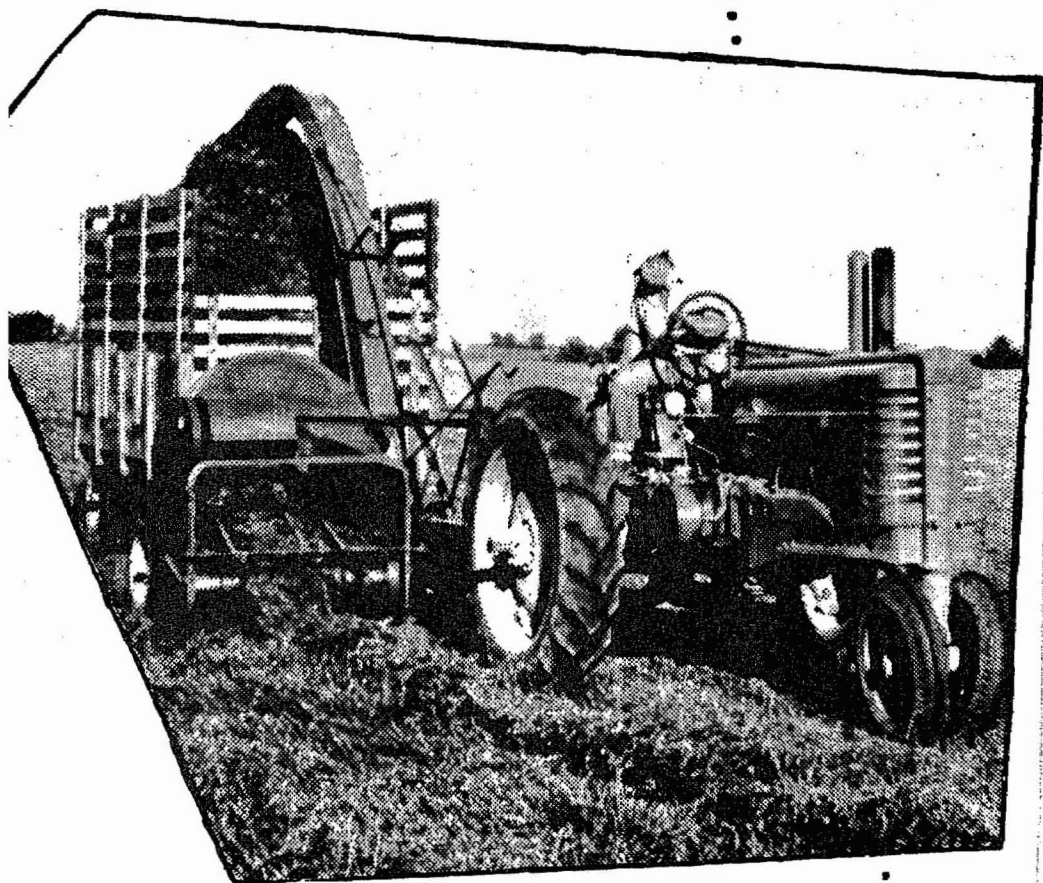


SILOS & SILAGE



EXTENSION SERVICE
MONTANA STATE COLLEGE
BOZEMAN, MONTANA

SILOS AND SILAGE

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From 1915 to 1925 many silos of various types were built in Montana as a means of preserving forage. Because of the large amount of hand labor required at that time in making silage, many farmers discontinued the use of their silos. Now, the coming of more modern machinery for making silage, higher feed costs and more information as to the superior food value of silage over hay has brought about a renewed interest in silage. Furthermore, the use of grass and legume silage is a step in the right direction in our soil conservation program. In the past, corn has been the principal silage crop because of its high yield per acre where climatic conditions were favorable. Other crops used for silage in Montana are oats and peas, sunflowers, sorghums, beet tops, alfalfa, clover and the grasses.

Advantages of Silage

Silage is a feed of great importance in the dairy, sheep and cattle feeding districts of the United States. Its popularity as a feed is due to its many advantages which are as follows:

1. Silage is a palatable feed relished by dairy cattle, beef cattle and sheep. It may also be used to a limited extent in feeding hogs.
2. More livestock can be kept on the farm because high yielding crops may be grown for silage.

3. A higher per cent of the nutrients are conserved in making silage than in dry curing forage. In making grass or legume silage, 80 to 85 per cent of the original dry matter may be retained while in making hay under fairly favorable weather conditions only about 75 per cent is retained. The loss in protein is even greater in hay making. Under unfavorable weather conditions one-half or more of the food value of the hay may be lost in curing and storage.

Silage will usually contain several times more carotene (the mother substance of vitamin A) than the dry cured hay.

4. Grasses or legumes can be harvested at the proper stage of growth even though the weather is unfavorable for making hay. The importance of cutting alfalfa at the proper time is shown by tests conducted at the USDA Field Station at Huntley, Montana. The results of this test are shown in the following table.

Stage of Maturity When Harvested	Yield of Prote- in Per Acre	Yield Butter- fat Per Acre
	<u>Lbs.</u>	<u>Lbs.</u>
Early bloom	1,427	404
One-half bloom	1,381	345
Full bloom	997	331

5. Silage can be fed with little, if any, waste.
6. Silage provides high-quality, succulent feed throughout the winter. Thus, the animals fed are usually in better physical condition and better production is obtained.
7. Grasses and legumes are usually harvested for silage before the common weeds produce seeds.

8. Good silage in a well-made silo can be kept for several years with little deterioration in quality. Thus, silage made in productive years may be carried over as a feed reserve in drouth years.
9. There is little, if any, danger of silage being destroyed by fire - assuring the farmer a winter's feed supply.
10. A cubic foot of silage generally contains about 3 times more food value than a cubic foot of loose hay. Thus, less storage space is required.
11. In making silage the crop is generally removed in a few days, permitting the early irrigation or cultivation of the land for succeeding crops.

Disadvantages of Silage

The principal disadvantage of silage in the past has been the high cost of the silo and necessary machinery and the large amount of hand labor involved in making and feeding silage. The cost of a good, permanent, upright silo is still considerable. To avoid this cost many farmers now build trench or pit silos that can be constructed at a relatively low cost. Modern machinery for making silage with a minimum amount of labor entails considerable expense. To minimize this expense farmers can cooperate in the purchase of some of the essential machines. Thus, the disadvantages in making silage in the past have now been partly eliminated.

Montana farmers who have built good trench or upright silos in late years have adapted labor-saving methods in making silage. They have harvested their silage at the proper time and have used approved methods in curing and preserving their silage. They are well pleased with the results obtained.

Size of Silo to Build

In building a silo the amount of silage needed should be considered. The following table gives the usual recommended daily allowance for farm animals.

