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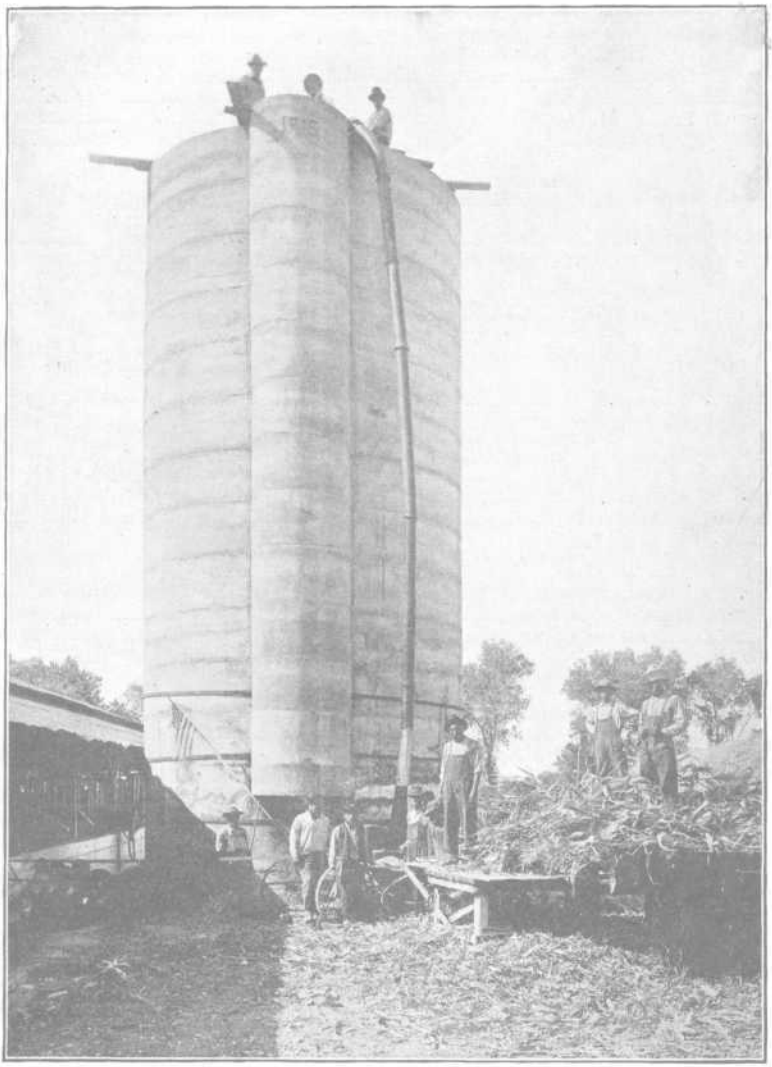
SILOS AND SILAGE CROPS FOR ARIZONA

BY W. A. BARR, COUNTY AGRICULTURAL AGENT



Filling concrete silo, 16x42 feet, Maricopa County.

Cooperative Extension Work in Agriculture and Home Economics, University of Arizona College of Agriculture and U. S. Department of Agriculture, Cooperating.

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SILOS AND SILAGE CROPS FOR ARIZONA

By
W. A. BARR,
County Agricultural Agent

Silos are adapted to every portion of the State where corn or any of the sorghums can be grown and are as necessary to the highest degree of success as they are in Wisconsin, New York, Illinois, Nebraska or any other state where thousands of farmers have proven them a necessary part of the farm equipment. Silage adds variety to the ration, adds succulence, stimulates the cow's appetite, is beneficial to the health of the cow by prohibiting the growth of undesirable bacteria in the intestines and stimulates milk production.

The farmer of Arizona with twelve cows, eight to ten head of young stock and the usual number of horses, hogs, and poultry found on such a farm, could realize 10% every year on an investment of $2,500 in a silo and silo filling machinery if the cost was as great as that. On a basis of $250 for a 10x30 silo, the size needed for twelve cows, and approximately $500 for cutting and filling machinery, your investment returns should be 33 1/3% each year.*

Silage combines well with alfalfa hay, alfalfa pasture, bran, shorts, oil meal and, in fact, scarcely any ration can be fed in which silage cannot be added to advantage. Experiments and the experience of practical dairymen prove that silage in the ration materially reduces the amount of both roughages and concentrates required to the extent of 30% to 50%.

Kinds of silos. Of the various kinds of silos in use today we have the metal; the concrete, of which there are the solid wall, the plastered metal lath, the concrete block and the concrete stave; the wood silo, comprising the stave, the Tung-Lok and the modified Wisconsin; the brick and the pit silo.† Each kind is good if rightly constructed. The silo has not an opponent except among the men who have never used a silo or through some mistake of their own in the construction or filling have failed to observe the principles of making good silage. Plans should be made some time before building, for while all silo owners praise the silo, probably one-half of them lament the meager considerations given to the important details and apologize with "But we were

*These figures are based on a production of 250 pounds fat per cow with a reduction in cost of production of eight cents or a substitution of approximately the amount of grain and hay required.

