Crib and Trench Silos
Michigan State University Extension Service
C.H. Jefferson, A.J. Bell
Issued June 1949
12 pages

EXTENSION BULLETIN 251

CRIB AND TRENCH SILOS

By C. H. Jefferson and A. J. Bell

MICHIGAN STATE COLLEGE

COOPERATIVE EXTENSION SERVICE

EAST LANSING

Cooperative extension work in agriculture and home economics. Michigan State College and U. S. Department of Agriculture cooperating. C. V. Ballard, Director. Cooperative Extension service, Michigan State College, East Lansing. Printed and distributed under acts of Congress, May 8 and June 30, 1914.

Crib and Trench Silos

By C. H. JEFFERSON[1] *and A. J. BELL*

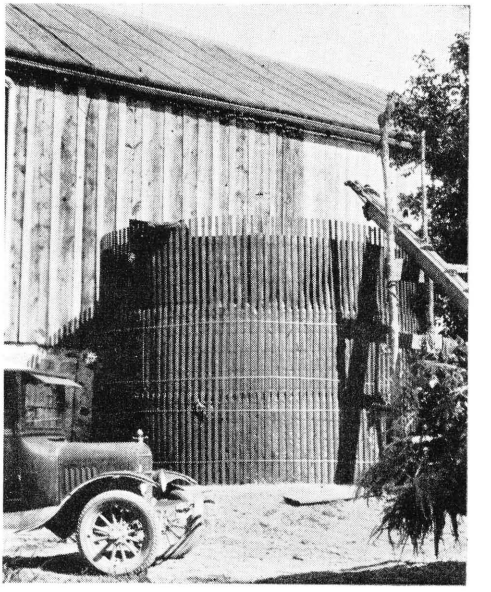
The silo as a means of preserving emergency feed crops was forcefully demonstrated during the drought period of the past decade. More recently, feed supplies have been threatened by late spring planting and early fall frosts. Michigan farmers are facing a potential feed shortage this year. This emergency, in addition to the demand for increased production on all farm fronts, makes it even more desirable to save all available feed by ensiling green or immature crops whenever possible. For many farmers who are on small rented farms, the initial cost of a permanent silo is prohibitive. There are, however, several types of temporary silos that may be constructed at a very small cost.

THE CRIB SILO

The crib or snow fence silo is one of the most practical for temporary use. It is constructed of super-imposed strips of snow fence[2] formed into a circle, the ends being securely fastened and the inside lined with a heavy waterproof paper (Figs. 1, 2, and 3).

HISTORY

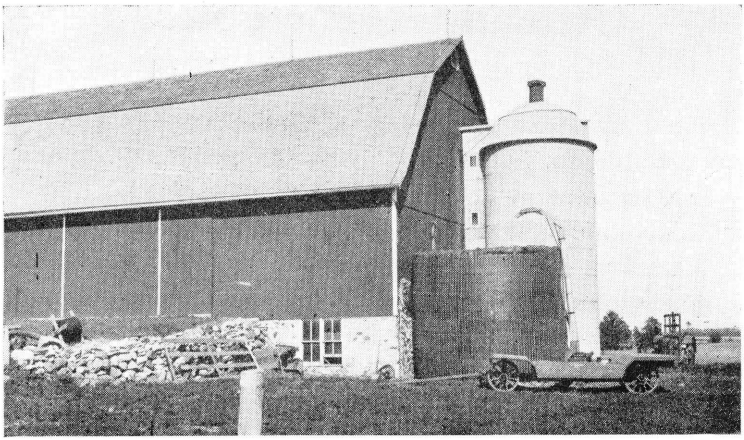
The crib silo seems to have originated in the arid section of the West in the late 1920's. In 1931, the South Dakota State College reported favorably upon about 40 that had been constructed the year before. During the same year, the University of Missouri issued Extension Circular 281, commenting favorably upon several crib silos constructed in that state. A few were built in Michigan, but the great number of permanent silos in this state provided extra storage for feed during the early part of that emergency.