Kind of Animals	Feed Per Day Pounds
Mature cows	35 to 45
Yearling heifers	20 to 25
Fattening yearlings	20 to 25
Fattening calves	15 to 20
Breeding ewes	3 to 5
Fattening lambs	1 to 3

From the above table, one can readily calculate the approximate daily requirement for his animals. Multiplying the daily requirements by the approximate number of days in the winter feeding period will give the total tonnage needed. Silage will usually weigh about 40 pounds per cubic foot in trench silos.

The following table gives the capacity of trench silos.

Depth	Top Width	Bottom Width	Tons of silage for various lengths			
			30 ft.	40 ft.	50 ft.	60 ft.
8	12	8	48	64	80	96
10	14	9	69	92	115	138

For the approximate capacity of pit silos, see Table 5.

The weight of silage will vary with the moisture content, kind of material ensiled, method of packing and depth of silo. As a rule, the best preserved silage is found in the lower portion of the silo.

Time of Harvesting Silage Crops

Silage crops are harvested when the plants are green, immature and when the yield of protein per acre is greatest. High-quality silage cannot be made from over-mature crops. Corn is generally harvested for silage when the lower leaves begin changing color and the kernels are in the early dough stage.

Red clover should be cut when about one-half of the plants are in bloom and the alfalfa when one-tenth to one-fourth in bloom. The best time to harvest the cereals is when the seed is in the milk or early dough stage.

Importance of Proper Moisture Content

Silage usually contains from 60 to 75 per cent water. Corn harvested at the proper stage of growth will generally contain sufficient water to pack and cure properly. If the silage crop for various reasons is too dry then a small stream of moisture should be added as the material goes through the cutter, or water may be sprayed on the silage at frequent intervals by means of a garden hose. When the material is inclined to be too dry, better curing will result if the cutter is set to cut one-half inch lengths or less. Finely cut material will pack closer and exclude the air better than coarsely cut material.

Two methods are used in making legume or mixed grass-legume silage. These methods are as follows:

- (1) Wilting method
- (2) By use of preservatives

The wilting method consists of wilting the freshly cut legumes or grass-legume mixture in the field from one to several hours, depending upon the weather and the original water content of the crop when cut. The aim is to reduce the water content to about 65 per cent when ensiled. When silage is made by this method the cutter should be set to cut at 1/4 in. lengths, if possible. Good, thorough packing in the

silage is also essential. No preservative is used. Under ideal conditions a very palatable grade of silage can be made by this method.

The difficulties encountered in making wilted silage are:

- (1) It requires considerable experience to tell when the material contains the right percentage of moisture. One simple but not highly accurate method is to take a representative handful of the material to be ensiled and twist it between both hands. If beads of moisture form on the tightly twisted portion, the moisture content is considered ample. A more accurate method is the use of a simple home-made moisture tester as described in Extension Leaflet, "Determining the Moisture Content in Hay."
- (2) There is danger of getting the material too dry. Delays in filling, hot winds and bright sunshine may result in over-wilting. In that case, the silage may spoil by molding unless water is added at the time of filling. Then, the problem arises as to how much water should be added and how it can be done.

The following table shows the amount of water that must be added per ton to silage crops that have become too dry before ensiling.

Per cent Moisture In Silage Crop	To Obtain 65% Moisture Gal. Per Ton	To Obtain 70% Moisture Gal. Per Ton
40	172	241
45	138	201
50	103	161
55	69	121
60	35	81
65	--	41

Water may be added by having a small stream flowing into the silage cutter or by sprinkling the material in the silo during the filling process. Where water is available under pressure, a garden hose is generally used. The amount of water discharged from the hose may be ascertained by noting the length of time required in filling a 10 gal. milk can. For example - if a two ton load of wilted alfalfa, containing 55 per cent moisture, is being ensiled and 65 per cent is desired then 138 gal. of water should be added ($69 \times 2 = 138$). If it requires two minutes to fill a 10 gal. can then 5 gal. can be added per minute. Thus, the water should be sprayed on for about 27 minutes ($138 \div 5 = 27.6$) per each 2 ton load.

The preservative method is accomplished by ensiling with a higher water content (70 per cent or more) and the addition of molasses, sugar, or ground barley, wheat or corn. In this case the legume or grass-legume mixture is ensiled immediately after it is cut in the field unless it is especially high in water when it may be wilted for only a short period. The amount of preservatives generally recommended are as follows.

Kind of Crop Ensiled	Kind of Preservative	Amount Recommended Per Ton
Alfalfa	Sugar	10-12 lbs.
	Molasses	7- 8 gal.
	Ground grains	150 lbs.
Grass-Legume Mixture	Sugar	7-10 lbs.
	Molasses	5- 6 gal.
	Ground grains	100-125 lbs.

The Montana Experiment Station made silage for several years from freshly cut red clover without the use of preservatives. The feeding trials conducted show that the silage had high feeding value, but it was observed that in late winter and spring it developed a

rather offensive odor, although it was not rejected by the animals.

Types of Silos and Their Construction

Several types of silos are adaptable to Montana conditions. Probably the type used most in recent years has been trench silo. However, fence silos, pit silos and upright silos have also been used successfully.

For information and details of construction on upright and fence silos see Farmers' Bulletin #1820, "Silos, Types and Construction," available through County Extension Agents.

Comparison of Various Types of Silos

Type of Silo	First Cost	Length of Usefulness	Amount of Spoilage	Cost of Filling	Freezing of Silage
Upright	Highest	Long	Low to Medium	High	Medium to High
Pit	High	Long	Low	Low	None
Trench	Low	Short to Long	High	Low	Low
Fence	Lowest	Very short	High	Medium to High	High

Trench and pit silos are given the most space in this bulletin because they are well adapted to Montana conditions.

Trench Silo

A. Advantages

1. It can be built with unskilled labor and with

machinery easily procured on the farm.

2. It is inexpensive to build in heavy soil that does not erode readily.
3. If built in heavy type soils it may serve several years without lining the walls with concrete.
4. It can be built quickly for emergency use.
5. In filling, the cut silage material can be dumped in saving on both labor and machinery.
6. The silage material can be packed by means of a tractor or horses.
7. There will be less trouble from frozen silage as compared with the upright silos.
8. There is little, if any, danger from poison gasses.
9. If properly built, the silage can be readily removed in feed carts, trucks or wagons. In large trench silos the silage may be removed by trucks and mechanical manure loaders.
10. The capacity can easily be increased by increasing the length and width.
11. The trench silo can be made permanent if the walls and floor are covered with concrete.
12. It cannot be blown down or destroyed by fire.

