Special Bulletin 181 November 1936

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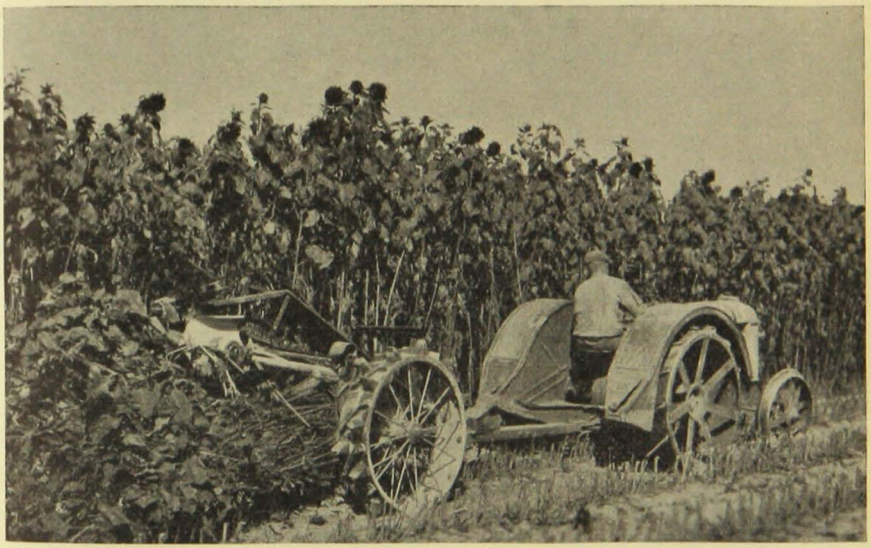

UNIVERSITY OF MINNESOTA
AGRICULTURAL EXTENSION DIVISION

SUMMARY

1. Silage crops are not well adapted to Northern Minnesota conditions because of the short growing season and early frosts.

2. During the winter the silage usually freezes badly in the silo, causing difficulty in removing and feeding.

3. The investment in the silo and silage machinery is relatively large in the small herds which are characteristic of this region.

4. Alfalfa usually yields more nutrients per acre than silage crops in Northern Minnesota.

5. No protein supplements are needed with home-grown grains in the average dairy herd when alfalfa or other good legume hay is fed as roughage.

6. The average cash and labor cost of producing a ton of nutrients in the form of silage in Northern Minnesota is about double the cost of producing a ton of nutrients in alfalfa hay.

7. Experiments have shown that milk production is not increased by feeding succulent feeds to cows getting plenty of good alfalfa hay, provided the cows have constant access to good water protected from freezing.

8. Feeding of silage should not be recommended to most dairy farmers of Northern Minnesota where it is likely to increase materially the cost of milk production.

SUNFLOWER SILAGE IN NORTHERN MINNESOTA

C. L. COLE, R. L. DONOVAN, AND NAT N. ALLEN[1]

While much has been learned about feeding dairy cows, no entirely satisfactory substitute for Nature's dairy ration, fresh green grass, has ever been found. The flush period of milk production still occurs during the early summer months when pastures are at their best. The most modern textbooks on feeding recommend winter feeding practices which are admittedly an attempt to simulate summer feeding conditions. It would seem that something is supplied by pasture, in addition to protein, carbohydrates, and other generally recognized nutrients, which is not easily replaced under dry feeding conditions. The term "succulence" has come into common use in connection with feeds supposed to have qualities similar to those of grass, and the use of succulent feeds in winter rations of milking cows has become a standard practice of most of the better dairymen.

SUCCULENT FEEDS AND WINTER MILK PRODUCTION

The feeds classed as succulent all contain a relatively large amount of water, thereby resembling fresh green grass. Root crops provide succulence in a very satisfactory form, but are not generally used as cow feed in this country. The reasons probably are that most root crops require a great deal of hand labor, and there are considerable losses in storage.

The coming of the silo greatly simplified the problem of providing succulent feed in most of the dairy farming sections where corn is the principal grain crop, and corn silage has become the standard succulent feed for winter milk production. In many places, however, dairy farming has pushed beyond the boundaries of the cornbelt. A large part of Northern Minnesota is not well adapted to growing corn, even as a silage crop. Sunflowers yield much more heavily, but most dairymen are not particularly enthusiastic about sunflower silage. The dark color and the coarse woody texture, together with the rather strong odor, are probably responsible. In actual feeding trials, however, sunflower silage has been found to be only slightly lower in feeding value than corn silage. In most of Northern Minnesota, the greater yield more than off-

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The authors wish to acknowledge the assistance of the late Clarence H. Eckles, who planned this investigation and gave valuable assistance during the earlier stages of the work.

sets the difference in feeding value, and sunflowers are found to be more satisfactory than corn as a silage crop.

