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Silos and Silage

BY

N. A. NEGLEY

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*In co-operation with United States Department of Agriculture

SILOS AND SILAGE

By
N. A. Negley.
Dairy Division, U. S. Department of Agriculture.
In co-operation with Alabama Experiment Station.

A large supply of succulent feed is important at all times for the most economical production of milk. Pasture furnishes this feed in summer and early spring, but in periods of drouth during late summer, and for a few months in the winter season, pastures do not furnish a dependable supply of feed. Winter pasture crops are often sown and if all conditions are favorable may supply an abundance of green feed during the winter months. It is very seldom, however, that all conditions are right and for this reason winter pasture crops are not dependable. If oats and rye are sown for pasture there are times during wet seasons when the land will be damaged by grazing, and if these crops are sown late and drouth or cold prevents a good growth, they make but little pasture in winter. On small farms it is rarely practicable to spare acreage enough for these crops to maintain a large herd.

Silage furnishes a constant supply of succulent feed for these periods cheaper than it can be obtained in any other way. An acre of corn producing 50 bushels to the acre will yield about 10 tons of silage, which will give six cows sufficient succulent material for four months.

Silage is simply "canned corn" preserved by the exclusion of air. Silos are built high so that the weight of the cut corn will pack the silage sufficiently to exclude the air. The round type of silo is the most economical and preserves the silage best.

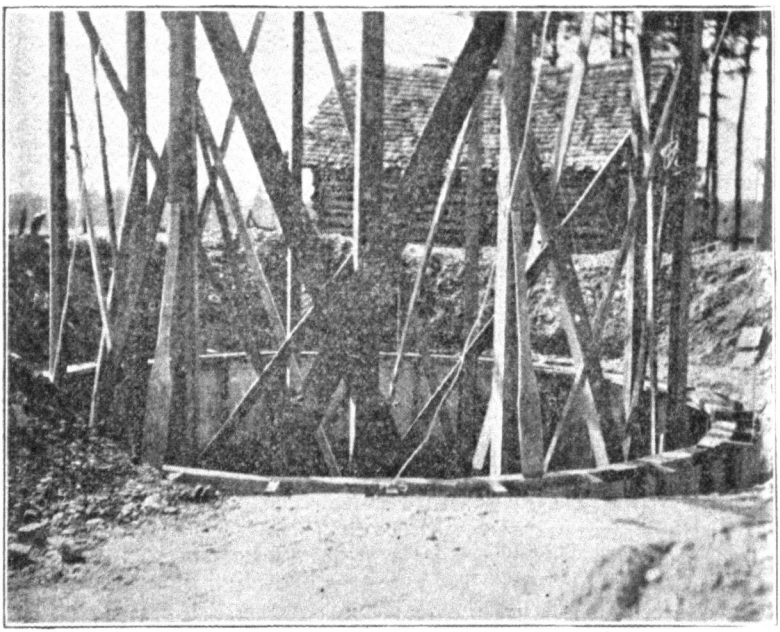
The diameter of a silo is determined by the number of cattle to be fed. Two or three inches of silage must be fed off the surface daily to prevent spoiling. The following table shows the diameter required for varying numbers of cows:

Table 1.—*Showing ratio between diameter of silo and number of cows to be fed.*

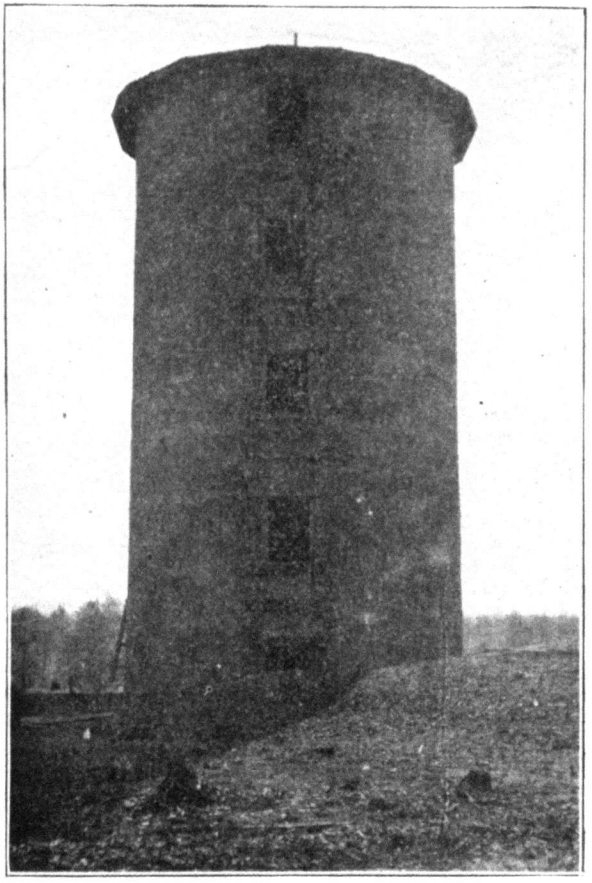
Diameter of silo (in feet).	Number of cows to be fed.
10	12
12	17
14	23
16	30
18	38

The concrete and stave silos are the two most common types in Alabama. In certain sections a few underground or pit silos are used.

