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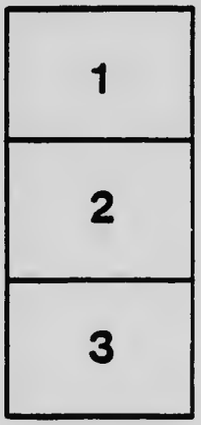

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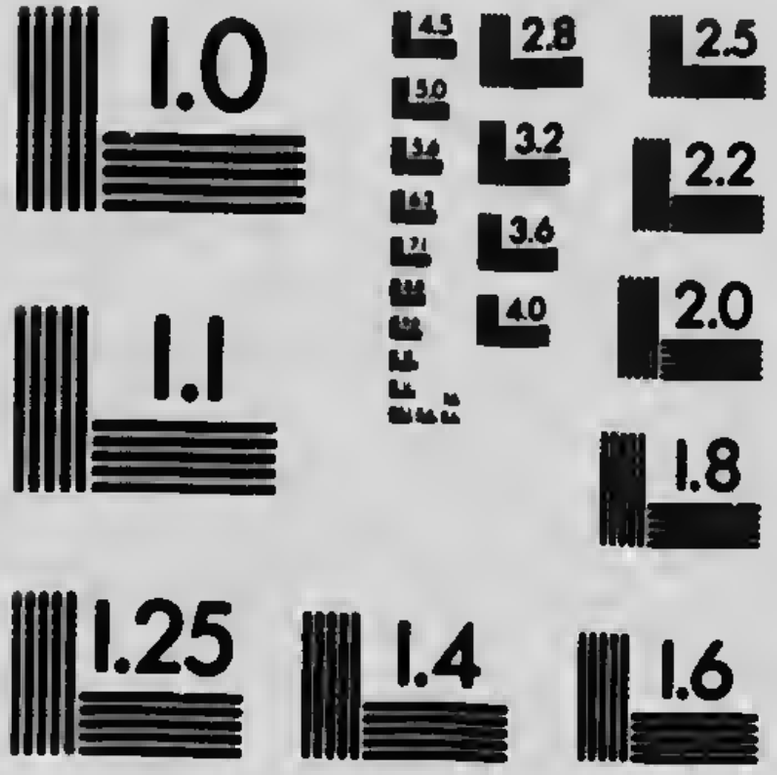

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PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF AGRICULTURE

(LIVE STOCK BRANCH)

SILOS AND SILAGE

BULLETIN No. 66

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1916.

PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF AGRICULTURE

(Live Stock Branch)

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BULLETIN No. 66

THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA.

PRINTED BY
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VICTORIA, B.C.:
Printed by William H. Cullin, Printer to the King's Most Excellent Majesty.
1910.

DEPARTMENT OF AGRICULTURE,

VICTORIA, B.C., December 27th, 1915.

To His Honour FRANK STILLMAN BARNARD,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

I have the honour to submit for your consideration herewith Bulletin No. 66, "Silos and Silage," prepared by Wm. Newton, Soil and Crop Instructor, under the direction of Wm. E. Scott, Deputy Minister of Agriculture.

A. C. FLUMERFELT,

Minister of Finance and Agriculture.

DEPARTMENT OF AGRICULTURE,

VICTORIA, B.C., December 27th, 1915.

Hon. A. C. Flumerfelt,

Minister of Finance and Agriculture,

Victoria, B.C.

SIR,—I have the honour to submit herewith for your approval Bulletin No. 66, entitled "Silos and Silage," which has been compiled by W. Newton, Soil and Crop Instructor, of the Live Stock Branch of the Agricultural Department.

I have the honour to be,

Sir,

Your obedient servant,

WM. E. SCOTT,

Deputy Minister of Agriculture.

PROVINCE OF BRITISH COLUMBIA.

DEPARTMENT OF AGRICULTURE (LIVE STOCK BRANCH).

HON. A. C. FLUMERFELT,
Minister of Finance and Agriculture.

WM. E. SCOTT,
Deputy Minister of Agriculture.

W. T. McDONALD, B.S.A., M.S.A.,
Live Stock Commissioner.

H. RIVE, B.S.A.,
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Veterinary Inspector.

S. A. K. WHITE, V.S.,
Veterinary Inspector.

WM. J. BONAVIA,
Secretary to the Department.

Fig. 1. Silo-filling demonstration at Kelowna, B.C.

SILOS AND SILAGE.

By W. Newton, Soil and Crop Instructor.

THE popularity of the silo in British Columbia is the foundation of a successful live-stock industry. With the introduction of the silo, we will be able to feed our animals better and with greater economy. The digestive organs of animals that chew the cud are so formed as to require comparatively juicy and bulky food. The cow cannot thrive on exclusively dry feed so well as the horse. The nearest ideal food for the dairy cow is good pasture. This is only available during the summer months. The best substitute during the period when pasture is not available is corn silage.

CORN FOR SILAGE.

Of all the crops suitable for putting into silos, corn is undoubtedly the best. Clover, alfalfa, vetch, peas, fall rye, fall wheat, and most of the spring-sown grains have been successfully made into silage both singly and in combinations. Under certain conditions it is profitable to use these crops, but corn will be the staple silo crop under most conditions.

Fig. 2. Corn grown for silage purposes at Penticton, B.C.

REASONS WHY CORN SHOULD BE USED AS SILAGE-CROP.

(1.) The plant is capable of yielding a large amount of valuable forage under a great variety of soil and climatic conditions.

(2.) Corn silage is excellent material to render other food more palatable. The succulent and appetizing nature of corn silage enables the animals to make better use of other roughage and the concentrates fed.

(3.) Corn silage properly made is superior to roots in feeding value and can be more cheaply produced.

(4.) The corn-crop is seldom a failnre. Corn is less snbject to unfavonrable seasonal conditions than any other crop. Furthermore, it is comparatively free from insect pests and fungus-diseases.

TIME TO HARVEST.

It is of great importance to know at what stage corn shonld be cut to secure the best results. The table which follows shows that it is of great advantage to allow the corn to reach the glazing stage.

Date of cutting.	Stage of Growth.	Corn per Acre.	Water per Acre.	Dry Matter per Acre
July 30	Fully tasselled	9.0	8.2	0.8
Aug. 9	Fully silked	12.9	11.3	1.5
Aug. 21	Kernels watery to full milk	16.3	14.0	2.3
Sept. 7	Kernels glazing	16.1	12.5	3.6
Sept. 23	Ripe	14.2	10.2	4.0

Only seventeen days was occupied in passing from the milk to the glazing stage, yet there was an increase in dry matter of 1.3 tons per acre.

When the corn is in the glazed stage the bnik of the kernels are hard (and dented, if a dent variety is nsed). The husks are turning yellow and the lower leaves will be dry.

The corn will keep better when cut at this stage. If it is cut earlier, too mnch acid is inclined to develop. If too ripe, it does not settle properly and the air is not sufficiently excinded to prevent spoiling.

IMMATURE CORN.

If the corn-crop has to be cut in a jnicy, immature condition, better silage will be made if the corn is allowed to dry ont a short time before ensilaging.

FROSTED CORN.

Corn that has been frosted to any extent shonld be cut and pnt into the silo immediately. Frosting seems to have no appreciable effect on the quality of the silage if put into the silo without delay, providing enough water is added to take the place of the loss dne to frosting. If allowed to stand in the field for some time after being frosted, poor silage will result.

DRY CORN.

