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Farmers Experience with Grass Silage

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FARMERS' EXPERIENCE WITH GRASS SILAGE

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How Information Was Obtained

Considerable interest in the practice of ensiling grasses and legumes as a means of preserving forage has been expressed in recent years. Controlled trials are now being conducted by the Experiment Station to determine the feasibility of this practice and to test various methods of storage.

Meanwhile, some farmers have been trying various methods of grass silage storage on their farms. What has been their experience? What are some of the difficulties encountered under farm conditions with these methods of handling grass silage?

To answer these questions, a survey was made in the summer of 1954 to determine the experience of farmers with various methods of storage. The questionnaire was designed to secure information regarding:

1. Differences in methods of storing grass silage in various parts of the state.
2. Actual farm costs in so far as they were known by farmers.
3. Farm results using different methods and practices in feeding silage.

Because of the relatively small number of farmers putting up grass silage, it was found that personal interviews were not practicable. Each county agent was contacted for the names of farmers known to be putting up grass silage. A questionnaire was sent to these farmers and they in turn named others who they knew were putting up grass silage. In this way the names of 364 farmers in various parts of the state were obtained[2] all of whom were sent questionnaires. Of 190 replies received, 168 were usable.

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[2]Undoubtedly, some farmers who put up grass silage were missed. However, the relatively small number finally found indicates that the practice is not as yet widely followed in the state.

The questionnaire was designed to provide information on the method of putting up silage, type of silo, cost of construction, cost of putting up the forage, keeping quality, and value of feed obtained. In addition comments were solicited on any other aspects or facts which the farmer might deem noteworthy.

These data provide an indication of farmers' impressions and may be of use to provide direction for further research. The information is being made available to farmers interested in putting up grass silage so that they might benefit from the variety of experiences of farmers throughout the state.

Types of Silos Used for Grass Silage Storage

Methods of preserving grass silage differ widely between farms. The primary difference was found in the type of storage facility or silo used. The types most frequently encountered in the survey were bunker, trench, upright, and stack.

This survey shows that the upright silo was the most common type of facility used. Out of 168 farmers replying, 49 indicated that they used only this type of facility. Forty-six put silage in a stack; 29 in trench silos, and 18 in bunker silos. Twenty-six farmers used a combination of types (see table 1). However, all of the 26 had at least one upright silo in the combination, 18 had at least one stack, 10 had one or more trench silos, and 2 had at least one bunker silo in the combination.

Importance of various types of silos differed considerably between areas of the state. In Area 3B, 4A, and 4B (see figure 1 for location of areas), the upright silo was the most commonly reported type. The popularity of the upright silo may be attributed in part to the fact that in many cases this type of silo was already there, having been built originally for corn silage. Areas 4A

Table 1. Use of Various Types of Storage Facilities by Economic Areas, 1954

Area	Upright Silo	Stack	Trench	Bunker	More Than One Type	Total
	(number of farmers reporting)					
1—West River	0	0	0	2	0	2
2A—North Central	1	6	5	1	0	13
2B—North James	5	8	9	2	2	26
3A—South Central	0	1	1	3	0	5
3B—South James	13	2	4	3	5	27
4A—Northeast	18	18	3	7	8	54
4B—Southeast	12	11	5	2	11	41
Total	**49**	**46**	**29**	**18**	**26**	**168**

and 4B also reported the largest number of stacks, but Area 2A had a higher ratio of stacks to the total of all types reported than was true of other areas.

Areas 2A and 2B reported more trench silos relative to total number of silos than was true of other areas. Only two replies were received from Area 1 and both reported using trench silos for storage. Bunker silos appeared to be fairly evenly distributed in number over the state with Area 4A reporting the largest number while Area 3A had the highest proportion of bunker silos relative to total number reported.