(Photo American Lumberman)

Fig. 1. A well built crib silo, showing details of construction.

[1]Former staff member.
[2]Welded-joint wire fencing may also be used.



(Photo American Lumberman)

Fig. 2. A temporary crib silo beside a permanent silo.

As drought conditions continued during 1934 and 1935, many crib silos were constructed in Michigan which provided satisfactory storage for emergency feed. During the past few years the need for temporary or auxiliary silos has not been great, but now increased demands for feed, together with material shortages and restrictions on farm construction, indicate that the crib silo may again become very popular in Michigan.

ADVANTAGES

1. Provides feed storage at a fraction of the first cost of most permanent silos.
2. Can be erected as needed.
3. May be moved from year to year and located where the feed is to be distributed.
4. Provides the renter with a silo that he may take with him.

CONSTRUCTION

The site should be level. Select the most nearly level site that is consistent with convenience in filling the silo and feeding ensilage. Any irregularities or slope to the surface of the ground which is to be the floor of the silo should be corrected and the surface checked with straight edge and level to be sure that it is level. Avoiding the leveling operation by simply digging a level trench for the snow fence or welded wire causes uneven settling of the silage which may result in an overturned silo.

At approximately the center of this leveled site, drive a stake. Fasten a wire to this stake and with the other end mark a circle on the ground

which is the same size as the proposed silo. The diameter of a silo depends upon the number of livestock to be fed from it, and the height of the silo depends upon the length of the feeding season. There are, however, other factors entering into the construction of a crib silo, and the builder must use his own judgment as to the size that will best meet his conditions.

A low, wide silo is much more stable than a high, narrow one. Experience indicates that the most desirable width is from 12 to 16 feet and the height from 16 to 20 feet. A 16-foot silo requires one complete 50-foot roll of fence for each section, and where this diameter is used, considerable splicing of wire is eliminated and no fence is wasted.

Before the snow fence is used, it should be thoroughly stretched by attaching one end to a post and using an ordinary fence stretcher on the other end. If the fence is not stretched before it is used, it will do so as the silage settles, resulting in torn paper and spoiled silage. When welded wire fence is used, no stretching is necessary.

A pole should be set up to support the elevator and distributor pipes. Where more than one silo is needed, time and labor may be saved by arranging to fill two from the same setting.

Set the first section of snow fence around the circle previously marked out and tie the ends together with the extending ends of wire. Line the inside with the paper which has been cut into convenient lengths. Several short strips from 10 to 14 feet in length are more convenient to handle and tend to reduce tearing as the silage settles. The ends of the paper should lap at least one foot. A few inches of the bottom edge of the paper should rest on the ground to help make the joint air-tight. The paper can be very effectively held in place by clamps made from two strips of lath nailed together at one end which are slipped over the paper and cribbing and left in place

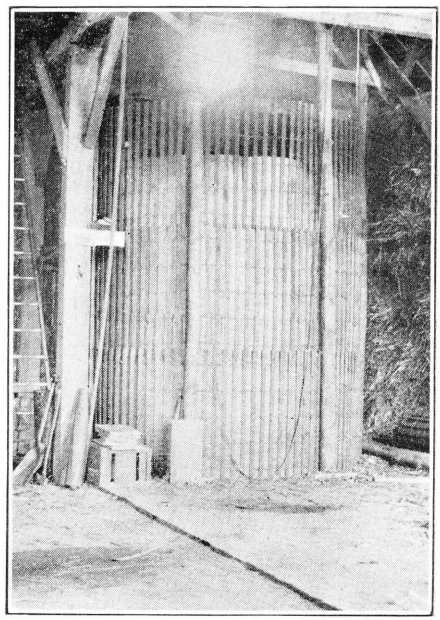


Fig. 3. A crib silo on a barn floor. Additional posts were placed under the floor to support the increased weight.

until that section of the silo is nearly filled. The paper should not be tacked to the cribbing or otherwise fastened in any permanent manner which would cause the paper to tear or prevent it from settling with the silage. Be sure to provide plenty of slack in the paper so that the weight of the silage will be borne by the fence and not the paper.

