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# The Farmer 

By Alice L. Webb.

Who used to be the butt of jokes?
The farmer.
Who stood in awe of city folks?
The farmer.
Who bought the gold bricks and said, "I vum!"
And wished that he had stayed 'tew hum'?
Who got least for his work, by gum?
The farmer.
Why buys the autos nowadays?
The farmer!
Who pays the tax for good highways?
The farmer!
Who feeds us all from day to day,
And gives us good, strong men? I say
Who owns this blessed U. S. A.?
The farmer!

## Why the Demand for a Silo?

There is but one answer-the prosperous farmer of to-day reads, and realizes the economic changes that are assisting and materially affecting all other industries. Progress, improved machinery, economy, are as necessary to the success of the farm as to any industry in the world. The wasted by-products of yesterday is converted into a utilized and profitable product of to-day. This most pronounced step of progress and economy was accomplished on the farm when the Silo came to the farmers' rescue.

The farmers are just beginning to centralize their efforts; granges are springing up like mushrooms in all parts of the country; they meet and hear what their fellow-farmers have to say. The Government or State experts impart to them their knowledge from experiments carried on, regardless of expense, from year to year. The wise man is he who benefits himself by the experience of others.

Too many crops are raised for the fruit alone, the straw, the stalks, the by-products being cast into the barn-yard and allowed to waste. The Silo came to solve one of these problems. It presented an always ready economical way of saving a large crop with the least possible waste. It converted the cornstalk from an otherwise withered unpalatable fodder to a sweet succulent food in a cheap, convenient and desirable form. It has done more than this (if you so choose)-it provides for the whole crop, the grain, the stalk undivided, to be fed at your pleasure with no other mechanical agency or expense, converting the labor of a winter into a few days.

## Advantages of the Silo

1. Silage keeps young stock thrifty and growing all winter.
2. It produces fat beef more cheaply than does dry feed.
3. It enables cows to produce milk and butter more economically.
4. Silage is more conveniently handled than dry fodder.
5. The silo prevents waste of corn stalks, which contain about one-third the food value of the entire crop.
6. There are no aggravating corn stalks in the manure when silage is fed.
7. The silo will make palatable food or stuff that would not otherwise be eaten.
8. It enables a larger number of animals to be maintained on a given number of acres.
9. It enables the farmer to preserve food which matures at a rainy time of the year, when drying would be next to impossible.
10. It is the most economical method of supplying food for the stock during the hot, dry periods in summer, when the pasture is short.

## Ten Factors of Profitable Farming

The ten essential factors of profitable farming, as recently set forth by Dr. W. J. Spillman, of the Federal Office of Farm Management, are:

1. Low real-estate prices for the land cultivated.
2. Production of commodities for which the supply is less than the demand.
3. Management of the business on as large a scale as capital and managerial ability will permit.
4. Production fo commodities of the highest quality.
5. A reputation for reliability.
6. Location for good markets available, and ability to buy and sell profitably.
7. Keeping only animals of highest productive capacity.
8. Large yields with relatively little labor and fertilizer.
9. Production at low cost.
10. Production of staple commodities for permanent profits.

## The Silo

The silo is a large cylindrical tank or cistern having air-tight walls and bottom, the height or depth being approximately twice the diameter. It is made for the purpose of storing and preserving green fodder in a chopped-up condition, keeping it in its green state for feeding all classes of live stock at times when natural green pasture is not available. This preserved green feed is called silage. By the use of the silo the entire plant, including stalks, leaves and seed, is "canned" very much as a housewife cans or preserves fruit and vegetables.

Not an Experiment.-While the silo is new throughout the Southwest, yet it has been in use in the United States for over thirty years, ninety-two farmers using them as early as 1882. It has long ago passed the experimental stage. Those who have used it most extensively are its most enthusiastic supporters. It is generally true that the farmer or stockman who constructed his silo long enough ago to thoroughly try out the silage with his stock has already built another, or perhaps a third one.

Advantages of the Silo.-The silo eliminates practically all waste in connection with the feeding of live stock. One ton of
cured forage will make three tons of silage, so that on farms where the forage has heretofore been cut and cured the quantity has been increased two-thirds when handld through the silo.

Loss in Field Curing.-Under field conditions of curing fodder much of its feeding value is lost. Various governmental experiment stations report this loss from 30 to 50 per cent. These reports do not consider losses caused by the wind blowing away the leaves and filling the fodder with sand and dirt. When we take all of these factors into consideration it is safe to estimate this loss at from 50 to 60 per cent. In other words, fully half of the feeding value is lost, resulting from field curing and dry fodder feeding, as is now commonly practiced throughout the Southwest.

Loss in Silo.-Silage retains practically all of the feed value together with all of the suceulence and palatability of the green crop. Every farmer knows the value of green kaffir or sorghum when fed to his dairy cows, steers, sheep, hogs and horses when pastures are dry and short. This indicates the value of an equal quantity of silage given to the same animals in the winter. Good silage is equal in feeding value to the green crop.

Silage may be considered as winter pasture. The silo makes it possible to supply live stock with June feeds in winter months.

Experimental data show that the total loss on feeds stored in the silo does not exceed 10 per cent, if the crops are properly handled, in well constructed silos. This slight loss is unavoidable and is largely due to surface spoilage and to certain chemical changes which take place. Thus the live-stock farmer without the silo often divides one-half of what he raises with the elements, when the silo will save at least 90 per cent of it.

## Place of the Silo in Humid and Irrigated Sections

The farmer in the humid or irrigated section states that the silo is an absolute necessity with him. He has found out that the silo will take the place of pasture where land is getting extremely high in price. He finds silage as valuable for summer as winter feeding. It is the farmer described above who has found out that the silo saves all the feed by making use of the entire crop, stores economically and safely, provides a succulent feed equal to grass, reduces the cost of feeding, stimulates milk production, produces growth and beef cheaply, reduces to a minimum the labor of saving and feeding, and•is a feed on which all classes of live stock do well.

## Place of the Silo in Sections of Limited Rainfall

Conditions are more favorable to silos in the Southwest than in any other section of the United States, and the use is more necessary and of greater benefit. Here it is that live stock must be combined with diversified farming. Under limited rainfall conditions there are very few cash crops. Kaffir, milo maize, and sorghum are the sure crops and in some high-altitude sections corn will take the place of kaffir and milo maize. The farmer who produces the crops named cannot afford to sell them for cash, especially when he stops to consider that he can realize more than twice as much out of them if handled through live stock. Again, the farmer or stockman who handles live stock cannot afford to feed the dry feed when he can make the same feed go more than twice as far if handled through the silo.

The silo permits the storage of crops produced in good seasons for use in seasons of total or partial crop failure. Again, the silo is always ready for storing crops that fail to fully mature. If a kaffir or milo maize crop gets only partially matured, and on account of dry weather or late season will not complete its growth, it can be made into silage at any time, thus preserving the entire crop that would otherwise be practically worthless. The immature crop placed in the silo is often worth more than if it had matured and been fed dry These features are of great importance to the dry-land farmer, giving him a practical insurance of a continuous feed supply.

Is this Business-like?-This question is worthy of closest consideration! Thousands of farmers throughout the Southwest are working hard the year around raising and caring for their fodder crops, and then when these crops are matured 50 per cent of the gross results are allowed to waste through the lack of silos. Enough good feed is going to waste every year on the average farm to build a silo that would hold it, and the silo is good for many years' use if properly constructed and handled.

Mr. C. M. Steed of Clovis, New Mexico, who owns an underground silo having a capacity of 135 tons, recently made the following statement to the writer: " My silo cost $\$ 250$, and I have been milking about 75 cows on an average for the past winter, there being fed a large ration of silage. I have saved enough on my bran bill alone this past winter to pay for my silo. My silo is giving perfect satisfaction, despite the fact that it cost more than it should to construct it. My plans of construction were poor and if I had it to do over I could build it very much cheaper.'"

## Silos and Stock Farming Necessary

The bulk of the crops of the Southwest are feed crops, and these cannot be considered as cash crops. To get the greatest cash income from these crops they must be marketed on the hoof. By combining good tillage methods with live stock farming, silage crops can be produced every year. The entire Southwest is a natural live stock country. We must bring the stock to the feed, instead of shipping the feed to the stock. At present the entire Southwest is not producing enough finished beef, pork, mutton or pouliry products to supply its own demands.

The beef" animal, dairy cow, hog and hen are the factors that must change our southwestern feed-stuffs into more marketable products. It is through this class of live stock that the agricultural possibilities of this country will be developed.

## Silage Feeding

Silage for Dairy Cows.-From the date of introduction of silos in this country, dairymen more than any other one class have found silage an ideal feed. The chief value of silage for dairy cows is in the succulence afforded, placing it on a par with grass for milk production. Silage not only supplies a cheap source of winter succulence, but will also supplant the dry pastures of midsummer, or it may take the place of the pasture system entirely.

As with other farm animals, dairy cows should be fed roughage in the form of hay or fodder in addition to silage. Forty pounds of silage per day is plenty for a cow. The amount of silage fed depends on the amount of other feed given. Silage should be fed after milking, and not before or during the milking period, as feeding at this time prevents the silage odor from getting into the milk.

Less Grain Required.-The results of an experiment conducted by the Ohio Experiment Station on this subject, as found in Bulletin No. 155, show the following:

One lot of cows received over 50 per cent of the dry matter from silage and less than 18 per cent from grain. The second lot of cows received over 57 per cent of dry matter from grain and no silage. The production of the two lots per 100 pounds of dry matter fed was as follows:

Cows fed silage produced 96.7 pounds of milk and 5.08 pounds of butter fat.

Cows fed grain produced 81.3 pounds of milk and 3.90 pounds of butter fat.

This shows the silage-fed lot to have produced nearly one-
sixth more milk and one-fourth more butter fat than the lot given grain ration, and at very much less expense.

Recent results in silage feeding in Minnesota on 12 herds of 216 cows showed an average net profit of $\$ 33.04$ per cow, while 16 herds with a total of 239 cows-to which no silage was fedshowed only a profit of $\$ 22.98$ per cow. This case shows that silage increased the net profit per head to somewhat more than $\$ 10$.

How to Feed Silage to Dairy Cows.-Following are good dairy balanced rations for our conditions:

1. Silage 40 pounds and fodder (milo or kaffir) 10 pounds, wheat-bran 5 pounds and cotton-seed meal 3 pounds.
2. Silage 30 pounds, millet hay 10 pounds, kaffir or milo chops 4 pounds, bran 3 pounds, and cotton-seed meal 2 pounds.
3. Silage 40 pounds, millet 8 pounds, bran $41 / 2$ pounds, cottonseed meal 3 pounds.
4. Silage 40 pounds, cow-pea or peanut hay 8 pounds, kaffir chops 5 pounds, cotton-seed meal $21 / 2$ pounds.
5. Silage 40 pounds, sorghum 10 pounds, kaffir or milo chops 3 pounds, cotton-seed meal $2 \frac{1}{2}$ pounds.
6. Silage 20 pounds, alfalfa 20 pounds, kaffir or milo chops 3 pounds.
7. Silage 40 pounds, cow-pea hay 15 pounds.
8. Silage 40 pounds, bran 6 pounds, ground field peas 6 pounds.

Corn will replace grain or fodder in any of the above rations where kaffir or milo maize is mentioned.

The above balanced rations are calculated as the total amount of feed needed for an entire day for a cow in full milk, weighing the neighborhood of 1,000 pounds, the animal to be fed twice a day, one-half of the ration to be fed at each feeding. it will be seen from the havoe rations-Nos. 4, 6, and 7-that such feeds as cow-pea hay, peanut hay and alfalfa hay decrease the grain ration very much. Many dairymen find that they get extra good milk yields without any grain in connection with plenty of silage, alfalfa, cow-pea or peanut hay. It will, however, pay to feed a small amount of grain with these rations. The three hays mentioned are especially rich in protein or milkproducing elements, but this is not true of millet and the dry fodders. The best grain feeds to buy are cotton-seed meal and wheat bran, both of which are rich in protein. However, it is dangerous to feed live stock too much cotton seed meal, especially dairy cows, 3 pounds per day being considered as the maximum amount for a cow. Where alfalfa cannot be produced the farmer will certainly find it profitable to raise cow peas, field peas or peanuts for hay. By doing this it will not be neeessary to buy or ship in much of such feeds as cotton-seed meal and bran to supply the protein or nitrogen.

Winter Dairying.-Without the silo it is almost impossible to :o profitable winter dairying. Under dry farming conditions it is desirable to breed so that the cows come fresh in the spring, If they freshen in the fall and are dry fed during the winter, the chances are that the majority of the cows will either be dry or nearly so by spring. Summer dairying often does not pay well, prices are poor, flies bad, and other conditions are unfavorable.

On the other hand, with the silo method, cows coming fresh in the fall go through the winter with little if any decrease in milk flow before being turned out to grass. In this way the milk flow will be kept up well through the summer or ?until the early fall, when the cows are dried prior to calving again. Winter dairying, under these conditions, is more favorable than summer dairying-no flies to bother, less other farm labor to interfere and prices are better.

Siliage for Beef Production.-Silage is forcing itself into the feeding ration for beef throughout the entire Southwest. Here it is that pasture grass is depended upon almost entirely, yet it is often not available for the growth of the beef animal more than six months out of the year, the other six months it usually maintains the life of the animal, but makes very little growth or fat.

Many of the cattle men of this section figure on losing a percentage of their herds each year. Some of them figure that if they do not lose over 5 per cent from cold weather and shortage of grass, they are doing well. In these calculations they usually fail to take into consideration the shrinkage in the growing of young stock, which often amounts to as much as 150 pounds the average animal. For example, take a steer of 900 pounds, allow him to run on the range all winter, and by the time grass comes again he will weigh about 750 pounds, which loss at 5 cents per pound would amount to $\$ 7.50$.