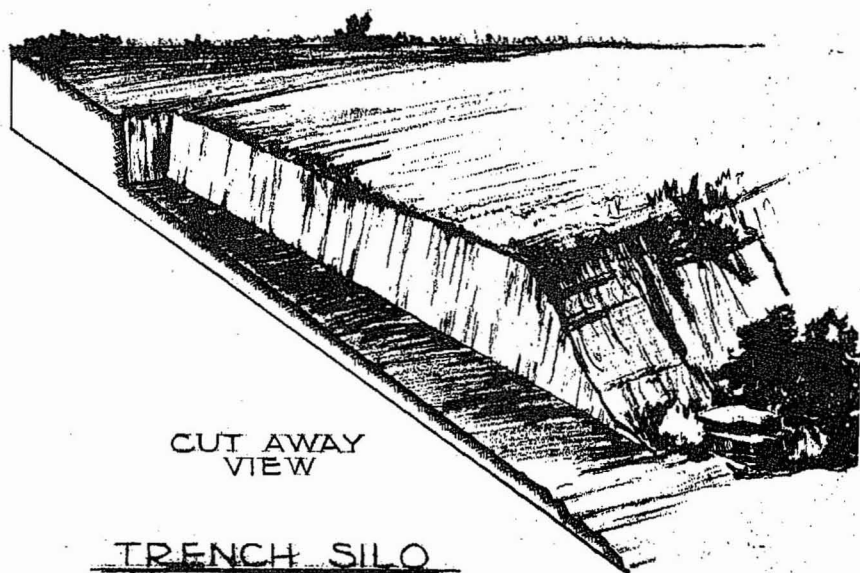


Figure 1. A Trench Silo

B. Disadvantages

1. Because of the larger top surface a higher percentage of the silage will be spoiled or of poorer quality than in a pit or upright silo.
2. Snow may drift into the open portion of the silo causing extra work and perhaps delays in feeding.
3. Unless the silo is built into a hillside or on well-drained soil, ground water may seep in causing silage below water level to spoil.
4. Trench silos dug on level ground frequently give considerable trouble in removing silage due to a muddy or icy incline.

5. Trench silos without concrete walls and floors must have their walls trimmed up and soil removed every year; otherwise, the walls will become rough and more silage is likely to spoil.
6. Unless the walls are lined with concrete, the silo in time will become too wide.
7. Suitable hills, in desirable locations for building a trench silo, are not frequently found on farms.
8. An abandoned silo generally becomes a hazard on the farmstead.

Many farmers regard the trench silo as a temporary method of providing silage for their animals until an upright or pit silo can be built. Others who have a good hill in a desirable location plan to line the walls of their trench silo and thus make it a permanent building.

C. Location

1. Should be convenient to barn or feed-lot.
2. Where it will not interfere with farm operations.
3. Where it can be fenced to avoid danger of livestock falling into it.
4. On a hillside or slope so that one end may be open and water will drain out.
5. An ideal location is where the lower end has a steep slope. See Figure 2. This allows a more uniform depth throughout the length. Such a slope is frequently found at the edge of a ravine. The probable high water level in the ravine should be below the trench floor.

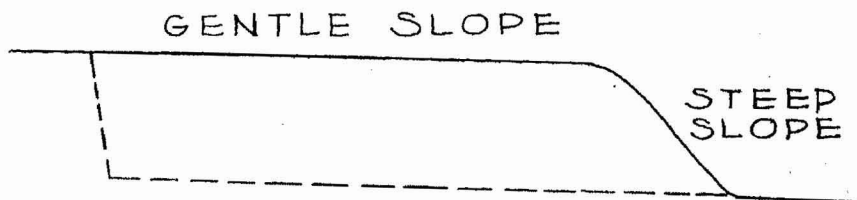


Figure 2. Desirable Slopes For a Trench Silo

D. Size

1. The amount of silage needed should first be determined from information on page 3.
2. Select a slope of:
 - a. Four inches per foot of depth in most soils.
 - b. Three inches per foot of depth in clay that stands well.
 - c. Five inches per foot of depth if soil is sandy and caves easily.
 - d. If soil will not stand at five inches per foot, walls must be lined.
3. Select as great a depth as possible from Table 1 consistent with the hillside or ravine edge location selected.
4. Select a bottom width, preferably between 8 and 12 feet. (See Table 1)
5. Select a length from page 3 or calculate the length of trench by dividing the total pounds of silage needed by the number of pounds per foot from Table 1.
 - a. Use the average depth (depth at deep end plus depth at lower end, divided by two).

Table 1
Dimensions and Weight of Silage Per Foot Length
of Trench Silos

Side Slope	Depth	Bot- tom Width	Top Width		Cross Sectional Area	Wt. of Si- lage Per 1 Ft. Slice
In. Per Ft. Depth	<u>Ft.</u>	<u>Ft.</u>	<u>Ft.</u>	<u>In.</u>	Sq. <u>Ft.</u>	<u>Lbs.</u>
3	8	8	12	0	80	3200
4	8	8	13	4	85	3400
5	8	8	14	8	91	3640
3	10	10	15	0	125	5000
4	10	10	16	8	133	5320
5	10	10	18	4	142	5680
3	12	12	18	0	180	7200
4	12	12	20	0	192	7680
5	12	12	22	0	204	8160

E. Staking out the trench

1. Set a stake at the floor level at the lower end of the trench and another stake every 10 feet on the center line.
2. Determine the depth the trench will be at each stake.
 - a. Level the edge of a board, as in Figure 3, to compare the elevation at each center stake with the lower end floor level stake, point 1.

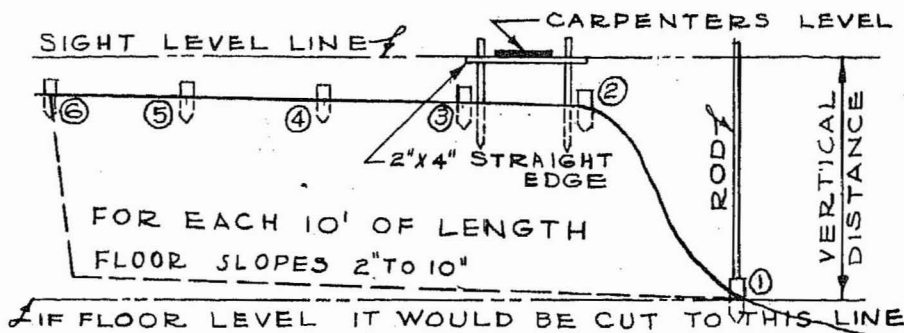


Figure 3.

- b. Determine the vertical distance between the ground and level line at each stake.
- c. Subtract the vertical distance at each stake from vertical distance at the lower end floor level, stake 1.
 1. This would give the depth at each stake if the floor was to be level. However, since the floor should slope down to the lower end, it will be necessary to subtract more at each point.
- d. The floor should slope between 2 and 10 in. in each 10 ft. of length. Thus, to find the true depth at each stake, subtract the amount of the slope, 2 in. to 10 in., from the depth for a level floor at stake 2. Double the amount of the slope should be subtracted at stake 3, triple the amount at stake 4, four times the amount at stake 5 and so on.