The first section is now filled with silage, uniformly distributed and uniformly tramped while it is being placed. If the silage is not uniformly distributed or uniformly tramped, it will settle more on the untramped side, which may result in an overturned silo. When the silage reaches to within a few inches of the top, the second section of fence is set up. This section is placed above and inside the first section, with the bottom ends of the pickets lapped about 6 inches past the top edge of the picket ends of the first section and held in place until this section is partly filled. Similar precaution should be taken in lapping the bottom edge of each successive strip of paper over the top edge of the preceding one. (See Fig. 4.) A more symetrical silo can be erected if the picket ends of adjacent sections of fence are tied together with twine until the section has been partly filled. The ties are then cut and the silage, paper, and fence allowed to settle as a unit.

Each additional section is set up and lined with paper in the same manner. Precaution should be taken to make each successive section of cribbing from 4 to 6 inches shorter than the previous section. These measurements should be taken after cribbing has been stretched.

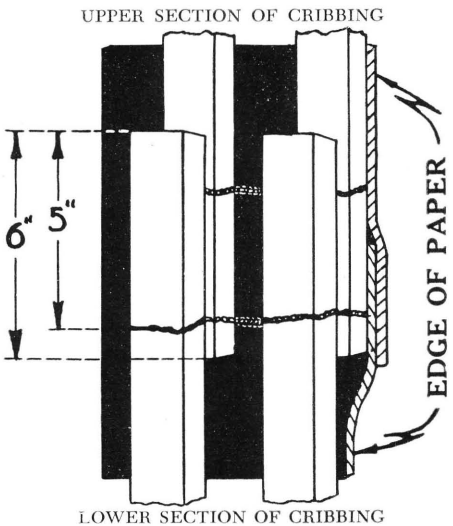


Fig .4. A detail showing method of joining adjacent sections of cribbing and paper.

Additional reinforcing may be necessary, even on silos 20 feet high which are to be filled with corn silage, and it is strongly recommended for all silos that are to be filled with grass silage. Such reinforcing can be provided by placing bands of No. 9 wire around the middle of each section of cribbing before the succeeding section is completely filled.

When a cover for the silage is considered desirable, a two-foot layer of straw, hay, or marsh grass has been found satisfactory. If no special cover material is to

be used, it has been suggested that the last load placed in the silo be as green and damp as possible and that the surface be wet down and tramped uniformly every few days for a period of two weeks.

When the silo is ready for use, the top covering of any spolied silage should be removed. As the silage is used, the sections of fence are removed, carefully rolled and stored for use another season. It is not advisable to try to save the paper.

MATERIALS

Materials used in the construction of a crib silo can usually be obtained from any lumber yard. The cribbing or snow fence is that used for corn cribs or along the highway to keep snow from drifting into the road. The pickets are 4 feet long, 1½ inches wide and ½ inch thick, securely wired to make a light, durable fence. The fence is available in 50- or 100-foot rolls.

The best paper is that composed of two thicknesses of waterproof paper, bound together with asphalt and having some reinforcing fiber between the two layers of paper. Heavy roll roofing may be used if the other is not available, but it is not very satisfactory.

Most of the papers are made in various widths, but the most satisfactory is 4 feet or the same width as the fence. This reduces to a minimum the number of joints in any silo and thereby reduces spoilage which usually occurs at the joints. The paper comes in rolls of from 600 to 1,200 square feet. A comparison of the costs of storing silage in different types of silos is given in Table 1.