To make good silage from corn that is very matnre or corn that has stood in the field for some time after cntting, water mnst be added. This can be accomplished by throwing water over the load before putting throngh the silage-cutter or by tnrning a small stream of water into the cntter. When this is done, nnless considerable surplus power is available, clogging of the blower may resnlt. The objection of wetting the silage every few feet inside the silo is that it is difficult to get the silage nniformly damp. If this last method is followed, plenty of water shonld be used, particularly aronnd the walls.

FILLING THE SILO.

Two types of machines are used in elevating the cut corn, the chain-carrier and the blower. The blower is found more satisfactory and is fast displacing the other type. In setting up the blower, care shonld be taken that the blower-pipe is perpendicular.

DISTRIBUTER.

Most blowers are supplied with a jointed distributing-pipe. (Fig. 3.) If a distributer is not attached, more labour is necessary in the silo to ensure a thorough mixing of the heavy and light parts of the corn-plant.

Fig. 3. Jointed-pipe silage distributer.

By using the jointed distributing-pipe shown in the accompanying figure, the presence of one man in the silo, distributing and tramping, is all that is required for that purpose. This one man may, with one hand on the distributer, direct the finely cut material to any part of the silo desired. The method most generally adopted by the man in the silo in such cases is to hold the distributing-pipe in front of him and walk around the silo, tramping the material into place as it leaves the pipe. In this way the need of extra labour, tools, etc., in the silo, to ensure the equal distribution of the corn, is eliminated.

As previously mentioned, the advisability of using water in the ensiling of corn, clover, or other crops has been much discussed. Ordinarily, the only times that water may conveniently be applied are either after the silo has been filled or after the cutting of each load. In the latter case it would necessitate a waste of time and additional equipment which the majority of farmers do not possess. The amount of water to add is a debatable question. The crop being cut for silage varies in moisture content according to the degree of maturity and wilting. Loads will often vary in moisture content, in which case it is obviously impossible to gauge the exact quantity of water which should be applied after the silo has been filled. In the use of a distributing-pipe lies the solution of this problem. A small stream of water just sufficient to moisten the cut material to the right degree of dampness may be run into the blower. By so doing the cut corn or clover becomes uniformly damp on its way to the silo, it is heavier, and packs more easily. The distributer controls the distribution of the wet material and adds to the comfort of the person inside the silo.

The cost of the jointed distributing-pipe is small, but to avoid even this additional expenditure one might make a distributer with canvas or jute sacks by ripping out the bottoms and joining them up to form a canvas chute.

The secret of making good silage is to have all the air excluded. For this reason the corn must not be too dry, and one or two men in the silo should be kept busy distributing and tramping. When filling, the material around the wall should be kept higher than the rest and thoroughly tramped. Otherwise mouldiing around the edge is apt to result.

The preservation of silage is due to three factors—pressure, heat, and acid. The pressure excludes the air. The heat due to fermentation pasteurizes the silage, killing many of the spoiling moulds. The acid is also detrimental to many of the spoiling moulds.

HAULING TO THE CUTTER.

The common hay-flats that are usually used in hauling the green corn from the field to the cutter are objectionable on account of the height the corn has to be lifted in loading. If low wheeled wagons are not available, a convenient low-down truck can be made as follows: Two 3- x 8-inch pieces are used, 18 to 20 feet in length, bolted together at one end to form a V. The apex of the V is suspended to

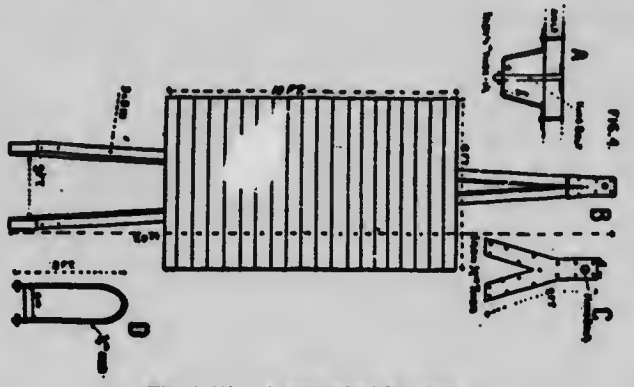

Fig. 4 (1). A convenient low-down truck.

Fig. 4 (2). Showing end boards.

the front axle by a long king-bolt. The other ends are attached below the hind axle by U-shaped clevises. On these timbers is built a rack 6 feet in width, with a bottom about 8 feet long. The end boards are 4 feet high, built flaring, so that they do not quite touch the wheels. (Fig. 4.)

ARGUMENTS FOR THE STAVE SILO.

(1.) Wood being a non-conductor of heat and cold, all parts of the silage reaches the highest temperatures and therefore keeps well.

(2.) A wood silo costs less, and if well constructed will last for a great number of years.

(3.) Better material can be procured in British Columbia for the construction of stave silos than in any other Province. The best stave silos are made of one-piece staves. These can be procured from British Columbia lumber firms at reasonable rates.

(4.) Farmers are more versed in wood-working than in concrete. Consequently, when home-made silos are erected, better silos are the result if the stave types are erected.

(5.) Stave silos can be easily repaired. If a faulty stave develops, it can be replaced without much trouble. If a concrete silo cracks, it is almost impossible to remedy it.

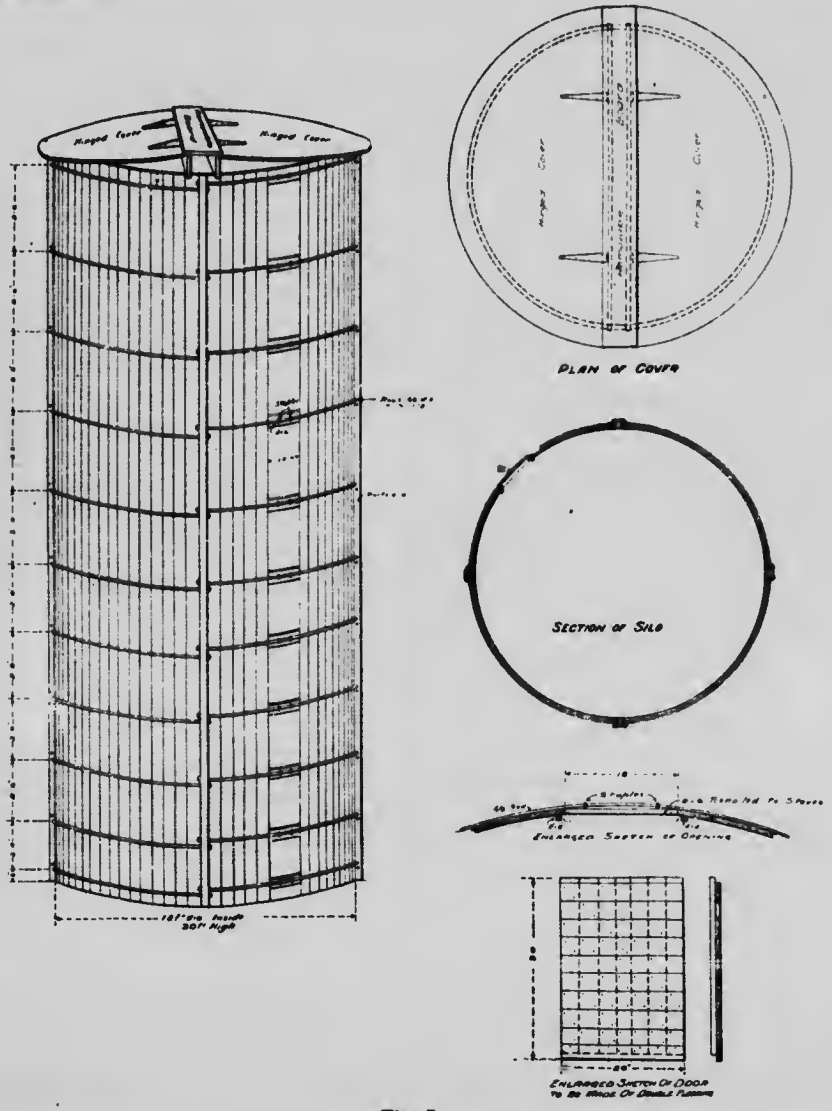

Fig. 5.