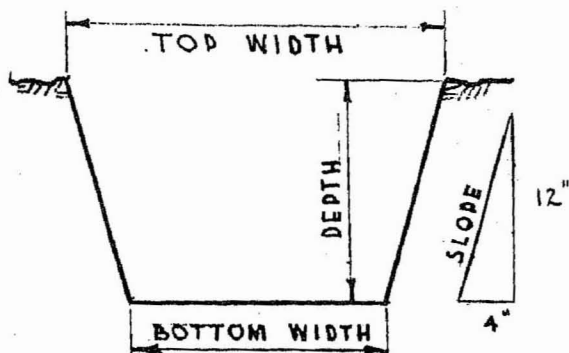


Figure 4. Cross Section of a Trench Silo

3. Determine the top width at each stake from Table 2. Set stakes at each 10 ft. on both sides of the center stake, half of the top width distance from the center stake.

Table 2

Top Width of Trench For Various Depths and Side Slopes; Assuming a Bottom Width of 8 Feet*

Depth in Feet	Side Slop in Inches Per Foot of Depth		
	3 inches	4 inches	5 inches
6	11 ft.	12 ft.	13 ft.
7	11 ft. 6 in.	12 ft. 8 in.	13 ft. 10 in.
8	12 ft.	13 ft. 4 in.	14 ft. 8 in.
9	12 ft. 6 in.	14 ft.	15 ft. 6 in.
10	13 ft.	14 ft. 8 in.	16 ft. 4 in.
11	13 ft. 6 in.	15 ft. 4 in.	17 ft. 2 in.
12	14 ft.	16 ft.	18 ft.

* To find the top width when the bottom width is to be more or less than 8 ft., add or subtract the amount the actual width differs from 8 ft. For example, if the width is to be 10 ft., add 2 ft. to each figure in Table 2. If the width is to be 7 ft., subtract 1 foot from each figure.

F. Digging the trench

1. Plow the staked out area staying 6 in. inside the side stakes so the slope can be smoothed down later.
2. Remove the dirt with a scraper or dozer.
3. Plow another layer staying a little inside (1 or 2 in.) the first plowed furrow.
4. Repeat steps 2 and 3 until trench is dug.
5. Smooth the slopes. A spade, mattock or grubbing hoe can be used. A long board or straight edge will help in keeping the slope uniform.

G. Lining the trench silo

If a trench silo is to be used for several years, the side walls will probably have to be lined to prevent caving. The cost of lining will be considerable. Before going to this expense, other silo types should be considered. It will take about the same amount of concrete to line the walls and floor of the trench silo as for building an upright concrete silo of equal capacity.

The most satisfactory lining for a trench silo is a 6 or 8 in. wall of reinforced concrete. See Figure 5. Other masonry walls are sometimes used but they are seldom satisfactory. Wood planks may be used where lumber is very cheap. However, they soon rot out and must be replaced.

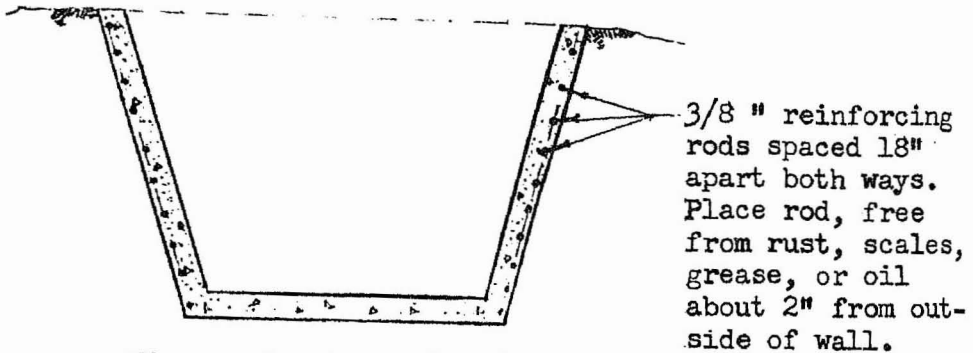


Figure 5. Concrete Lining
For Trench Silo

The Pit Silo

A. Advantages

1. A pit silo is very economical to build when the wall can be plastered.
2. There is a minimum of spoilage.
3. Silage is better preserved several years.
4. Practically no trouble is experienced from the freezing of the silage.
5. Owing to its depth and shape, it has a large capacity for its size.
6. It is easy to fill the pit silo.
7. The smooth plastered walls allow the silage to settle uniformly and retain the juices.
8. Pit silos may be considered permanent if kept in good repair.
9. The cost of maintenance is low.
10. Door problems common to upright silos are eliminated.

11. It can be built with unskilled labor and with machinery easily procured on the farm.
12. Forage can be dumped into the pit without packing.
13. The location is not dependent upon topography.
14. A pit silo cannot be destroyed by fire, wind, etc.

B. Disadvantages

1. In the past the greatest disadvantage has been the inconvenience in getting the silage out. With electric power a basket operated with an electric hoist overcomes this disadvantage.
2. Considerable hand labor is necessary in construction.
3. There is some danger from poisonous gases during filling or shortly after filling when the pit is not completely full. When new silage has been in the pit for over one day, the air should be mixed by pulling a bucket, umbrella or the like up and down before entering. The presence of gas may be determined by lowering a lighted lantern. If the lantern goes out, more air must be mixed in.
4. Without protective measures, children and livestock may fall in.
5. Cannot be constructed where there is a high water table.
6. Cost of construction in rocky soil is high.