THE TRENCH SILO

DESCRIPTION

The trench silo is simply a ditch dug in the ground, usually with the aid of a plow and slip scraper, to a depth of 8 to 10 feet. The width at the top is about 10 feet and at the bottom about 9 feet. For temporary use, the side walls are carefully smoothed with a spade, but if the silo is to be used year after year, a permanent finish for side walls is desirable. Several materials have been used including plank, poles, brick, stone, plaster, or concrete. (See Fig. 5.)

HISTORY

The trench silo has been used for many years in European countries for storing beet tops and certain legumes. Its first appearance in America seems to have been in western Canada where several trench silos were built immediately after the World War. From Canada, the idea spread into Montana, Minnesota, the Dakotas, and then into the South and Southwest where soil and drainage conditions were most favorable. During the past few years, the number of trench silos in Michigan has increased. They are particularly popular in the Upper Peninsula where permanent silos are not so numerous as in the southern part of the state.

ADVANTAGES

1. It is cheaper to construct than most upright silos.
2. It is adapted to either temporary or permanent construction.
3. If temporary, it can be constructed with virtually no expenditure for materials.
4. If permanent, a large part of the materials used in its construction may be found on the farm.
5. No skilled labor is necessary in its construction.

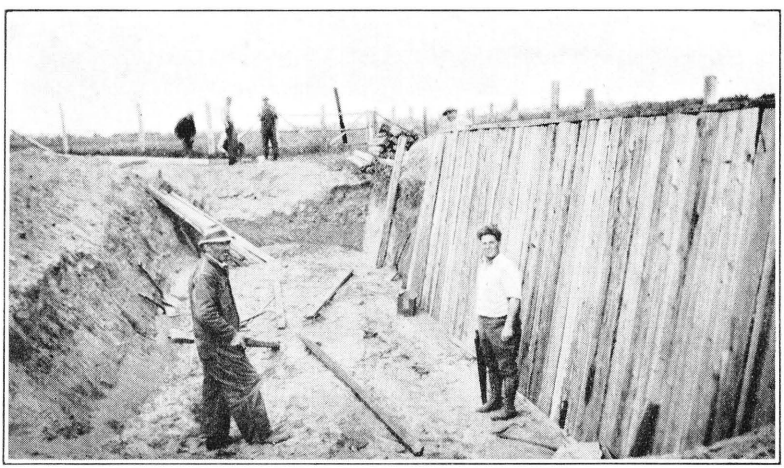


Fig. 5. A trench silo under construction in the upper peninsula. Cedar posts were used to line the inside.

6. The silo may be filled with simple equipment, consisting of cutting table without blower attachment.
7. The silage does not freeze except under severe conditions.
8. Unchopped fodder may be stored if desirable.

TABLE 1. *Yearly overhead cost on different types of silos.*[1]

Type of Silo	Capacity	Estimated Cost	Estimated Life	Cost per Year	Cost per Ton of Silage per Year
Temporary Crib	50 tons	Mat. $30 Lab. 5	Fence—5 yrs. Paper—1 yr.	$23.75	$0.47
Temporary Trench	50 tons	Mat. $10 Lab. 20	2 yrs.	$18.15	$0.36
Permanent Trench	50 tons	Mat. $60 Lab. 40	20 yrs.	$14.15	$0.28
Permanent Upright	80 tons	Mat. $200 Lab. 100	20 yrs.	$42.00	$0.53
Permanent Upright	80 tons	Mat. $350 Lab. 150	40 yrs.	$57.50	$0.72

[1]*These costs are based on pre-war prices for materials and labor.*

Cost estimates in Table 1 do not include charges for filling but do include all items charged against construction. The overhead cost on all of the permanent silos was computed from the following formula which includes interest, depreciation, taxes, repairs and insurance:

$$C = \frac{I\,(1.03 + .09y)}{y}$$*

Where C = yearly overhead cost
I = initial investment
y = estimated life in years

The yearly costs of the temporary silos were computed in a similar manner, but some of the factors such as taxes and insurance that may not apply to temporary construction were omitted from these calculations.