†A detailed description of the pit silo, with illustrations, has been published by A. L. Paschall in Arizona Agricultural Extension Service Circular No. 8, July, 1916.

in a hurry." Having satisfied yourself that you need and are going to build a silo, let us consider the factors that must insure the success of that silo, viz:

The size, the construction, the location and the care given.

The size. There is no greater and yet no more common mistake made in silo building than getting the diameter too great, which results in a loss of silage. After feeding from the silo has begun, it is necessary to remove daily in depth from the top surface 1½ inches in winter feeding and 2 to 2½ inches in summer feeding, otherwise the silage will not be strictly fresh and its palatability will be lessened which is one of its chief values. The diameter of the silo must always be determined by the number of stock to be fed, and the height of the silo by the number of feeding days.

TABLE I. CAPACITY OF SILOS

Inside diameter Feet	Inside Height Feet	Capacity Tons	Number of feeding days	Minimum lbs. removed daily
8	20	17	121	280
	24	20	142	...
	24	34	130	...
10	28	42	160	525
	32	51	200	...
	26	55	132	...
12	30	67	177	755
	32	74	195	....
	30	91	175	....
14	32	100	193	1030
	36	118	228	....
	32	131	181	....
16	36	155	230	1340
	40	180	270	....
	36	196	...	....
20	40	281	...	....
	44	320	...	....

Capacities are figured on a basis of weight of silage per cubic foot 48 hours after filling. Silos will not have the given capacity unless refilled as there will be four or five feet of settling.

TABLE II. NUMBER OF HEAD OF STOCK THAT MAY BE FED FOR 200-DAY PERIOD FROM VARIOUS SIZED SILOS ON THE BASIS OF 35 POUNDS PER DAY FOR DAIRY COW, 25 TO 28 POUNDS EACH FOR FATTENING CATTLE AND 3 TO 3½ POUNDS PER DAY EACH FOR SHEEP

Diameter of silo in feet	Height of silo in feet	No. of Dairy cows	No. of fatten-cattle	No. of sheep
8	30	10	12	90
10	32	14	21	175
12	34	20	30	250
14	34	28	40	340
15	34	32	48	430
16	36	36	54	500
18	36	45	68	625
20	36	60	85	800

Every silage feeder frequently wants to know the approximate amount of silage left in his silo after the upper 6, 8 or 12 feet of silage have been removed. This can readily be determined when the cubic feet of silage and the mean weight per cubic feet have been found. For convenience Table III is given. To ascertain the number of tons of silage remaining in a silo, multiply the surface area by the height of the column of silage and that product by the mean weight per cubic foot at this depth, dividing the number obtained by 2000, which will be the tons of silage remaining.

TABLE III.

Diameter of silo Feet	Surface area Sq. ft.	Height of column of silage (feet) and weight of silage per cubic foot (pounds)			
8	50.27	6	229	14	29.1
10	78.54	7	238	15	29.8
12	113.09	8	245	16	30.5
14	153.94	9	253	17	31.2
15	176.60	10	261	18	31.9
16	201.06	11	268	19	32.6
18	254.47	12	276	20	33.3
20	314.16	13	283	21	34.1

The *construction.* No matter what kind of silo you build, certain general principles must be kept in mind if the silo is to be a success. First of all, the silo must be air tight, for upon the absolute exclusion of air depends the sweetness, succulence and palatability of the silage. If no air gets in through the walls the silage can be kept from spoiling even close to the sides of the silo.

The silo must be kept as nearly smooth on the inside as is possible to make it. This is necessary so that there will not be any friction to prevent the silage from settling properly after the silo is filled.

The walls of the silo must be strong enough to hold an enormous pressure. This pressure comes only while the silage is settling. After the first few days, the settling process ceases, largely when the mass has been shaped into form.

The silo should, of course, be durable. To make it so may require a little more initial expense, but the added years of service it will give will make this a good investment.

The walls of the silo should be perpendicular. If the walls slant outward from the bottom, they present a surface that tends to support the silage. This, of course, prevents it from settling as it should.

If, on the other hand, the walls of the silo slant inward toward the top, the silage in settling will have a tendency to fall away from the

walls and leave air spaces which are the breeding spaces for the bacteria that cause the silage to spoil.

The silo should be deep and narrow, not of great diameter, so that the silage will pack well. Another advantage of the narrow silo is found in feeding, saving much work in getting the silage from the silo.

The inside surface of the stave silo should be coated with asphaltum paint or carbolineum, and the concrete silo with boat pitch or some effective concrete surfacing material. A window in the silo chute affords light needed in both the chute and the silo. A roof is necessary and adds to the appearance of the silo.

The silo is not at fault when poor silage results from putting in the crop too green or over-ripe and dry, or without being finely cut and well packed.