RELATIVE ECONOMY OF DRY AND SUCCULENT ROUGHAGES

Even in sunflower silage, nutrients for milk production are produced at considerably greater expense than in dry roughages. In the first place, silage requires special storage facilities. The original outlay may represent a considerable investment for a substantially built permanent silo. In this case, interest and depreciation costs alone may contribute heavily to the expense of feeding silage. It is true that trench silos or other forms of temporary silos may be had with a minimum cash outlay, but loss due to spoilage of feed is likely to be excessive and such silos are usually recommended only for emergency use, or to supplement the permanent silos in years of heavy production.

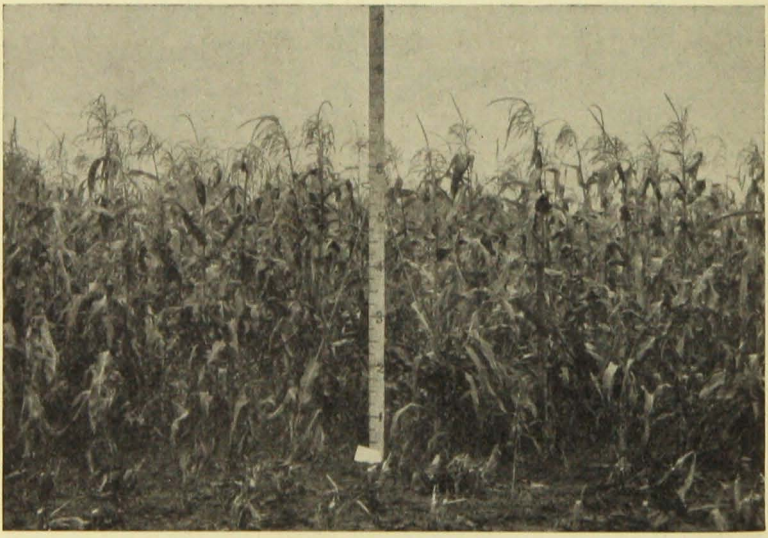

FIG. 1. A TYPICAL STAND OF NORTHERN MINNESOTA CORN
Even good crops of corn in Northern Minnesota do not produce heavy yields of silage. Sunflowers such as shown on the cover page yield much greater tonnage.

The investment in machinery is considerably greater for the production and ensiling of silage crops than for the production of hay.

In addition to these items of expense, much more labor is required for production of nutrients in the form of silage than in the form of hay. A recent study of costs and labor requirements for production of various

crops in the cut-over regions of Minnesota, by Pond and Crickman, is published in Bulletin 295 of the Minnesota Agricultural Experiment Station. They found that the average labor requirement for an acre of sunflowers producing 8 tons of silage was 30.1 man hours and 55.2 horse hours. An acre of alfalfa yielding 2.5 tons of hay required only 12.2 man hours and 17.4 horse hours. Using figures obtained from analyses of sunflower silage and alfalfa hay grown in the cut-over regions of Northern Minnesota, the 2.5 tons of alfalfa produced on an acre of land will contain 498 pounds of digestible crude protein and 2,599 pounds of total digestible nutrients, as compared with 206 pounds of digestible crude protein and 2,118 pounds of total digestible nutrients from 8 tons of silage produced by an acre of sunflowers. Requiring less than half as much labor, and less cash outlay for seed and equipment, alfalfa yields more nutrients and more than twice as much protein per acre in comparison with sunflowers. With liberal use of good legume hay, purchase of expensive protein concentrates is not necessary, and the growing of legumes aids greatly in the conservation of soil fertility. Fair yields of legume hay of excellent quality may be secured on most dairy farms of Northern Minnesota.

REASONS FOR RECOMMENDING SUCCULENT FEEDS

In view of these facts, silage can not be justified as an economical source of nutrients for milk production under Northern Minnesota conditions. Silage is fed because it is felt that a succulent feed is essential for the winter ration. The question naturally arises in the minds of better dairymen whether favorable effects due to the succulence of silage are sufficient to offset the greater cost of the nutrients which it provides. When we look for actual proof that a succulent feed is essential for economical winter milk production, it is found that this is largely an assumption based on reasoning rather than on definite proof. It is true that there are reports of increased production from the feeding of silage, but in most instances the cows received more nutrients, which may have been responsible for the increased production rather than the succulent nature of the feed.

A QUESTION FOR THE COWS TO ANSWER

Experience has shown that questions regarding feeding can not be answered safely on the basis of mere logic or reasoning. Only the cows themselves can answer questions as to how they react to various sorts of treatment. Moreover, if we are to expect a clear-cut answer from the cows, feeding experiments must be set up very carefully and the results analyzed with the greatest of care.

Since many dairymen of this state are sacrificing economy to provide succulence in the winter ration, it seemed advisable to secure directly from the cows information as to the importance of succulence in the winter ration. With this in mind, an experiment was planned to provide a definite answer.

PLAN OF EXPERIMENT

This experiment was carried out at the North Central Experiment Station at Grand Rapids, where conditions are fairly representative of a large part of the northern section of the state. The cows used were Guernseys, some of which were purebreds and the rest grades resulting from use of purebred sires for a number of generations. Fourteen of these cows which were due to calve during the late fall months were divided into two groups of seven each, with care in equalizing the groups for producing ability as judged by previous records, and for age, date of freshening, and size.