LOCATION

The factors to be considered in locating a trench silo are surface drainage, type of soil, and convenience for filling and feeding. Surface water should drain away from the silo. If it seeps into the silo, the walls may cave in and spoil part of the silage. The remaining silage is also harder to remove. Ground water should be kept out of the silo, preferably by natural drainage, but if necessary, a drain may be laid around the sides near the floor. If a permanent floor is laid, it should be provided with a drain. Otherwise, a pump may be necessary to remove any surplus water before the silo is refilled.

The trench silo may be excavated in a light, sandy loam that will

*Method of Computing Machinery Costs, E. C. Sauve, Michigan Agricultural Experiment Station Quarterly Bulletin, May 1931.

hold its shape while the trench is being dug, but light enough to be well drained. A soil free from clay, hardpan, or loose rock is desirable.

The most convenient place for feeding will usually be near the barn. A very practical arrangement in connection with a bank barn is shown in Fig. 6, where one wall of the barn serves as one side of the silo. Sometimes a silo in the field is more convenient for feeding as well as filling. This is especially true for feeding lambs or steers.

METHOD OF CONSTRUCTION

Excavation for a trench silo can be made with a team or tractor and a plow and slip scraper. When the trench has been dug to the approxi-

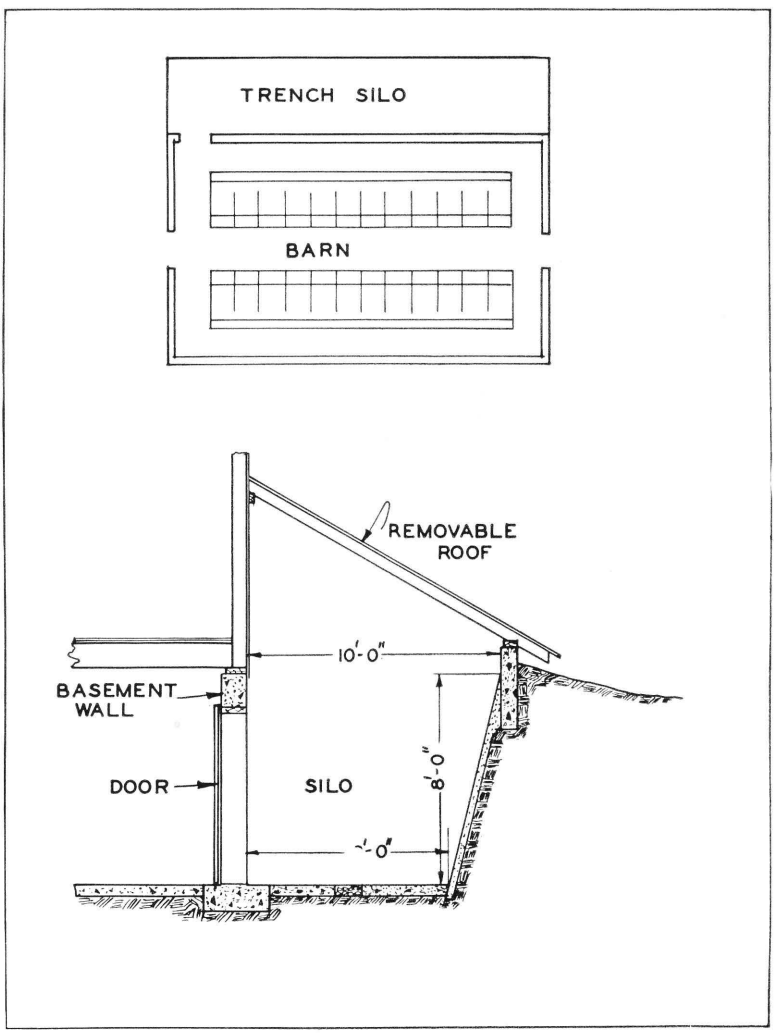


Fig. 6. A convenient location for a trench silo.

mate dimensions, the side walls and bottom are finished with a spade. The sloping side walls let the silage settle more uniformly and eliminate many air pockets that would otherwise be present if the walls were straight. The silo may be made entirely underground, partly underground and partly above ground, or entirely above ground. The usual dimensions are 10 feet wide at the top and 9 feet wide at the bottom if the sides are to be lined. The walls of unlined trench silos may not hold their shape unles the slope is increased by making the top width 12 feet instead of 10 feet.

