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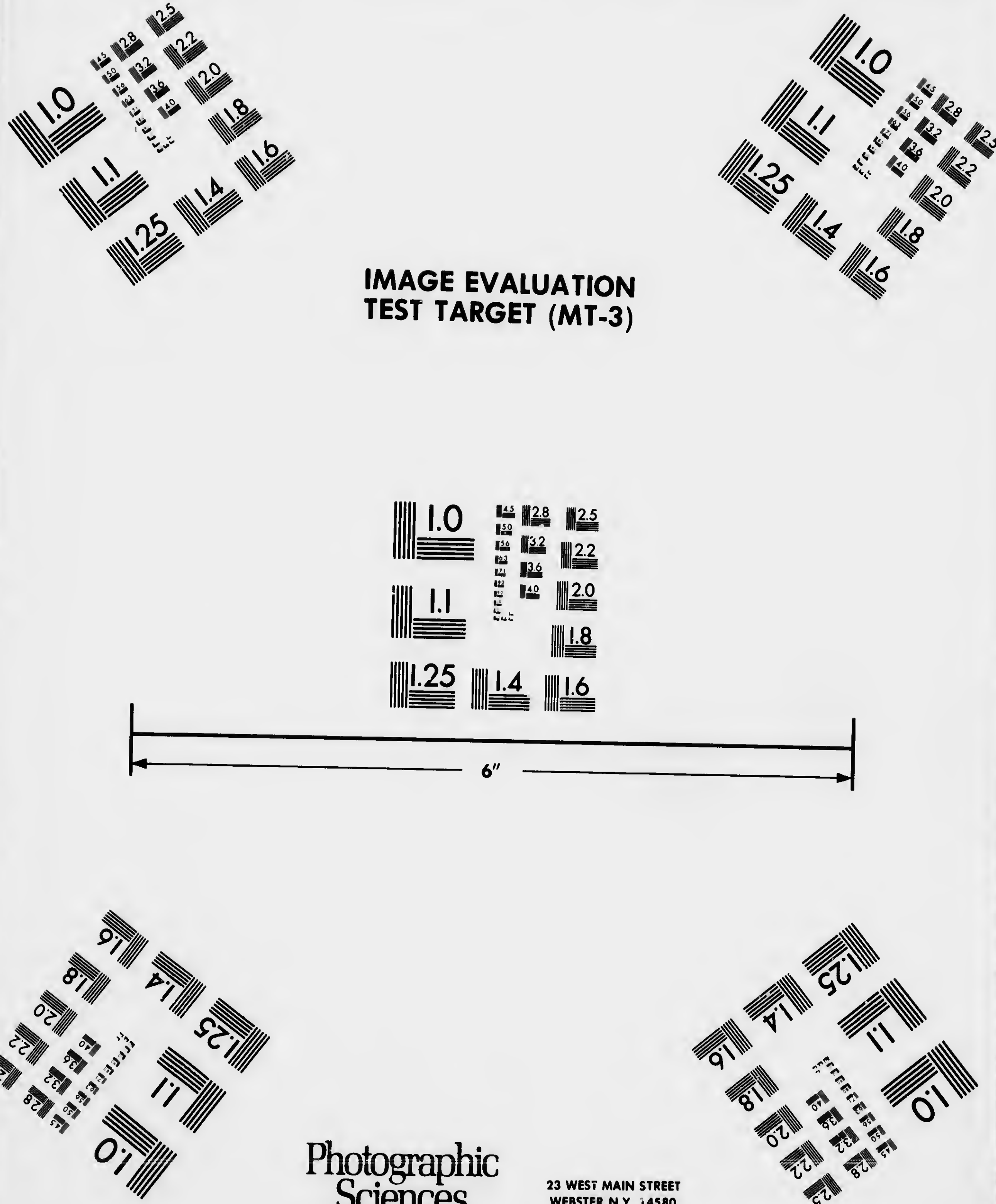

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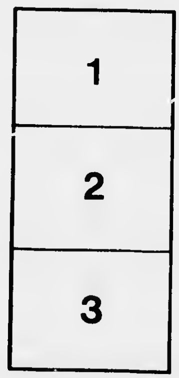