The location. As silage is a heavy feed, the first consideration in locating a silo should be convenience for feeding. This, as a rule, requires it to be placed at one end of the barn, especially if the rows of cows face each other and there is a feeding alley between.

The care given. The silo is one farm building which must have attention at the proper time. If this is not given, it may mean the loss of the silo or at least a great reduction in its efficiency. It is almost impossible to put sufficient emphasis on the necessity of keeping the hoops of the stave silo at the proper adjustment when the silo is empty. The hoops should never become so loose that they sag. They should be tightened, a little at a time, at intervals throughout the summer, and loosened when the silo is filled. If the hoops are tightened excessively when the silo is dry there is danger of the staves buckling during a few days' rain or when the silo is filled the expanding of the staves may cause the breaking of the hoops or the lugs.

Sometimes the silo will get out of plumb even though the hoops are tight and the silo is well anchored. In case this happens, the silo should be straightened before filling. This can be done with a heavy wire stretcher or a block and tackle and a team of horses.

Assistance to builders. The policy of the Agricultural Extension Service of the University of Arizona in reference to silo building in this State is, and will continue to be, to recommend the silo to every man who can to advantage use a silo, and give instructions in building where the builder requests such help. No particular type or kind of silo will be favored other than the silo that has demonstrated its desirability through efficiency, durability and ease of construction. A bill of materials with instructions for building will be furnished by the Agricul-

tural Extension Service of the University of Arizona to each builder who requests the same for either the concrete solid wall silo, the tile silo, the 2x6-inch tongue and grooved stave silo or the modified Wisconsin silo.

A great many who have built silos up to the present time have favored the solid wall concrete silo because of its durability as contrasted with silos built of wood. Much adverse criticism has been offered in various places by agents of manufactured silos, but it is done to secure business and in the majority of instances in entire ignorance of the merits of the concrete silo.

The Concrete Silo

The determining factors in deciding to build the concrete silo should be an available supply of sand, gravel or rock, and common labor at reasonable prices. A few farmers in a community may cooperate in the purchase of silo forms and, by an exchange of labor in building their silos, construct them at a very moderate cost. An experienced concrete worker should be employed in all instances where a concrete silo is built in this manner in order to insure the use of the proper proportion of materials, placing the wet concrete at the proper time, using sufficient reinforcement and proper alignment of the silo forms in placing each course of concrete.

Marking out foundation. With one end of a 2x4-inch sweep nailed to a stake located at the center of the proposed silo, circles may be marked on the ground for the foundation. This foundation should be 22 to 30 inches wide and about 24 inches deep. The foundation should be reinforced with strands of wire laid around in the concrete as placed at intervals of 5 to 6 inches in depth of concrete.

Silo floor. A floor in a silo is highly desirable for the reason that where used no silage is lost, rats or gophers cannot burrow into the silage and a sufficient amount of moisture is retained to keep the silage in the proper condition for feeding to the bottom of the silo. The floor should not be dispensed with except under conditions where the ground is reasonably firm and even under such conditions a floor will pay for itself in a short time. It is well to provide a drain from the bottom of the silo which can be used to clean out the silo when empty and also to remove excess moisture which may occur by placing the crop into the silo too green or by the use of an excessive amount of water when the crop is placed in the silo over-ripe.