(6.) A stave silo can be moved at a small cost if convenience demands a change in position.

(7.) It has long been understood that the acids in silage are wood-preservatives, hence a properly constructed stave silo on a concrete base should be a permanent feature on the farm.

CONSTRUCTION OF STAVE SILOS.

Fig. 5 shows a type of construction recommended by the Department of Agriculture.

Fig. 6. The table shows the capacities and the exact amounts of materials necessary in the construction apart from the fonndation.

		LUMBER.					HARDWARE.							
Size.	Capacity.	No. of 2"x6".	No. of 2"x4".	No. of 4"x4".	No. of 2"x2".	Amount 1"x12".	No. of Rods.	Length of Rods.	3" Nails.	2½" Nails.	Strap-hinges, 3"x9".	2½" No. 155 Staples.	Yards Roofing.
Feet.	Tons.					Feet.		Ft. in.	Lb.	Lb.		Gross	
8x20	20	53	6	3	2	190	21	9 0½	7	3	6	2	17
9x20	25	57	6	3	3	190	21	10 1	7	3	6	2	19
9x24	30	57	6	3	3	210	24	10 1	7	3	6	2	19
9x26	33	57	6	3	3	225	27	10 1	7	3	6	2	19
10x20	32	66	6	3	3	210	24	11 2	7	3	6	2	21
10x24	37	66	6	3	3	230	27	11 2	7	3	6	2	21
10x26	40	66	6	3	3	240	27	11 2	8	4	6	2½	21
10x28	44	66	6	3	3	255	30	11 2	8	4	6	2½	21
10x30	47	66	6	3	3	270	33	11 2	8	4	6	2½	21
11x20	33	71	6	3	3	215	24	13 2	7	3	6	2	22
11x22	43	71	6	3	3	225	24	13 2	7	3	6	2	22
11x24	46	71	6	3	3	240	27	13 2	8	4	6	2½	22
11x26	49	71	6	3	3	255	27	13 2	8	4	6	2½	22
11x28	53	71	8	3	3	265	30	13 2	8	4	6	3	22
11x30	57	71	8	3	3	280	33	13 2	10	5	6	3	22
12x22	50	78	8	4	4	235	36	10 0½	8	4	6	2½	25
12x24	54.5	78	8	4	4	250	36	10 0½	8	4	6	2½	25
12x26	59	78	8	4	4	265	40	10 0½	10	5	6	3	25
12x28	64	78	8	4	4	275	40	10 0½	10	5	6	3	25
12x30	68	78	8	4	4	290	44	10 0½	10	5	6	3½	25
13x24	63.5	82	8	4	4	260	36	10 10	8	4	6	3	27
13x26	69	82	8	4	4	275	36	10 10	10	5	6	3	27
13x28	74	82	8	4	4	290	40	10 10	10	5	6	3½	27
13x30	79	82	8	4	4	300	44	10 10	10	5	6	3½	27
14x26	80	80	8	4	4	285	40	11 7½	10	5	6	3½	30
14x28	86	89	8	4	4	295	40	11 7½	10	5	6	3½	30
14x30	92	80	8	4	4	305	44	11 7½	10	5	6	4	30
15x26	92	95	8	4	4	295	40	12 5	10	5	6	4	32
15x28	99	95	8	4	4	310	40	12 5	10	5	6	4	32
15x30	106	95	8	4	4	320	44	12 5	10	5	6	4	32
15x32	113	95	8	4	4	335	44	12 5	12	6	6	4½	32
16x26	104	104	8	4	4	305	40	13 2	12	6	6	4	34
16x28	112	104	8	4	4	315	44	13 2	12	6	6	4	34
16x30	120	104	8	4	4	330	44	13 2	12	6	6	4	34
16x32	128	104	8	4	4	345	48	13 2	12	6	6	4½	34
16x34	136	104	8	4	4	360	48	13 2	12	6	6	4½	34

2"x6"—2"x4"—4"x4"—2"x2" to be as long as silo is high.

Two nuts and two malleable washers for each rod.

Where continuous doors are used, it will require flooring to the amount of the height of the silo in feet, multiplied by 4.

FOUNDATION.

A silo should rest upon a foundation broad enough to prevent any appreciable settling, and deep enough to rest on a soil which is never disturbed by frosts.

A concrete foundation is always recommended. A pit or cellar is seldom necessary in this Province to get below the frost-line. The door, where possible, should go to the bottom of the silo, so as to avoid any unnecessary work in getting

the silage out; therefore, only when the silo is on a side-hill would a pit be recommended. When a pit is used, care should be taken that the wall of the silo is even with the wall of the pit, for an edge prevents the proper settling of the silage. (Fig. 7.)

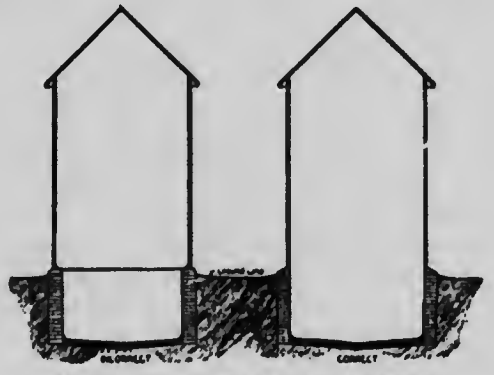

Fig. 7. Correct and incorrect methods of constructing silo foundations.

A concrete ring 14 inches in width may prove sufficient. This will allow 6 inches both on the outside and the inside of the staves. Although not absolutely necessary, a concrete floor will be easier cleaned, and rodents will be prevented from tunneling underneath the foundation and getting into the silo. Four anchors should be set into the concrete for anchoring the four posts.

POSTS AND RODS.

For silos up to 11 feet in diameter three posts 4 x 4 inches are used. When over 11 feet four posts are used. These posts take the place of a stave and act as a framework to the silo. The first operation is to bore the holes in the posts according to the spacing of the rods. The spacing of the rods increases with the height of the silo. The first should be 6 inches from the bottom, and the distance apart should vary from 2 feet at the base to 3 feet 6 inches at the top. The holes are bored through the posts at an angle, entering the post against the stave and coming out 1 inch from the stave. Iron rods ⅝ inch are used, threaded 6 inches at both ends and supplied with nuts and malleable washers. The rods should be purchased best to the circumference of the silo. After the holes in the four 4 x 4 uprights are bored, they are set up and the rods are inserted. In one section of the silo a number of the rods are left out in order to allow the staves to be drawn inside the silo to be inserted.

Various types of staves can be used. If full-length dressed and beveled tongued and grooved staves are used, a more permanent and satisfactory type of silo is the result. Rough 2 x 6 staves have been used and have given good satisfaction for a number of years. The small extra expense of securing dressed staves of good quality will undoubtedly pay. When the less durable woods are used the practice of creosoting the staves is recommended.

INSERTING STAVES.