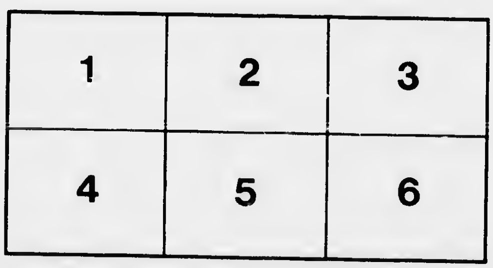

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

THE STAVE SILO

BY

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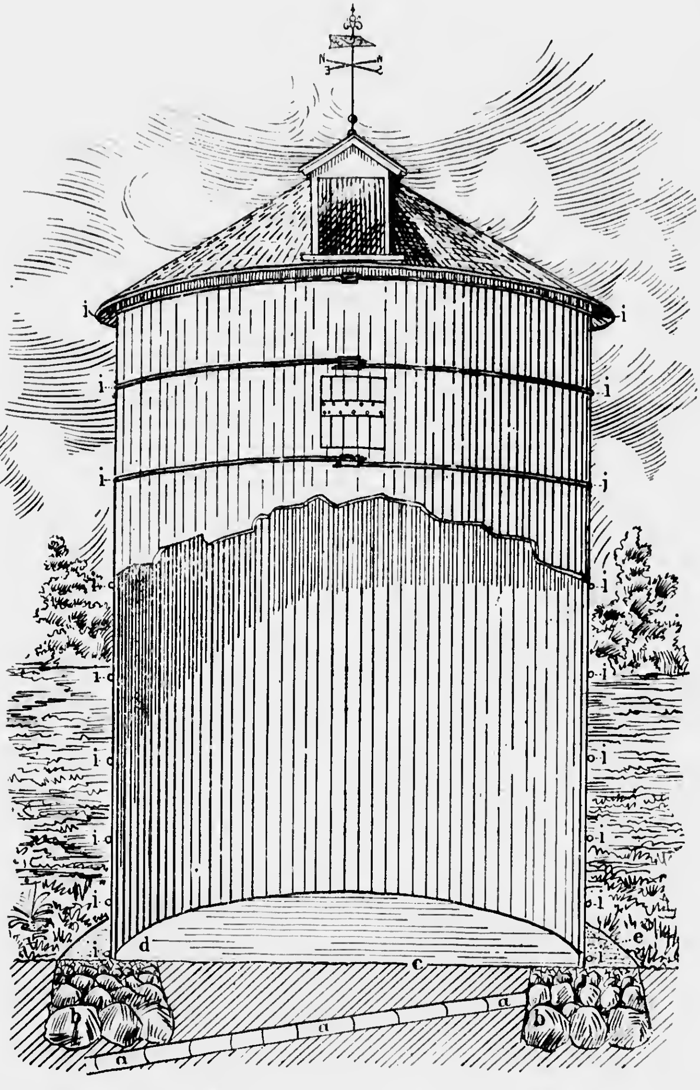

Fig. 5.—Longitudinal section of Stave Silo, showing: *a a a*, drain; *b*, foundation; *c*, ground floor; *d*, cement floor inside; *e*, cement floor outside; *i i i*, etc., hoops.

CONTENTS

THE STAVE SILO.

As the live stock of the country increase in number and improve in quality, more and more interest is taken in the preservation of succulent food for their use during the winter. In many parts of Canada the cheapest crop for such a purpose is Indian Corn (*Zea mays*) and since the preservation of this forage is an important consideration, so the question of silos and silo building is claiming more attention. Many letters have been received asking for directions for constructing silos and inquiring as to the relative economy of the different kinds of silo in use.

The most common objection advanced to the more general use of the silo is the considerable expenditure necessary to erect such a large air-tight chamber, as well as the subsequent expense of maintaining such a building in repair, and the apparent short life of the silo as commonly constructed.

From extensive observation and study of silos and silo construction, and from experience here with a number of different silos, it would appear that the tub or stave silo is the form of cheap silo that for various reasons is most worthy of recommendation. It combines simplicity and cheapness of construction with the requisite conditions, to preserve the ensilage in the very best condition for feeding.

No data are as yet available as to the longevity of the Stave Silo, its probable life depends, however, upon the quality of the material used and the proper construction of the foundation and sides.

The first point to decide when preparing to build is the amount of ensilage to be stored and the size of silo required for such an amount. A good average daily ration for a cow being from 35 lbs. to 40 lbs., the amount required for a given number of cattle during a certain period may be easily estimated. By referring to the following table, the approximate capacity of different sized tub silos may be ascertained :—

TABLE giving the approximate capacity of stave silos for well matured corn silage, in tons.