Unless the soil is unusually well drained, a maximum depth of 12 feet is recommended. The cross sectional area corresponds to the diameter of an upright silo and will vary with the size of the herd. The length corresponds to the height of an upright silo and will vary with the length of feeding season. Capacities of different size silos and the dimensions suggested for different size herds are shown in Table 2.

Some trench silos have been used for one or two years without any lining on the inside walls. If used year after year, however, the silage begins to spoil around the edges, owing perhaps to bacteria which remain in the soil. The earth walls begin to scale off, leaving pockets which must be patched up or smoothed by widening the silo. For that reason, the walls are usually lined with a more permanent material (Fig. 7). The curbing around the top, which may be either logs, plank, concrete, or stone, acts as a retaining wall for the excavated earth and reinforces the edge of the trench against caving in. Plank or poles are not so satisfactory for a permanent lining as some of the other finishes because it is difficult to obtain a smooth, even surface after the lumber begins to warp. Where they are used, the wood should be thoroughly seasoned and painted with a preservative.

Plaster is not permanent if applied directly to the earth bank. A better method is to lay poultry mesh along the bank held in place by iron or wood pegs driven into the earth and the plaster applied over it in two or more courses. A total thickness of two inches seems to be satisfactory. The plaster is made by mixing one part of Portland cement and one-tenth part of lime with three parts of sand and enough water to make it workable.

The stone is laid up in the same way that brick or block would be laid and the surface made smooth with a trowel coat of cement plaster.

TABLE 2. *Approximate size of trench silo needed for differnt size herds if three tons of silage are allowed per cow per year.*

Number of Cows	Tons Needed	Top Width in Feet	Bottom Width in Feet	Depth in Feet	Length in Feet
6	18	7	6	6	30
8	24	7	6	6	38
10	30	8	6	6	35
12	36	8	6	7	38
14	42	10	8	8	30
16	48	10	8	8	35
20	60	10	8	8	42