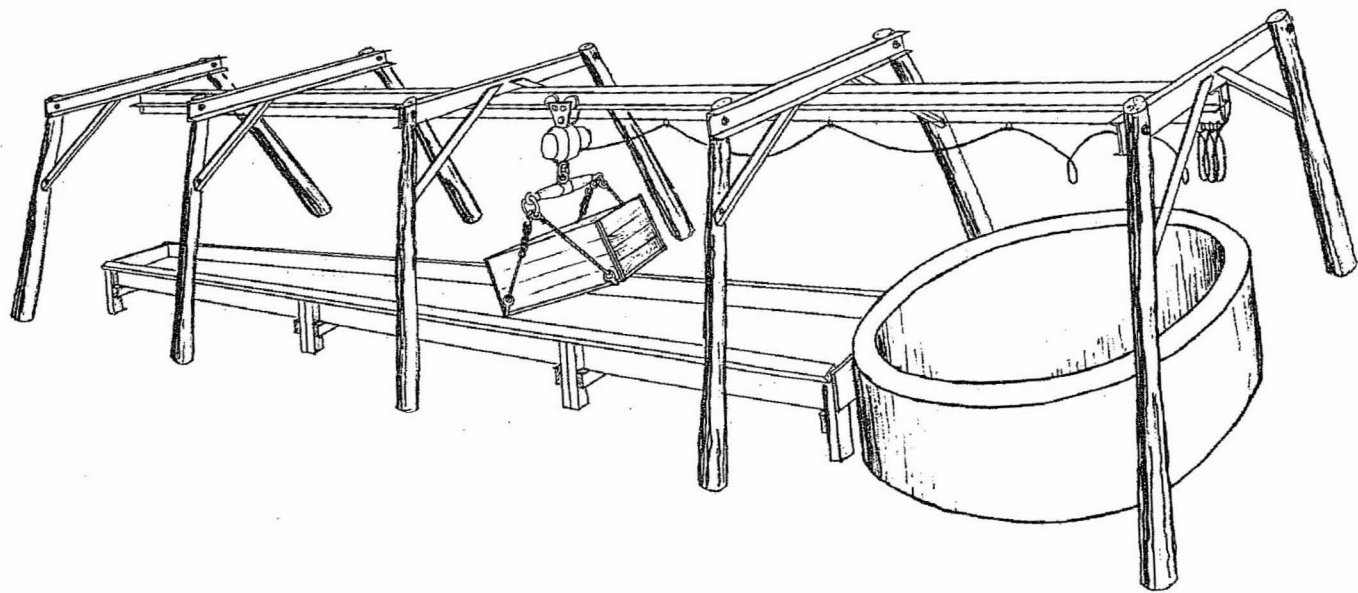


Figure 6. Pit Silo and Feeding Arrangement

C. Location

1. Should be convenient to barn or feed-lot, but at least 6 ft. from a barn wall.
2. The water level in the soil, if any, must be below the bottom of the pit.
3. Any fairly dry soil that is free from seeps, rocks and sand strata should be satisfactory.
 - a. The water table and character of the soil may be observed in a nearby well, or
 - b. A small hole may be dug with a soil auger the proposed depth of the pit.
4. The silo must not receive seepage or drainage from barns or feed-lots.

D. Size

1. The amount of silage needed must first be determined from page 3.
2. Determine diameter and depth from Table 5. Consider depth to water table.

Table 5
Capacity of Round Pit Silos (Grass Silage)

Inside Diameter of Pit	Depth of Pit Silo						
	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.	26 ft.	30 ft.
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
10	24	27	30	33	37	41	52
12	34	38	43	48	54	61	75
14	46	51	58	65	73	81	100*

*If over 100 tons are needed, consider additional silos

3. Pit silos are usually 10 to 14 ft. in diameter and 20 to 25 ft. deep. Depths as little as 14 ft. are sometimes used when the water table will not permit them to be made deeper.

E. Constructing the pit silo

1. Mark a circle on the ground locating inside of silo.
2. Set treated poles in ground for hoist. These can be used for hoisting the dirt and for hoisting the silage later. See Figure 6.
 - a. Poles should be 3 ft. away from the silo.
 - b. Poles should be placed so the hoist may become a part of the feeding system and so that a truck may be backed up to the silo from at least one side for filling.
 - c. Poles should extend 10 ft. above ground and 4 ft. or more in the ground.
3. Rig up hoist, electric motor preferred, to use in loading all dirt as well as silage later.
4. Dig hole 3 to 4 ft. deep and 6 in. larger on all sides than the inside diameter of finished silo.
5. Build circular forms for concrete collar.
 - a. Collar should be at least 6 in. thick, extend 3 ft. to 4 ft. below surface and the same amount above ground. The height above ground should be high enough to prevent children and livestock from falling in and low enough that the truck or wagon may be backed up to the edge for filling.

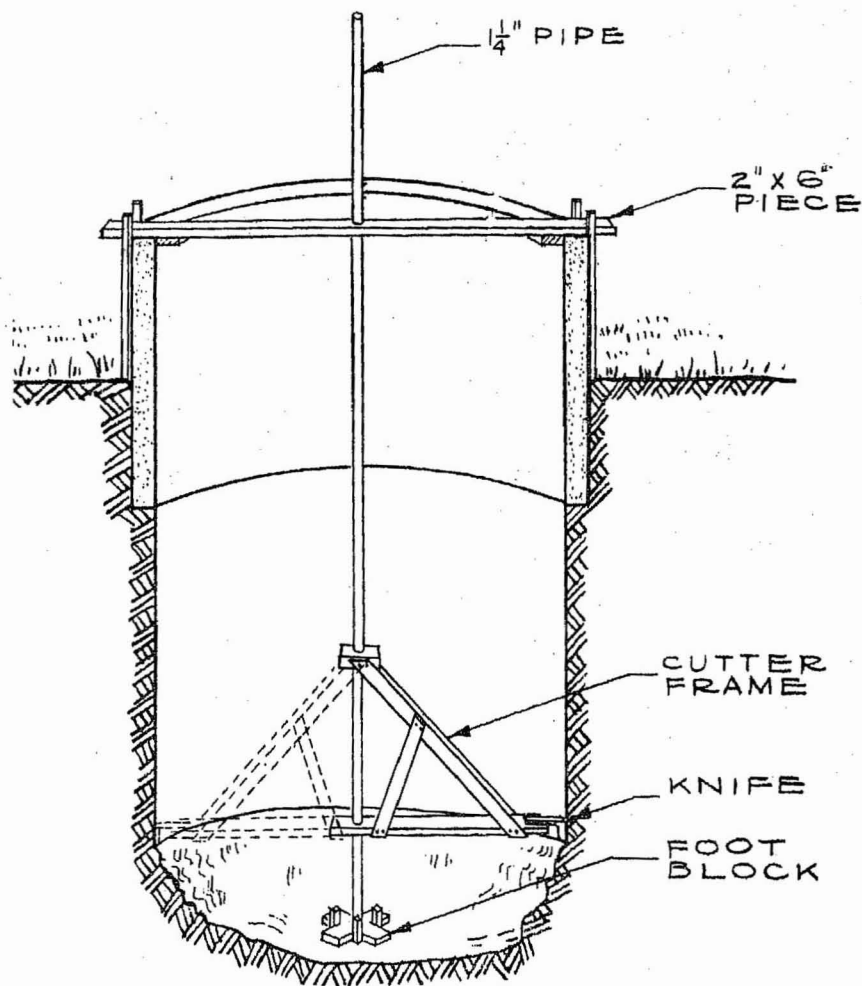


Figure 7. Digging a Pit Silo With Smooth Circular Walls

6. Pour concrete collar - mix concrete with 1 sack cement to 2 $\frac{1}{4}$ cubic ft. of sand and 3 cubic ft. of gravel. It is better to screen out sand from gravel and remix in proper quantities. However, if bank run gravel is used, mix 1 sack of cement to 4 cubic ft. of sand and gravel.