Depth in Feet.	Inside Diameter in Feet.									
	15	16	17	18	19	20	21	22	23	24
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
20	58	66	75	84	94	104	115	126	138	150
21	62	71	80	90	100	111	123	135	147	161
22	67	76	86	96	107	119	131	144	153	172
23	71	81	92	103	115	127	140	154	168	183
24	76	86	97	109	122	135	149	163	179	194
25	80	89	103	116	129	143	158	173	189	206
26	85	97	109	123	137	151	167	183	200	218
27	90	102	115	129	144	160	176	194	212	230
28	94	108	122	136	152	168	186	204	223	243
29	99	113	128	143	160	177	195	214	234	255
30	105	119	134	151	168	186	205	225	246	268

In all silo construction, a most important point is to build as high as possible, since each foot added in height increases by so much the chance of success and gives a more than proportionate increase in capacity, due to the greater pressure of the taller column of material.

The silo may be built inside the barn or adjacent to it, as convenient. If built outside, it may be expected to prove as satisfactory as if built under cover, though scarcely so long-lived. While in the case of the unprotected tub silo, a small amount of ensilage may be frozen to the sides, especially on that side exposed to the prevailing winter wind, this may be mixed as it falls with the rest of the ensilage, and may be used without injury to the stock.

Probably the general method of building may be explained most clearly by going into the details of construction of a silo of a particular size.

Construction of Stave Silo.

The Foundation.

For a stave silo 20 ft. in diameter a circular trench 18 inches to 2 ft. wide and with an outer diameter of 22 ft. is dug about 2 feet deep or below the frost line.

The surface soil over the whole included area and for 2 ft. outside is removed to a depth of 10 or 12 inches at the same time.

The trench is then filled to the level of the interior with stone well pounded down, the surface stone being broken quite small and thin cement (1 part of cement to 4 of sand thoroughly mixed poured over, well worked in and left for a few days. This is followed by a coat of good cement (1 part cement to 3 sand), care being taken when finished to have the surface level and smooth.

Pure cement sprinkled on dry shortly after last coat and worked in with a trowel will make a superior finish.

Ample drainage should be provided (See fig. 5) whether the silo be built inside the barn or outside. This is essential to the preservation of both the silo and the ensilage. If any fear of rats be entertained, they may be guarded against by spreading a thin coat of grouting over the area inside the trench.

The above is to be preferred to cementing the entire interior because more economical and equally serviceable.

A stone wall might take the place of the above described foundation, but it would be necessary to line the inside with cement wherever the ensilage might be expected to touch it.

The top of the wall would also required a coat of cement in such case.

The circular line to mark the position of the staves might be drawn by means of some hard pointed article attached to a bit of string half the length of the diameter of the proposed silo. A spike driven in the centre might serve as a pivot.

The Staves.

Any of our common soft woods may be used for staves. Hemlock, pine and spruce seem to be equally serviceable.

The staves may be from $1\frac{1}{2}$ to 3 inches thick, by from 5 to 9 inches wide. The smaller the silo the less must be the width of the stave. The best is probably 6 x 2 inches, dressed on the inside and sized square on the edge. By using the staves with a tongue and shallow groove, they may be expected to be more easily kept in place. A cross section of a stave so dressed and having a slight bevel is given in figure 1.

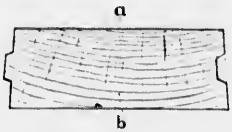

FIG. 1.—A section of a stave. The face *a* is $\frac{1}{16}$ to $\frac{1}{8}$ less than *b*.

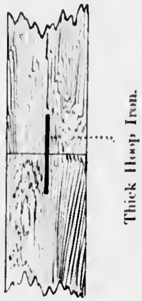

FIG. 2.—A stave splice.

In any case, great care must be taken to have lumber well sized and with no loose knots or shaky spots.

It will be found impossible to get staves much over 20 feet long, and so for a 30 foot silo it will be necessary to make up each stave from two or more pieces. These must be of exactly the same size. The ends should be carefully squared, and it is generally advisable to insert a bit of heavy hoop iron as shown in figure 2. This is not imperative, but where the parts of the stave are not connected in some way it will be necessary to insure the join coming immediately under a hoop.

Erecting the Silo.

When built under cover it will usually be found easy to erect scaffolding for use in setting up the silo. Where the silo is built outside and over 20 feet high, the erection of scaffolding becomes rather more difficult.

One method is to erect 4 posts 6 x 6 the desired height and equidistant from each other, on, or 2 inches outside, the circle traced on the cement.

If placed on the circle they will take the place of staves.