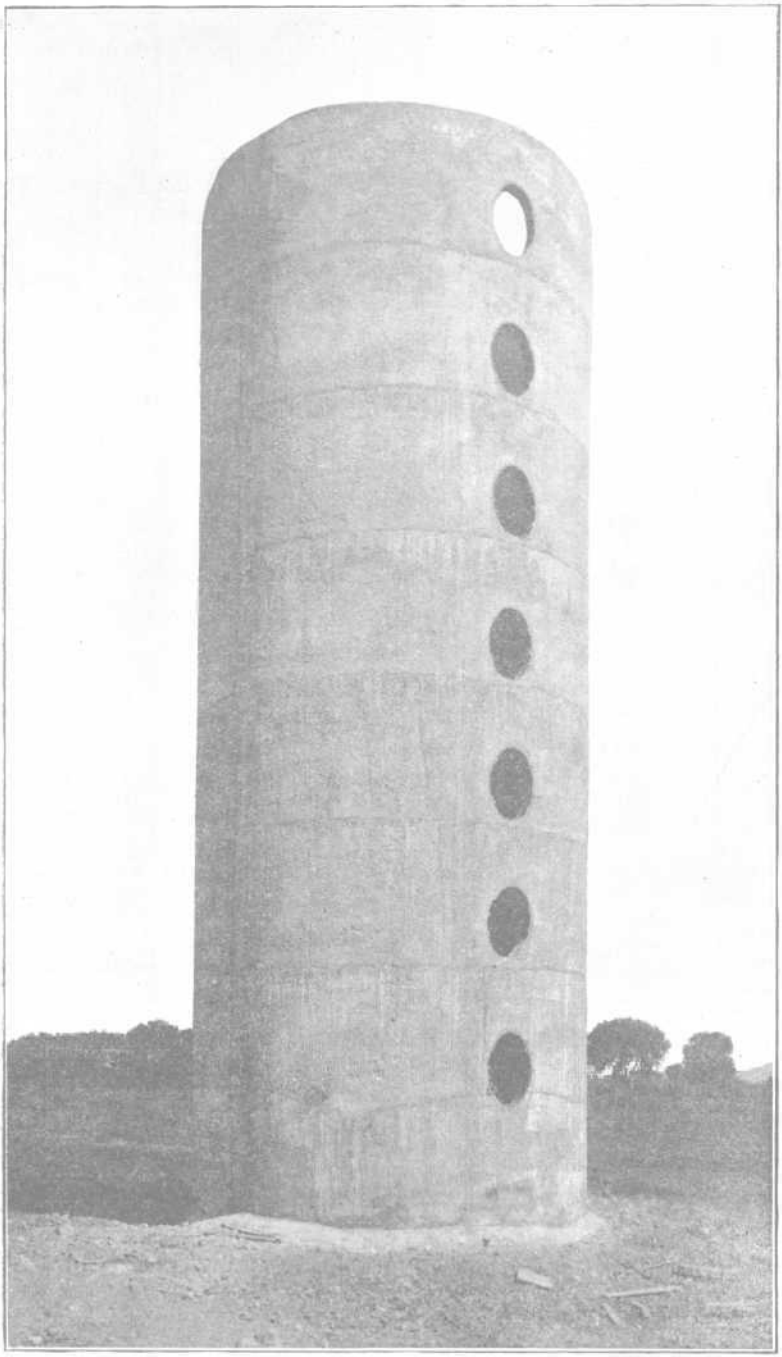

Fig. 1. Home-made concrete silo, 14x40 ft., on farm of J. T. Butler, Lehi, Arizona.

Silo forms. The forms used in building this type of silo consist of two parts, circular in shape, one inside the other, the concrete being placed between them to make the wall. These forms are kept 6 inches apart by using 2x6-inch spacers, so that the silo walls, when complete, will be 6 inches in thickness. In silos 12 feet in diameter or less, a wall 5 inches thick is sufficient. The forms are built 3 to 5 feet in height so that 3 to 5 feet of the silo wall can be built at one time without shifting forms. After the first 3 to 5 feet of concrete is in place, the forms are loosened by means of the adjusting bolts, raised, and again set. This operation is repeated until the silo walls are finished.

The inner form consists of a wooden supporting frame, which has an upper and a lower circle cut from 2x12-inch material with 1x8-inch facing boards outside of and adjoining the circles; and around this frame is nailed sheet metal of 18 gauge.

The outer form should be in two pieces of equal length of 16 gauge iron. A straight-edge should be used for lining up the metal sheets before marking for punching, as otherwise the outer form will not set plumb, and a bulging outer wall will likely result. A set of forms 5 feet high and 14 feet in diameter have been built by the State Council of Defense and the Agricultural Extension Service of the University of Arizona and are available for rent at a reasonably low figure to farmers desiring to build a concrete silo.

Reinforcement. The reinforcement consists of woven wire which should be the same width as the height of the silo forms and in the first 20 feet of the silo should be doubled; one inch diameter gas pipe and three-fourths inch round rod iron used for reinforcement at the doors complete the material required for strengthening the walls.

Doors. Either the continuous or the intermittent type of door may be used, many preferring the continuous type of door. When this type is used, a door form is constructed of 2x6 jambs and at the outer side of each one inch diameter gas pipes are stood vertical to the door form to which are tied the woven wire running around between the forms. These gas pipes are tied togethr by cross rods of iron seven-eighths inch in diameter. After the silo is completed, the wooden door form is removed. The doors are fillers of 2x8 tongue and grooved material, the ends of which fit into a rabild 2 inches in depth in the concrete door jamb, thus making a continuous smooth surface all the way round inside the silo. When the intermittent type of door is used, the patented oval cast iron door form is used, placing one each of these forms in each course of concrete, making about eight doors each 42 inches in a

vertical direction in a silo 40 feet high. If this patented type of door is not desired by the builder, he may construct a door form which is inserted between the metal forms at the desired heights in the silo wall for silo doors.

Scaffolding. When using the commercial forms for concrete silo building, all scaffolding is provided, the scaffolding consisting of a center mast with a spider which attaches to the forms for holding into position while filling and for lifting. When using the home-made silo forms, scaffolding must be provided and should consist of a 4x4 center post with 2x6 posts around the edge of the inner silo form. The scaffolding is most conveniently handled in sections 10 to 12 feet in length. The 2x6 posts are tied to the center posts by 1x6 or 1x8 material, which supports the silo forms and the working platform. All scaffolding is used inside the silo, there being no necessity for scaffolding outside.