- a. The amount of water per sack of cement should not exceed 6 $1/4$ gal. if sand is damp or 5 $1/2$ gal. if sand is wet.
 - b. Only clean, hard aggregate free from dirt and vegetable matter should be used. Only good drinking water should be used for mixing.
7. Make knife with frame for cutting smooth circular walls. See Figure 7.
 8. After concrete collar has had time to set about 2 or 3 days, dig hole on down 3 to 6 ft. deeper depending on tendency of soil to cave. Be sure to stay inside of silo so walls may be shaved smooth later.
 9. Put on the top 2" x 6" piece and locate the center of the foot block with a plumb bob suspended through the center hole at the top.
 10. Set the foot block in place, insert the circular cutting device, Figure 7, and cut the walls down smooth.
 11. Plaster the side walls down this far.
 - a. Any large holes in the wall from rocks should be covered with metal lath before plastering.
 - b. Plaster should be reinforced with woven wire fastened to the side walls with spikes or rods.
 - c. Two coats of plaster each $3/4$ in. to 1 in. thick should be applied.
 - d. Mix plaster 1 part cement to 2 $1/2$ parts clean sand.

- e. Second coat should be applied before the first coat is completely dry.
 - 1. Before applying the second coat of plaster, brush on a coat of thick paint made from cement and water. This will help bond the second coat and increase the water tightness.
 - f. Do not extend the second coat down to the bottom of the first coat so the joint will not be at the same place for both coats.
12. Dig hole down another 3 to 6 ft. and continue smoothing of the walls and applying the reinforced plaster coats. Repeat until satisfactory depth has been reached.
13. Square off bottom of pit. Do not install a watertight floor. A dirt floor is usually satisfactory.

The Fence Silo

The fence silo is the most temporary and one of the simplest to construct. It consists of three or four tiers of snow fence or welded wire formed in a circle and lined with strong paper. The cost of the silo is small and so may be a desirable way to put up silage to try the first time.

However, since new paper must be purchased every year and since it must be completely rebuilt every year, the cost over a period of years may be higher than permanent types of silos. Also, the percentage of spoilage runs fairly high due to freezing, breaks in the paper or fencing and from poor top cover or no cover at all.

The fence silo can be filled with a blower or an elevator in a manner similar to filling permanent upright silos or it can be filled by hand. This is another advantage for the farmer who is trying silage for the first time since he will not have to invest in

expensive machinery.

The fence silo can be located at any convenient place in the feed-lot or near the barn so feeding the silage is not a big problem.

Grass Silage Harvesting Methods

Five basic silage harvesting systems are or have been in use as follows:

1. Mowing, raking and dumping into silo without chopping.
2. Mowing, raking, hand loading, hand unloading and hand feeding to stationary chopper.
3. Mowing, raking, machine loading (loader), hand unloading and feeding to stationary chopper.
4. Mowing, raking, pickup with field chopper, mechanical unloading. See front cover.
5. Director cut with field chopper, mechanical unloading. See Figure 8.

Legumes and grasses may be ensiled without chopping. If cut when green, ensiled without wilting, distributed by hand and especially well packed by tractor or horse it will keep with little loss. The objections to this method are: (1) There is a lot of work involved in distributing uncut material evenly and (2) It is difficult to remove from silo. A broad axe is generally used to chop off a 2 to 4 foot slice.

Hand methods involve a lot of time and hard labor. It may be necessary in small operations where cash outlay for equipment is inadvisable.

The third method is commonly used where field choppers are not available. Modern cylinder rake-bar loaders, commonly known as heavy-duty or green-crop

loaders are the most satisfactory type to use in picking up the crop.

The field-chopper method, where one man gathers, chops and loads the crop, is the easiest and fastest way to harvest grass silage. This method reduces the labor requirements to half that required by the green feed loader system. In addition, it takes the hard work out of the silage operation.

For moving the green material from the field to the silo, trucks, trailers and wagons are all widely used. Fair-sized loads may be built without the care required in loading dry hay. If a truck and hay loader are used the driver can throw the peak of the load forward by a quick stop. By this method of loading the forage is not so solidly packed and may be dumped at the stationary chopper and fed from the ground without too much tangling.

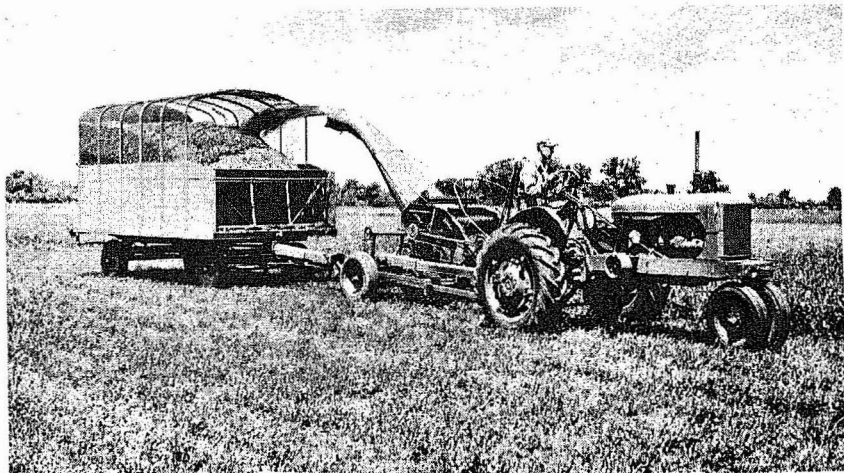


Figure 8. Operating a Direct Cut Field Choppers.

If dump bodies are not available, the load may be placed on home-made canvas or wire slings and slid off at the chopper. Rolling the grass off may be unsatisfactory as the green, unchopped material is then difficult to pull apart.

Wagons, trucks or trailers with good, tight boxes about 12 to 16 ft. long will meet most capacity requirements. These are loaded only to a depth of three or four feet. Rubber-tired vehicles are particularly satisfactory for fast highway travel and are pulled more easily over rough and soft ground.

For most grass and legume crops the chopper is best set to cut $1/2$ in. lengths. For pasture clippings a $3/4$ in. setting is satisfactory. For mature material or when the crop is being ensiled in temporary silos or without preservatives a $1/4$ in. cut is recommended.