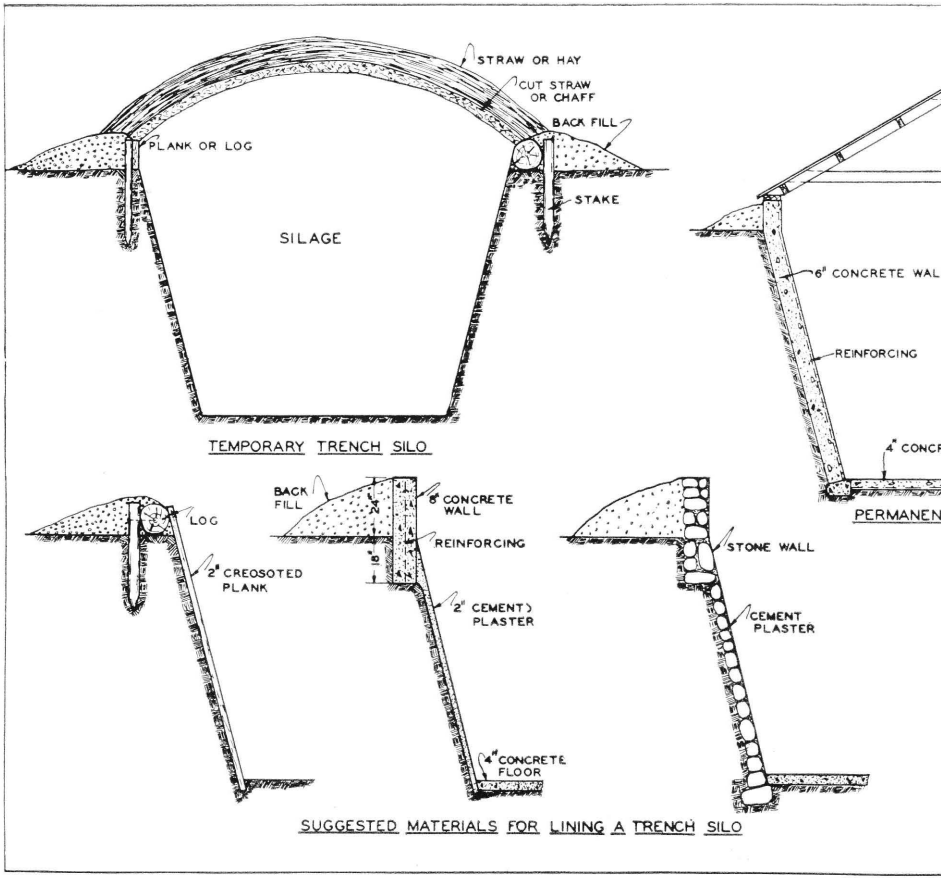


Fig. 7. Construction details of a trench silo (see Table 2 for dim

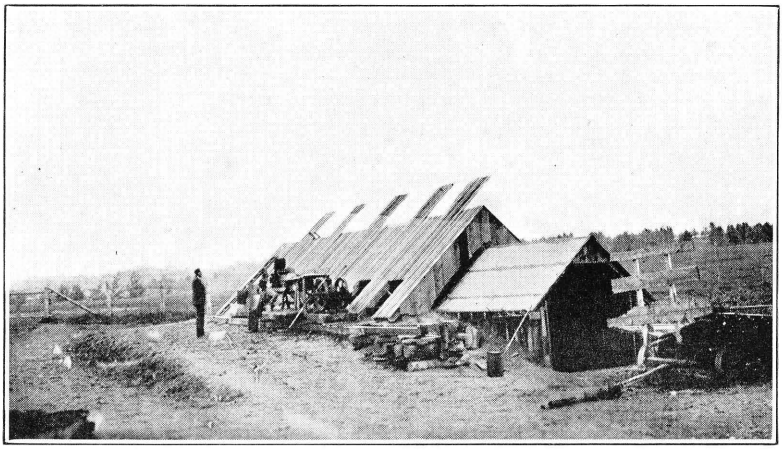


Fig. 8. Using low-cost machinery for filling.

The concrete finish is reinforced with iron rods running both ways or with wire mesh and poured in forms the same as for any wall.

The top of the silage should be covered to prevent spoilage. There are several ways of doing this. One method is to lay waterproof paper over the ensilage and cover this with 8 or 10 inches of cut straw, hay, or marsh grass, thoroughly wet down and packed. Some owners sow oats or barley on this. The seed sprouts and forms an air-tight cover.

One owner lays the waterproof paper and covers this with quack grass sod. The sod grows, effectively sealing the silo.

When putting in frosted or ripe corn fodder, more attention should be paid to packing the mass of ensilage. This can be done by adding water and sealing the top with waterproof building paper covered with 8 inches of dirt.

The silage is fed from the end, similarly to slicing a loaf of bread. Only enough is uncovered at one time to last not more than a week.

FILLING MACHINERY

The cost of filling the trench silo is much less than for an upright silo. (See Fig. 8.) The only equipment necessary at the silo is a cutting table and some source of power. No blower is required, which reduces the cost of the cutting machinery about 75 per cent as compared with that used in filling upright silos. In some cases, it may be desirable to put whole bundles of corn or other fodder into the silo. This practice is not common, but has proved satisfactory. In fact, the first crops ensiled were stored in this way.

Issued September 1943
Second Printing, June 1949

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