These posts will serve in the place of clips for the hoops which may be made in two or four parts as preferred and tightened on the posts.

If the posts are used and the scaffolding erected outside the silo, it will be necessary to erect four other temporary posts of 2 x 4 material. A study of figure 3 will make this clear.

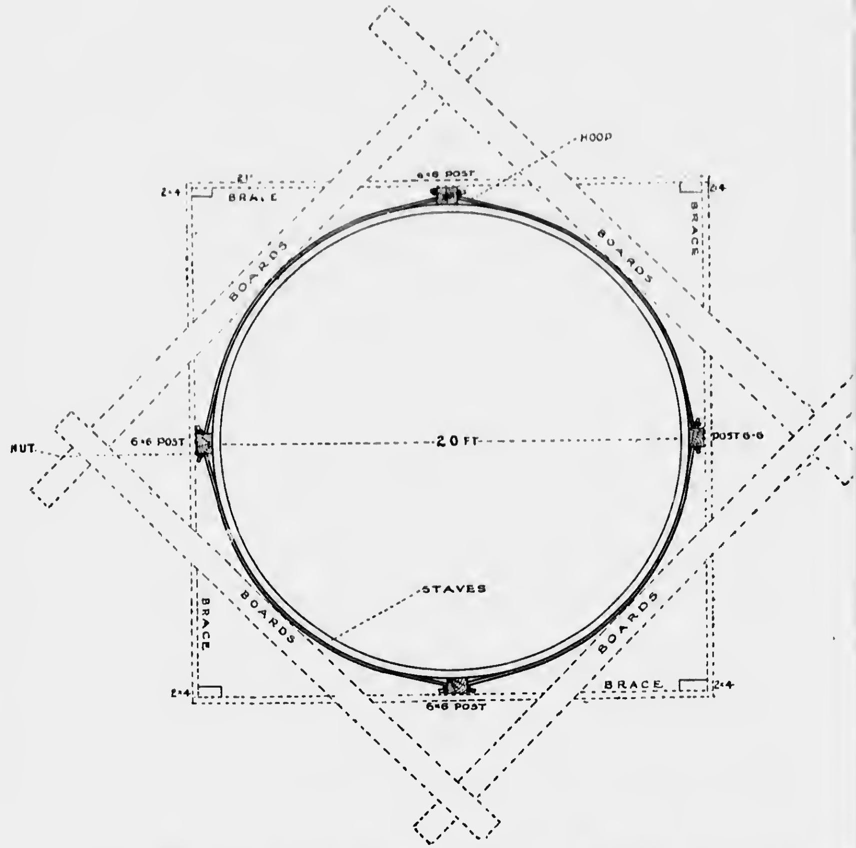

FIG. 3.—Plan of scaffolding that may be used when posts are employed instead of clips to hold the hoops in positi
The 2 x 4 pieces are temporary posts supporting braces at intervals. Boards
resting upon the braces form scaffolding.

A better, though somewhat more expensive plan is to erect scaffolding inside the silo. Three circular platforms of the exact diameter of the silo are constructed as shown in fig. 4. One is placed on the foundation, one near the splicing lines of the staves and one near the top. The staves may then be quickly and easily placed, toe nailed, hooped and the doors cut.

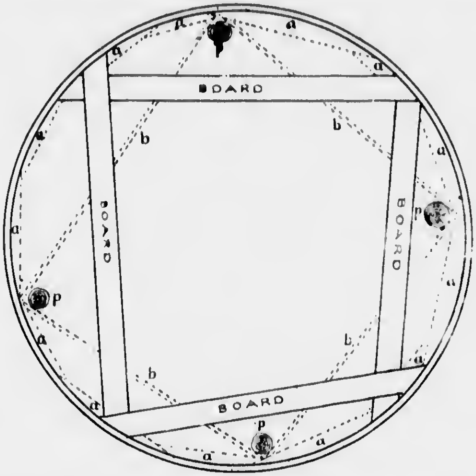

FIG. 4.—Plan of interior scaffolding, *a*, *a*, *a*, etc., boards cut as segments of 20 feet circle; *b*, *b*, *b*, *b*, braces nailed to *p*, *p*, *p*, *p* posts and extending to support circular platform made up of *a*, *a*, *a*, etc.

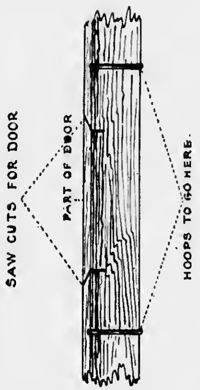

FIG. 6.—Part of stave showing saw cuts to be made for a door before erecting stave.