Mixing the concrete. A mixture of one part of cement to two parts of sand and four parts of gravel, under average conditions, makes the most desirable mixture. This, however, can be varied, depending upon the sharpness of sand and gravel and the freedom from dirt. Where ordinary pit or river run sand and gravel are used, it is well to screen a portion to determine the relative amount of fine and coarse material and vary the amount of cement as may be necessary. It is well to use a power mixer when such can be obtained for a more uniform mixture is secured and the harder part of the labor is taken care of.

Hoisting concrete. The most desirable method of raising the concrete is by the use of a horse hitched to a rope running over pulleys, one fastened to the ground anchor and another to a projecting arm secured to the center post and one of the posts near the edge of the inner silo form. The concrete may be raised in buckets, wheelbarrows or coal scuttles and can easily be poured into the silo form from one of these or by the use of a guide trough extending from the center post to the silo form.

Raising forms. The silo forms are filled each day and after the concrete has set over night the forms may be loosened, hoisted, reset and refilled, this operation repeated each day until the silo is complete. The forms of the average silo form manufacturer are more easily raised than are the home-made forms for provisions for contracting and withdrawing from the silo wall are more perfect. Care should be exercised that the green wall is not injured in raising the forms and further that the forms are plumbed vertically and horizontally before starting to refill. When the silo is completed the forms are taken down by dis-

assembling and lowering to the ground one section at a time. The scaffolding can be taken down in the same manner.

Wall finish. The interior silo wall should be surfaced with a cement wash or with a surface material which has a tar pitch base which will fill the pores in the concrete, giving a smooth surface and preventing the action of acids of the silage on the cement in the wall. The exterior wall does not need any surface material except cement plaster to patch any open places which may have been caused by the concrete sticking to the silo forms or the lodging of forced particles of gravel against the outer form.

The roof. When the last course of cement is being placed, six to eight bolts, 12 to 14 inches in length, may be set in the upper portion of the course. These bolts should have a threaded end and plates cut to the circumference of the silo can be placed over these bolts and to these can be nailed the rafters for the silo roof. A circular roof is the most preferable, using shingles or prepared roofing for covering.

Silo chute. A chute is quite necessary for any silo as feed is saved and convenience in feeding is augmented. The silo chute should be 24 to 28 inches square or may be constructed half round, using 1x4 matched lumber which is run vertically for the covering of the chute. A common practice is to fasten this chute to the door jambs by means of supports which are bolted to the jamb.

The Tile Silo

Tile for silo building makes a structure which is efficient, durable and ornamental. In many places the cost of the tile makes the building of this silo prohibitive. Where the tile can be obtained without shipping long distances, this silo will, as a rule, not cost more than the concrete silo. The principal consideration is to insure sufficient reinforcement to offset the bursting pressure from the inside occasioned by the settling of the silage.

The foundation. The foundation is constructed of concrete in much the same manner as the foundation for the concrete silo. It is not necessary to use quite so large a foundation as the walls are not so heavy as the walls of the concrete silo.

The scaffolding. It is highly advisable to provide a scaffolding which is convenient, thus saving much time in building. The working platform should be movable and should be held in place by pins which are inserted into holes in the corner posts, thus avoiding the use of nails

which would have to be pulled and redriven each time the working platform was moved. The holes in the corner posts may be spaced about three feet apart in each post, thus allowing three feet of the silo wall to be laid without changing the working platform.

The tile block. The tiles are hollow blocks made of clay and burned in a kiln as are brick. They are usually 4x8x12 inches and should be curved to a circumference meeting the circumference of the silo. If the tiles are not curved so that a circle is formed when laid end to end, it will be necessary to cut the corners of each block and plaster to give a smooth surface. The blocks are laid on edge in cement plaster and the wall reinforced, as the blocks are laid, by the use of heavy wire or steel rods running horizontally between each two layer of tiles in the lower half of the silo and in alternate courses of the tiles in the remaining part of the silo. Grooves should be made in the tiles in which the reinforcement is placed. When finished, the interior walls should be given a wash of cement plaster or be surfaced with a heavy paint such as is frequently used in surfacing concrete walls.

The door. Most frequently the door is of the intermittent type with two courses of blocks separating the doors, these continuous courses being for the purpose of tying the silo wall more firmly together. The continuous type of door may be used by the use of door jambs which may be of wood or of concrete. Doors for closing the silo may be made of one inch matched lumber doubled, one course of the lumber running vertically and the other horizontally. This silo will no doubt become well known and popular in this State if provisions are made for manufacturing the tiles locally.

Wood Silos

Wood silos built in various styles have for many years been used successfully in various parts of the country for preserving silage. In many places their popularity has been due to the comparative cheapness of lumber as compared with other material for silo building. The chief objections to wood silos are the attention required to keep in good repair and the lack of durability. These objections to wood have caused many builders to turn to building material which gives a structure that requires less attention and lasts for a longer period.