It has been found cheaper and more convenient to build the scaffolding on the inside of the silo rather than the outside. Scaffolding in the shape of a stool half the height of the silo is usually sufficient. A short ladder can be used to reach the top of the silo from the stool. To hold the staves in place, staples are driven over the rods into the staves. A staple should be inserted over every alternate rod, each stave alternating with the next.

The staples will give greater rigidity to the silo and will avoid the danger of the staves getting out of place during the summer when the silo is empty. The use of staples is particularly advantageous if the staves are not tongued and grooved.

The tongues in silo staves are usually made larger than are used for ordinary purposes.

Fig. 8. Stave silo being filled at Penticton, B.C.

SPLICING STAVES.

The stave splice may be made by making a saw-cut with a hand-saw and inserting a piece of galvanized iron. A V-shaped splice with a tongue is also satisfactory. Both these splices are shown in Fig. 7. When it is not possible to secure full-length staves the joints should be broken in order to give greater strength to the silo.

Fig. 9. Two methods of splicing staves.

Silo Doors.

The silo doors should be so arranged that the minimum amount of silage will have to be disturbed when they are taken out. The continuous door has proven to be more convenient than the non-continuous types. In stave silos the doors are very often made of the same material as the silo itself. Sections of the staves are cleated together to form the doors. The advantage of the continuous door suggested the use of the staves without the cleats to fill the continuous opening. In the case of many of the silos constructed by the Department of Agriculture during the past season sections of the tongued and grooved staves were placed one on top of the other as shown in Fig. 10. The advantage is very evident when the silage is taken out. One 6-inch section can be taken out at a time. If rough staves are used, the same system can be followed. In this case, however, it is advisable to use a roll of building-paper. By attaching it to the bottom of the door-space it can be unrolled against the inside of the door as the silo is being filled, thus ensuring that the door is practically air-tight.

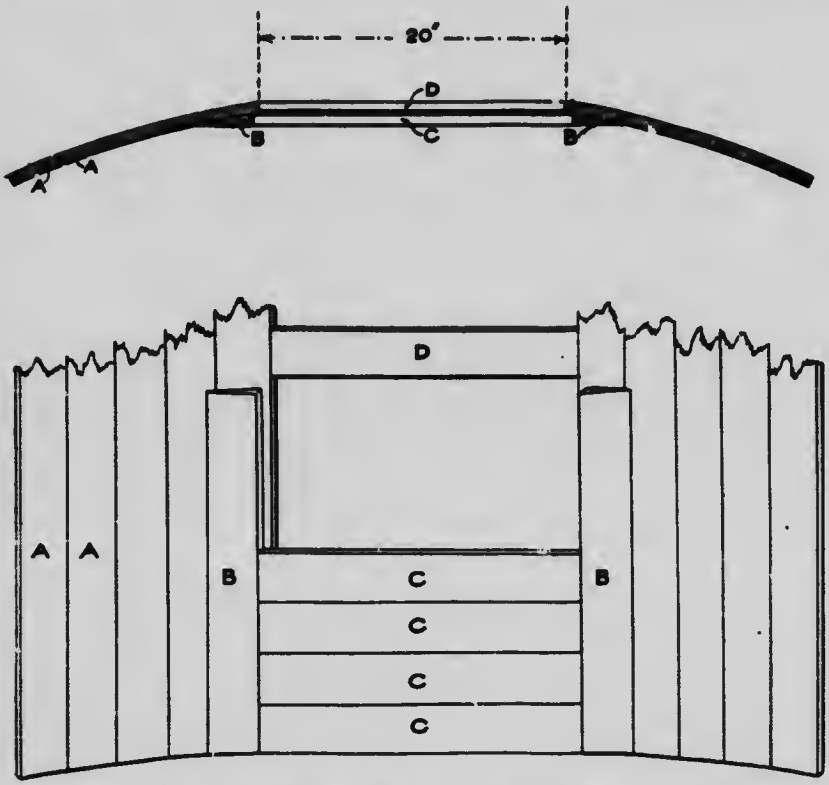

Fig. 10. Diagram of silo door. A. Silo wall, 2" x 6" staves. B. Door-jambs, 2" x 6", diagonally cut. C. Sections of tongued and grooved staves filling the continuous opening. D. Braces keeping the staves apart to form the continuous opening.

Roof.

Although not absolutely essential, a roof [illegible] has many advantages, especially for winter feeding. During stormy or [illegible] weather the snow is kept out and the silage is prevented from freezing. Fig. 11 suggests an attractive and

easily constructed roof. It consists of two wings on hinges that can be lifted up for convenience in filling, and a sliding door between the wings. Roofing-paper is probably the most convenient material for covering the roof.

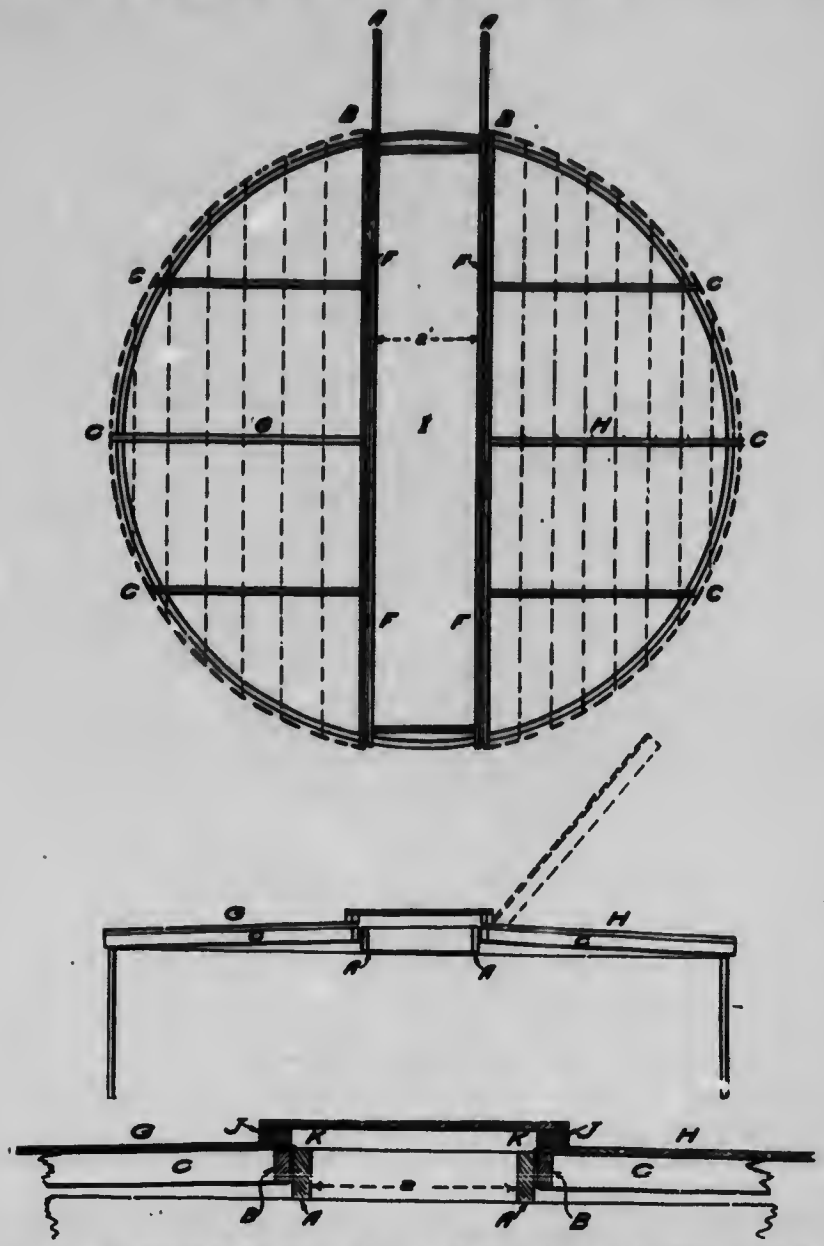

Fig. 11. Diagram of silo roof. A, 2" x 6"; B and C, 2" x 4"; F, hinges; J and K, 2" x 4". The roof is in three sections, G, H, and I. G and H are hinged to the frame A-A, and may be tipped up when the silo is nearly full to allow filling to the top. The sliding door, I, can be moved to either side and leaves an opening for the blower to deliver into.

