atmosphere for a number of days, it moulds quite rapidly and not infrequently a considerable loss results. On this account I prefer to feed from the top of the silage, so that more or less of the entire surface can be fed every day. To accomplish this purpose I planned in the new silo (No. 3) the shoot, shown in the cut, over the door of the silo. This consists simply of a 2"x10" spiked on edge securely to the silo, twenty inches from the corner. Twenty-inch pieces of shiplap lightly tacked to this projecting plank connect it with the adjacent wall, thus forming a 10"x20" shoot which passes through the inner door of the silo.

This shoot has been used in emptying silo No. 3 to our entire satisfaction. The silage kept without moulding as well in contact with the shoot as that from any other portion of the silo. In other words, the shoot did not promote decomposition of the contact ensilage in the least. Every man having a practical acquaintance with the subject will recognize the importance of removing the ensilage, beginning at the top of the mass, and we can think of no means by which this can be accomplished so satisfactorily as by the device here figured, or something like it.

STATION EXPERIMENTS WITH SILAGE, 1888-9.

In the late summer and fall of 1888, beginning August 13, we put away in two silos a total of one hundred and fifteen (115) tons of silage, placing thirty-five (35) tons in silo No. 1, and eighty (80) tons in silo No. 2. A record was made of all silage placed in the silos, but weighing of silage taken from the silo was only made in the case of silo No. 2. It should be said that all of this 115 tons, except sixteen tons of odds and ends obtained from various forage experiments, was had from a corn-field of eight and one-half (8.35) acres nearly. The results of this experiment, including the feeding of the silage and the various determinations made by weighing, are given in concise form as follows:

1. Eight and one-half acres of corn gave 98.8 tons of silage, an average yield of 11.83 tons per acre. The maximum yield of a measured acre was 16.1 tons.

2. The 115 tons of silage fed by us in the winter of 1888-9 carried 56 head of cattle 123 days, an average daily feed — with small-grain ration — of 34 lbs., or one cubic foot of silage.

3. Of the 80 tons placed in silo No. 2, 10,347 lbs., or 6.47 per cent., spoiled. This loss was chiefly caused by the yielding of the silo walls. The amount rejected by the cattle, due almost wholly to over-feeding, was 1,296 lbs.—less than 1 per cent. of the 80 tons. The loss by evaporation was 7 per cent.

4. The cost of labor in cutting the corn, hauling it fifty rods to the silo, and storing it therein, was 62 cents per ton. This does not include any charge for use of machinery or power. This cost has been greatly reduced in 1889.

5. Assuming that one acre of corn produces 24,000 lbs. of silage, each animal consuming 34 lbs. daily, and deducting 10 per cent. for waste, we find that one acre of corn put in the form of silage will carry, with a small-grain ration, three cattle during the feeding season of 195 days, with 80 days' feed to spare.

6. Best results will be had when silage is fed with hay or other dry fodder. Silage of itself is not a sufficient food where much is expected of cattle.

PITTING GREEN CORN.

An interesting experiment in preserving green corn in a trench-like excavation made in the soil of the corn field, was made this year with very satisfactory results. With team and scraper an excavation was made, which, when completed, was some thirty (30) feet long, fifteen (15) broad, and two-and-one-half (2½) feet deep. Early in October corn which had been considerably frosted was placed in this pit, care having been taken to arrange the stalks evenly in two tiers, placing tops and butts alternately right and left, so as to keep the corn-pile level. Then a heavy iron roller was kept in constant motion upon two rows of plank, which were shifted with the roller back and forth from one side or end of the stack to the other, to be out of the way of the stacking. All told, some ten (10) tiers—it was not weighed —of corn were placed in the pit. The filling occupied portions of three (3) days, and at the end of that time the stack was not much above the surface of the ground. The stack was then covered with straw to the depth of four (4) inches; the scraper was set at work again, until the stack was covered with earth to the depth of twenty (20) inches. (This doubtless was two or three times as much earth as need to have been used for this purpose.)

On opening the pit for the first time — late in December— its contents were found to be the very perfection of ensilage. The ears of corn were soft as when put in the pit, and nearly as sweet; the stalks and blades were juicy, and bad only a faint suggestion of acidity. Certainly no silage made upon the College farm the present season will equal in quality that taken from this "hole in the ground." Of waste by rotting, there seems to have been absolutely none.

It seems to me, that in this experiment there is the suggestion of a truth that might be given a very wide practical application. Upon a dry knoll, or in a sandy, friable soil, a silo with capacity for a hundred tons of stalks might be dug at very slight expense, and might be filled without the need of expensive machinery of any kind.

STEAMING SILAGE.

In view of the fact that practical men generally agree that silage materials should go into the silo in a condition of abundant moisture (succulence), while scientists tell us that the filling should be done slowly in order to allow the development of great heat—sufficient to destroy the bacteria of

acetic fermentation—it has seemed that both objects might be satisfactorily accomplished by steaming the mass of ensilage either during or immediately after filling the silo. To test this question, a small silo—one having capacity for three or four tons of silage—was constructed in the experiment barn, in the fall of 1888. This silo, except in the matter of size, was made precisely as that described in the foregoing pages. It was connected with the boiler by means of a half-inch steam pipe, which discharged steam into the space beneath a perforated false bottom, at a point near the middle of the silo floor. Live steam at a pressure of sixty (60) pounds was applied to the ensilage as soon as the silo had been filled, and this pressure was maintained until the steam escaping from the top of the mass told us that it was thoroughly cooked. Three trials of steaming were made, as follows:

EXPERIMENT No. 1.— In November the silo was filled with frosted sorghum cut in half-inch lengths, steamed, as above indicated, and promptly covered in with tarred paper and a tight-fitting board cover, which again was covered with eight inches of earth. At the expiration of about three months the contents of the silo were examined, when the mass was found to be in very bad condition. A large part—practically all, for the sound silage could hardly be separated from the spoiled—was mouldy and had a rank, rotten smell.

EXPERIMENT No. 2.— The silo was filled in June, 1888, with very succulent clover, which was cut and steamed as before, and afterwards covered in carefully. An examination of this clover ensilage, made three months after filling, showed the entire contents of the silo to be a disgusting mass of rotten clover.

EXPERIMENT No. 3.— In this experiment, green corn cut and stowed away in the silo as usual, was employed. The trial was made early in the season of 1889, and the silo was uncovered and examined about two months after it had been filled. As with the sorghum and clover, the great mass of ensilage thus treated, was mouldy, musty, and in a state of incipient rottenness, and wholly unfit for cattle food.

These facts seem to me to settle the question of steaming ensilage, so far as the practical man is interested in the subject. In every case tried by us, steaming seemed to give the ensilage a long start in the direction of rottenness.