Stave silos. Stave silos are obtainable in all parts of the State through the agents of silo manufacturing companies. The staves are or should be of 2x6 tongue and grooved material, beveled on the edges

to meet the circumference of the silo in addition to being surfaced smoothly on both sides. The silo as ordered includes the lumber for the staves, the doors, the silo hoops and lugs and anchoring cables. To complete the silo, it should be remembered that cement, sand and gravel for floor and foundation, sheeting and shingles for the roof, material for the chute and paint for the silo will be needed.

Foundation and floor. Mark out the foundation as described under concrete silo construction, allowing for a 12-inch footing. A trench may be dug to a depth of one foot and around the outer edge of the trench a form 4 inches high, built of ½x4-inch material is constructed by bending this thin material inside of 2x4 stakes set about 3 feet apart. The trench and the entire surface inside this 4-inch form may then be filled with concrete, giving a floor 4 inches in thickness, extending over the foundation wall. The floor should be given one-half of an inch slope to the center of the silo, where a tile drain should open, the opposite end of the drain extending beyond the foundation wall. While placing the concrete for the footing, set six to eight anchoring bolts for guy wires one-half inch in diameter and 18 inches long.

The scaffolding. The use of scaffolding is optional with the builder, but advisable in constructing a silo more than 30 feet in height. If scaffolding is constructed, six, seven, or eight posts may be set up around the outside of the foundation, bracing the posts by cross-ties from one to the other. Planks are placed for walks at different elevations, these being chosen with reference to convenience in handling the hoops. Eight to 10 feet is sufficient height between the walks. The work may begin at one side of the door and proceed around the silo until complete; or, a part of the staves may be set up, working from one side of the door, and the remainder working from the opposite side, the work coming to completion opposite the door of the silo. The last stave can be put into place by spreading the adjacent staves out from the true circle, inserting and crowding them back to the circle.

The staves. In placing the order for silo staves, care should be exercised to insure delivery of only select material, free from knots, with good edges and with three-eighths to one-half inch tongue and grooved and beveled to give tight inner and outer surfaces. Staves should be piled in such manner when unloaded that it will be unnecessary to turn them when ready to erect. The outside surface being wider than the inside surface, this can easily be done. By the use of a half-inch rope, a man on the highest walk of the scaffolding or the top of the door frame can draw the staves up with the assistance of a man handling the lower end of the stave. The first stave can be toe-nailed to

the door post at the top and bottom, and succeeding staves held in place by barrel staves or lath, which have been water soaked, which will be tacked to each stave as erected at both the top and the bottom inside of the silo.

Silo hoops. In silos of 12 feet diameter or less the hoops may be one-half inch rods. In silos 14 feet in diameter or larger the hoops on the lower half of the silo should be three-quarters to seven-eighths inch diameter. Place the bottom hoop on first, then the top hoops and tighten both, after which the remainder of the hoops may be put on and tightened. Care must be taken to have the lugs come at various places on the silo, rather than in line, lest a sharp angle should be formed and the pulling brought on only a few staves, thus causing the silo to get out of shape. Measure across the top of the silo in several places to see if the silo is round. Should it not be round, it can be trued by forcing planks of the proper length across the small diameter.

The Modified Wisconsin Silo

A type of wooden silo in general use in many places is the Modified Wisconsin silo. The foundation and floor of the Wisconsin silo are constructed as for the stave silo, placing anchoring bolts in such positions as will allow the bolting of the sill to the foundation. The sill is cut to conform to the circumference of the silo from 2-inch lumber doubled to break joints. On this sill are set upright 2x4's 12 inches apart, which are built up to the desired height of the silo. These are plumbed from side and edge and well braced. After all are in place a plate, cut similar to the sill, is nailed in place on the upper ends. Red or white cedar strips, three-eighths inch thick and 6 inches wide are then nailed horizontally inside the studding. Over the first layer is placed heavy building paper and then another layer of the sheathing is nailed in the same manner as the first, but breaking joints. This type of silo is strong and durable. If sheathed outside the appearance is greatly improved and the silo strengthened.

The intermittent door is used because of the difficulty of constructing the continuous door and retaining the strength of wall adjacent to the door frame that will obviate the danger of bursting from inside pressure of the silage. However, the continuous type of door may be used if three to four hoops are placed around the silo at intervals of 3 feet each from the bottom. The same type of roof and silo chute may be used in the building of this silo as is used for either the concrete or the stave silo previously described.

SILAGE CROPS

Corn. Corn is the principal silage crop; first, because it ordinairly will produce more food materials to the acre than other crops; second, because corn is easier to harvest and put into the silo than roughage crops, as alfalfa, barley, oats and peas; third, because corn makes a cleaner flavored, more palatable silage than other crops; and fourth, because corn packs well and contains the right amount of sugar to produce the proper amount of acid for the best preservation and for the best quality of silage, when put into the silo at the right time.