Upright Silos

Slightly over half of the upright silos being used for grass silage were originally built for corn silage. However, most farmers who had built upright silos specifically for grass silage had previously put up grass

Table 2. Types of Storage Facilities Reported by Economic Areas, 1954

Area	Upright	Stack	Trench	Bunker	Total*
1—West River	0	0	2	0	2
2A—North Central	1	6	5	1	13
2B—North James	7	9	10	2	28
3A—South Central	0	1	1	3	5
3B—South James	18	5	5	4	32
4A—Northeast	26	25	5	7	63
4B—Southeast	23	18	11	4	56
Total	**75**	**64**	**39**	**21**	**199**

*Total number reported exceeds number of replies as some farmers reported more than one type.

Replies of a number of farmers indicated they were concerned with the greater lateral thrust exerted by grass silage compared with corn silage. Several indicated they had used additional iron reinforcing to cope with this problem.

Cost of construction of upright silos varied widely depending on the type and location. Reported costs for a properly reinforced 14x 40 concrete stave silo with a roof ranged from $1,200 to $1,500 with most reporting the lower figure. The same type of silo with a 16-foot diameter with a capacity of almost 200 tons generally cost $150 to $200 more.

For a 200-ton capacity concrete stave silo costing $1,500, based on a 5 percent interest rate and 20-year amortization, the per year cost will be about $90. This is less than 50 cents per ton of silage stored if the silo is only used for one crop per year. A number of farmers reported excessive and in which the walls will be sufficiently stable so that the silo does not have to be rebuilt each year.

Almost all of the trench silos used by farmers had earth walls. A few had concrete or crushed rock floor. The sizes of the trenches varied from 50 to 210 feet in length and from 10 to 24 feet in width. Heights ranged from 6 to 18 feet.

In most cases a trench was dug with a bulldozer and the dirt was pushed up on the sides to make low walls above the ground as well as below. In such cases the only cost was that of excavation. Where the soil is a heavy clay type, the walls usually stand for a long time without any support. However, in lighter soils it is usually necessary to provide some type of support for the walls. Planks, concrete blocks, or poured concrete generally were used for this purpose.

Drainage generally was provided

by selecting a hillside for the construction, permitting drainage from the open end of the trenches. In some cases tile was put in the floor of the trench to provide a good drainage system.

Costs reported by farmers varied so much that it is difficult to summarize them. Cost depended on such things as excavating equipment available, type of soil, natural drainage. Data from the Agricultural Engineering Department indicate a cost of 80 cents to $1 per ton capacity for excavating, $1 to $2 per ton for concrete floor, and $2 to $3 per ton more for walls, making a total of $3 to $6 per ton of capacity. These figures are based on custom or hired labor and new material. Naturally, where labor and equipment are available around the farm, this can be reduced.

The largest trench silo cost $300. It was cut into a clay bank with large equipment. It had a capacity of nearly 1,000 tons, giving a cost of about 30 cents per ton. The majority were about 100 feet long, 10 feet high, and 12 to 16 feet wide. The reported cost was about $100. This would indicate a per ton cost of about 35 cents. However, in most cases no allowance was made for the farmer's labor in figuring the construction cost.

Bunker Silo

The bunker silo is very similar to the trench silo. In many cases the bunker was made by pushing together two long piles of dirt to form walls. This generally resulted in less steep walls than is true of the trench silo, which is cut out of the packed dirt or clay. Other farmers reported bunkers made with planks for walls. In some cases dirt was pushed up behind the planks where it served the dual purpose of providing additional strength to withstand the lateral thrust of the grass silage and additional airtightness.

Bunker silos generally were smaller than trench silos. The longest reported was only 100 feet with most of them around 50 feet in length. Bunker silos generally were wider, with the largest 30 feet across. The most commonly reported heights were 6 to 8 feet.

In general, the cost for material and labor ran higher per ton of capacity for a bunker silo than for a trench silo. Average original cost ran close to 50 cents per ton. The costs varied somewhat with size and type of material. The larger silos were less expensive to construct per ton capacity. The highest cost reported was slightly under $1 per ton capacity. The lowest reported was about 20 cents.

Generally the drainage problem is not as serious with the bunker as with the trench silo. However, it is necessary to have a location that will permit the escape of liquids.

Stacks

Stack storage was second in number to the upright silo. This type of storage for grass silage was most common in Area 4A with Area 4B having the next largest number. This type was also the most common supplementary type of storage unit found on farms. An upright silo and one or more stacks were reported on 18 farms.