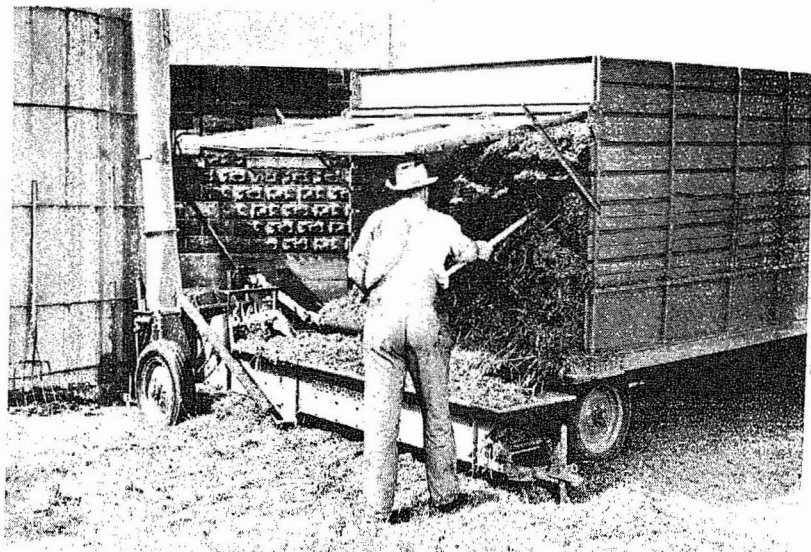


Figure 9. Unloading Into Stationary Chopper and Blower From Wagon With Canvas Bottom and Mechanical Unloader

Rocks, horseshoes, hay rake teeth and similar objects in the field are a real hazard to the field chopper or silage cutter. To avoid excessive repair bills the meadows used for growing silage crops should be free from the above hazards.

Unloading Methods

Different unloading methods can be described as follows:

1. The load may be pitched off at a rear or side opening.
2. It may be dumped directly into the blower hopper.
3. It may be pulled off by means of a tractor or winch attached to a canvas or false front in the box. See Figure 10.
4. It may be pulled off by driving the truck out from under the load as indicated in Figure 11.
5. The load may be slid off by power-driven unloading conveyor built into the bed of the vehicle. See Figure 12.

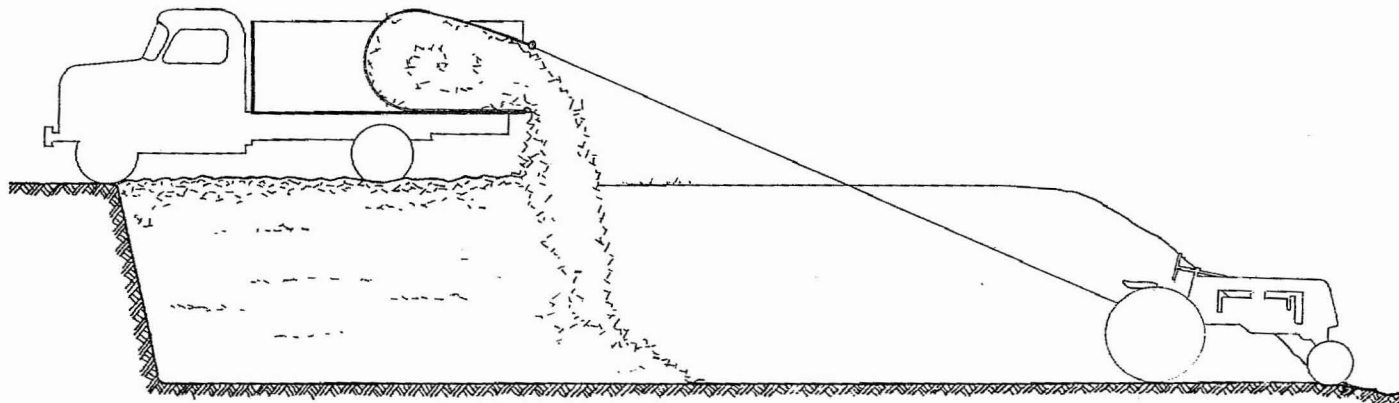


Figure 10. Filling and Packing a Trench Silo With a Truck and Tractor

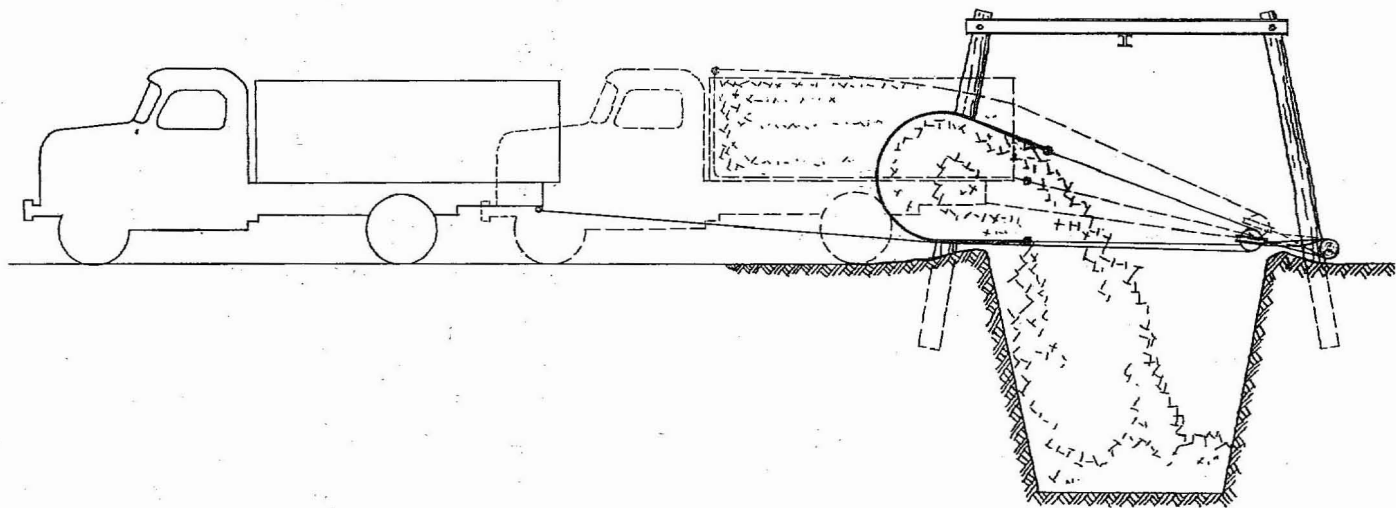


Figure 11. Pulling a Load of Forage Off a Truck Into a Silo By Its Own Power

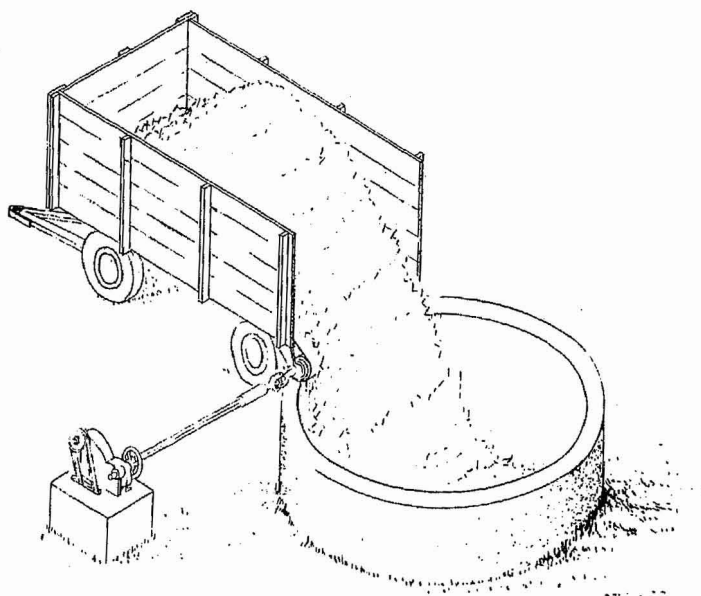


Figure 12. Unloading Chopped Forage With a Canvas and Mechanical Unloader

Any of the above methods can be used for unloading directly into trench or pit silos. For fence or upright silos any of the above methods may be used for unloading at the silage cutter or blower. However, after pulling the load off, as in methods 3 and 4, it will have to be pitched into cutter and blower.