Place the same steer on a silage ration at the beginning of the winter, and instead of a loss of 150 pounds he will gain that much, a saving of $\$ 15$, and has not consumed more than $\$ 5$ worth of silage, provided that he has been fed 40 pounds daily, an average feed for 120 days. This represents a clear saving of $\$ 10$ on this one steer alone, to say nothing of the thousands of others that could be handled in the same way, besides saving the total weight of the 5 per cent in number which the cattle man had expected to lose through death on account of feed shortage and cold:

To show further the value of silage for beef production, we give the following, which tells of Mr. B. F. Markland's experience at Altus, Oklahoma, during the first five months of 1913 :

January 1 Mr. Markland bought 30 head of Panhandle calves at $\$ 35$ per head. He fed these calves a good ration of silage
and a small amount of cotton seed meal. Five months later he sold the calves on the Fort Worth market for $\$ 60$ per head. After paying for the feed and all other expenses and derlucting a liberal salary for himself, he states that he still had $\$ 400$ profit.

During the winter of 1911-12 the Texas Experiment Station conducted a steer feeding experiment on the farm of Col. 'T. S. Bugbee of Clarendon, Texas, comparing silage with cotton-seed hulls, with the following results:

Cattle used were 40 head of range bred three and four-yearold grade Shorthorn and Hereford steers. They were fairly uniform as to conformation, quality and condition. The average weight when the experiment began was 904 pounds and the value per head was $\$ 42.50$.

The feeds used were cotton-seed meal, cotton-seed hulls, silage and hay, all of average quality. The silage was composed of about 75 per cent of milo maize, 15 per cent of corn and 10 per cent of sorghum. The cost of the feeds was as follows:




When on full feed the rations were as follows:
Lot 1. Cotton-seed meal 7 pounds and hulls 30 pounds.
Lot 2. Cotton-seed meal 7 pounds and silage 50 pounds.
It is stated that Lot No. 2 was also fed a small amount of hay.

The results of the experiment, showing a profit of nearly $\$ 10$ per head in favor of the silage-fed steers, were as follows:

Lot 1, on hulls, profit per head__-........- $\$ 0.75$
Lot 2, on silage, profit per head_-.-.-.-.--- 10.40
The results showed that the silage was the cheapest feed, and there was practically no shrinkage difference in the two lots in shipping, while the dressing percentages were practically the same. The silage steers showed better finish and brought 20 cents per hundred weight more than the hull-fed steers on the market.

While silage provides succulence and roughness and places the animals under grass conditions, yet it is advisable to furnish some feed in addition that is rich in protein or nitrogen that produces muscles, bone, hair, etc. Alfalfa, cow-pea hay, peanut hay or field-pea hay is rich in protein and makes a good combination with silage. Cotton-seed meal in small quantities of from 2 to 3 pounds per day is a good addition to this silage ration. For a fattening ration this cotton-seed meal can be fed in larger amounts for short periods only.

Ordinarily when alfalfa hay is worth from $\$ 12$ to $\$ 15$ per
ton for beef production, silage is worth from $\$ 5$ to $\$ 6.25$ per ton. Feeding experiments on beef production at the Iowa Experiment Station during 1911-12 on two-year-old steers showed silage at $\$ 3.20$ per ton to be equal to clover hay at $\$ 7.66$ per ton.

Silage for Sheep.-Silage is especially valuable to stimulate the milk flow of ewes with lamb, but it should not form more than one-half the ration. Good silage, that is not mouldy or too acid, is very desirable feed for winter feeding of both ewes and lambs. Silage-fed ewes giving too much milk at lambing time should be allowed a limited ration of silage shortly before the time of birth. It must be remembered that silage is a milk producer, and that there is some danger of feeding too much at lambing time. Some dry roughness should always be combined with silage for sheep feeding, preferably alfalfa, cow-pea hay or field-pea hay. A good grain ration to combine with the silage may be composed of about two parts kaffir or milo, with one part of oil meal or cotton-seed meal.

Silage is an excellent feed for fattening lambs and older sheep as well as for ewes. It increases the gains and cheapens the ration. Lambs should be brought to a full silage ration very carefully and slowly to prevent scouring. Two pounds per day will be sufficient silage for lambs in addition to other dry roughage and grain. Year-old fattening sheep will require more feed, both of silage and roughage, three pounds of silage being about right for a daily ration.

Silage for Horses.-Mouldy silage is not good for horses. Horses do well on a small amount of silage fed with other feeds. Young growing horses, as well as older ones that are not working, will make good use of from 5 to 15 pounds of silage daily. For work horses, silage is too washy to be fed in quantity over 4 to 5 pounds daily.

Silage for Hogs.-The hog is not a roughage-eating animal, although grass is a necessary addition to its ration. Silage will take the place of grass to a large extent, although it is bulky and low in feeding value for the hog's limited digestive capacity. Many hog breeders claim that silage makes an excellent and succulent feed for brood sows, causing them to produce strong, healthy pigs. A small amount of silage is good for the hog and it makes a saving in the cost of feeds.

Silage for Poultry.-Silage fed in small quantities is an excellent pounltry feed. It takes the place of grass in the winter feeding ration. Silage within itself is not much of an egg producer, but it furnishes succellence, which is very necessary, helping to keep up the general condtion of the flock, thereby producing desirable results.

## Silage Crops

Kaffir corn, milo maize, and the sweet sorghums must be considered as the best silage crops for the entire Southwest. These crops are drouth resistant and more depndable than corn. Corn is considered the best crop for silage in what are known as the "Corn States". It may also be best in the higher altitudes, like certain sections of New Mexico, and in some of the irrigation districts.

Kaffir Silage.-There is no question but that kaffir is the best general crop for silage throughout the entire Southwest. It will out-yield corn in both seed and fodder, it is dependable and produces feed that is equal if not superior to corn grown in the Southwest. Feeding experiments show silage made from this crop to be equal to corn silage. In a recent report from the Kansas Experiment Station, kaffir silage and cotton-seed meal produced the highest profit in a calf-feeding experiment, the second best results coming from sweet sorghum and cottonsed meal. The calves used in the experiment were high-grade Herefords. The Kansas station reports that it cost $\$ 2.66$ per ton to produce the kaffir and cane silage and that the corn silage cost $\$ 3$ per ton. The cost of the added weight on these calves, per 100-pound gain of the animals under test, was:

Kaffir silage and cotton-seed meal_-_-_----- \$3.27
Sorgham silage and cotton-seed meal_----- 3.46
Corn silage and cotton-seed meal_--------- 3.60
Corn stover, shelled corn and alfalfa hay_--- 3.66
Corn silage and alfalfa hay_---------------- 3.83
Kaffir is ready to be siloed at the time the seed is in the dough stage and before it is thoroughly ripe. Stunted kaffir without seed makes good silage and should be cut before it dries up. It will pay to cut and silo this crop, even if it does not make more than one ton per acre. In this way the silo will save what otherwise is usually lost.

Sweet Sorghum Silage.-Until recently the sweet sorghums have usually been considered a poor substitute for corn or kaffir in the silo. The conditions under which this crop grows in sections of limited rainfall overcome the difficulties found in other sections. Many claim that sweet sorghum silage contains too much acid. This is often true unless the crop is made into silage at the proper stage, this stage being at the time the seed is in the dough, beginning to harden. Sour or acid silage comes from putting up the crop too green. Sorghum made into silage by itself does not make as good quality as is the case in mixing it
with one-half kaffir or milo maize as the silo is being filled. Sorghum for silage should be grown in rows and cultivated the same as kaffir.

Milo Maize for Silage.-Milo maize does not produce as good quality of silage as kaffir or sweet sorghum, although it is a crop worth filling a silo in case the supply of kaffir or sweet sorghum is not sufficient.

Corn for Silage.-Indian corn, where used for silage, should be placed in the silo, ear and all, at the time the corn is getting into the hard dough stage.

Other Silage Crops.-Cow peas grown with kaffir and other crops improves the feeding qualities of the silage very much. The cow peas furnish the protein or nitrogen part of the feed, which is very necessary and costs so much when bought in the form of cotton-seed meal and oil meal. Field peas are equal to cow peas as a silage crop, especially when mixed with corn or other crops.

Usually it does not pay to make silage of alfalfa. The improvement shown in making silage of it is not sufficiently great over the dry hay to justify the expense of the process.

## Making the Silage

The crop for silage should be cut while green, before the leaves dry, and at the time the seed is in the dough stage. The entire plant cannot be placed in the silo in its whole condition, and it must be cut into short lengths of one-half to one inch.

Cutting the Crop in the Field.-The cutting can be done with corn knives by hand, or with a corn harvester, the latter being preferable. The crop as it is being cut should be delivered directly to the silage cutter, not being allowed to partially dry, but should be made into silage at once.

Cuting the Silage.--The silage cutter must be placed near enough to the silo so the feed can run directly into it from the machine. The green fodder as it comes from the field is run through the cutter, lengthwise, and is chopped into lengths of one-half to one inch.

Is Anything Added to this Silage?-The question is often asked: "Is salt added to the silage?" no. There is no advantage in adding salt. Nothing else is added unless it be water.

Water Added.-Water is added to the silage as it is being placed in the silo only under condition that the crop being placed in the silo is too ripe to dry. Enough water is added to make up for the juice that should naturally be contained in the plant. This water should be thoroughly mixed with the
silage. If a blower elevator is used the water should run into the blower through a pipe or hose from a tank or barrel, keeping a steady stream running all the time.

The question is asked: "How much water shall I add?", There is more danger of not adding enough water than too much. Add about as much water as the silage will hold without accumulating. Silage is not pickled in its own juice like sauer kraut, but all the juice is held within the stalks and leaves. Remember that no water is added unless the silage crop is too dry or overly ripe.

Silage from Dry. Fodder.-It often happens that all of the silage is removed from the silo at a time when a large amount of dry fodder is still available. It may be desirable to make silage out of this fodder before grass comes on. A fair grade of silage can be made from this fodder by running it through the silage cutter into the silo. In this case a large quantity of water must be added to make up for the dried-up juices naturally in the green plant. This water should be thoroughly mixed with the cut-up feed and should be running into it constantly as the silo is being filled. At the time the silo is finally filled, more water should be added at the top. In a silo holding 100 tons or more the writer has known of instances where a threefourths inch stream was allowed to run into the top for at least 24 hours, with good results.

Tramping Necessary.-During the time the silo is being filled the silage should be kept well distributed and thoroughly tramped, especially around next to the wall. The tighter the silage is packed the better it will keep. This is particularly true of that feed which is near the top of the silo. By thoroughly tramping the top less silage will spoil than when it is left loose.

Remember that the thorough distribution of the silage and packing it as the silo is being filled has much to do with its keeping qualities. If the cut material is allowed to drop all in one place, and has no further attention, the constant falling of the feed will tend to make that portion more solid, while the outside will be loose, and the coarse materials will roll to the outside while the finer portions will remain in the center, rendering the silage less uniform than with a general distribution and thorough packing.

Surface Spoilage.-Feeding may begin immediately after filling the silo, but usually some time passes before the feeding starts, and in this case the exposed surface will mould and spoil to a depth of from a few inches to a foot or more, depending on the amount of tramping at the top. The top is often covered with chaff, chopped bear grass or something else, to prevent the spoilage below. Oats are sometimes sowed thickly on the top and are watered occasionally, causing them to sprout and form
a sod which protects the silage. As the silage settles, it tends to draw away from the walls, but by tramping around the edges every day for a week or ten days, the spoilage can be decreased very much. Water should be added to the surface for a few days, especially if it becomes dry. On account of the danger of some surface spoilage, it is advisable to remove the seed from the last two or three loads placed in the silo, as the grain which might otherwise be lost can thus be saved.

Number of Men Needed to Fill Silo.-The number of men and teams needed for hauling the silage crop to the cutter will depend upon the distance the haul is to be made, the size of the cutter, the engine, and the size of the loads. Just enough teams should be used to keep the cutter going. At least one man is required in the silo, another to run the cutter and a third to operate the engine.

Co-operation Advisable.-Neighbors owning silos will find it advisable and profitable to "exchange" work in silo filling, and also in the buying of silo-filling machinery, as in this way the burden of labor and expense is greatly lightened for all parties.

Is it Necessary to Fill Silo all at Once?-It is not necessary to fill silo all at once, or continuously, unless the feed crop is drying too rapidly. Suppose the silo is to be filled from two or three different fields, these maturing at various times. In this case the field first maturing is siloed and thoroughly tramped into place. The top of the first filling may spoil to a slight depth before the second becomes matured, in which event it is only necessary to remove the spoilage and continue the filling as the succesive crops mature.

Is it necessary to Remove all Silage from Silo each Year?The foregoing question is easily answered-no. Any part of the silage not needed this year can be held over until next year, or longer, if necessary. At any time when it is desirable to fill the empty part, all that is required is to remove the spoiled surface and begin placing the new silage on top, just as though it contained nothing or was entirely empty. Silage will keep for an almost indefinite time, instances being on record of perfect condition at the end of seven years.

Frozen Silage.-No bad results come from feeding silage that has been frozen, provided it is fed as soon as it is thawed, but silage spoils very soon after thawing. It should not be fed in the frozen state. When thawed it is eaten with the same relish as though it had not been frozen.

Cost of Silage.-Col. T. S. Bugbee of Clarendon, Texas, states that he can produce the silage crop and put it in the silo for $\$ 2$ per ton. Col. O. Keiser of Canyon, Texas, states that the cost of silage, counting interest on the land, cost of raising and gathering the silage crop, silo depreciation, also on the filling
and farm machinery, is about $\$ 1.30$ per ton, according to his records during the past two years. The writer is certain that the cost may be safely placed at $\$ 2$ per ton.

Changes that Take Place in the Silo.-The silage being placed in the silo in its green, wet condition, soon heats. No alarm need be felt on account of this, as it is perfectly natural. This heating continues for several days, after which the silage gradually cools off. Slight fermentation takes place. This process requires air. The silage carries only a limited amount of air into the silo, and as soon as this is exhausted the fermenting process stops.

The odor and acid taste of the silage is due to a chemical change of the plant sugar to organic acids. This process that goes on in the silage softens the contents of the silo and partially pre-digests it, while the heating process partially cooks it, and the two combined really render the feed more digestible and palatable than it was in the natural state.
Machinery.-Machinery required for filling the silo consists of a silage cutter, with an elevator or blower, but the elevator or blower attachment is not necessary in filling the underground silo. An engine or horse power is also required to furnish power.

Silage Cutter.-The size of the cutter required depends on the rapidity with which it is desired to fill the silo, and also on the available power. For small farms and silos, where an engine is not to be had, a two or three-horse sweep or tread power may be used with a cutter having a capacity of from two to four tons per hour, depending on whether the silage is elevated or dropped into a pit.