Reported size of stacks differed widely. None of the stacks exceeded 100 feet in length and most were less than 50 feet in length. Widths varied from 10 to 40 feet, and heights ranged from 4 to 20 feet.

This type of storage generally has little problem of drainage since it usually is possible to find a location where there is natural drainage away from the stack. The problem of spoilage is much more acute. The ratio of surface area to volume is much higher with this method than any other. Therefore, packing and proper moisture content are doubly important. Cribbing was used on many of the stacks found in the survey. However, most of them had no vertical support at all, and no covers were reported on any of the stacks. Some farmers did use straw or other material to put over the silage.

Use of only cribbing and no cover generally resulted in very low costs for the stack method. The reported cost for cribbing ranged from $9.50 to $55 per stack and averaged about 20 cents per ton of capacity. Naturally there were no construction costs when no support was used for the stack. However, it probably was necessary to use more labor to build the stack if no support was used.

Methods of Harvesting

Little standardization existed in methods used in putting up silage. The amount of equipment used varied from a cutter, two or three wagons, and two or three tractors to a chopper, seven or eight tractors, wagons, trucks, and a blower. The manpower required varied with the amount of equipment used.

Well over half of the farmers used tractors to pack their stacks. The others generally used two men to do the building and packing. Packing, where done, was accomplished by manpower in the upright silos. A large percent of the farmers indicated they either did not pack or only had a man in the silo to finish it off. All but two of the bunker and trench silos were packed with power equipment. Generally tractors were used for this purpose. Occasionally a truck or bulldozer was used.

Time required to put up silage varied widely. In most cases labor used ranged from 1¼ to 5 man hours per acre. Approximately 3 man hours per acre was the most commonly reported. There was little difference in the reported time between different types of silos.

While large amounts of equipment were used on most farms to put up grass silage, it can be put up with a minimum of equipment. A mower, swather, or field cutter with some type of power and a couple of large wagons and power for them will suffice for putting up grass silage in a trench silo. For an upright silo a blower is necessary and it may be necessary for a stack, depending on the size planned.

Where farmers reported they had hired the work done, the costs reported ran from less than $1 to $3

per ton of silage produced. This varied to some extent with the amount of equipment and labor furnished with the custom job. Most of the farmers reported total costs of less than $2 per ton, but their own labor and labor exchange with neighbors may have been left out.

Without figuring the value of his own labor, a farmer may expect to put up grass silage for $2 per ton or less. Assuming a dry matter content of about one-third, the cost per ton of dry matter would be about $6. This compares with about $4 per ton baling charge for the equivalent amount of hay. The cost of hauling bales must be added to this $4. Thus it appears that the cost per feed unit for putting up grass silage may be less than for baled hay with a reasonably efficient operation.

Spoilage and Quality Related to Type of Storage

Preservatives were used by only a few farmers. However, some of the farmers putting up grass silage in upright silos apparently substituted use of preservatives for packing. Preservatives were more frequently used in upright silos than in other types. The largest spoilages were reported in low stacks, particularly where long grass was used. The higher the stack, the lower the percent of spoilage, other conditions being the same.

Average percent loss from spoilage differed considerably between various types of silos. The upright had the lowest average percent loss from spoilage, while the stack had the highest. Little difference existed between the bunker and the trench silo.

A properly constructed upright silo generally provides the greatest airtightness, particularly the glass lined steel silo which is thoroughly closed and sealed. Thus one would expect spoilage to be lowest for this type. However, spoilage reported was still quite high in some upright silos where other desirable conditions were not met.

Farmers were asked to summarize their over-all experience with the keeping quality of their grass silage. They were asked to classify it as excellent, good, fair, or poor. Results are summarized in table 3. Opinions expressed generally favor the upright silo with the trench silo next. The stack and the bunker appeared to be the least satisfactory. The percent of farmers rating their silage as good or excellent ranged from 95 for those with uprights to 50 for those with stacks.[3] Tests indicate that the difference is statistically significant.