PAINTING THE SILO.

A good coat of paint on the outside of the silo will add to the appearance and length of life of a silo. When durable woods such as Douglas fir and western larch are used it is not advisable to paint the inside. Painting the inside will prevent the proper settling of the silage to a certain degree.

CONCRETE SILOS.

It has been admitted by those who have studied the subject from an impartial standpoint that silage can be kept in good condition in a silo of any material, be it concrete, stone, tile, or wood, if the material is properly used. Concrete silos will always be popular. They are permanent, wind-proof, rodent-proof, and fire-proof. A good concrete silo will remain almost indefinitely.

There are two general methods of concrete construction, the monolithic and the concrete block. With the former the materials are hauled to the site and there mixed and placed within forms or curbs. With the latter the blocks are made and cured at some convenient place and afterwards are hauled to the site for use in the construction of the wall.

Fig. 12. Monolithic concrete silo.

The monolithic is usually the easier of the two for the inexperienced to build, and is usually a little cheaper than the block. Details of the construction of the solid-wall monolithic follow.

FOUNDATION.

It is poor economy to erect a concrete silo without a substantial foundation. On the selected site lay out a circle of a size at least 12 inches greater than the required inside diameter. Drive a stake with a large nail on the top. Prepare a sweep with a hole in one end to fit over the nail, and a sharp-pointed stick 6 inches

farther from the nail than half the diameter of the silo. Keep the sweep true by means of a level and draw the circle. Excavate within the circle to the depth of 4½ feet, keeping the wall sloping slightly outwards and having the bottom level. Then mark off another inch the exact size of the inner diameter, using the same circle. Drive stakes with their outer edge on this circle around the silo about 2 feet apart, and brace them from the middle. Then bind thin boards around the outside of these stakes. This constitutes the inner form of the foundation, the earth wall being the outer. Before completing this, cut under the bank to give footing to the foundation. Drainage for the foundation tends to prevent settling. A tile drain around the outside of the footing would remove any water that might accumulate.

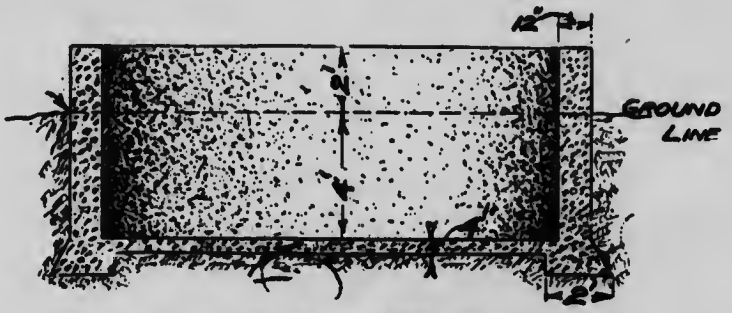

Fig. 13 (1). Foundation.

Fig. 13 (2).

FORMS.

The metal forms or silo curbs undoubtedly will give better satisfaction than the wooden forms, but unless there are a number of concrete silos to be erected in a district they would prove expensive.

Directions for constructing Wooden Forms.—When metal forms are not available wooden forms may be constructed. In constructing wooden forms, first make two circles on a barn floor or some level place to represent the inner and outer circle of the wall of the silo to be built. This can be done with a sweep pivoted to a central point with two nails through the end to act as markers. The two nails should be not less than 3 inches apart, for it is not wise to build a wall less than 6 inches thick. By tacking wide boards lightly to the floor as shown in the diagram, the patterns can then be marked with the sweep and scratching nails. It has been found convenient to build the forms in sections one-sixth the circumference of the silo. The distance between the central pivot and the outside scratch will divide the outside circumference into six equal parts. An outside and inner form must be built for each section. By tacking two boards 8 inches wide and 4 feet long opposite each other, as suggested in the diagram, an inner and outer pattern can be marked at the same time with the sweep. Two of these should be bolted together to complete the pattern for a section. Each outer and inner sectional form should be built 3 feet or 3 feet 6 inches high, using three sectional patterns faced with metal sheeting or matched lumber. To hold the patterns together and to give strength and rigidity to the forms, 2- x 4-inch material may be used. The ends of the sectional forms should be sawn in a line from the centre of the silo

so as to fit in a circle. When complete, set up and bolt together in a circle, placing the inner form first. Bolt securely through the ends of the sectional forms by means of short pieces on top. To keep the inside form just 6 inches from the outside form, make several pieces 6 inches long as spacers.

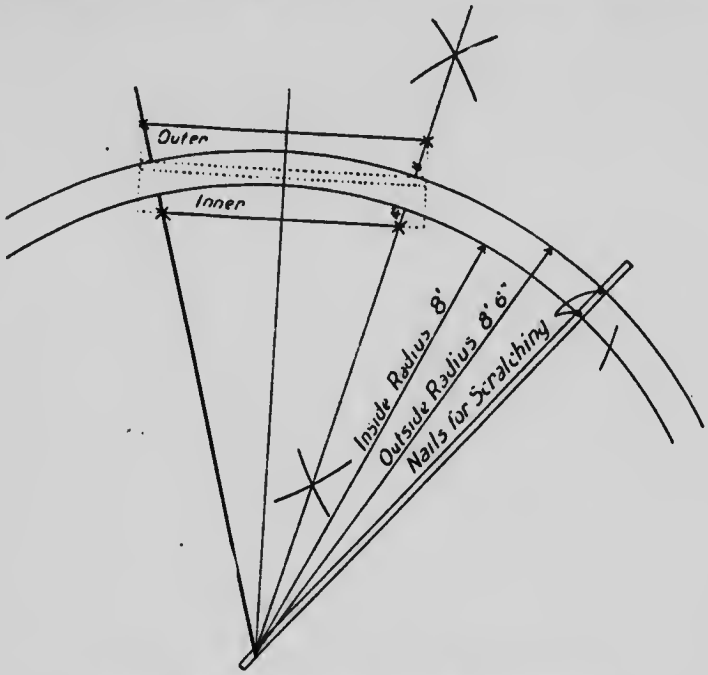

Fig. 14. Showing the method of laying out the forms.

MIXING THE CONCRETE.

The concrete should be prepared on a smooth, water-tight mixing-board, about 10 x 12 feet in size. A suitable mixture for silo-construction is 1 part cement, 2 parts sand, and 4 parts coarse gravel, commonly known as 1 to 6. The most convenient

Fig. 15. Silo forms.

method of measuring is by means of the bottomless box. The gravel or stone used should be clean and free from any foreign substances which destroy the action of the cement. After adding the cement to the gravel and sand, mix thoroughly by shovelling, then add sufficient water and shovel again back and forth at least three

times. Concrete hardens rapidly, and should uot stand long after the cement is wet without being placed. The manner of handling is of great importauce when placing concrete, for the materials must not separate when poured, as good concrete is obtained ouly when the stones and gravel remain in coutact with the mortar. Avoid ponring from a height on this account, and have the mixture wet enough to be handled without breaking apart. To prevent cavities, place a layer about 1 foot deep in the forms, and then tamp or puddle with a flat spade or sharpened board. By working the spade along the sides of the form until the water rises on top a smooth surface will be secured. The npper surface shonld be irregular to make a stronger bond with the next layer, and if the second be poured before the previous one has thoroughly set it will give additional strength. A little dry cement sprinkled npon the surface before ponring is also a great aid in obtaining a good connection.