Varieties of Corn

The best variety of corn to use is that which will mature and yield the largest amount of grain to the acre, since the grain contains approximately 63 per cent of the digestible nutrients.

Bulletin 78, Arizona Agricultural Experiment Station, states, relative to planting and varieties of corn: "If planted about the middle of June in the southern part of the State where irrigation is practiced or as soon as the rainy season begins in July under dry-farming, the tassel and silk will escape the intense dry heat of summer and early varieties will escape the frosts of autumn. Consequently a good crop may be grown during this part of the year. The quick-growing varieties are well suited to this region, both under irrigation and dry-farming: Mexican June, Hickory King, Forney's Red Dent and Navajo Dent.

"In the northern part of the State, where irrigated or dry-farmed, corn can be grown successfully by planting in May and June. In these sections the large Dent corns, such as Colorado Yellow Dent and Bloody Butcher, the flint corns and the Moqui soft corns can be grown successfully."

Corn should preferably be cut for silage when the kernels are past the milk stage and are glazed and are dented, and when the lower leaves of the plant are turning brown. The New York Experiment Station found that corn in the silk stage contained 90 percent more dry matter than when in the tasseled stage; 30 percent more in the milk stage than in the silked stage, and 55 percent more in the glazed stage than in the milk stage. Immature corn is poor feed, whether fed green or put into the silo. When corn is frosted before it has reached the desirable stage of maturity, it should be put in the silo at once. If it is

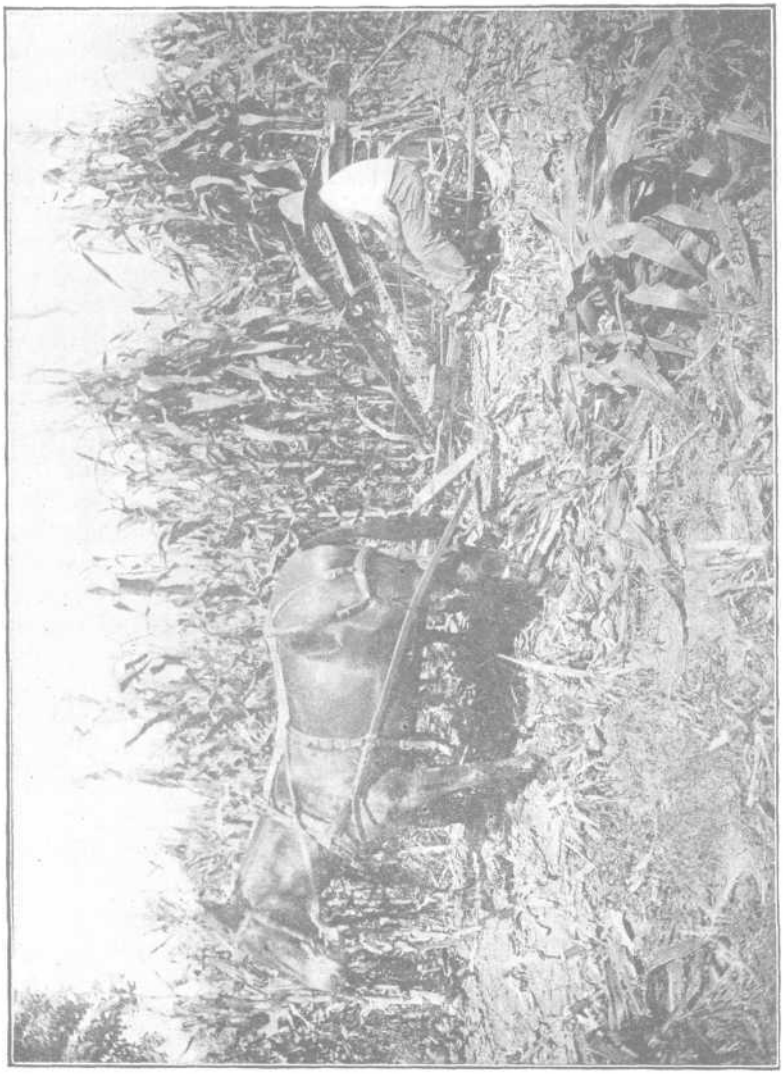

Fig. 2. Cutting corn 12 ft. high for silage with corn binder, Salt River Valley.

left standing in the field for any length of time after frosting, water should be added to replace that lost by evaporation.

Sorghums. Sorghums, both saccharine and non-saccharine, are readily made into silage. The Kansas Experiment Station investigations show that sorghums harvested and siloed after quite mature, make silage with a comparatively small amount of acid and more palatable than corn silage. A mixture of corn and kafir, corn and milo or corn and cane makes excellent silage.

Alfalfa. Owing to the high protein content of legume silage, such a silage is difficult to keep. This difficulty can be largely overcome by adding to the legume some carbonaceous crop, such as rye, which contains sufficient sugar to afford the production of enough acid to prevent the protein content of the legume from decaying. The rye should be mixed with the legume in the proportion of two-thirds legume and one-third rye.