The canvas conveyor has been used frequently and found satisfactory. The canvas bottom winds on a roller mounted to the rear of the vehicle bed. This roller may be a 2 1/2 in. pipe mounted with a bearing on each end. A shaft extends through the bearing on one end and may be either splined or square to hook up with the power drive for unloading.

The canvas should move about 2 ft. per minute. A good idea that can be incorporated with this type of conveyor is the use of an automobile transmission in the power drive. Three speeds are then provided. It is best to have the slow speed set at about 1 ft. per minute.

Commercial built mechanical unloading devices, as shown in Figure 12 can be purchased or made locally.

Distributing and Packing in Silo

To avoid spoilage and loss due to air pockets, it is essential that the forage be distributed uniformly and well packed.

In trench, fence and upright silos it is necessary to distribute and tramp during the entire filling operation. The forage should be kept high in the center and uniformly packed over the entire surface. In fence and upright silos the distribution and packing is generally done by a man with a pitchfork.

In trench silos mechanical methods are often used. One method indicated in Figure 10, takes place when the truck or wagon is backed over the part of the trench already filled while it dumps its load. Another way is to push the silage around with a dozer or blade on a tractor. Sometimes a horse is ridden back and forth over the silage. To distribute the forage the horse may be hitched to a piece of woven wire or some kind of a drag. Whatever method is used, the forage should be kept high in the center and packed uniformly over the entire surface.

In pit silos it is usually not necessary to distribute and pack the forage during filling except that whenever filling stops for half a day or longer, the top should be leveled off and tramped down. When the pit is full it should always be rounded off, high in the center and the top well tramped.

Sealing the Top

To prevent excessive spoiling on top it is necessary to provide an air-tight seal.

One method of sealing is to add a foot or two of any low value material such as green weeds, wet cut straw or wet sawdust. This material, if kept wet for a while, will rot and thus form a protective seal for the more valuable silage. In some instances grain has been sown in this wet material. The seeds sprout and thus tend to form a better seal.

Another method is to lay building paper over the top and cover with 6 to 8 in. of wet straw and then 3 or 4 in. of dirt. This forms a very good seal but is a little more inconvenient to put on and take off.

The cover or top seal is recommended for all types of silos to prevent spoilage. It is, however, most important on the trench silo, which has such a large surface exposed.

Removing and Feeding Silage

From an upright or fence silo the silage is usually dug out and thrown down by hand. However, mechanical silo unloaders are available for upright silos. The silage should always be dropped into a cart and wheeled to the mangers or feed bunks. If floors are not available where the cart must be pushed, it is well to provide a track of either planks or concrete.

Frequently, the feed bunks themselves may serve as the track for the cart. The filled cart is first pushed to the outer end of the feed bunks and the silage is distributed on the way back. This leaves the empty cart at the silo ready for the next feeding or makes it available for another load if more than one car full is needed.

For pit silos the system indicated in Figure 6 is very good. A basket is lowered into the pit, filled

with silage and hauled up by means of an electric hoist. The operator may ride up and down in the basket or use a ladder as he chooses. The basket, hoist and all is then pushed out over the feed bunks by means of an overhead track. With one end of the basket equipped with an end gate and tilted down the silage is raked out as the basket is pushed along.

A basket 2 1/2 ft. wide, 4 ft. long and 3 ft. deep will hold 600 or 700 pounds. To tilt down on one end it can be hung by chains which hook in any link to vary their length. While changing the length of chains, the weight is taken off of them by setting the basket in the feed bunk for a moment by means of the electric hoist. See Figure 13.

To get the feed out of trench silos a system almost identical to that described for pit silos can be used. The overhead track should extend over the full length of the silo. The disadvantage is that with some methods of filling the trench these posts are in the way.

Mechanical manure loaders on tractors can be used to advantage in getting silage out of the trench. The silage can be dumped directly into the feed bunk or into a cart, truck, or wagon rack. If the silo is some distance from the feed bunks, the method of dumping the silage into a wagon rack is very good because the same tractor can be used to pull the wagon.

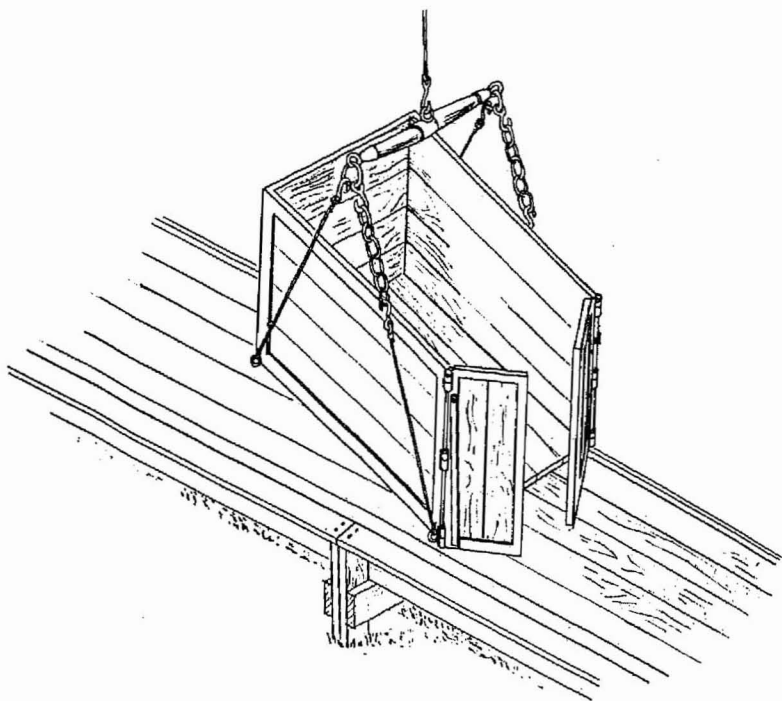


Figure 13. Silage Basket Can Be Tilted Down
On One End

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