The advantages of a concrete silo are durability, freedom from damage by wind and fire, and low cost of upkeep. Where sand and stone or gravel can be obtained on the farm, or at reasonable cost, the concrete silo can be erected very cheaply and is preferable where the farm buildings are permanently located and the business definitely established. A form is required in building such a silo, but anyone handy with tools can construct the form. The remaining work can be done with common farm labor.



Beginning the wall. Form and scaffolding for a concrete silo.



Concrete silo, Marbury, Alabama.

Following are bills of material for concrete silos of 12 and 14 feet diameter, to which local prices of materials can be applied, and the total cost of the silo other than labor obtained. For these sizes, five men working half a day can build 3 feet of wall.

BILL OF MATERIALS FOR A CONCRETE SILO.

Inside Dimensions 12 by 24 feet; Capacity 49 Tons.

Concrete Material.

(Proportions: 1 part cement, 3 parts sand, 5 parts stone.)

	Concrete.	Cement.	Sand.	Stone.
Footing and body of silo	18.2 yds.	86 bags	9.9 yds.	16.2 yds.
Floor, if needed	1.4 yds.	7 bags	.8 yds.	1.3 yds.
Total, including floor	19.6 yds.	93 bags	10.7 yds.	17.5 yds.

Reinforcing Material.

12 pieces woven wire fencing 38½ feet long, 36 inches wide, double lower 3 courses.
4 pieces 2-inch angle iron 2 feet long for door sills.
8 pieces scrap iron 4½ feet long for door sides.

Form Material.

(Chord, 2 feet 4 inches.)

Inside form: Rings, 13 pieces 1 by 6 inches by 14 feet; studding, 16 pieces 1 by 4 inches by 12 feet; sheet iron, No. 20 or 22, 4 pieces 36 inches by 9 feet 8 inches.
Outside form: Rings, 16 pieces 1 by 6 inches by 12 feet; studding, 16 pieces 1 by 4 inches by 12 feet; sheet iron, No. 20 or 22, 4 pieces 36 inches by 10 feet 8 inches; strap iron, 24 pieces ⅜ by 1 by 24 inches, bent to curve of outside form and drilled for 4 rivets of 7 pound size: 2-inch right angle turned up one end and drilled for ½-inch bolt.
100 tinner's rivets of 7 pound size.
½ package tinner's rivets, 1¾ pound size.
12 machine bolts ⅜ by 6 inches, long threads.

Roof and Doors.

Plates, 7 pieces 2 by 6 inches by 12 feet.
Rafters, 4 pieces 2 by 4 inches by 18 feet.
Sheathing, 250 feet B. M. of 1 by 6 inch stuff.
1 piece 2 by 4 inches by 12 feet for door frame in roof.
2½ squares prepared roofing or 2,000 shingles.
8 bolts ½ by 18 inches, with nuts and washers.
48 feet B. M. tongue-and-groove flooring for doors.
28 square feet waterproof paper for doors.
2 door forms, 1 piece 2 by 6 inches by 16 feet; 2 pieces 2 by 3 inches by 10 feet.
20 pounds 8 penny common wire nails.
30 pounds 10 penny common wire nails.
5 pounds 20 penny common wire nails.

BILL OF MATERIALS FOR CONCRETE SILO.

Inside dimensions: 14 by 30 feet; capacity 91 tons.

Concrete Material.

(Proportions 1 part cement, 3 parts sand, 5 parts stone).

	Concrete.	Cement.	Sand.	Stone.
Footing and body of silo	27.2 yds.	128 bags	14.7 yds.	24.0 yds.
Floor, if needed	1.9 yds.	9 bags	1.1 yds.	1.7 yds.
Total, including floor	29.1 yds.	137 bags	15.8 yds.	25.7 yds.

Reinforcing Material.

14 pieces woven wire fencing 46½ feet long, 36 inches wide, double lower 3 courses.
5 pieces 2-inch angle iron 2 feet long for door sills.
10 pieces strap iron 4½ feet long for door sides.

Form Material.

(Chord, 2 feet 8¾ inches).

Inside form: Rings, 16 pieces 1 by 6 inches by 12 feet; studding, 16 pieces 1 by 4 inches by 12 feet; sheet iron, No. 20 or 22, 4 pieces 36 inches by 11 feet 2 inches.