MATERIAL FOR ONE CUBIC YARD OF CONCRETE.

	Mixture 1-2-4.	Mixture 1-2½-5.
Barrels cement per cubic yard concrete	1.3	1.07
Cnbic yards sand per cubic yard concrete	0.42	0.44
Cubic yards stone per cubic yard concrete	0.84	0.88

COST PER FOOT IN HEIGHT OF SILOS.

Mixture, 1 part cement, 2½ parts sand, 5 parts gravel. Wall, 6 inches thick.

Diameter.	Cement.	Sand.	Gravel.
	Barrels.	Cu. Yds.	Cu. Yds.
10	0.65	0.269	0.538
12	0.778	0.32	0.642
14	0.903	0.372	0.74
16	1.03	0.422	0.844

To determine the amount of material necessary for any silo, mnltiply the figures given after the diameter by the desired height, thns: A silo 14 feet in diameter and 30 feet high requires—

Cement ..... 0.903 x 30 = 27.09 barrels.
Sand ..... 0.372 x 30 = 11.16 cubic yards.
Gravel ..... 0.74 x 30 = 22.2 „

Then mnltiply the amount of material by the prices. The above figures make allowance for neither foundation nor floor, but the previous table will assist in determining the cost of these.

WALL.

The forms are first to be set in place, ready to receive concrete. The thickness of wall should not be less than 6 inches, and the forms described are suited to this. It is impossible to give very definite directions for the erection of staging when elevating the forms. It sometimes will be wise to obtain the assistance of a mechanic when commencing. Scaffolding is necessary, both inside and out, to support the forms. The sections when in place are bolted together as provided for during their construction. This holds them rigid. The first section of the wall will be built with the forms resting on the foundation, the inner one being barely on the inner edge of the fonndation, so that the inside wall of the silo will be perpendicular from the bottom up. To keep the walls so throughout after the first section has been laid, allow the forms to lap back on the solid concrete at least

6 inches at each raising. For raising the forms and hoisting the concrete, block and tackle is necessary. When the forms are removed each time smooth down both surfaces with a board, and when the silo is completed go over the inner surface with a thin coat made of 1 part cement to 1 part sand, applying it with a whitewash-brush. Keep the inner surface wet for a week, and a smooth and lasting surface will result.

REINFORCEMENT.

Different shapes of iron and steel are used in reinforced-concrete construction. For silo-construction wire is very satisfactory, as it offers a rough surface where wires are twisted together to form a cable, and laid as a continuous band in the concrete; ⅝-inch steel rods may be used, but are more suitable for vertical reinforcement. Wire, to be fit for this purpose, should approach ⅛ inch in diameter, and be of good material and not old.

Pour about 1 foot of concrete into the forms all the way round, then lay in the reinforcement about 2 inches from the outside of the wall. The size of the cable needed can be determined by the table given below. If rods are used, the ends must be firmly hooked together.

AMOUNT OF HORIZONTAL REINFORCEMENT NEEDED FOR SILOS.

Distance in Feet from Top of Silo.	SILOS UP TO 16 FEET DIAMETER (using No. 9 Wire).		SILOS UP TO 16 FEET DIAMETER (using ⅝" Mild-steel Rods).	
	No. of Wires in Cable.	Distance apart of Cable.	No. of Rods.	Distance apart of Rods.
5	2	12	1	18
5-10	2	10	1	18
10-15	2	8	1	14
15-20	4	8	1	12
20-25	4	6	1	10
25-30	4	6	1	8
30-35	5	6	1	6
35-40	5	4	1	4

Silos 25 feet high and 10 or fewer feet in diameter are stated to need no vertical reinforcement except around the door openings. It is, however, a safe plan to place rods, iron or steel, 3 feet apart vertically around the silo. Short lengths, 3 or 4 feet long, with the ends bent into hooks to join them, are found convenient. On either side of the doors vertical reinforcement must be placed and joined by twisting with the horizontal reinforcement. (Fig. 17.) To prevent a concrete silo from becoming porous they should be painted on the inside every couple of years with a thin solution of cement and water.

Doors.

The continuous doors are just as advantageous in the case of the concrete silo as the stave silos. The reinforcement, however, must be continuous and extend clear around the silo or the construction might spread at its weakest point. This weakness is overcome in this plan by the use of two 2-inch gas-pipes as shown in Fig. 16. Holes large enough to receive ¾-inch rods are drilled in both pipes in the same relative positions at intervals of 12 inches. Through these holes ¾-inch stay-rods are placed as shown in Fig. 16. These stay-rods also form a convenient ladder for gaining access to the silo.

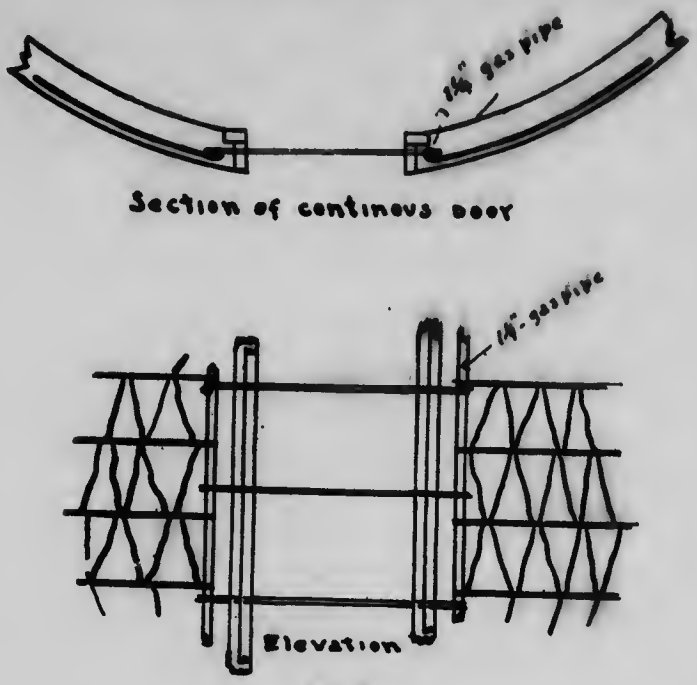

Fig. 16.

A cheap type of roof can b[illegible]ed similar to what is described for the stave silo. The conical roofs need not be expensive and are more attractive. A door for filling large enough to admit the carrier or elevator from the silage-cutter should be left in the roof. The steeper roofs permit the silo to be filled above the top of the wall, so as to be nearly full after settling. A simple type roof is shown in Fig. 18.

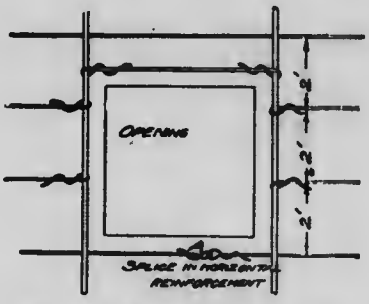

Fig. 17. Reinforcement around a non-continuous door.