It is usually desirable for a farmer to own his own cutter. Often it is a good plan for several neighbors who own silos to co-operate in buying both the cutter and the power or engine, a gasoline engine being excellent for this purpose. A cutter having a capacity of from three to four tons per hour can be secured with elevator for about $\$ 100$, and without the elevator this same cutter will cost about $\$ 40$. An engine of 3 horsepower will run the cutter without the elevator, while one of 5 to 7 horse-power will be required where the elevator is used. A 13 -inch cutter without elevator and with a capacity of 4 to 6 tons per hour and requiring an engine of 2 to 4 horse-power to run it will cost about $\$ 65$. With carrier or elevator 30 feet long this cutter will cost about $\$ 130$, and will require from 6 to 8 horse-power engine.

Oftentimes the owner of a threshing outfit can be induced to buy a large size cutter, and an outfit of this kind can be hired by the day. Sometimes two or three farmers will go together and buy a cutter, and then hire someone with a thresher engine to furnish the power. About twice as much power is
requared for a cutter with a blower attachment as where no blower is used, and the common carrier requires very much less power than the blower. Thus it will be seen that without either the blower or the elevator the owner of an underground silo can get along with less expensive cutter and power machinery.

The machinery, like the silo itself, should be made of firstclass material, not being purchased too much with the idea of cheapness. It will pay to secure good, standard machinery.

## Silo Construction

Two Types.--In this part of this book two general types of silos are recognized: Those above ground and those under ground. The underground type will be handled largely from the standpoint of low cost of construction and its adaptability to the needs of the farmer or stockman of limited means.

Materials used in both types of silos, as well as the class of their construction, should be first class in every respect, as silo losses depend largely upon the construction. Silo walls and bottoms must be air-tight.

Shape of Silo.-The shape of the silo should be that of a cylinder-round without corners, as silage cannot be packed sufficiently tight in corners to keep the air out, and thus prevent spoilage. The walls must be rigid with little or no tendency to springiness, and they should also be smooth on the inside so as to offer no obstruction to the settling of the silage.

The depth should be as great as practicable in proportion to the diameter, so as to keep the exposed feeding surface small, and at the same time to secure pressure.

Depth and Diameter.-The advisable depth of a silo is twice its diameter. The diameter is controlled by the size of the herd to be fed, and the depth by the length of the feeding period. In order to feed silage faster than there is danger of it spoiling, about 2 inches should be removed from the entire surface each day. The silage should be removed evenly from the surface, and not gouged out first here and then there. By removing 2 inches of silage daily, 5 feet will have been removed at the end of 30 days, and a silo that is 30 feet deep will furnish feed at this rate for 180 days, or 6 months.

Capacity of Silo.-The size of the silo should be made in proportion to the size of the herd to be fed. Since the capacity of round silos is not so readily computed as in the case of rectangular silos, the following table shows at a glance the approximate number of tons of silage that a round silo, of a diameter from 10 to 26 feet, and from 20 to 32 feet deep, will hold, of well-matured silage, in tons:

| Depth of Silo, Feet. | Inside Diameter of Silo, Feet. |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 10 | 12 | 14 | 15 | 16 | 18 | 20 | 22 | 24 | 26 |
| 20. | 26 | 38 | 51 | 59 | 67 | 85 | 101 | 127 | 151 | 177 |
| 21. | 28 | 40 | 55 | 63 | 72 | 91 | 112 | 135 | 161 | 189 |
| 22 | 30 | 43 | 59 | 67 | 77 | 97 | 120 | 145 | 172 | 202 |
| 23. | 32 | 46 | 62 | 72 | 82 | 103 | 128 | 154 | 184 | 216 |
| 24 | 34 | 49 | 66 | 76 | 87 | 110 | 135 | 164 | 195 | 229 |
| 25. | 36 | 52 | 70 | 81 | 90 | 116 | 143 | 173 | 206 | 242 |
| 26. | 38 | 55 | 74 | 85 | 97 | 123 | 152 | 184 | 219 | 257 |
| 27. | 40 | 58 | 78 | 90 | 103 | 130 | 160 | 194 | 231 | 271 |
| 28. | 42 | 61 | 83 | 95 | 108 | 137 | 169 | 204 | 243 | 285 |
| 29. | 45 | 64 | 88 | 100 | 114 | 144 | 178 | 215 | 265 | 300 |
| 30. | 47 | 68 | 93 | $-105$ | 119 | 151 | 187 | 226 | 269 | 315 |
| 31. | 49 | 70 | 96 | 110 | 125 | 158 | 195 | 236 | 282 | 330 |
| 32. | 51 | 73 | 101 | 115 | 131 | 166 | 205 | 248 | 295 | 346 |

As there will be from 5 to 6 feet of settling, the silos will not have the capacities shown in the foregoing unless they are refilled.

## Acreage Required to Fill Silos, Including Feeding Capacity

The following table does not claim to be accurate as to fractional parts of acres required for filling, neither minutely exact as to number of cattle to be fed, but is as safe as a table of the kind can be made, taking into consideration certain and everpresent variations in quality and density of silage, etc.

| Dimensions. | Capacity, tons. | Acres to fill, 5 tons per acre. | Cows it will keep $6 \mathrm{mo},. 40 \mathrm{lbs}$. of feed per day per head. |
| :---: | :---: | :---: | :---: |
| $10 \times 20$ | 28 | 6 | 8 |
| $12 \times 20$ | 40 | 8 | 11 |
| $12 \times 24$ | 49 | 10 | 13 |
| $12 \times 28$ | - 60 | 12 | 15 |
| $14 \times 22$ | 55 | 11 | 12 |
| $14 \times 24$ | 61 | 12 | 15. |
| $14 \times 28$ | 67 | 15 | 23 |
| $14 \times 30$ | 87 | 17 | 25 |
| $16 \times 24$ | 67 | 15 | 23 |
| $16 \times 26$ | 87 | 17 | 25 |
| $16 \times 30$ | 115 | 23 | 32 |
| $18 \times 30$ | 124 | 24 | 35 |
| $18 \times 36$ | 135 | 27 | 41 |

It is safe to say that we can depend upon securing at least 5 tons of green kaffir, sorghum or milo from an acre any average season, and in many years the yield will be greater.

Amount of Silage required.-The following table shows approximately the feeding rations of silage for different classes of live stock:

| Kind of Stock. | Pounds Daily. |
| :---: | :---: |
| Dairy Cows. | 25 to 40 |
| Stock Cattle (wintering ration). | 25 to 40 |
| Fattening Cattle (18 months to 2 years) | 15 to 30 |
| Sheep (ewes). | 3 to 5 |
| Fattening Lambs.. | 3 to 5 |
| Fattening Sheep.. | 3 to 4 |
| Horses................ | 5 to 15 |

Fioundation.-Whatever material is used in silo construction, wood, brick, stone, concrete or metal, it should stand on a good, solid foundation. A concrete foundation is as good as can be made. Excavation should be made deep enough to give the footing a solid bottom. In constructing a concrete foundation it is a good plan to set bolts in the cement before it sets, having the threaded ends stick above the surface far enough to pass through the sill or bed plate of the silo. This furnishes a means of anchoring the silo to the foundation.

The inside of the foundation should be made flush with the inside of the silo, especially if the bottom of the silo is below the top of the foundation. The thickness of the foundation wall should be from 15 to 20 inches at the base, but may be drawn in at the top to from 8 to 12inches, the misture being one part of cement to three parts of sand and three to five parts of gravel, this furnishing a good construction.

Floor.-The underground silo does not require a floor. In order to prevent rats from working under the silage in the silo constructed above the ground, it is usually a good plan to make a concrete floor. This floor should have a drain which is protected against rats and vermin. The accumulated juices from silage, gathering in the bottom, should not be allowed to cover any part of the silage, as it will cause it to spoil.

Roof.-As far as the keeping qualities of the silage is concerned, a roof on the silo is not necessary. The roof sometimes strengthens the silo construction, besides adding to its appearance. In humid sections heavy rains should be kept out, and in such localities the roof is needed. In sections of limited rainfall no damage comes from rain. The underground silo top should be protected from dirt or sand.

Cost of the Silo.-The cost of the silo depends upon size, material used, workmanship and type. Silos constructed above the ground cost more than those under the ground. Wooden silos, which are the oldest and most generally in use, cost from $\$ 2$ to $\$ 3$ per ton capacity, depending on size, the smaller costing more in proportion than the larger ones. Concrete silos usually cost slightly more than those constructed of wood. The metal silo has perhaps the highest cost of any on the market at present. The costs mentioned in this connection represent first costs and not those of maintenance, the latter being very small. The cost of the underground silo is about $\$ 1$ to $\$ 1.50$ per ton capacity, depending on size, it being understood of course that the larger sizes are built at a decreased cost as compared to the smaller ones.

## Wooden Silos

Location of Silo.-Location is an important matter, as the silo should be placed as close as possible to feeding pens or barns, the feeding of silage being an every day matter during the whole winter. If the silage is to be fed in the barn, it is advisable to construct the silo in connection, as this will be found to greatly facilitate the handling of the feed.

Stave Construction.-The wooden stave silo is simple of construction, and is therefore not an expensive type. It is this type of silo that has been favorably mentioned by agricultural writers for many years. Commercial stave silos are on the market in large numbers, each having its own peculiar talking points or merits.

It is known that a well-onstructed wooden silo will preserve silage as good, if not better, than any silo now on the market. It is a type of silo that can be constructed quickly and cheaply. In the construction of this type of silo, especially in the entire Southwest, it pays to use the best materials obtainable. It does not pay to use cheap lumber, redwood, cypress, and fir being considered the best materials for wooden silos, as the contraction and expansion of these woods is very limited under either dry or wet conditions.

The main objection urged against the wooden stave silo throughout the Southwest is that the staves shrink during dry weather, or at the time when the silo is empty, and expand again at the time the silo is filled. There is no question of the application of this objection to the poorly constructed silo, or one made from an undésirable grade of lumber, and even the well-constructed silo made of suitable woods in not entirely free from this criticism. Extreme dry and hot weather causes the best of wood to contract slightly, and at the time of such con-
traction the slack should be taken up by tightening the hoops or metal bands always found at regular intervals or spaces apart, to hold the stave construction together. When the silo is re filled, the hoops or bands should be loosened as much as 'they were tightened to meet the expanded condition, following the contraction.
The wooden stave silo that is allowed to dry apart too much without having the slack taken up, is likely to be blown down or to become loosened from the foundation during high winds. All staves should be tongued and grooved, as in the absence of this precautionary method or process the continued shrinking and swelling will create cracks sufficiently large to admit air. With a variable lumber of poor grade and grain skrinkage cannot be entirely taken up by the tightening of the hoops.

Desirability of the stave silo depends upon the material, construction and care with which the hoops are tightened and loosened to meet the variant moisture conditions, and likewise on how well it is painted inside and outside, as coal tar on the inside and paint on the outside will greatly increase the life of the construction.

The wooden stave silo in addition to being placed on a good foundation should be well braced with guy wires and securely anchored.
"Common Sense" Wooden Silo.-This type of silo is constructed of $2 \times 4$ 's laid flat-wise on each other, producing a structure of octagonal form, or having eight sides, with as many angles or corners. This silo most nearly approaches the round construction, and for this reason is far better than the square one, as the latter presents four sharp corners. These $2 \times 4$ 's are laid around rather than up and down, thus making a strong construction.

This silo is painted on the inside with roof coating, and then lined with roofing paper, and should also be painted on the outside the same as other farm buildings. It is a good plan while laying the $2 \times 4$ 's upon each other to put some kind of a coating like coal tar between the layers or courses. These silos are sometimes furred, weather boarder, and painted, as a means of assuring prolonged life.

Some criticism comes from owners of these silos, setting forth the high cost of material required for the making of the 4 -inch wall, and also that the lining or roofing paper sometimes cracks, and that it is a hard matter to pack the silage tight enough in the corners to keep out the air. There is contraction and expansion in this type of silo to limited extent. This silo is a good one when properly made of first-class materials.

## Concrete Silos

The concrete silo has been given a thorough trial throughout nearly all of the dairy and stock feeding districts of the United States, and is now past the experimental stage, with results showing that it not only preserves the silage, but is durable, cheap in construction and well adapted to Southwestern conditions. Concrete silos are more cheaply and readily constructed in sections having an abundant supply of sand and gravel, as these materials enter largely into the construction.

For Southwestern conditions the concrete silo has an important place, as it can easily be made air-tight, and does not shrink or expand to any appreciable extent by dryness or moisture. A concrete wall is a poor conductor of heat and cold, and therefore the silage is kep.t at almost uniform temperature. It has sufficient weight and strength to withstand severe windstorms, and its cost does not exceed that of the average over-ground type of silo.

Concrete silo construction requires skilled labor and cannot properly be put up by the average farmer or stockman; however, one expert can erect the silo with the assistance of the farmer or stockman.

With concrete construction like that of wood and metal, it pays to use only the best of material and workmanship, special care being taken to avoid the use of dirty sand or gravel and an inferior grade of cement.

Unfavorable Criticism of Concrete Silos.-Statements are in constant circulation by representatives of different types of silos to the effect that silage does not keep well in concrete construction. Statements of this kind are erroneous, even though it is true that a part of the silage does spoil in some concrete silos. It is equally true that the same thing occurs with wooden and metal silos.

The truth of the matter is that properly put up silage keeps as well in properly constructed concrete silos as in most other types.

Many concrete silos have been faulty on account of the use of poor materials, improper reinforcing of the walls, porous walls that are not absolutely air-tight and poor foundations. Many wooden and metal silos have produced bad results because of the use of poor workmanship and poor materials, and yet this does not prove that all wooden and metal silos are failures.

Solid Wall Silos.-The solid wall concrete silo is now in more general use than any other concrete type. This silo is constructed as a one-piece wall. A two-piece mould, one for the outside and one for the inside, is required, and between this
the wall is cast. The mould may be made of wood or sheet iron to a height of from 3 to 8 feet, thus requiring that the wall be made in sections. The mould should be adjustable, so that it may be easily removed from the freshly cast wall to a position for the next section above, and so on to completion.

The thickness of the solid wall is usually from 6 to 8 inches When this type of silo was first used it was customary to construct the walls very thick, and no metal reinforcements were used. Later, it was found that much stronger walls could be made by making them thinner and using metal reinforcements in them, this reinforcement being in the form of woven hog wire, bands of iron or strands of wire placed in the center of the concrete wall as hoops during the time it is being cast into the mould.