Outside form: Rings, 16 pieces 1 by 6 inches by 14 feet; studding, 16 pieces 1 by 4 inches by 12 feet; sheet iron, No. 20 or 22, 4 pieces 36 inches by 12 feet 3 inches; strap iron, 24 pieces ⅜ by 1 by 24 inches, bent to curve of outside form and drilled for 4 rivets of 7 pound size; 2-inch right angle turned up one end and drilled for ½-inch bolt.
100 tinner's rivets of 7 pound size.
½ package tinner's rivets, 1¾ pound size.
12 machine bolts ⅜ by 6 inches, long threads.

Roof and Doors.

Plates, 8 pieces 2 by 6 inches by 14 feet.
Rafters, 8 pieces 2 by 6 inches by 10 feet.
Sheathing, 300 feet B. M. of 1 by 6 inch stuff.
1 piece 2 by 4 inches by 12 feet for door frame in roof.
3 squares prepared roofing or 2,400 shingles.
10 bolts ½ by 18 inches, with nuts and washers.
60 feet B. M. tongue-and-groove flooring for doors.
35 square feet water-proof paper for doors.
2 door forms, 1 piece 2 by 6 inches by 16 feet; 2 pieces 2 by 3 inches by 10 feet.
20 pounds 8 penny common wire nails.
30 pounds 10 penny common wire nails.
5 pounds 20 penny common wire nails.

The stave silo is recommended where material for concrete cannot be obtained at a reasonable cost, and where lumber is cheap. They are erected more easily, quickly, and cheaply than concrete silos, they permit of moving and are preferable where business and buildings are not permanently established. However, they are not so durable and are subject to damage by wind and fire, and owing to the shrinkage of staves in summer when the silo is empty, attention is required to tighten the hoops. The better grade of lumber makes the more durable silo, but where this is not available at reasonable prices a very satisfactory silo can be made of cheaper stuff. The staves can be made of 2 x 4 inch or 2 x 6 inch lumber and need not be tongue-and-grooved nor beveled. Four men can erect the ordinary silo in about three days. Following are bills of materials for 10 and 12 feet stave silos:

BILL OF MATERIALS FOR A STAVE SILO.

Dimensions 10 by 22 feet (above foundation); capacity 34 tons (no allowance made for settling).

Concrete Material.

(Proportions: 1 part cement, 3 parts sand, 5 parts stone.)

	Cement.	Sand.	Stone.
Foundation wall, 1 by 3 feet	17 bags	1.89 cu. yds.	3.11 cu. yds.
Floor, 4 inches thick	4 bags	.42 cu. yds.	.69 cu. yds.
Total	21 bags	2.31 cu. yds.	3.80 cu. yds.

Lumber.

101 pieces 2 by 4 inches by 22 feet (or 51 pieces 2 by 4 inches by 16 feet, and 101 pieces 2 by 4 inches by 14 feet), for staves.
16 lineal feet 2 by 4 inches, dressed, in 2 feet lengths, for door cleates.
4 pieces 2 by 4 inches by 16 feet, for rafters.
1 piece 2 by 4 inches by 12 feet, for door frame in roof.
200 feet B. M. 1 by 6 inches, for roof boards.
9 pieces 2 by 4 inches by 12 feet, for stakes for foundation form.
175 feet B. M. ½ by 6 inches, for foundation form 1 foot above ground.

Hoops (10 in number).

15 ⅝-inch rods 11 feet 9 inches long, ends threaded 6 inches, hexagon nuts.
15 ½-inch rods 11 feet 9 inches long, ends threaded 6 inches, hexagon nuts.
15 ⅝-inch lugs.
15 ½-inch lugs.

Roofing

2 squares prepared roofing.

Hardware.

32 bolts ⅜ by 6 inches with nuts and washers, for door cleats.
4 eye bolts ½ by 24 inches, bent up 3 inches on straight end, for anchor.
4 square-headed bolts ¾ by 4 inches, with nuts and washers, for anchor bolts.
20 pounds 30 penny spikes.
5 pounds 20 penny nails.
5 pounds 8 penny nails.
101 splines 2 by 3¾ inches, if two-piece staves are used.

BILL OF MATERIAL FOR A STAVE SILO.

Dimensions: 12 by 24 feet (above foundation); capacity 55 tons (no allowance made for settling).

Concrete Material.

(Proportions: 1 part cement, 3 parts sand, 5 parts stone.)

	Cement.	Sand.	Stone.
Foundation wall, 1 by 3 feet	20 bags	2.27 cu. yds.	3.74 cu. yds.
Floor, 4 inches thick	6 bags	.64 cu. yds.	1.05 cu. yds.
Total	26 bags	2.91 cu. yds.	4.79 cu yds.

Lumber.