The doors should not be cut out till the silo is hooped, but preparation should be made for the cutting by selecting a stave which it is decided shall form part of the door and making saw cuts two or three inches deep along one edge at the top and bottom of each door (see fig. 6).

The door should be about 4 staves wide and about 18 inches high, or just large enough to admit a man.

The top and bottom should be sawn with a bevel in such a way as to cause the tightening of the joint by the pressure of the ensilage. The greater the bevel the better.

A glance at fig. 6 will show how and where the saw cuts should be made.

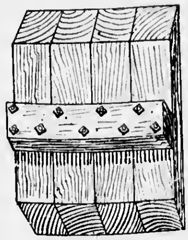

FIG. 7.—Door showing bevel and bar on outside.

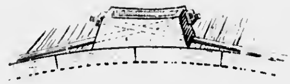

FIG. 8.—Showing clip made of wood or iron to be used where posts are not left in sides.

The parts of the door may be held in place by a 6-inch bar cut to fit the curve and to which each part is firmly bolted (see fig. 7).

The Hoops.

Round or flat hoops may be used. Round hoops in 2, 3 or 4 sections are the most easily handled. They may be joined by means of metal or wooden clips so bored as to admit of putting a nut on the exserted end of the rod, or by passing through the uprights as shown in figure 3.

They may be held in place by wire fencing staples driven in at intervals. When the silo is exposed to the weather, care should be taken that each stave is so attached to two or more hoops.

It will be found necessary to give the proper curve in the book before attempting to put it in place. This is most easily done by using a tire bending machine such as may be found in any carriage or repair shop.

Round iron or steel ¾-inch through will be found strong enough for a 20-foot silo.

The hoops should be nearer together at the bottom and further apart towards the top. (See fig. 5.)

The first hoop should be not over 4 inches from the foundation.

The second about 18 inches from the first and the third 2 feet higher.

The space between hoops may gradually increase to 4½ feet at the top.

Where the silo is built outside, it will be found necessary to roof it in most parts of Canada.

When posts form part of the silo wall they may be utilized as supports for the roof. In cases where posts have not been used, it will be found necessary to erect two or more or construct a frame work from 2 x 4 scantling to carry the roof. In any case, care must be taken to allow an opening for filling.

A CHEAP RECTANGULAR SILO.

When it is not convenient or possible to build a stave silo, a very cheap rectangular one may be constructed by erecting strong (3 x 10) studding around a bay or part of a bay in a barn and lining with one ply good matched lumber one inch thick. Such a silo has been in use at the Central Experimental Farm for eight years and has given good results.

CROPS FOR ENSILAGE.

The best material for ensilage appears to be corn, but almost any crop cut at the proper stage may be used.

Clover has been used with success in some parts, but it is rather uncertain as its peculiarities have not been studied sufficiently as yet. The conditions necessary for success with this plant and the exact stage of cutting appear to be more exacting than in the case of corn (*Zea mays.*) Any plants with hollow stems as rye or clover are more uncertain of curing properly than those with solid stems as Indian corn or mangold tops.

Preparation of Material.

Most material for ensilage seems to give best results when cut previous to storing in silo.

Indian corn put in uncut has been known to come out in good shape, but the loss from feeding the long coarse stalks and the uncertainty of properly curing much more than make up for the trouble of cutting.

Clover has been a success in many instances when put in the silo uncut.

Sorghum, where it can be grown, makes an excellent crop for ensilage. It needs to be cut. The best length to cut corn, &c., for the silo is into pieces three quarters of an inch long.

FILLING THE SILO.

In filling the silo it will be found an excellent plan to have the material as it falls from the carrier or blower descend through a tube made up of a number of salt sacks tacked together with the bottoms out. By this means it will be found possible to mix the leaves and stems much more thoroughly and easily than where forks are used in keeping the surface level.

Packing the ensilage evenly in all parts of the silo is a considerable factor in the quality of the finished product.

The silo should be filled to the top, allowed to settle, then filled again.

This filling up operation should be continued as long as possible.

The ensilage needs no pressure on the top nor cover of any kind as it very soon forms a layer of partially decayed matter 2 or 3 inches thick, quite impervious to air, which serves as a protector for the rest of the contents of the silo. This process may be hastened, however, and a small saving of ensilage effected by pouring about a pail of water to the foot of surface and sowing oats thickly over it, or by scattering chaff on top and wetting it in the same way.