The Feeding Value of Silage and Other Succulent Crops Compared

1 ton of corn silage is equal to 1.5 tons of sugar beets.
1 ton of corn silage is equal to 1.8 tons of rutabagas.
1 ton of corn silage is equal to 1.8 tons of carrots.
1 ton of corn silage is equal to 2.2 tons of turnips.
1 ton of corn silage is equal to 2.4 tons of mangels.
1 ton of corn silage is equal to 1.4 tons of parsnips.

TABLE IV. COMPOSITION OF SUCCULENT FEEDS. DIGESTIBLE NUTRIENTS IN 100 POUNDS

	Dry matter in 100 lbs.	Crude protein	Carbohydrates	Fat	Nutritive ratio	Total digestible nutrients in 1 ton
Corn silage	26.40	1.40	14.20	0.70	1:11.3	326 lbs.
Red clover silage	28 00	1.50	9.20	0 50	1:06.9	224 lbs.
Apple pomace silage	15.00	0.70	9 60	0 50	1:15 3	216 lbs.
Mangel	9.10	1.00	5.50	0.20	1:05.9	134 lbs.
Sugar beet	13.50	1.30	9.80	0.10	1:08.5	224 lbs.
Rutabaga	11.40	1.00	8.10	0.20	1:08.5	186 lbs.
Carrot	11.40	0.80	7.70	0.30	1:10.5	176 lbs.
Kale	7.68	1.93	4.68	0.35	1:02.8	139 lbs.
Parsnip	11.70	1.10	10 10	0.20	1:09 6	228 lbs.
Artichoke	20.50	1.30	14.70	0.20	1:11.7	320.4 lbs.
Turnip	9.90	0.90	6.40	0.10	1:07.3	148 lbs.

Filling the Silo

In setting up the outfit for filling the silo, many farmers make the mistake of trying to assemble the delivery pipe on the ground and raising it all put together. This puts an unreasonable and entirely unnecessary strain upon the joints. A better way to put up the pipe is to tie a rope around the distributor hood, the other end of the rope passing through a block pulley at the top of the silo and back to the ground. The hood should then be hoisted high enough so that a section of delivery pipe can be attached below it, then hoisted again so another section can be added.

If the pipe is slanting, there is undue friction on the upper side caused by the great force of the silage as it passes through the tube, requiring greater power and wearing out the tube. Also, some of the sediment will settle to the bottom of the pipe, more will gather over it and, finally, the pipe will be clogged up. There should be an air vent in the silo, to allow the air to escape and to prevent a back pressure on the blast.

Silage spoils in two ways, both of which can be avoided. It either rots or a white mold forms. Rotting is caused by air, and can be prevented by making the silo air-tight and then packing the silage into it tight. The white mold is caused by the fodder being too dry when put through the silage cutter.

Cooperation in Silo Filling

The high cost of silo-filling machinery makes it oftentimes advisable for several farmers to cooperate in the purchase of a cutter and engine, or at least a cutter, since an engine is more easily rented than a cutter. Neighbors can help one another in filling, so that there need be a very small cash outlay, and labor is assured.

The capacity of the silage cutter on green oats, or alfalfa is from one-third to one-half that of corn.

The Chemical Action in Silage Making

Soon after green corn is stored in the silo, fermentation starts and the temperature of the mass rises to a temperature of from 65 degrees F. to as high as 125 degrees F. The higher temperature is found only near the surface; 85 degrees is the most favorable temperature for rapid fermentation which stops the growth of undesirable bacteria.

A silo is a type of quick vinegar factory. In the cutting up of silage, every piece is covered with a thick film of juice which gives a fine medium for the growth of sugar fermenting yeasts and bacteria which begin to grow as soon as the silage is placed in the silo. The bacteria change the sugar to acids and the yeasts, the sugar to alcohol, but the alcohol is immediately changed to acetic acid.

The first ten feet in the bottom of the silo is in a water-logged condition, owing to the great pressure from above and the juice that is squeezed out. The change of sugar to acid is brought about by the bacteria that are in the dust and on the teams and men handling the silage. The acidity of the silage is the most important factor about fermentation. It is the acid that preserves and prevents the change to humus of the silage.

Amount to feed. Silage feeding may begin at once, though the silage is not as good as will be found later. For dry cows, farrow heifers and cows giving but 15 to 20 pounds of milk daily, a ration can be made from silage and hay, but grain must be added if any amount of milk is produced, for the hay and silage ration would be too bulky if enough were given to supply the needed nutrients. For young dairy animals, feed 15 pounds of silage and 8 pounds of hay; for heifers due to freshen, add oats and rolled barley, 4 pounds daily; dairy cows, 30 pounds to 45 pounds daily; breeding flock, 3 pounds per head daily with hay and grain; horses, 8 pounds to 10 pounds daily with hay; hogs, 2 pounds to 3 pounds daily with grain.