The quality of silage as reported by farmers corresponded closely with the amount of spoilage. Where spoilage was high the quality of the silage was low. Where spoilage was low the quality of the usable silage was uniformly better, with good

[3]Those farmers reporting more than one type were not included in the percentage figures due to the difficulty of relating the answer given to a specific type of silo.

Table 3. Keeping Quality of Silage by Storage Facility Used

Keeping Quality	Upright	Stack	Trench	Bunker	More Than One Type	Total
	(number of farmers reporting)					
Excellent	18	7	11	2	13	51
Good	20	19	11	7	7	64
Fair	2	16	7	5	3	33
Poor	0	1	0	0	0	1
Total	**40**	**43**	**29**	**14**	**23**	**149**

green color and high palatability to livestock. This type of silage probably had higher feed value.

Where estimated percent of loss was high, the remaining silage was generally described as light brown or darker. Where spoilage was low, the silage was described as various shades of green. Occasionally high spoilage and light green color were reported.

Neglecting the differences which occurred in color, high percentages of spoilage are serious. The differences in the amount of usable silage must be taken into consideration in deciding which silo is the most profitable. The upright silo costs the most for original construction, and the amortized annual cost was the largest—nearly 50 cents per ton capacity when taxes and insurance were included. However, the average spoilage reported was much less than for a stack.

In deciding what type of silo will produce silage most economically, original cost, spoilage cost, and quality of the usable silage should be taken into consideration.

Other Factors of Importance

Forage Used for Silage

While alfalfa was the predominant type of forage reported, a number of other types were used (see table 4). Out of 167 farmers who replied to this question, 70 reported using alfalfa alone and 45 used an alfalfa - brome mixture. Thirty - six farmers reported using alfalfa with some other type or types of forage such as sweet clover, red clover, oats, and corn. Sixteen farmers reported using forages with no alfalfa included. One farmer reported using an alfalfa-quackgrass mixture.

Almost no relationship could be noted between type of forage and reported spoilage or color. However, a comparison of type of forage and satisfaction with results as expressed by farmers indicated that farmers were slightly less well satisfied when they used alfalfa alone than with other types (see table 5). This may be explained by chance or by the fact that farmers expected somewhat more of alfalfa.

Also most of the farmers who re-

Table 4. Types of Forages Used for Silage

Single Forage		Mixture of Alfalfa and One Other Type		Mixture of Alfalfa and Two or More Types		Other (No Alfalfa Included)	
Type*	Number	Type	Number	Type	Number	Type	Number
A	70	A–Br	45	A–Br–SC	10	SC–O	2
SC	8	A–SC	10	A Br–RC	8	SC–C	1
RC	4	A–O	2	A–Br–RC–SC	1	SC–RC	1
		A–C	2	A–Br–SC–O	1		
		A–RC	1				
		A–Qg	1				

*Symbols: A—Alfalfa, SC—Sweet Clover, RC—Red Clover, Br—Brome, O—Oats, C—Corn, and Qg—Quackgrass.

Table 5. Satisfaction With Various Types of Forage Under Different Types of Storage

Type of Forage	Upright Silo	Pile or Stack	Trench	Bunker	More Than One Type	Total
	(number of farmers reporting)					
Alfalfa						
Satisfied	13	16	9	5	4	47
Unsatisfied	0	5	1	2	1	9
Alfalfa-Brome						
Satisfied	14	6	8	4	6	38
Unsatisfied	2	2	1	0	0	5
Alfalfa and Other						
Satisfied	7	5	2	2	9	25
Unsatisfied	1	0	1	0	1	3
Other Only (no alfalfa included)						
Satisfied	4	2	4	0	1	11
Unsatisfied	0	0	1	0	0	1

ported they were dissatisfied with alfalfa put up the silage in a stack. Over half of the farmers who reported they were dissatisfied with results obtained with silage from alfalfa alone were storing it in stacks. The percent of farmers dissatisfied with silage from alfalfa only was significantly higher for those using the stacks than the percent of farmers with the same type of forage in an upright silo.

How Grass Silage Was Fed

Ease and labor required in feeding grass silage are important factors in deciding what type of silo to use. The upright silo is at a disadvantage compared with other types in that silage cannot be self-fed from it.