To make the solid wall concrete silo or any form of concrete silo perfectly air-tight and water-proof, the inside of the wall should be washed or painted with pure cement and water as soon as the mould is removed. A good wall is made of one part cement, two parts of clean, sharp sand, and 4 parts clean gravel or broken stone.

The hollow wall concrete silo is more expensive than the solid wall, and is no better for Southwestern conditions. It is especially adapted to cold sections where there is danger of the silage freezing.

Concrete Block Silo.-There is no question but that the concrete block silo is better adapted to conditions prevailing with the average farmer than any other concrete type. With a little knowledge of concrete mixing, he can construct the blocks at home. These blocks can be made in commercial moulds, or home-made moulds. The commercial mould usually makes a hollow block having circular form, while the home-made mould makes a solid block not circular in form. The hollow block shows a saving in material and adds a dead-air space to the wall. The dead-air space has no particular value for Southwestern conditions, but is not at all objectionable. The circular form of block lays in the wall to an advantage without causing open joints on the outside. These open joints are overcome in the home-made straight-faced block by making the block slightly longer on its outside face than on its inside face. The regular dimensions for solid blocks are about $8 \times 8 \times 16$ inches, and for hollow blocks $8 \times 10 \times 16$ inches.

The required reinforcement which takes the place of the hoop on the stave silo is placed between every second course of blocks. This reinforcement is in the form of an iron rod, heavy wire like No. 6, or several strands of smaller wire twisted together and made into the form of a hoop, with the ends tied together. The reinforcement is laid into a groove cast in the block for
that purpose. After the reinforcement is placed, the groove is filled with rich cement mortar made of about one part cement and two parts sand. Enough of this mortar is then spread over the top of the course of blocks for laying the next course of blocks.

The block silo is made air-tight by plastering the inside directly on the blocks with a rich cement mortar. This is done before the mortar between the blocks sets, thus causig the plaster to set to it. The completed plastered wall is finally washed on the inside with pure cement and water.

Col. E. S. Bugbee of Clarendon, Texas, has five block silos of 150 tons capacity each, which he constructed at home with farm labor, the block mould bseing home-made $8 \times 8 \times 16$ inches, with groove for reinforcement. These blocks were made 15 inches long on the inside and 16 inches long on the outside face, which made them lay to a circle without causing open joints on the outside. The blocks were laid and the inside plastered with no labor excepting that available on the farm.

Colonel Bugbee states that the entire cost of these silos, holding 150 tons each, was $\$ 250$ per silo. It is the stated intention of this gentleman to build a number of addition silos of the same type this year.

Cement Plastered Silos.-The cement-plastered silo is not a common construction throughout the Southwest, although it is being found very successful and practical, and is made by using metal lath as reinforcement and also as a form on which to plaster. This lath is held in place in the circular form for a silo by use of temporary studding placed on the outside. With the studding in place, about three coatings of cement are applied to the inside. These three coats as soon as set are strong enough so the studding can be removed, after which from two to three coatings of cement are applied to the outside. This completes the wall except the washing with pure cement and water. This wall is from $21 / 2$ to 3 inches thick, resembling a silo cast in a mould.

Cement Stave Silos.-The cement stave silo is of recent origin, only a very few being in use. They promise, however, to be all right, and we belive that they will fulfill the requirements placed upon them. The cement staves $2 \times 10 \times 30$ inches are made like cement blocks before being placed in the silo, the staves being properly cured are tongued and grooved, set on a good foundation, and are held in place by means of iron hoops like the wooden stave silo. After being erected the cement stave silo im made air-tight by use of an inside covering of waterproofing.

## Metal Silos

Metal silos are now coming into use throughout many of the Southern states. This is a new type of silo, the use of which has not been fully demonstrated in all sections, but the results, so far as observed thus far, are proving very satisfactory, and we know of no reason why this type should not prove a success from every standopint.

The common objection to the metal silo has been that the silage acids will injure the metal, but the manufacturer is overcoming this by protecting the-metal with some sort of paint. It may be said in support of the metal silo that it does not dry apart, nor is it so subject to blowing down as those silos made of lighter materials, or those materials used in the form of strips or staves. The present cost of the metal silo is somewhat higher than many farmers care to pay.

## Underground Silos

The underground silo is exceptionally well adapted to those districts having a limited rainfall, and in such localities may with impunity take the place of the over-ground construction. It is distinctly a Western type, and the Western farmer and stockman, especially those of limited means, find it possessed of many interesting and worthy features.

No longer an experiment, the underground silo has a value that is fully demonstrated. In New Mexico, Texas, and Colorado, as well as Nebraska, a number of these silos have been in constant use for years, giving perfect satisfaction. The underground type, if properly constructed, will keep silage as well as the average silo of the over-ground variety and will be found to justify all reasonable claims made for it.

The underground silo is not only free from the possibility of blowing down or drying apart, but has no hoops that need tightening or expanding, and the expense of maintenance is comparatively nothing. Its type of construction appeals strongly to the man who has but little capital and who desires a silo. It can be built by the farmer himself when he is not otherwise engaged on the farm. The cost of construction is conservatively placed at from $\$ 1$ to $\$ 1.50$ per ton capacity, which includes the price of materials and labor.

Not only is the cost of construction of this silo cheap and favorable to the farmer who desires to make a dollar go as far as possible, but owing to the fact that neither a blower nor an elevator is required in connection with the silage cutter, expensive machinery is unnecessary. The silage cutter without con-
veyor costs about one-half as much as with the combination. The power required is about one-half as much with the cutter alone as compared to cutter and conveyor combined.

Construction.-As stated in the outset, the underground silo is especially well suited to sections where this is limited rainfall, but it is equally true that it should not be constructed in wet ground, or where the water is near the surface.

The walls should be even and perpendicular, the depth about twice the diameter, and the size of the hole, which is round, proportioned to the number of animals to be fed. The assumption that an underground silo must of necessity cover a wide area at the expense of its depth, thus causing a great loss through spoilage on account of its extensively exposed surface, is illy based and has no legitimate place in the consideration of this important construction. There is no more reason for the assumption that the underground silo should have a width out of harmony with its depth, than that the over-ground construction should be equally disproportionate with the accepted rules of is especially weel suited to sections where there is limited rainsilo building. There is no reason why the depth should not in all cases conform to the rules of dimensions applying to the overground silo, namely: Depth equal to twice the diameter.

Cement Covering.-The earth wall of the successful underground silo must necessarily be covered with cement to prevent the silage juices from being absorbed. If the earth wall stands well, without danger of caving, a $1 / 2$ to $3 / 4$-inch covering of good, rich cement plaster on the dirt will be found sufficient. It is often found advisable to plaster on close-mesh rabbit wire that has been securely anchored to the dirt wall, this plaster being put on in from two to three coats, the first being a roung or scratch coat. The first two coats will be well constructed if made of about one part cement to four parts of clean sharp, sand, while the third coat should be made of one part cement and three parts of sand. In applying these coats of cement the second should be put on before the first gets well set, and the third should be put on before the second gets set.

In order to save the necessity for scaffolding in the application of this plaster, it should be put on at the time of digging the hole, beginning at the top and finishing downward in sections as the excavation progresses.

If there is danger that the earth wall will cave, or not stand well, the applied cement wall should be made from 2 to 3 inches thick, a wooden or metal mould or form being required to hold the cement in place until after it "sets." This mould or form need not be over 3 feet in height, which arrangement requires that construction of the cement wall begin at the bottom of the silo, and the structure will be in sections of 3 feet each, rather
than all at one time. Thus three feet at each placing of the mould or form, the wall is continued upward from the bottom until the top is reached. The form is moved up as rapidly as the section which it last held sets. A good mixture of this wall will be made of about 1 part cement, $21 / 2$ parts sand and $21 / 2$ parts of gravel or broken stone. This mixture should be made wet enough to pour, and must be tamped or stirred enough after being placed in the mould to insure driving out all air and closing open spaces.

The top of the underground silo should be constructed sufficiently high above the surface to keep out storm or flood waters. This cement wall or plastering should not be considered as finished until after it has been plainted or washed with pure cement and water, which can be easily applied with a whitewash brush or broom. This wash fills up all pores and small openings, thus making the wall both air-tight and water-proof. It is not necessary to construct a floor in this type of silo.

Removal of Silage.-Perhaps the main objection against this type of silo has always been that it is too laborious to elevate the silage from it, but this is not so serious as it has often been represented, and is largely offset or over balanced by the cheapened cost of construction and the lessened expense of machinery, together with the ease of filling. The silage is easily elevated by use of a horse in connection with a block and tackle or windlass. It is also raised by hand with a swinging derrick in connection with a windlass and pulley. This silage is often elevated to an overhead track from which it is suspended and carried to the stable or yards in an invertible manure carrier box or trip-bottom box.

# The Test of the Relative Values of Cotton Seed Meal and Silage, and Cotton Seed Hulls for Fattening Cattle. 

By John C. Burns<br>Assisted by T. P. Metcalfe

The experiment reported in this bulletin was conducted during the past winter and spring in co-operation with Colonel T. S. Bugbee of Clarendon, Texas, who furnished the cattle, the feeds, the scales, and, in fact, everything connected with the work except the man who did the feeding and collected the data.

Th purpose of the experiment was to ascertain whether cottonseed meal and silage may be used more profitably for fattening cattle than cotton-seed meal and cotton-seed hulls, the two feeds which compose the ration that is used much more than any other for fattening cattle throughout the South. The high price of cotton-seed hulls during recent years emphasizes the importance of finding, if possible, a more economical feed to take its place, either partially or altogether. Because of the low nutritive value of this feed and the relatively large amount necessary to use, it is this portion of the ration rather than the meal that makes the feeding of meal and hulls so expensive at current prices.

The feeding of silage to dairy cattle has been practiced extensively and with a high degree of success for many years, but only recently has it been looked upon with much favor for beef production. The experiment herein reported is the first one that has been conducted by this Station for the purpose of testing the value of silage in a ration for beef cattle. The results should be of considerable practical value from the fact that the experiment was conducted entirely under actual farm conditions. Since these are the results of only one experiment, they should not be taken as absolutely conclusive and for this reason the Station will conduct other experiments along the same line during the coming fall, winter, and spring.

## Cattle Used

The cattle used in the experiment were 40 head of rang bred three and four-year-old, grade Shorthorn and Hereford steers, all of which were dehorned. Though not highly graded they
showed a preponderance of improved blood and represented about the average of the cattle of the Panhandle section of the State. They were the "tops" of a bunch of about 200 head and were fairly uniform as to conformation, quality, and condition. Their average weight when the experiment began was 904 pounds, and the value placed on them was $\$ 42.50$ a head.

## Feed Used

The feeds used, namely, cotton-seed meal, cotton-seed hulls, silage, and hay, were of average quality.

The silage was composed chiefly of milo maize, which had been harvested when the heads were about mature and the stalks and leaves were still green. The other components of the silage were sorghum and Indian corn. It was estimated that the larger portion of the silage fed consisted of about 75 per cent milo maize, 15 per cent Indian corn, and 10 per cent sorghum. That which was fed during the last 20 days of the test contained a somewhat higher percentage of Indian corn.

The hay was composed of sorghum and Johnson grass, about half and half.

An average sample of each lot of feed was analyzed by the Chemical Division of the Experiment Station. These analyses are shown in the following table:

TABLE I.

| Feeds. | Period used. | Percentage composition. |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Water. | Ash. | Pro- <br> tein. | Crude fiber. | Nitro. <br> freeextract. | Fat. |
| Cotton-seed meal. | Dec. 8, 1911, to <br> Mar. 13, 1912. | 6.42 | 5.65 | 43.45 | 7.39 | 24.67 | 10.42 |
| Cotton-seed meal. | Mair. 14, 1912, to Apr. 5, 1912. | 6.26 | 5.49 | 44.05 | 9.28 | 25.72 | 9.20 |
| $\begin{aligned} & \text { Cotton-seed } \\ & \text { hulls. } \end{aligned}$ | Dec. S, 1911, to Feb. 26, 1912. | 10.91 | 2.50 | 5.07 | 46.05 | 33.79 | 1.68 |
| Cotton-seed hulls. | Feb. 27, 1912, to Mar. 13, 1912. | 10.15 | 2.58 | 4.81 | 43.00 | 38.33 | 1.13 |
| $\begin{aligned} & \text { Cotton-sced } \\ & \text { halls. } \end{aligned}$ | Mar. 15, 1912, to Apr. 5, 1912. | 8.24 | 2.44 | 4.50 | 45.65 | 37.49 | 1.68 |
| Silage | Dec. S, 1911, to Mar 14,1912 | 66.02 | 2.82 | 2.54 | 8.86 | 19.15 | . 61 |
| Silage | Mar. 15,1912 , to Apr. 5, 1912. | 60.52 | 3.05 | 3.28 | 10.57 | 21.70 | . 88 |
| Hay | $\begin{aligned} & \text { Jan. 8, } 1912, \text { to } \\ & \text { Apr. } 5,1912 . \end{aligned}$ | 8.48 | 7.21 | 4.22 | 30.78 | 48.02 | 1.29 |

The cost of the feeds was as follows:

| Cotton-seed m | \$27.00 per ton. |
| :---: | :---: |
| Cotton-seed hulls | 8.50 per ton. |
| Silage | 2.50 per ton. |
| Hay | 7.00 per ton. |

The crops from which the silage was made were grown on Colonel Bugbee's place. Though the actual cost of productionincluding rental value of the land, the preparation of the soil, planting, and cultivating the crops and placing them in the silowas estimated to be considerably less than $\$ 2,50$ a ton, this price is placed on the silage because it is thought that it represents more nearly what the average cost of production would be throughout the State.

## Plan of Experiment

The afternoon of December 7, 1911, the steers were divided into two lots, designated as Lot 1 and Lot 2, the former containing 15 head and the latter 25 head. The division was made as equally as possible with regard to average weight, quality, and breeding. Only 15 head were used in Lot 1 for the reason that this number was considered sufficien to eliminate any differences in the result that might be attributed to differences in individuality, and because it was not desirable to purchase any more cotton-seed hulls than was necessary to conduct the experiment properly.