121 pieces 2 by 4 inches by 24 feet (or 82 pieces 2 by 4 inches by 16 feet), for staves.
16 lineal feet 2 by 4 inches, dressed, in 2 feet lengths, for door cleats.
4 pieces 2 by 4 inches by 18 feet, for rafters.
1 piece 2 by 4 inches by 12 feet, for door frame in roof.
250 feet B. M. 1 by 6 inches, for roof boards.
10 pieces 2 by 4 inches by 12 feet, for stakes for foundation form.
175 feet B. M. ½ by 6 inches, for foundation form 1 foot above ground.

Hoops (10 *in number*).

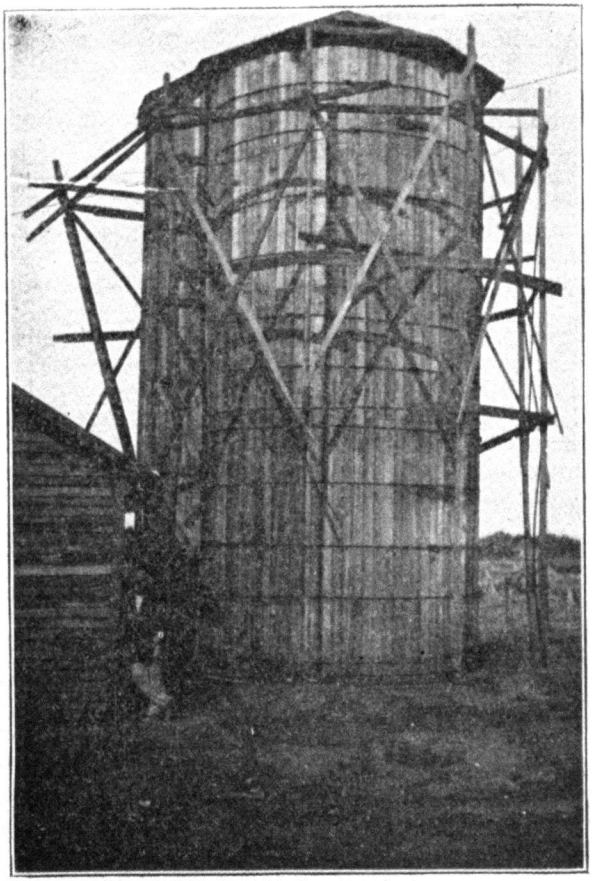
18 ⅝ inch rods 13 feet 11 inches long, ends threaded 6 inches, hexagon nuts.
12 ½-inch rods 13 feet 11 inches long, ends threaded 6 inches, hexagon nuts.
18 ⅝-inch lugs. 12 ½-inch lugs.

Roofing.

2½ squares prepared roofing.

Hardware.

32 bolts ⅜ by 6 inches with nuts and washers, for door cleats.
5 eye bolts ½ by 24 inches, bent up 3 inches on straight end, for anchor.
5 square-headed bolts ¾ by 4 inches, with nuts and washers, for anchor bolts.
25 pounds 30 penny spikes.
5 pounds 20 penny nails. 5 pounds 8 penny nails.
121 splines 2 by 3¾ inches, if two-piece staves are used.



Stave silo with scaffolding, Troy, Ala.

The pit or underground silo is not commonly in use but is found in certain sections where the character of the soil is such that sufficient depth can be obtained without water rising in the silo or the walls caving. A little less expensive machinery can be used in filling this silo, because no elevator or blower is required, but the cheapness of construction and the small saving in machinery expense is overcome by the inconvenieuce and the amount of labor required to hoist the silage twice daily out of the pit. In underground silos a poisonous and deadly carbonic acid gas sometimes collects which renders these silos dangerous. Taking these things into consideration, we would not recommend the pit silo, if it is at all possible to build one of the other types.

Raw coal tar thinned with gasoline to the consistency of paint, should be applied to the inside of the stave and concrete silos and also to the wall of the pit silo, if it is plastered.

The machinery is the expensive part of the equipment for a silo and it is advisable that several farmers in the community co-operate in buying it. Where this arrangement is made it is advantageous for the owners to exchange labor, thus making the silo filling cheaper and easier. It is economy to buy machinery of sufficient capacity so that the silos can be filled in a short time.

The greatest cause of dissatisfaction with silage has been that the silos have been filled improperly. The corn should be cut for silage when the kernel is well dented and glazed and the lower leaves of the stalk have begun to turn brown. The corn should be cut in about one-half inch lengths and well distributed and thoroughly packed in the silo. If the corn gets too mature, water should be added to it as it is put in the silo. This can be done by running a stream from a barrel or hose directly into the blower. When the silo is full, the surface should be soaked with water and thoroughly tramped for a short time each day for several days. A thin layer of the surface silage will rot and form an air-tight seal over the top. When feeding is begun, this layer of rotten silage is thrown away. If for any reason silage feeding should stop after once begun a small layer will rot and form a seal as before.

The extension department of Auburn will be glad to furnish bills of materials and detailed information regarding construction, type, size, and capacity of silos.