If a silo unloader is used, the silage can be moved by power directly to the livestock without further handling. However, very few silage

unloaders are found on South Dakota farms. Only five farmers reported they used mechanical silage unloaders in their upright silos. One advantage of the mechanical silage unloaders cited by these farmers was that the machine cut the silage and "fluffed" it up so the cattle ate it all even when it was frozen in the silo.

Use of power equipment in handling silage from other types of silos was more common. Fifteen of the farmers using a trench silo indicated they used a power scoop to get the silage out of the trench. Two farmers self-fed from their trench silos. Of the farmers with bunker silos, four used a power scoop to remove silage and three self-fed the silage. Of those farmers reporting silage in stacks, only four reported they used power equipment, but twelve self-fed out of the stack.

It would appear that a great deal more use could be made of power equipment for handling grass silage. There is likely to be little additional investment needed for handling silage with a tractor and scoop on more farms, since many farmers already have this equipment.

A mechanical unloader for an upright silo is a large investment. However, "throwing down silage" takes an estimated 1 hour per ton. Thus 200 man-hours are spent on the average in unloading a 16x40-foot silo. The labor expenditure must be weighed against the required capital investment per silo amortized over the expected life of the equipment plus cost for electricity, servicing, and maintenance.

Problems farmers reported with feeding grass silage varied with the type of silo. The most common complaint with the trench silo was that a power scoop or wagon sometimes got stuck in the bottom of the trench. This also was mentioned by some farmers having bunker silos. Soft floors also bothered where silage was self-fed. Next in importance to soft floors, freezing and snow drifting were most common complaints with bunkers and trench silos, particularly in the spring.

Feeding complaints were less common with the stack method. Mud around the stack, difficulty in getting silage loose, and large amounts of spoiled silage were mentioned.

With the upright silo, by far the biggest problem was difficulty in getting silage out. Many farmers reported that grass silage packed much harder than corn silage and was difficult to get loose. Some difficulty with freezing was mentioned.

The most common method of handling silage, regardless of the type of silo, was to haul it a short distance and feed it in bunks. In the case of the stack, self-feeding and pitching directly into bunks which were moved up as the silage was used were about as common as moving the silage to more distant bunks. The practice of pitching directly into feed bunks also was followed to a limited extent with other types of silos.

Farmer Evaluation of Silage

An expression of over-all satisfaction with methods presently employed by farmers in putting up grass silage was obtained. Farmers

Table 6. Satisfaction of Farmers With Grass Silage by Storage Facilities Used

Satisfied With Results	Upright	Stack	Trench	Bunker	More Than One Type	Total
	(number of farmers reporting)					
Yes	39	30	23	11	20	123
No	3	7	4	2	2	18
Total	**42**	**37**	**27**	**13**	**22**	**141**

Table 7. Farmers' Opinions of Grass Silage as Compared With Corn Silage Related to Storage Facilities Used

How It Compared With Corn Silage	Upright	Stack	Trench	Bunker	More Than One Type	Total
	(number of farmers reporting)					
Better	11	2	5	4	4	26
Equal	10	13	7	5	6	41
Not as good	12	20	10	3	11	56
Total	**33**	**35**	**22**	**12**	**21**	**123**

were asked whether they were satisfied with the results obtained, how grass silage compared with corn silage, whether they planned to continue putting up grass silage, and whether they planned to use a different method in the future.

Of 141 farmers replying, 123 said they were satisfied with grass silage (see table 6). Twenty-seven did not reply to this question. Out of the 18 who indicated they were dissatisfied, 7 were putting up grass silage only in stacks. Percentage satisfied ranged from 93 percent of those putting silage in upright silos down to 81 percent of those putting grass silage in stacks.[4] However, the difference was not statistically significant.

Farmers were also asked how their results with grass silage compared with corn silage (see table 7). Almost all of the farmers who put up grass silage were putting up corn silage or had done so in the past. Of the 123 farmers replying to this question, 26 said grass silage was better than corn silage, 41 said it was equal to, and 56 said it was not as good as corn silage.