The pens in which the cattle were fed were practically equal in all conditions that might have had a bearing on the results. Each had a shed open on the south side which afforded protection against the cold north wind to some extent, but which did little more than this as will be explained later. The cattle in both pens had free access to salt and water at all times.

The two lots were fed as follows:
Lot 1. Cotton-seed meal and cotton-seed hulls.
Lot 2. Cotton-seed meal, silage, and, during a part of the experiment, mixed sorghum and Johnson grass hay.

The cattle were fed twice daily, early in the morning and late in the afternoon. The meal and hulls were thoroughly mixed together in the feed trough. The silage was placed in the trough, the meal sprinkled over it, and then the two feeds were thoroughly mixed together with an ordinary hull fork. The hay was supplied in a separate trough, though a rack would have been better.

A preliminary feeding period of a few days would have been desirable in order to get the cattle to eating well before beginning the actual test, but on account of the late date, the experiment proper was begun on the day of the first feeding.

## The Feeding Test

The experiment covered a period of 119 days, from the morning of December 8, 1911, to the evening feed of April 4, 1912.

The rations per steer for the first day were as follows:
Lot. 1. Three pounds cotton-seed meal, 19 1-3 pounds cottonseed hulls.

Lot 2. Three pounds cotton-seed meal, 24 1-5 pounds silage.
Hay was added to the ration of Lot 2 on January 8. This adition was made because the steers in this lot were not eating a sufficient quantity of the silage, possibly because of its succulent character, to afford them as much dry matter as was being consumed by those in Lot 1 . It was found, however, that the steers did not take to the hay very readily; indeed, they did not seem to relish it at any time, though they were supplied with it until the end of the experiment. It is doubtful, therefore, whether the addition of hay proved to be of any advantage. The average daily amount consumed per steer was slightly over 3 pounds.

After the first few days as much hulls for Lot 1 and as much silage for Lot 2 were supplied as the steers would clean up, the daily amounts for each steer being about $282-3$ pounds of hulls, and about 50 pounds of silage, respectively.

The cotton-seed meal for both lots was gradually increased. On January 6 the amount reached 6 pounds a head daily for each lot, this amount remaining unchanged until February 11, when 7 pounds a head daily was fed. When, therefore, the steers were on full feed their rations were as follows:

Lot 1. Seven pounds cotton-seed meal, 30 pounds seed hulls.
Lot 2. Seven pounds cotton-seed meal, 50 pounds silage, 3 pounds hay.

The writer feels confident that the results would have been more satisfactory if a smaller quantity of meal had been fed. There was one steer, in particular, in Lot 1 that showed the evil effects of the heavy meal feeding towards the end of the experiment. Though Lot 2 received the same quantity of meal per steer there were apparently no injurious effects-a fact which would seem to indicate that a larger quantity of meal may be fed successfully in connection with silage than with hulls, or that the injurious effects of the meal may, at least to some extent, be counteracted by the silage.

For a feeding period of 119 days, with cattle of the weight of those used, better results should have been obtained, especially in Lot 1 and probably in Lot 2 also, if the quantity of meal and been increased gradually from 3 pounds at the start to 5 pounds
at the end of 40 days; continued on this amount until the end of 80 days and then increased to 6 pounds for the remainder of the period.

A great mistake made by many feeders in Texas is that they do not feed their cattle sufficiently long to finish them. As a general rule the higher price received for finished cattle will more than pay for the 30 to 60 days of extra feeding necessary to finish them. It is rarely the case that cattle are in proper condition to be marketed at the end of 120 days of feeding. Three or four-year-old steers should generally be fed 150 days and younger cattle a still longer period, two-year-olds requiring about 180 days. It is, however, less practicable to carry cattle on straight meal and hulls for longer than 120 days than on many other kinds of rations.

The cattle that were used in this experiment were not finished when they were marketed, and it is believed that had they been fed 30 days longer the results would have been more profitable, provided the quantity of meal previously fed had been such as to permit of further feeding, which, however, was not the case. Though, apparently, the silage-fed steers could have been fed longer without injurious effects, it would probably have been better for them as well as for the hulls-fed steers, if the feeding was to have lasted 150 days, for the allowance of meal to have been about as follows: Two to $21 / 2$ pounds of meal for the first thirty days; 3 to $31 / 2$ pounds for the second 30 days; 4 to $41 / 2$ pounds for the third 30 days; and 5 pounds for the last 60 days; the increases to have been made gradually or not at a greater rate than about $1 / 4$ pound per day.

There was no trouble in getting either lot of steers to eating well, but it was very noticeable from the beginning to the end of the experiment that the steers of Lot 2 relished their ration of meal and silage much more than the steers of Lot 1 relished their ration of meal and hulls. The steers in Lot 2 would eat the silage about as readily before the meal was mixed with it as afterwards, whereas those in Lot 1 did not care for the hulls until after the meal was mixed with it.

The droppings from the steers of both were in good condition throughout the experiment, no scouring or digestive disorders being indicated.

The weather conditions were unusually severe during the greater portion of the period that the expriment was in progress. A few days after the cattle were started on feed a heavy snow fell and in melting placed the pens and the space under the sheds in very bad condition. This was followed by alternate freezing and thawing, so that when the ground was not frozen the mud was knee deep. The steers' feet became very sore and for several days it seemed to be an effort for them to get to the
feed troughs. These conditions begain about December 19, and with the snows that fell in February, the pens and sheds were kept in such a bad condition until near the close of the experiment that there was no dry place for the cattle to lie down. Neither lot, therefore, made the gains that they should have made had the conditions been normal.

The final results of the experiment are shown in the following table:

TABLE II.

|  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Lot No. 1........ | 895 | 15 | $\begin{gathered} 712.5 \\ \text { cotton-seed } \\ \text { meal. } \\ 3316.8 \\ \text { cotton-seed } \\ \text { hulls. } \end{gathered}$ | 236 | 1.98 | $\begin{gathered} 301.9 \\ \text { cotton-seed } \\ \text { meal. } \\ 1405.4 \\ \text { cotton-seed } \\ \text { hulls. } \end{gathered}$ | \$10.04 |
| Lot No. 2........ | 909 | 25 | 716.1 cotton-seed meal. 5661.0 Silage. Hay. 278.7 | 242 | 2.03 | $\begin{gathered} 295.9 \\ \text { cotton-seed } \\ \text { meal. } \\ 2339.0 \\ \text { Silage. } \\ \text { Hay. } \\ 115.0 \end{gathered}$ | 7.32 |

The table shows the results to be considerably in favor of the cotton-seed meal, silage, and hay ration. The steers of Lot 2 made a slightly greater gain at a much lower cost. Since the amount of cotton-seed meal fed to each steer was practically the same in both lots, the difference in favor of Lot 2 must be attributed to the silage and the small amount of hay. This is certainly a favorable showing for silage, to say the least. It is apparent that at current prices silage can be utilized to much better advantage than cotton-seed hulls for fattening cattle.

Though the silage used in this experiment was composed chiefly of milo maize, it is reasonable to believe that silage made of Indian corn, kaffir corn, or even sorghum would, at least, give equally as good results. It remains, however, for other experiments to determine definitely the relative value of the various kinds of silage for fattening cattle.

## Marketing

As previously stated, the ration test ended with the afternoon feed of April 4. The final weights were taken early in the morning of April 5, before the cattle were given anything to eat. On that day and until noon of the following day the steers in both lots were fed corn husks (shucks) in liberal quantity, preparatory to shipping, no other feed being given. On the afternoon of April 6 they were shipped to the Kansas City market, and were unloaded there about $6 \mathrm{p} . \mathrm{m}$. , April 8. In order to ascertain the shrinkage that had occurred since the morning of April 5, the steers of each lot were run across the scales immediately after being unloaded, before they were fed or watered.

A comparison of the weights is shown in the following table:
TABLE III.

|  | Average weight at Clarendon. Pounds. | Average weight at Kansas City. Pounds. | Shrinkage. Pounds. |
| :---: | :---: | :---: | :---: |
| Lot No. 1. | 1131. | 1047 | 84 |
| Lot. No. 2 | 1151 | 1068 | 83 |

It will be observed that there was practically no difference in the shrinkage of the steers of Lot 1 and those of Lot 2.

The two lots of steers were sold separately to Swift \& Company on the morning of April 9, having been supplied in the meantime with hay and water.: They were weighed by the buyers at about 11 a. m.

A statement of the weights of the steers and the prices received for them is shown in the following table:

TABLE IV.


The table shows that the silage-fed steers sold for 20 cents per hundredweight more than the hulls-fed steers. By comparing this table with Table III it will be seen that the "fill" received by Lot 1 was 13 pounds per steer and that received by Lot 2 15 pounds per steer.

## Slaughter Test

Through the kindness of Swift \& Company, slaughter records of the two lots were furnished us. Lot 1 dressed 58.45 per cent and Lot 258.2 per cent, the difference being too small to be of importance.

The following communication from Swift \& Company indicates their estimate of the cattle on the hooks:

# SWIFT \& COMPANY <br> STOCK Yards Station <br> Kansas City, Kansas 

April 12, 1912.
Prof. J. C. Burns,
Agricultural and Mechanical College,
College Station, Texas.
Dear Sir: We attach herewith statement showing yield, etc., on cattle killed Wednesday, April 10, 1912.

Lot 1,15 cattle, costing $\$ 6.75$ alive, were of a medium grade, 3 in this lot being on the "fair" order.

Lot 2, 25 cattle, costing 6.95 alive, dressed out considerably better than Lot 1, there being but two slightly below the average flesh and quality of the whole lot.

These two lots of cattle are not what we consider a well finished bunch of cattle, but classify according to our grading as "fair or medium".

Yours respectfully,

Swift \& Company. PER. H. L. H.

## Financial Outcome

A statement of the initial cost per steer, the average expense in marketing, the average selling price, and the average net profit for each lot is shown in the following table:

TABLE $V$.

|  | Lot 1. | Lot 2. |
| :---: | :---: | :---: |
| Number of steers | 15 | 25 |
| Cost per steer at beginning of experiment | \$42.50 | \$42.50 |
| Cost of feed consumed per steer during experiment. | 23.715 | 17.72 |
| Cost of shucks ( $\$ 6$ per ton) consumed per steer preparatory to shipping | . 08 | . 067 |
| Freight charge per steer in marketing....-.-........... | 3.46 | 3.46 |
| Cost of yardage per steer on market...- | . 25 | . 25 |
| Cost of hay per steer on market.-....-- | . 375 | . 375 |
| Commission per steer in selling.-..-..................... | . 50 | . 50 |


| Total cost per steer.-.. Selling price per steer | \$70.88 | \$64.87 |
| :---: | :---: | :---: |
|  | 71.55 | 75.27 |
| Net profit per steer.- | \$0.67 | \$10.40 |

The net profit of $\$ 10.40$ a head on the steers of Lot 2 as compared with the net profit of 67 cents a head on the steers of Lot 1 shows that silage has a high value for beef production.

Neither the labor involved in feeding, on the one hand, nor the value of the manure, on the other, is included in the above statement. As a general rule, however, the value of the manure offsets the cost of labor in most feeding operations, a fact that should be more generally recognized.

## Summary

1. Silage was a much cheaper feed that cotton-seed hulls and yielded slightly larger gains.
2. There was practically no difference in the shrinkage of the two lots of steers in shipping.
3. There was practically no difference in the dressing percentage of the two lots.
4. The silage-fed steers showed considerably better finish and brought 20 cents a hundredweight more on the market than the hulls-fed steers.
5. The net profit on the silage-fed steers was $\$ 10.40$ a head and the net profit on the hulls-fed steers was 67 cents a head.

The results of this experiment seem to indicate that a ration of cotton-seed meal and silage may be used far more profitably than a ration of cotton-seed meal and cotton-seed hulls for fattening cattle.

## Economy of the Silo

A great deal has been said and written about the value of the silo on stock and dairy farms, but very little has been written about the economy of the silo.

Actual results will show that when maize, kaffir and other similar forage are fed from the stack, as is the usual custom in New Mexico and West Texas, counting the waste in hanling the crop to the stack and then feeding on the ground where noch is trampled under foot, much blows away and some is refiss, it is impossible to get more than 40 per cent of the crep into your
livestock. In other words, it is necessary to grow 100 acres of forage in order to get the feeding value of only 40 acres. Thus it is necessary to carry the cost of producing 60 acres of forage as a fixed "overhead" cost-or depreciation-whichever term you care to use - which must be added to the cost of the feeding value of 40 acres. In other words, if it costs $\$ 5$ per ton to produce a crop of maize or kaffir, $\$ 5$ per ton would be the net cost plus 60 per cent "everhead" expense or depreciation, bringing the total net cost per ton up to $\$ 11$ for actual feeding results.

With a silo and feeding from troughs it is possible to get 90 per cent of your crop into your live stock, as there is practically no waste, except the depreciation in hauling from the field to the silo, which loss does not equal 10 per cent of the whole. Thus from 100 acres the feeding value would be 90 acres. At a cost of $\$ 5$ per ton for production plus 10 per cent depreciation, the net cost would be only $\$ 5.50$ per ton, compared with $\$ 11$ for dry feed.

In other words, if it takes 100 acres of cultivated land to feed 25 head of cattle or other live stock on dry feed, with the addition of a silo it would be possible to feed the same number of stock on 40 acres of cultivated crop, or 60 head from the same 100 acres by using a silo. And this, counting ensilage of no more value in actual feeding units than dry feed. Add to this the difference in feeding value, increase in weight and saving of time in feeding and you have the net economy of the silo. But if there wasn't any difference in the value of the two feeds, the economy in saving alone is at least 50 per cent. However, there is a big difference in the value in favor of ensilage.

For a dairy asset there is no other thing that will compare with the silo in this country or any other section of New Mexico or West Texas, making it possible to produce cream at less than half the cost of production where a silo is not utilized, thus making this the most economical and profitable dairying section of the United States-considering land values in the older settled States where dairying is the principal occupation of thousands of farmers.

A canvas made by the Wisconsin State Board of Agriculture shows that there is a total of 42,821 silos in that State. This means that approximately one-fourth of the farmers of the State are using silos.

The largest silo in the South, it is said, will be built at the Texas Experiment Station, feeding and breeding farm of the Agricultural and Mechanical College. The silo is of reinforced steel and concrete construction, and has a capacity of 400 tons.