The plate is made two-ply of inch boards sawed to the circle of the silo. The 2 x 4 rafters are attached to the plate and to a round circular block at the top of the roof. A 2 x 4 piece is mortised in about half-way between the plate and the block. The sheeting is sawn into triangular pieces diagonally across to prevent waste. Prepared roofing is superior to shingles for silo roofs.

LOCATION OF SILO.

The silo should be placed so that the minimum amount of labour is necessary in feeding. The silo may be placed in the barn, but it is seldom economical to do so. It is usually best to place it adjacent to the barn and in close proximity to

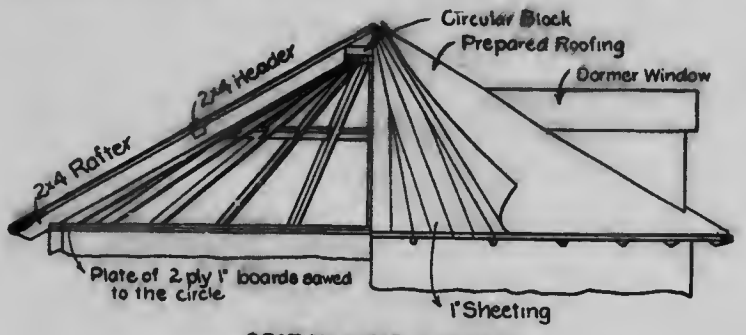

Fig. 18. Silo roof of prepared roofing.

the feedway. It is preferable to place it at the north end of the barn, where it will not interfere with the direct sunlight entering the barn. Another advantage in placing a stave silo in the shade of the barn is that it will prevent the staves warping. The following diagram shows a convenient arrangement:—

ALFALFA AND CLOVER SILAGE.

Alfalfa and clover can be successfully made into silage. The wisdom of using these crops for silage purposes depend upon local conditions. As a rule, these crops can more advantageously be made into hay to be fed with corn silage. Silage cannot be fed as the sole ration with good results, but dry alfalfa or clover hay

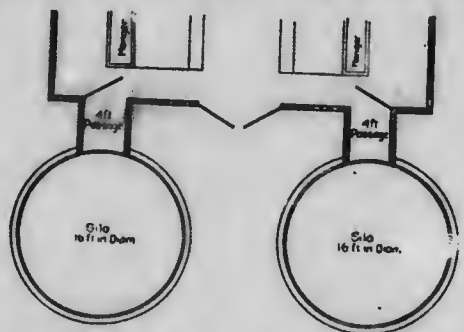

Fig. 19. Plan of the silos of Fig. 1, showing a convenient arrangement for feeding.

with corn silage make almost an ideal combination. In districts where corn is not a successful crop clover or alfalfa can be used to advantage. Even in districts where corn is a successful crop certain cuttings are almost impossible to save as hay on account of unfavourable weather conditions. These cuttings could be profitably put into silage. To make good silage from these crops they should be cut the same time as they would be cut for hay—alfalfa, when a few flowers are beginning to appear, and clover, when it is in full bloom. As soon as the crop is cut it should be put into the silo. The silage cutter should be set to cut ¼ inch length, for the finer the material the better it will pack into the silo. Great care

should be taken to thoroughly tramp the silage, especially around the outside of the silo. Keeping the silage against the wall higher than the remainder of the silo will cause the material to settle more firmly.

ADDING WATER.

Unless water is added, alfalfa or clover will not pack to the same extent as corn. For this reason the addition of water is recommended. If a small stream can be turned into the silage-cutter, better silage will result. The thorough wetting of the walls of the silo while filling will also tend to prevent fire-fanging and moulding around the outside. Clover or alfalfa silage will usually have a stronger odour than corn silage, but, when fed, good results will be secured if it is properly made. The odour is due to the high protein content of the clover and alfalfa. If these crops are mixed with grasses sweeter and better silage will be secured. This is probably due to an increase in the carbohydrate content from which the preservative acids are formed. Essentials in making clover and alfalfa silage:—

(1.) A good silo.
(2.) Finely cut material.
(3.) Thoroughly damp material.
(4.) Thorough tramping.

ENSILING OTHER CROPS.

The use of grain-crops for silage purposes has not yet become popular, but many tests have been made with good results. According to our present knowledge, the best time to cut grain for this purpose is when the entire plant is yet green and the kernels are in the milk stage. At this time the straw is not hollow, and a more thorough exclusion of the air from the silage is the result. The rules that apply to the making of clover or alfalfa silage apply equally to the making of grain silage; i.e., the material must be cut fine, thoroughly dampened and tramped. The fall-sown grains, fall wheat and fall rye, are popular for this purpose on account of the tonnage that is usually secured. A mixture of either of the two crops mentioned with fall vetch has given good results when made into silage.

SIZE OF SILO.

When a silo exceeds 16 feet in diameter it requires more work to get the silage to the door than in the smaller types. It also requires a large amount to be fed daily in order to keep the silage from spoiling, due to contact with the air. The pressure on the silage is measured by the height of the silo rather than by its diameter, so the tall, slim silo will hold practically as much per square foot of wall surface as the short, broad one. On account of the extra capacity of the tall ones, it is seldom advisable to build one less than 30 feet in height. If the blower is used in filling, the height does not interfere with the convenience or cost of filling to any noticeable degree.

At least 1½ inches should be fed daily during the winter and twice that amount during the summer, if the silage is to be kept in good condition.

RATE OF FEEDING FROM SILOS OF DIFFERENT DIAMETERS.

Diameter in Feet.	Approximate Minimum Pounds to be fed daily.		Number of Different Kinds of Stock to keep the Silage from spoiling.				
	Summer.	Winter.	500-lb. Calves.	Stock Cattle.	Beef Cattle.	Dairy Cattle.	Sheep.
8	300	150	25	15	12	7	100
10	500	250	43	25	20	12	166
12	700	350	58	35	28	18	233
14	1,000	500	83	50	40	25	333
16	1,200	600	100	60	48	30	400

USING SILAGE.

In feeding out the silage the surface should be kept as level as possible. It may be fed direct to cattle just as it comes out of the silo. It is a good plan, however, to mix 10 or 15 lb. hay or chaffed straw with every 100 lb. silage. Mixing enough cut hay and silage to last three or four days will be found very satisfactory. Any meal that is being fed can be thrown on the mixture after it is in the manger. Frozen silage should not be fed, but when once thawed it is as good as any other.

Fig. 20. Filling a silo with corn at Revelstoke, B.C.

SILAGE FOR THE DAIRY COW.

Corn silage has long been established as a dairy feed. It is, however, a mistake to think that good corn silage, on account of the grain it contains, will do away with the necessity of feeding concentrates. Cattle will make better use of the meal ration if silage is fed. Suitable rations would be:—

For yearling heifers—	
Corn silage	25–35 lb.
Clover or alfalfa hay	4 „
Straw or chaff	4 „
Bran	2 „
For dry cow—	
Corn silage	40–60 lb.
Mangels	5– 8 „
Straw	6– 8 „
Clover or alfalfa	5 „
For cow in milk—	
Corn silage	30–50 lb.
Mangels	5– 8 „
Clover hay	6– 8 „

Meal mixture: Bran, oats, gluten, or oilcake or cotton-seed meal, equal parts. One pound of meal to 3 to 5 lb. milk produced per day.

Calves can be fed silage with safety when they are three to four months old.

SILAGE FOR BEEF.

The producer of beef on high-priced lands cannot afford to be without a silo. More economical gains will be made if silage is used as part of the roughage ration. Suitable rations would be:—

For steers running over winter (1,000 lb. weight)—

Corn silage	60–75 lb.
Straw	8–12 „
Clover or alfalfa hay	2– 4 „

For fattening steers (1,000 lb.)—

Corn silage	50–60 lb.
Straw	6– 8 „
Clover or alfalfa hay	3– 6 „

Meal—starting at 1 lb., to go up to 10 lb. per day.