However, the opinions expressed varied according to the type of silo used. Less than 6 percent of the farmers putting up silage in stacks said it was better than corn silage, 37 percent said it was equal to, and 57 percent said that it was not as good.

Compared with this, one-third of the farmers putting up grass silage in upright and bunker silos said grass silage was better than corn silage.[5] The percent of farmers who

[4]Those farmers reporting more than one type were not included in the percentage figures due to difficulty of relating the answer given to a specific type of silo.

[5]Those farmers reporting more than one type were not included in the percentage figures due to difficulty of relating the answer given to a specific type of silo.

Table 8. Farmers' Responses to Question "Do You Plan to Continue Putting up Grass Silage" Related to Storage Facility Used

Plan to Continue	Upright	Stack	Trench	Bunker	More Than One Type	Total
	(number of farmers reporting)					
Yes	39	27	23	16	23	128
No	5	9	3	1	0	18
Undecided	1	4	1	0	2	8
Total	**45**	**40**	**27**	**25**	**25**	**154**

Table 9. Farmers' Responses to Question "Do You Plan to Use Any Different Methods in the Future" Related to Storage Facility Used

Plan to Use Different Methods	Upright	Stack	Trench	Bunker	More Than One Type	Total
	(number of farmers reporting)					
Yes	15	19	11	6	8	59
No	21	8	13	6	11	59
Undecided	4	3	1	2	4	14
Total	**40**	**30**	**25**	**16**	**23**	**132**

said that grass silage compared favorably with corn silage was significantly smaller for those using stacks than for any of the other silo types.

Farmers were asked whether they planned to continue putting up grass silage (see table 8). The percent of farmers planning to continue ranged from 68 to 94 percent with the lowest percent found among those putting up silage in stacks. A significantly higher percent of those putting up silage in bunker and upright silos planned to continue as compared with those putting silage in stacks.

The final question was designed to check on their satisfaction with the method of putting up silage presently employed (see table 9). Sixty-three percent of those replying who put up silage in stacks planned to use a different method. This compares with only 37 percent of the farmers putting up silage in upright silos who planned to change methods. The percent planning no change was almost twice as large (53 percent) for those putting up silage in upright silos as for those putting up silage in stacks.

Replies to other questions suggested that in some cases farmers thought the question as to whether they planned to make any changes applied to all aspects of storing and feeding silage. Thus the figures may overstate the percent who plan to change type of silo used. The large fixed investment in upright silos makes this less flexible; and, therefore, changes in silo type are less likely.

Summary and Conclusions

The object of this study was to secure information which would help farmers in selecting their method of putting up grass silage. Replies to a mailed questionnaire were secured from 168 farmers who had experience with grass silage. Most of these farmers were located in the eastern part of the state.

1. Results of the survey indicate that farmers generally are satisfied with ensiling as a method of preserving grasses and legumes.
2. There were significant differences in reported results obtained with different types of storage and with different methods of handling the forage. Farmers who put up silage in upright silos reported considerably less spoilage and were generally better satisfied than farmers who used other types of units. Also, these farmers were more inclined to continue putting up silage in the same manner.
3. Farmers who put up silage in stacks had relatively high spoilage losses and were the least satisfied with results obtained. Indications are that stacks produced the lowest quality of edible silage.
4. In general, the trench type silo was between the upright and the stack silo on most criteria of evaluation. Cost and spoilage ratios somewhat favored the trench to the bunker silo.
5. The actual cost of putting up the silage varied little between types of storage, but the original cost as well as the amortized cost of upright silos was somewhat above cost of other types.
6. Low original cost of a trench and comparitively low spoilage ratios appear to favor this type of silo where conditions are favorable to its construction and use.
7. Generally there was little difference in results obtained with different types of forage used in grass silage. Farmers generally were somewhat less satisfied with alfalfa alone than with other types of forage, but this may be attributed in part to the fact that stacks were more commonly used for alfalfa than for other types of forage. Almost all of the silage put up contained some alfalfa.
8. Satisfaction with grass silage shown in the survey suggests that more farmers might consider this practice in South Dakota.