This is the fourth silo that has been constructed by the College in: an endeavor to determine which type is best suited to the farmers and stockmen of Texas.

The North Dakota Experiment Station will carry on a pork production contest this year.. Twenty-four cash prizes are being offered: First, $\$ 100$; second, $\$ 50$; third, $\$ 30$; fourth, $\$ 25$; fifth, $\$ 15$; the next five $\$ 10$ each; and the eleventh to twenty-fourth, $\$ 5$ each. The contest is open to boys and girls 10 to 18 years of age. Each contestant must secure a sow and raise her litter of pigs. The awards are to be made on the amount of pork production from the litter of one sow at the smallest cost, and the greatest gains per day.

The United States Government has recently issued a bulletin on raising cattle in the South. This bulletin is authority for the statement that the Southwest must furnish the beef supply of the future, because cattle can be raised in abundance there at less expense than in any other section of the country. The winters are short and less severe and it requires much less feed to winter them. There are 300 kinds of grasses that grow in the South indigenous without cultivation, all of which are good food for cattle.

## An Era of Silo Building

Silos are being erected all over the Southwest and this means cheaper feeding. Succulent food is almost a necessity when pastures are brown and sear. Animals will not make satisfactory gains on dry feed, even though a balanced ration be fed.

The coming of the silo means conservation of feed. It is conservatively estimated that when corn is husked in the field and the stalks left to bleach, 40 per cent of the feeding value of the plant is wasted. Even a greater loss, perhaps, is sustained when kaffir, milo, and saccharine sorghums are grown for grain and the heads only saved, leaving the stalks to decay in the field.

Roughage is indispensable to economical feeding and what crop will produce more per acre than corn or one of the sorghums when converted into silage? Feeding from the silo is also much more convenient than feeding from the hay loft where bulky roughage must be handled. Animals consume the entire plant when silage is fed, whereas much of the stalks are wasted when fodder is fed instead.

The silo gives a better opportunity for raising live stock on a small farm; as a few acres only of good land will be sufficient to fill one or two silos, whereas a great deal may be needed when
the land must be sown in pasture. The advent of the silo means more than would at first appear. It means that those who have made this advance in conserving their feeding resources will take advance ground in other progressive practices of farm management.

## When Farms Produce More

It is a fact, as shown both in this country and in Europe, that no section has ever maintained its wealth in agricultural products for any considerable length of time without animal husbandry as the main industry or to supplement general farming. True, when a section of the country is first brought into cultivation the soil, being virgin and very fertile, may produce in abundance and it would appear that fertility is inexhaustible. But experience teaches that crops, when they are sold and removed from the farm, soon reduce the humus and fertility constituents so that the land no longer produces profitably.

Animal husbandry is necessary for permanent fertility. It is essential to general farming in that it reduces waste, obviates the necessity of marketing such bulky products as hay, fodder, grain, etc. It distributes labor, in many instances providing work for the men and teams when crops do not demand attention.

The problem of feeding the people is the greatest with which we are confronted. We have advanced so fast in city population and industries other than farming that food production has not kept pace. Without an abundance of food no people can make great progress, nor can they remain in peace and contentment. Our farms are now required to supply the people with meat as well as bread. Ranches have been converted into farms in many sections. The sudden transition from ranching has diminished the supply of live stock faster than the small farms can meet the deficit. This means that if our section of the country is to maintain its standing plans must be provided for raising more animals on small farms.
Land owners must assist their tenants to raise animals. This can be done by helping the tenants secure breeding stock, providing pastures, buildings, etc., erecting cross-fences so diversified crops may be grown. This will make it possible for the fertility of the farm to be maintained and relieve both land owner and tenant from dependence upon cotton as a money crop.

Before this can be accomplished more feed crops must be produced. The proportion of cotton to grain, hay and pasture crops must be reduced. More feed stored and more animals fed. This will mean greater investment, as live stock represent consider-
able capital ; barns, creameries, dairies, silos, etc., must be built. This will require co-operation on the part of the banks and other business men, but it is co-operation that will build the Southwest. Capital wisely invested in live stock, silos, and other farm building means more wealth not only for the producer, but for the country. It means larger crops, better profits, longer schools, good roads, and progressive agriculture in all that it signifies.

A country cannot prosper when its people have no food, or even when a large per cent of the inhabitants are paupers. Great manufacturing plants, transportation companies, professional men and local business men are dependent upon the food crops produced on our farms. Then if we are dependent upon the crops and animals raised on our farms isn't it desirable to conserve the supply by eliminating waste in distribution as well as in production? And doesn't this responsibility of eliminating waste fall upon all of us as well as the producer?

## The Silo on a Texas Dairy Farm

Twenty years ago Joe Bobbit was an ordinary blackland farmer in Central Texas. Like all of his neighbors, every year he planted a fair acreage in corn, some oats and occasionally a little of other grains; the rest of the farm was in cotton. Like his neighbors, also, Mr. Bobbitt "ran an account" at the store for the year's supplies, and at the end of the year, if the season was good and the price of cotton a little up, he about broke even and could begin the new year with a clean sheet-not debit, no credit. If the cotton market was rotten-and it often was-he sometimes lacked a little "coming out" and started the new year behind. But land was cheap, supplies didn't cost much, and he managed to get along and accumulate a comfortable area of black land:

Along about the same time the Bobbitts were milking six or seven cows, ordinary scrubs of those days and void of a single drop of dairy-type blood.

The whole herd, Mr. Bobbit says, barely supplied his little family, and the cream that rose on the mlik was not thicker than a newspaper. When they all went dry at once, he was so disgusted that he sold the entire bunch for $\$ 10$ a head and bought two young registered Jerseys for $\$ 250$. They have never been without plenty of milk and butter since.

When Mr. Bobbitt bought those two Jerseys 20 years ago he had no more idea of getting into the dairy farming business than of becoming a railroad president or a Mexican revolutionistHe was simply tired of depending on scrub cows for milk that
at best was scant in cream and quantity, and determined once and for all to provide a future supply, abundant, rich, and never failing. Unconsciously and without intention he grew into dairy farming.

There was a natural increase in the number of milch cows. Mr. Bobbitt soon saw that to keep up their quality he must have a bull of unimpeachable pedigree, and to do this with profit a still larger number of cows had to be kept. This meant a greatly increased supply of cream and a growing number of surplus calves. Six miles away at Hillsboro was an unfailing market for all the butter he could furnish, but it was too far to deliver milk. A market at good prices was never wanting for all the calves, male and female, he would sell. From the beginning, therefore, his dairy farming found two avenues of incomemaking butter and selling it in Hillsboro and selling the young stock he did not find it convenient to keep.

Mr. Bobbit has 300 acres of land, part of it creek bottom and part of it upland and broken. Some 250 acres are in cultivation and the remainder, mostly broken and hills, is in pasture. In his herd of Jersers are 33 milch cows and as many more calves and yearlings. At different times, as his experience as a breeder prompted, he has brought in new blood and in getting what he wanted he has never been stingy. The splendid bull now at the head of the herd was imported from the Island of Jersey, where he had been first and second once each in the great shows held annually in the original home of his breed.

Mr. Bobbitt's farm, known as Plum Hill Dairy Farm, is, as its name implies, devoted entirely to the dairy business. Some cotton is planted every year, but principally as one item in his general scheme of diversification and rotation. The equipment of the farm, its crops, its operations and its business transactions are all aimed at the production of perfect butter and as nearly as possible perfect butter producers.

Plum Hill Farm is fenced into a number of different enclosures so that at any season of the year there is some crop or pasture on which the cattle may run and find rich grazing except during an unusually severe winter season or a long continued summer drouth. At present, for example, there are two or three winter oats pastures and a permanent pasture of native rescue grass. The latter pasture is also green with mesquite grass in the spring and summer. Mr. Bobbitt has a splendid dairy farm, but his cattle, milch cows, and all, run in the pastures day and night the year round. Very seldom indeed, he told me, is the weather such as to necessitate their spending a night in the barn. Thus practically all manure is returned immediately to the land from which it comes and without labor, and keeping the dairy barn clean is an easy matter.

Six years ago Mr. Bobbitt built the first two silos in Mill County-now there are many of them. They were each of 55 tons capacity and made of staves. Inexperience and therefore uncertain as to the effect of the Southwestern climate on a stave silo when exposed to extremes of heat and moisture, he inclosed them with boarded walls and put a roof over them. Two years ago he bought another 150 -ton silo, but its concrete foundation and floor set three feet in the ground increases its capacity 15 tons. A covered and walled-in area, roomy and well-lighted, connects the three silos with the dairy bain.

Some 50 feet away is the dairy house, which is, in fact, a small farm creamery, well lighted and airy and with a concrete cellar or basement. The dairy house is equipped with a steamturbine driven separator of 1200 pounds capacity, steam boiler, power-driven churns, running water, and other modern necessities and conveniences. With its equipment the dairy house represents an investment of about $\$ 1200$; the barns and silos an additional investment of nearly $\$ 3000$.

For his silos Mr. Babbitt grows as a principal crop ordinary corn. It is generally contended that for the Southwest sorghum is the best silage crop, but after six years of experience with corn kaffir, milo and sorghum Mr. Babbitt is convinced that corn here, as in the North, is easily the best. It makes just as good or better silage and the yield per acre is much greater than with either of the other crops. But he is no one-crop man even in the matter of silage; he grows several acres of kaffir and usually a few acres-seldom more than five or six-of sorghum. The crops are harvested with two corn-binders and put into the silos by cutter driven with a gasoline engine.

A few other grain crops are grown, but for feed for the work animals that make the silage crops and haul the butter to town. No crops are sold except the few bales of cotton. Mr. Bobbit fed silage to his mules during the fall and winter when they were not at work, cutting their grain ration in half, and they are fat and in fine condition generally. He intends putting up another 150 -ton silo in time for the coming season's filling so that he may have plenty of silage for his work stock; he believes that he can thus cut down their grain feed at least one-third even when they are at work.

The milch cows of Plum Hill Dairy Farm are fed silage night and morning, all they will eat up clean, the year round. They are also fed an average of about three pounds of cotton-seed meal a day per cow.

He used to put up and buy from 3,000 to 4,000 bales of hay a year, Mr. Bobbitt say, and he thought a cow couldn't get along without hay. This winter he hasn't fed them a bale, and they
have done as well as ever, if not better. If you have silage you have no need of hay.

Selling only butter and dairy stock, as Mr. Bobbitt does, eliminates most of the drudgery of dairy farming. They get about their milking at 5.30 in the morning, and are through milking and feeding, have the cream separated and get their breakfast in time for the boys to get off to school. In the afternoon milking is begun at 4.30, and all the work is done and they are ready for supper by sundown these short winter days-

At present they are milking 26 cows and they carry 70 to 75 pounds of rich, golden butter to market twice a week. One groceryman in Hillsboro takes the entire output of the farm and wishes they could furnish him a great deal more.

Mr. Bobbitt figures that his butter business just about pays the expenses of the farm-labor, feed that is bought, interest on investment, and repairs-and that the profit all comes from the sales of increasing stock.

He has about $\$ 4,000$ in equipment and he could sel his herd for not less than $\$ 10,000$. Land around his is valued at $\$ 125$ an acre. which would make his worth $\$ 37,500$, but it isn't. It wont pay a reasonable interest on that amout; its real value, based on returns, is nearer $\$ 50$ an acre, or $\$ 15,000$ for the whole tract. He consider that he has an investmen of about $\$ 30,000$ that pays good returns and a satisfying profit. He could sell five times as many heifer calves as he does.
Plum Hill Farm is well equipped with conveniences such as waterworks, power, and rural mail delivery. One of the pike roads to be built out of a recent bond issue will pass within a half-mile of the house.

The Bobbit family is happy and contented. One son is in the State University and will complete his course this year. A daughter is doing splendid work as a student in the State College of Industrial Arts. Another son has been in the University two or three years, but is at present at home helping with the work of the farm; he intends to take up his school work a year or two later. The younger children have the advantage of a good district school a mile from their home.
Mr. Bobbitt has found Jersey cows and silos a wonderfully profitable combination on the Southwestern farm.

# Growing Crops to Fill the Silo 

By A. B. Connor, Agronomist, Texas Experiment Stations.

Someone has said that the silo is the poor man's necessity aud the rich man's luxury, for by it both gain a better and more independent living. Sixty-four per cent of the nutrients in the corn plant is contained in the grain and cob, and 36 per cent in the stalks and leaves. The silo makes possible the saving of this 36 per cent, which would otherwise be lost if only the ears were harvested. During the fermentation process silage undergoes a change which softens the fiber and makes more digestible the nutrients contained, and hence a greater amount is assimilated by the animal. Silage contains a lactic acid which has a beneficial effect on the animal by acting as an appetizer and a tonic.

The principle involved in making silage is that of bringing about fermentation without decomposition of the materials used. This requires the exclusion of air and the presence of a certain amount of sugar necessary to fermentation. This principle is applied in the preservation of many foods, such as sauer kraut and canned fruits. The acidity of silage combined with lack of air contact are the two elements of preservation. The sugar necessary for acidity is generally present, but the exclusion of the air is entirely in the hands of the man preparing and putting up the silage.

The size of the silo will depend upon the number of animals to be fed and the length of the feeding period. It is necessary to remove two inches of silage each day after feeding has begum to avoid loss by spoiling. One cow will eat 30 to 35 pounds or 1 cubic foot daily. To find the number of cubic feet contained in 2 inches of a given silo, multiply the circumference by onefourth the diameter and divide by six. Accordingly one can figure the size of silo requirede to feed a certain number of cows a given number of days. One can also figure the exact period required to exhaust a silo of a given height.

## Silage Crops

A silo 30 feet deep will furnish silage for practically six months if fed at the rate of two inches daily. A silo 30 feet deep will hold a greater tomnage than two silos 15 feet deep, all being the samediameter. A silo 32 feet deep and $1 \pm$ feet in diameter has a capacity of approximately 100 tous. A silo of the same height and 20 feet in diameter has a capacity of approximately 200 tons.

In constructing a silo the wall should be sufficiently strong to withstand the pressure imposed upon it after being filled so as to insure against side openings. This outward pressure is 11 pounds per square foot for every foot of depth and amounts to 330 pounds per square foot at the base of a 30 -foot silo.