A good meal mixture would be corn, bran, and barley and oilcake-meal, gluten-meal, or cotton-seed meal. Take bran and corn, bran and barley, equal parts; or bran, corn, and barley, equal parts, to which add one of the last three equal to one-quarter of the total weight of the meal mixture when ready to feed.

Fig. 21. A small silo at Thrums, B.C.

SILAGE FOR SHEEP.

The experience of every sheep breeder and feeder is that some succulence is necessary to ensure the greatest gain and thrift in the stock. Results indicate that corn silage judiciously fed can replace roots in the ration. By judicious feeding of silage free from mould. Also that the quantity fed to breeding ewes should be limited to 2 lb. daily per head. Ewes' suckling lambs can be fed as high as 3 lb. silage per day with good results.

SILAGE FOR HORSES.

Silage has not been generally fed to horses, partly on account of a certain amount of danger that attends its use and partly through prejudice. In many cases horses have been killed through eating mouldy silage, for horses are particularly susceptible to the effect of moulds, and under certain conditions certain moulds that grow on silage are deadly poisons to horses. Feeding a few pounds of good corn silage has a beneficial effect on the system of a horse, particularly when idle.

POINTS IN FAVOUR OF SILOS.

(1.) The silo provides for an abundance of palatable and succulent feed during the winter.

(2.) Makes use of the entire corn-plant. Can be used to save an alfalfa or clover crop during wet weather.

(3.) Ensures the live stock capacity of the farm.

(4.) Good summer feed when pastures are short.

(5.) Is economical storage.

(6.) Feed is ever at hand, which means a saving of labour in feeding.

(7.) Will reduce the cost of fattening cattle.

(8.) Will increase the milk-flow.

NOTES SUBMITTED BY PARTIES WHO HAVE ERECTED SILOS IN BRITISH COLUMBIA.

NANAIMO.

Dimensions of stave silo, 9 x 20 feet.

Cost of staves, Douglas fir, double dressed, ...	$21 00
Cost of hardware, rods, staples, etc.	25 00
Cost of lumber for roof	2 00
Cost of labour	20 00
Total cost	$68 00

The silo was filled with corn that yielded approximately 8 tons to the acre. Inferior seed was used. The corn silage turned out A 1. One foot of cut straw was placed on top of the corn. This was thoroughly soaked with water and it acted perfectly as a seal. No waste at all occurred except around the doors, which can be remedied by the use of tar-paper.—H. VICARS.

KELOWNA.

Dimensions of silo, 38 x 13 feet (10 feet concrete, 28 feet wood).

Cost of staves, double dressed, tongued and grooved	$109 00
Cost of lumber for roof	6 30
Cost of hardware, rods, staples, etc.	30 18
Cost of cement, stone, etc., for concrete-work	20 00
Cost of labour	124 00
Total cost	$289 48

The lower 10 feet of the silo is made of concrete and is below the surface of the ground. I wish to express my entire satisfaction with my silo. The silo was filled with corn. The yield was approximately 15 tons per acre.—M. HERRON.

THRUMS, B.C.

Cost of material for 10- x 20-foot stave silo.

Cost of staves and posts at $18 per M.	$25 00
Cost of foundation (plank) at $18 per M.	8 15
Cost of hardware, 32 rods, ⅝" x 8' 6"	24 75
Cost of lean-to roof lumber, 217 feet at $18 per M.	4 00
Cost of shingles, 1,500 at $2 per M.	3 00
Cost of labour, 2 men, 3 days at $3 per day	18 00
Total cost	$82 90

I enclose photo showing style of roof detailed above.—R. W. CHALMERS.

THRUMS, B.C.

I have to acknowledge receipt of November 30th, and would like to say that the silage (peas and oats) has quite exceeded even our most sanguine expectations. The following are some of the reasons why I would recommend pea and oats silage:—

1st. The cows like it, and give a large quantity of milk on it.

2nd. We have absolutely no waste in feeding.

3rd. We can grow a very heavy crop to the acre. The heaviest plot ran 20 tons to the acre.

4th. Not so dependent on hot weather as corn.

5th. We can seed to peas and oats in April or March, and can cut and feed, or fill silo at the end of June. Then plough and reseed, getting two crops, and still have time for planting fall wheat or rye.

6th. Our land is in better condition after two crops of peas and oats than it was before.

7th. As the crop is not cultivated, I save time for other work.

We have never needed to feed such a small amount of concentrates to get maximum amount of milk. The cost of placing the crop in the silo was approximately $1 per ton. This compares favourably with making the same crop into hay.—R. W. CHALMERS.

GANGES, SALTSPRING ISLAND.

Dimensions of stave silo erected, 12 x 30 feet.

Cost of staves, posts, and lumber for roof	$ 47 00
Cost of hardware, rods, staples, etc.	43 00
Cost of cement for foundation	11 00
Cost of labour for construction	30 00
Total cost	$131 00

This silo was filled with corn. The yield was approximately 7 tons to the acre.—PRICE BROS.

STRAWBERRY VALE, NEAR VICTORIA.

Dimensions of silo, 16 x 32 feet.

Cost of lumber, staves, scaffolding, etc.	$ 52 00
Cost of hardware, rods, staples, etc.	49 00
Cost of labour for construction	32 75
Total cost	$133 75

The silo was filled with corn, which yielded approximately 15 tons to the acre. The expense of filling for the past season was approximately $300 for 160 tons of corn. The horse-labour is charged at the rate of $3 per day, including man. Man-labour is charged at the rate of $2 per day. We paid $70 of the above amount for filling-machinery hire. Another year I should be able to fill for $1.50 per ton, paying $2 per day for outside help. This year was wasted time unnecessarily, owing to our lack of experience.—E. RAPER.

METCHOSIN.

Dimensions of silo, 10 x 30 feet.

Cost of lumber, staves, lumber for roof, etc.	$ 48 00
Cost of hardware, rods, staples, etc.	23 00
Cost of cement for foundation	3 00
Cost of labour	27 80
Total cost	$101 80

Two- x six-foot staves, double dressed, tongued and grooved, were used.—H. R. HAMMOND.

MOUNT LEHMAN.

Dimensions of silo, 10 x 26 feet.

Cost of lumber, staves, lumber for roof, plank foundation, etc.	$32 25
Cost of hardware, rods, staples, etc.	28 63
Total cost	$60 88

G. H. GUY.

CHILLIWACK.

Dimensions of silo (concrete), 32½ x 16 feet. Total cost of material, $190. Labour, 4 men 9½ days and 1 horse for hoisting. The total cost of the silo was $297, plus the cost of hauling the cement, gravel, and lumber. Five hundred pounds of large wire was used as reinforcement material. Three strands were used twisted to form a rope laid in the concrete about 6 inches apart. The metal silo curbs were used. Scaffolding was erected on the inside only. Lack of experience in silo-building made the construction unnecessarily expensive.—JOHN MCINTYRE.

BURTON.

Dimensions of silo, 10 x 24 feet.

Cost of lumber, staves, roof, etc.	$26 00
Cost of hardware, rods, staples, etc.	33 70
Cost of labour	27 00
Total cost	$86 70

The silo was filled with corn that yielded approximately 13 tons per acre. The silage is turning out well, although the silo is not only small, but rough 2 x 6 staves were used in the construction.—T. MILLAR.

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