Corn is generally reputed to produce silage superior in quality to other crops. Recent experimental work indicates that kaffircorn silage is approximately equal in feeding value to corn silage. Milo, feterita, and other grain sorghums produce good silage, perhaps of about the same feeding value as Indian corn. The sweet sorghums produce silage of good quality, but not equal in feeding value to either Indian corn or grain sorghums. Legumes cannot be siloed alone satisfactorily because they do not contain the sugar necessary for proper fermentation. Legumes are high in protein and add materially to the feeding value of ensilage made from corn, kaffir corn, and so forth. They can be utilized to great advantage either by mixing at silo or by growing in same row with corn, kaffir corn or sorghum.

Since the semi-arid region is primarily suited to the production of grain sorghums, this section is admirably provided with silage crops that equal Indian corn in quality and excelling it in point of yield.

Indian corn should be harvested for ensilage after the ears have become well glazed. This may not be possible at times on account of drouth, but even in such case the corn should not be cut green as it will produce inferior silage. Kaffir corn, milo, feterita, and similar grain sorghums should be allowed to ripen seed before cutting, as they contain a higher percentage of juice and sugar than corn ; hence, if cut earlier, would likely produce sour silage. The sweet sorghums must be allowed to ripen thoroughly on account of their high juice and sugar content. Too often silage crops are cut green, which results in poor silage.

## Cost of Filling the Silo

The cost of filling a silo varies considerably, depending upon the management of labor and the length of the haul. This cost, on 31 different farms in Michigan and Wisconsin reported in Farmers' Bulletin 292, United States Department of Agriculture, 86 cents per ton. Increased cost due to length of haul is unavoidable. Much depends, however, on the management of labor and teams in filling. The figures compiled from these 31 farms bore out the fact that the type of machinery used had little to do with the cost so long as the machinery was efficient. They also brought out the fact that much of the increased cost of putting up silage is due to the poor utilization of teams and
labor. The man who hauls small loads increases his cost materially. About eight men required ordinarily. One man with three horses to the corn harvester; two men to load wagons in the field; three or four men with teams to haul to the cutter; one man to feed the cutter, and one man in the silo to spread and tramp silage, exclusive of a man to attend the engine. This outfit may be reduced by two men by utilizing two boys to drive wagons from the field to the cutter and by having one man unload wagons.

## Feeding Value

The Indiana Experiment Station found silage extremely palatable as a winter feed for breeding ewes and young lambs. Si-lage-fed ewes gave birth to lambs one pound heavier than ewes receiving dry feed. It apparently has a desirable effect on the digestive system and general health of breeding ewes in winter. The Ohio Experiment Station found that silage may be used advantageously in fattening cattle where stover and hay are high in price. They found one ton of silage to equal for beef production 4.42 bushels of corn, .03 tons of stover and .25 tons of hay. Valuing corn at 50 cents per bushel, stover at $\$ 5$ per ton and hay at $\$ 10$ per ton, the value of corn silage is 4.06 per ton.

The Texas Experiment Station found silage a much cheaper feed than cotton-seed hulls and it yielded larger gains. Silagefed steers showed considerably better finish and brought 20 cents per hundredweight more on the market than hulls-fed steers. The total profit on silage-fed steers was $\$ 10.40$ per head, while the profit on hulls-fed steers was 67 cents per head, a difference worth considering.

## Feeding Silage in the Southwest

By Carl N. Kennedy, Department of Animal Husbandry, Texas A. \& M. College.

Experiments conducted at Texas Experiment Station, as well as experiments conducted elsewhere, indicate that silage will be one of the leading factors in cheapening the cost of production and thereby increasing the profits in many of the different forms of feeding. This is especially true in regard to beef cattle, dairy cattle and sheep, the animals which have four stomachs. Ther are able to use a greater amount of silage than horses and hogs, and experimental data shows no injurious effects, as sometimes reported in the case of horses.

Conditions in the Southwest are favorable to the use of silage. It is no uncommon occurence for drouth to attack a corn crop at the time when it would make good silage, but very little corn. Last summer many farmers with silos saved a large portion of their crop that would have been largely wasted if they had been without silos. Many sections can grow corn or sorghum to the stage where it will do for silage that cannot grow the same crops to maturity.

Another important reason for the silo is to supplement pastures during the season of drouth or during the winter time. It is a well-established fact that stock do better on silage and also produce gains more economically on silage than on dry feeds during such periods.

Dairy cattlemen are undoubtedly making the largest use of the silo. The reason is that it has been found necessary to provide some form of succulence in the dairy cows' ration. The New Jersey Experiment Station carried on a test comparing soiling, or green feed crops, with silage. They found that while cows did slightly better on the green cut feed it was not as profitable owing to the larger amount of labor involved. In this state it is doubtful if soiling crops would be profitable as compared to silage, and besides, silage can be had at times when it is impossible to obtain green crops.

Data collected from cows in the Iowa Cow-Testing Association showed that the cows fed on silage produced 6 per cen more milk and 7.8 per cent more fat than the cows not fed on silage. In an experiment carried on by the Mississippi Experiment Station during the winter time silage-fed cows decreased 3.38 gallons of milk monthly per cow while the dry-fed cows decreased 13.67 gallons. Hence it is safe to assume that silage will increase the production of cows.

Dairy cattle are not the only animals that make a profitable use of silage. The Texas Experiment Station is taking the lead in trying to answer the question, "Can the Southwest fatten her beeves with profit, and if so, how?" The resulis up to date point conclusively to the fact that beef can be fattened profitably by the use of silage. This was clearly demonstrated in experiments conducted during the winter of 1912-13. Four lots of steers fed different combinations of cotton-seed and its products and silage made profits ranging from $\$ 14.32$ to $\$ 20.01$.

The rations fed when on full feed were: Lot 1, 30 pounds silage and 6 pounds cotton-seed meal. Lot 2, 52 pounds silage and 6 pounds cotton-seed meal. Lot 3, 42 pounds silage, 15 pounds cotton-seed hulls and 6 pounds cotton-seed meal. Lot 4, 48 pounds silage and 8.9 pounds of cotton-seed meal. The price of the feeds were: Cotton-seed meal, $\$ 27$ per. ton; cotton-seed
hulls $\$ 7$ per ton ; cotton-seed, $\$ 17$ per ton, and silage, $\$ 2.50$ per ton.

Computed on a basis of the final selling weight at Fort Worth or the gain less the shrinkage we find that Lot 1 gained 239 pounds; Lot 3, 258 pounds, and Lot 4, 235 pounds. The net profit on each lot was respectively $\$ 14.32, \$ 20.01,15.8 \pm$, and $\$ 18.70$. Hence, on this basis, the meal and silage ration produced both the largest gain the largest profits. The ration of cottonseed and silage ranked next in total profits. However, this ration did not prove as satisfactory as some of the others, as toward the last of the experiment the cotton-seed caused the steers to scour excessively and cotton-seed meal had to be substituted for the seed. In the period after the meal was substituted the steers quit scouring and made an average gain: of 3.3 pounds for a period of 19 days as compared to an average gain of 2.09 pounds previous to that time. This further shows that the meal is superior to the cotton-seed for fattening purposes at the prices given. In regard to the other two lots the one receiving a ration of meal, hulls, and silage proved superior to the one of meal and hulls alone.

The results indicate that a ration of meal and silage is considerably superior to the others. If one has plenty of hulls with it. On the other hand, there does appear to be an advantage in a ration of meal, hulls, and silage over one of meal and hulls alone. The financial results would, of course, be modified in accordance with the prices of the hulls and silage.

There is also considerable discussion at presen in regard to whether or not silage-fed steers will dress as high as those fed on other feeds. A carload of Hereford steers, fed on a ration of silage, meal, kaffir chops and either hulls or sorghum hay were exhibited by the station at Fort Worth in the spring of 1913 and won the first prize for carload of highest dressing steers of the show with a dressing percentage of 66.02 per cent. This rather disproves the statement that that silage-fed animals are low in dressing percentage.

Results equally as good as those of the station are being obtained by practical stockmen who use judgment in their feeding. Many are also using silage for wintering young stuff and breeding stock. As a result their stock is going through the winter in much better shape than that of other stockmen who feed meal and hulls and have no silos.

As yet but little experimental data has been provided by any of the Southern experiment stations in regard to silage for sheep feeding. However, the results so far obtained by the Northern stations have been favorable, and there is no reason for their data not being applicable to our conditions. The results obtained at the Indiana station show that while silage-fed sheep make no
larger gains than those fed entirely on dry feed they made those gains much more economicaly. Under our conditions, where there is even more difference in the prices of dry feeds as compared to silage, there should be a wider difference in the cost of gain.

In sheep feeding the majority of practical men do not feed silage exclusively, as is often fed to cattle, but use about onehalf of some dry roughage and one-half silage. The sheep apparently do somewhat better on a combination of this kind than upon one of silage alone.
At present some people are feeding silage in limited quantities to horses and hogs with success. However, care must be taken in the case of horses that no mouldy or spoiled silage be fed, as death has been caused from this source. The digestive tract of the hog is limited in size and hence they cannot make a large use of bulky material such as silage. Some men are getting favorable results by feeding small quantities of silage to their brood sows. However, it is likely that for the present at least that the feeding of silage to hogs and horses will be in limited quantities and confined to those farmers and ranchmen that put up silage for some of the other classes of stock that they feed-
If the Southwest is to compete successfully with Northern and with imported animal products they must seek economical methods of production and improve the quality of their output. Silage as a feed enables great strides to be taken in each. Silage is without a doubt one of the most economical feeds. By using it stockmen are fattening their animals and hence improving their quality and enhancing the profits.

## The Road to More Prime Beef

By A. J. Rickart.
It is announced that the Rankins, of Missouri, are this year stocking up with calves for the first time, and will save the calf crop for grazing and breeding purposes. The high level to which stocker and feeder prices have risen in the past few years has made it advisable for these master stockmen to go into the business of raising their cattle, thus changing the policy of depending upon the range country for raw material.

The spread of the silo is having the effect of enlarging the demand for stock and feeding cattle, and at the same time is curtailing the supply. It enlarges the capacity of every community to handle cattle, and as silos are being built in both the Southwestern range country and in the Corn Belt, the tendency is to finish more cattle on the range, thus reducing the supply of
thin cattle from that section and increasing the cattle-carrying capacity of the corn country.

In Kansas at the beginning of the present year there were estimated to be 7,000 silos. It has been figured that 5,400 silos will be built in that State during the present year. The erection and filling of a 200 -ton silo, other things being equal, means that sixty cattle can be wintered where thirty were wintered without it.

On this basis the 12,000 silos of Kansas mean an increased capacity for wintering a third of a million cattle above the number that could have been wintered two or three years ago. Other corn-growing states are as active as Kansas. Silo builders say that from present indications the number of silos in the country will be doubled this year. Thus the demand for stock cattle and feeders in the Corn Belt promises to increase rapidly.
In the Panhandle of Texas hundreds of silos have been built in the past year or two, and a large number of cattle were fattened there last winter on silage and cotton-seed meal. In February a consignment of steers, fattened on this ration in that country, sold to Kansas City packers at $\$ 8.80$. The top price for prime corn-fed native steers the same day at the same market was $\$ 9.20$.

## Years of Good Prices Ahead

Stock cattle carried through the winter on a ranch that possesses a silo come out in the spring in fair tlesh, and go on grass, either in their native counttry or in Northern pastures, in good condition. They are capable either of making a quick finish for market off the Northern pastures, if it is desirable to market them early, or of developing good to choice quality and big weight later in the summer before the grass season is over. If kept in Texas or the Southwest, more of the cattle get fat enough for the killers during the summer season and fewer are left over for Corn-Belt feeders in the fall.

Meat consumption is so far ahead of meat production in this country that there are doubtless several years of good prices ahead for cattle raisers. The good prospects are causing range men to build up their herds as rapidly as possible. A single instance, typical of many others, was noted recently when a ranch owner at Raton, New Mexico, took out from Kansas City a herd of 105 head of breeding animals, consisting of 30 bulls from 18 to 24 months old, 45 yearling bulls and 30 cows from 1 to 5 years old.

The Government has taken a hand in restocking the ranges. The Commissioner of Indian Affairs is putting herds or cattle
on the big reservations, and is mapping out plans for the improvement and development of all the live-stock of the Indians. He has purchased beef cattle for a number of reservations out of Indian funds. The Government is also increasing the stock of sheep on the reservations, particularly in Arizona and New Mexico.

The Kent Bill was introduced into Congress as a solution of the question of the proper handling of the public grazing lands. Representatives of the American National Live-stock Association went to Washington to urge the enactment of this bill, which provides for a ten-year lease of Government land at maximum grazing fee of 4 cents an acre, and a minimum fee of $1 / 2$ cent an acre a year. The provisions of the bill permit fencing and various other improvements, and amply safe-guard the lessees from infringement by settlers. The intent of the bill is to promote cattle raising on the public domain. Approximately $45,000,000$ acres are involved.

At the recent Fort Worth convention of the Texas Cattle Raisers' Association several significant features were brought out, pointing to a new era in cattle raising in the Southwest. During the last year 553 new members were admitted to the association, with cattle holdings of 282,726 head. The membership is now 2,700, and in no previous year have so many cattlemen sought admission to the association. The large increase is taken to indicate that there are more active cattlemen in the territory covered by the association, which includes Texas, and parts of New Mexico, Oklahoma, and Kansas, than ever before.

## Fewer Cattle for Corn Belt Feeders

On the last day of the convention at Fort Worth a 17 -year-old boy created a sensation by telling the members what the babybeef organizations of Texas are doing. The membership of the baby-beef clubs is restricted to boys, and the object of the clubs is to excel in rushing calves to early maturity. The boys have the incentive of prizes, some of which are contributed by the Texas Cattle Raisers' Association. The advent of the Texas cattlemen into the baby-beef ranks is significant of a change in their methods. Formerly their chief concern was numbers; now it is quality. The immature animal was once their aim; now it is the finished bullock. Though this promises more beef, it is one other condition that works toward fewer cattle from the ranges for feeders in the Corn Belt.

In the Northwest country the vast irrigation projets undertaken in recent years have resulted in the raising of great quan-
tities of alfalfa and other forage crops. The bulkiness of these crops and the distance to market make it imperative that they be fed to live-stock. Irrigation has also increased the prothetion of sugar beets, and wherever there is a sugar mill many cattle are fattened on pulp and tops. These changed conditions in the Northwestern range country have also helped to diminish the number of stock cattle and feeders available for Corn Belt feeders, while at the same time augmenting the beef supply. The fact that there is an enormous shrinkage on fat cattle and sheep shipped to central markets from the distant Northwest, while discouraging to shippers, is not sufficient so as to outrank the benefits derived from feeding the crops where they are produced.

These changed and changing conditions in the cattle-raising industry indicate a replenishment of the beef supply within a few years. More of the range cattle will be fattened on the range, and more farm-raised cattle will be fattened on the farm.

While there will always be some stockers and feeders available from the range country, they will not supply the enlarged capacity of the Corn Belt region for finishing cattle. More cattle must be raised on farms, and some of the biggest cattle finishers have already accepted the changed conditions.

# FEEDING METHODS DISCUSSED BY DEMONSTRATION AGENTS 

Silos and Silage Are Given Great Boost in Address Before Body of Government Men in Oklahoma City-Boys and Girls Clubs Are Given Hearty Endorsement<br>-_Kansas and Oklahoma Cattle Buyers Are Now Getting Busy in Texas

Boys' and girls' clubs, dry farming, ensilage and the values of various crops as food for live-stock were some of the subjects discussed by the Texas Demonstration Agents of the United States Department of Agriculture Tuesday afternoon at the meeting of agents in the auditorium.
"Ensilage and progressive methods of feeding will solve the live-stock problems of West Texas,' said T. P. Metcalf of Amarillo, State Feeding and Demonstration Agent. "I recently conducted a contest for the comparison of ensilage and grass as to their feeding values. I fed two lots of cattle of 54 head each for 48 days. The two lots weighed practically the same at the start, but the ensilage and meal-fed cattle gained three and onethird pounds per day and the grass and cotton-cake cattle gained about two-third of a pound per day. The ensilage cattle gained 142 pounds and the grass-fed cattle gained 12 pounds. They were then driven 18 miles to a railroad and enroute the grassfed cattle lost 24 pounds and the ensilage-fed cattle lost 55 pounds. They were shipped to market and both lots lost 55 pounds on the way. From the time we bought the cattle to the time we sold them, the grass-fed cattle lost 47 pounds each and the ensilage-fed cattle gained 32 pounds each. The grass-fed cattle brought 7 cents per pound and the ensilage-fed cattle brought $\$ 7.50$ per hundredweight. The matter of feed alone made a difference of 79 pounds each in these lots of cattle. Each ensilage-fed animal netted us. $\$ 10.85$ more than the grass-fed cattle. The difference in price received for the two lots was $\$ 585.90$.
"It is impossible to fatten cattle in winter on grass. I have heard several men say they considered straight ensilage better than cotton-seed hulls."

The price at which ensilage is sold in Texas was discussed. The prices named ranged from $\$ 3$ to $\$ 10$.

Dr. Proctor called attention to the fact that, as cotton-seed hulls sell for $\$ 10$ per ton, and as ensilage is admittedly better food than hulls, ensilage should sell for at least $\$ 10$ per ton. He said the average cost of producing ensilage is $\$ 2.25$ per ton and said that, considering the low cost of producing it and the high valuation being put on it by those who buy and sell it, silos will doubtless help reduce the high price of meat.
"Some breeders consider ensilage worth twice as much as hulls for fattening purposes," said J. L. Quicksall, Assistant State Agent of Waco, who acted as chairman. "If every person in the United States would raise a surplus yearling, it would not reduce the cost of meat in this country. The Southern States are going to have to supply this country with meat. Don't sell your corn and then buy meat. Sell you corn on foot and not on the ear.
"Encourage the farmers to plant crops that will grow every year. Uvalde County formerly raised cotton entirely and bought $\$ 100 ; 000$ worth of feed from outside the county every month. Since our demonstrator has been there they raise enough feed to supply the county and they are raising more cotton than ever before. It is not necessary to raise corn to fatten hogs. The prize-winning hogs at the Fort Worth show last fall never saw a grain of corn. Plant peas or peanuts or any grain and let the hog harvest his own living."
Mr. Quicksall related an instance in which a farmer had turned his hogs into his pea field and put them in condition for the market at a cost of 3 cents per pound. And he added that Fort Worth is paying about 9 cents per pound for hogs.
O. J. Stitt of Memphis, Hall County, said that a pretty good menu for hogs is barley and wheat, with a little corn for dessert to fill them out.

## Suggestions on Feeding Corn Ensilage

Ensilage is not a balanced ration. Something should be fed with it. Corn ensilage is a food which may be termed "grass like." For this reason it can be used very much as pasture in the feeding of domestic animals. The analysis of good corn ensilage, however, will show that it is richer than a great many of the pasture grasses and, therefore, will go farther in feeding.

As soon as the silo is filled the feeding operation may start and, though it be in the heating process, it will be just as good food and will be relished by the animals quite as much as old silage. It is generally conceded, however, that silage which is several months old is better than newer silage. Some feeders prefer silage that is six months to a year old. However, it may
be safely said that silage can be fed from the time the blower pipe is taken out of the silo until the feeder desires to open his silo, and this may be after it has stood for several years.

Silage is strong in carbohydrates, the principal food requirement for all animals, but needs protein to balance it. Alfalfa hay is perhaps the cheapest and best for this purpose. Throughout the alfalfa belt it should form a part of the ration where silage is used. This is not necessary, but simply makes it possible for the feeder to gain a greater economy in his operations and at the same time give the animal a wholesome balanced ration.

Corn silage may be fed out of doors in bunks, in the stall, or in fact any place where animals can eat it without waste. In very sever weather it is best to feed silage inside, as some will freeze and this will be hard for the stock to masticate, although the feeder need not be alarmed over feeding freezing silage. It will not injure the animals, but frozen food is not easy for them to consume.

In feeding milch cows it is a very good plan to give the hay in a rack outside or some place where the animals will not waste it, and feed the ensilage in the barn after milking. It may be given twice a day in rations from 10 to 15 pounds at a feeding or 20 to 30 pounds per day. Some large animals will take as high as 40 to 50 pounds of silage per day and make good use of it. In fattening stock or steers, silage may be fed twice a day in small rations ranging from 10 to 15 pounds as a feed for grown stock and for young animals from 6 to 12 pounds. Sheep will consume from 2 to 4 pounds daily and horses from 4 to 12 pounds when not working. It is not advisable to feed work horses large quantities of silage, no more than to give them large quantities of new grass.

It requires a feed shortage to make the silo popular with some people. It is during a time of short feed that it is made to appear valuable.

## How to Make Money

No up-to-date dairyman or cattle feeder need buy very much outside of his own manufacture to feed his beef and dairy cattle. If he will purchase a first-class round silo, and fill it with good mature silage at the proper time, he need not buy any stock foods or appetizers. Silage has a flavor that makes every kind of stock around the place have an appetite.

Silage is a succulent food, rich in carbohydrates and poor in protein. Therefore it must be fed with some other food rich
in protein to balance the ration. Here the farmer comes in again as the manufacturer and supplies this protein with alfalfa; or if he has not alfalfa, good clover or pea hay will answer'. This can be manufactured on his farm, and we asser't that if a man has good silage and alfalfa, clover or pea hay, he need not buy an ounce of mill feed, as he has almost a balanced ration, and his cows will be sleek and in good order and will give a fine flow of milk. His steers and young cattle will do better than on any other feed he could feed. The great secret of making money on the farm in the dairy and cattle business is to manufacture what you feed, and when you sell your milk, butter, and your young cattle the money stays with you to invest. But where the man hauls his milk to the creamery and hauls back as much concentrated foods and mill feeds as his milk comes to, he is not getting paid for his labor.

Therefore, we urge every farmer, dairyman, or cattle raiser to get in the manufacturing business and manufacture his own food products. We can assure you he has only to make this start when he will see the great gains in his net profits. When our farmers, dairymen, and cattle-raisers come to comprehend all the fine possibilities there are in a well-managed farm, they will not only be prouder of their profession, but will make more money.

## Silo Conclusions

The following conclusions of facts were arrived at after five years' investigation at the Storrs Experimental Station.

1. The fermentation of corn silage is essentially the change of sugar into several acids. .The most important change is the conversion of a part of the sugar by lactic acid bacteria into lactic acid. A second change is produced by the action of yeasts on the remaining sugar, changing it to alcohol. The acetic bacteria change the alcohol into acetic acid.
2. The exclusion of air is necessary for the proper production and preservation of silage.
3. The walls of a silo should be non-conducting to heat, cold, and moisture.
4. Mature corn makes silage of better quality with less waste.
5. Silage undergoes a ripening, somerrhat similat to the fipening of cheese, which softens the fibre, and makes more digestible the proteins and adds new and agreeable fiavors. This ripening' occupies from three to four weeks.
6. A silo is the cheapest form of storage.
7. Any farm product can be siloed, providing there is sufficient sugar in the mixture to be fermented into acid to preserre it.
8. The following mixtures silo successfully and make a very desirable and nearly balanced ration: Alfalfa and rye, clover and timothy or wheat or oats, and peas, and corn and cow peas or soy beans.
9. Nothing excels the feeding of silage, especially legume silage, during the dry summer months, for keeping up the milk flow to its highest point.

## Every Dairyman and Cattle Raiser Should Have a Silo for the Following Reasons:

1. Because corn ensilage is the nearest and most economical substitute for pasture grass, which is the most ideal of all our rations.
2. That an acre of corn ensilage yields from 600 to 2,000 pounds more nutrients per acre than any other of the farm crops.
3. That there is a great economy of space in its use.
4. That its use makes it more pleasant to feed stock and also saves a great deal of time and labor.
5. Because with its use in the winter ration, larger gain in milk flows are the results.
6. With its use, practically the entire food value of the corn crop is saved.
7. That the silo enables the farmer to keep double the number of head of stock on the same farm.
8. That our fields are cleared and ready for fall wheat or rye, as all cornstalks are safely stored in our silo instead of going to waste in the fields.
9. Lastly, and probably the most convincing of all, is the fact that practically every farmer now using the silo would not do without it. When we can grow and store away for winter use a food that takes the place of pasture, and that food can be raised on our farms at less cost than any of our present feeds, the equipment for the storing of such feed should be installed on every stock and dairy farm.

One acre of corn made into silage will produce more feed than four acres of clover hay.

SIZE, WEIGHT, AND CAPACITY OF ROUND SILOS.

| Outside <br> diameter <br> in feet. | Height <br> in <br> feet. | Approx. <br> capacity <br> in tons. | Approx. <br> weight of | Silo. | Acref | Corn. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |

## More Facts About Silage

The Dairy Division of the Department of Agriculture has for a number of years conducted experiments in growing, preparing and feeding silage. The results of these invsetigations have lately been summed up by the Department in Farmers' Bulletin 578.

Cost accounts kept for silos on 31 farms in Wisconsin and Michigan show that the cost of putting up a ton of silage varies from 46 to 86 cents. Cost records kept for 87 silos in various parts of the United States give 87 cents a ton as the average cost of filling.
"The cost of producing a ton of silage," explains the Department, "varies, of course, with the acre yield, the cost of growing an acre and the cost of filling the silo. In general, it may be stated that from $\$ 1.50$ to $\$ 4$ a ton represents the limits between which most of the silage is produced.'"

As to the use of silage the Department draws from its records of various feeding experiments with various classes of cattle several rations that have been found to give satisfactory results.

Rations for dairy cows are classified in accordance with milk yield and the quality of this yield, as follows:

For a 1300 -pound cow yielding 40 pounds of milk testing 3.5 per cent: Silage, 40 pounds; clover, cowpea, or alfalfa hay, 10 pounds; grain mixture, 10 pounds.

For a cow of the same weight yielding 20 pounds of 3.5 per cent malk: Silage, 40 pounds; clover, cowpea, or alfalfa hay, 5 pounds; grain mixture, 5 pounds.

For a 900 -pound cow yielding 30 pounds of 5 per cent milk: Silage, 30 pounds; clover, cowpea or alfalfa hay, 10 pounds;
grain mixture, 11 pounds.
For a cow of the same weight yielding 15 pounds of 5 per cent milk: Silage, 40 pounds; clover, cowpea, or alfalfa hay, pounds; grain mixture, 5 pounds.

A good grain mixture to be used in a ration that includes silage and some sort of legrminous hay is composed of: Corn chop, four parts; wheat bran, two parts; linseed-oil meal or cot-ton-seed meal, one part.

The Department classifies rations for fattening steers according to locality. The following rations have been found highly satisfactory for a 1000 -pound steer:

For the Corn Belt:
Ration 1. Corn silage, 25 pounds; corn stover; 6 pounds; cot-ton-seed meal or oil meal, 3 pounds; shelled corn, 14 pounds.

Ration 2. Corn silage, 25 pounds; clover hay, 7 pounds; shelled corn, 15 pounds.

For the Eastern States where hay is very high and corn is relatively high :

Corn silage, 30 pounds; corn stover, 6 pounds; cotton-seed meal or oil meal, 4 pounds; shelled corn, 10 pounds.

For the South where cotton-seed meal is of moderate price and corrpea hay is raised on the farm :

Ration 1. Corn silage, 35 pounds; cowpea hay, 8 pounds; cottonseed meal or oil meal, 7 pounds.

Ration 2. Corn silage, 30 pounds ; cotton-seed hulls, 12 pounds; cotton-seed meal, 7 pounds.

For the West where corn cannot be raised :
Ration 1. Kaffir silage, 30 pounds; prairie hay, 3 pounds; cotton-seed meal, 3 pounds; kaffir meal, 10 pounds.

Ration 2. Kaffir silage, 25 pounds; alfalfa, 7 pounds; kaffir, 15 pounds.

In conclusion the Silo Publishing Company wishes to inform the readers of this book that we are not agents nor are we connected with any silo company either manufacturing silos or silo machinery, but if the reader is desirous of getting in touch with one or more relable companies who are selling silos and silo machinery in this State, we will be glad to refer you to several concerns that we have investigated and know to be perfectly reliable.

The author of "Silos and Their Uses" has made rather an exhaustive study of silos and machinery necessary to equip one and may have overlooked some valuable data in compilling this book, so we have decided to open an information bureau and at any time should any of our readers wish or desire any information along our lines, we will be glad to furnish you such information as you desire to the best of our ability.

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