Each cow was placed on experiment immediately after calving. The two groups were handled in exactly the same manner except for the roughages fed. The cows of one group were given approximately 3 pounds of good sunflower silage per 100 pounds of live weight, and were given as much good alfalfa hay as they would clean up readily. The cows of the other group received no silage, but were fed alfalfa hay from the same lot and in the same manner. Naturally they ate more hay than the group that also received silage. The roughages were supplemented in both groups by a concentrate mixture consisting of equal parts of ground oats, ground barley, and standard middlings, with one per cent salt and one per cent bone meal added. This grain mixture was fed in amounts sufficient, with the roughages, to meet the requirements of each cow for maintenance and production according to the generally used Haecker feeding standards. Care was also taken to avoid loss of weight or excessive gains.

During the pasture season no silage was fed. Cows producing less than 10 pounds of milk daily received no grain. Cows producing 10 to 15 pounds of milk received 3 pounds daily of the same grain mixture as was used during the winter. For each additional 5 pounds of milk, 2 additional pounds of grain were fed. When pasture became too short to supply the requirements of the cows for bulk, alfalfa hay was added.

When each cow freshened for her second lactation, the method of feeding was changed, so that when all had freshened, the treatment of the two groups was reversed. Those which had silage during the first year of the experiment received no silage during the second, and vice versa. By this arrangement, the production of each cow during a lacta-

tion period when she received silage was compared with her production during a lactation when she had no silage. The reversing of the groups prevented misleading interpretation of differences owing to conditions not connected with the feeding of silage.

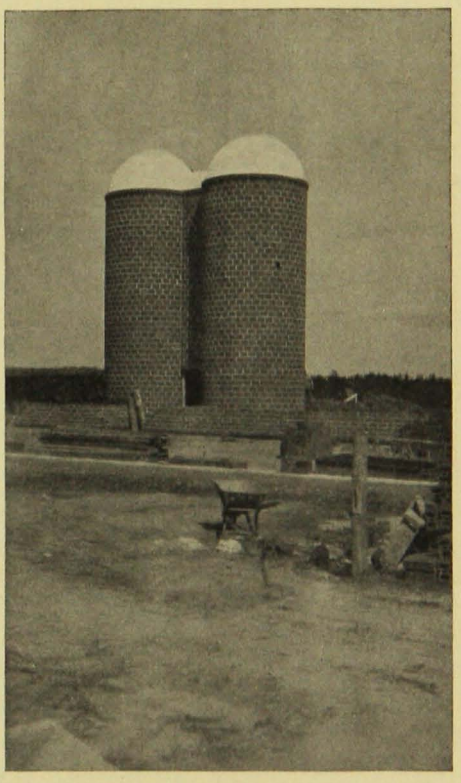

FIG. 2. A PAIR OF MODERN SILOS ERECTED AT A COST OF APPROXIMATELY $1,000

Silos such as these are erected at considerable cost, and interest and depreciation may add materially to the cost of silage.

Five cows freshening during the spring months were also handled in a similar manner, but because of the small number were not divided into groups.

The feeds were carefully weighed and records kept of the amounts consumed. Samples were analyzed, and the amount of nutrients consumed was calculated. All of the milk of each cow was weighed and tested for butterfat. The cows were weighed monthly.

The sunflowers used for silage and the alfalfa hay were locally grown and were of good quality.

The cows were milked twice daily and were given no more care than would be received by the herd of any good dairy farmer. Water was kept constantly before the cows during the winter months by use of water bowls. During the pasture season, the cows were kept on pasture night and day, being in the barn only at milking time. The pasture was native grass, mostly blue grass.

OBSERVATIONS ON THE BEHAVIOR OF THE COWS

It was found that the cows ate much more hay than had been anticipated. When they had no silage, they averaged 25 to 30 pounds of alfalfa hay daily per head, or about 3 pounds per hundred pounds live weight. Even when receiving silage in the amount commonly fed, the cows averaged about 20 pounds of hay, or 2 pounds per hundred pounds live weight. When less was fed, the cows ate the oat straw used for bedding.

No difficulty was experienced in getting the cows to eat the desired amount of sunflower silage.

Pasture conditions were good during the spring and summer of 1932, the first year of the experiment. Only grain was required to supplement the pasture. The following summer was extremely unfavorable for pasture. A dry spring and summer followed a winter of very light snowfall. Grazing was very poor, even during the spring and early summer, and while an average of 970 pounds of hay was fed in addition to grain to supply adequate nutrients, the milk production of all cows was considerably less than for the previous year, again emphasizing the favorable effects of summer pasture.

One cow from the fall-freshening group and one from the spring-freshening group were lost through disease, all others completing the experiment in good condition.

RESULTS OF THE EXPERIMENT

The results with the group of cows freshening in the fall are summarized in Table 1. It was found that the cows averaged 6,429 pounds of milk during the first 300 days of lactation when silage was fed, as compared to 6,356 pounds when hay alone was used as roughage. The average fat production was 266.1 pounds when fed silage, as compared to 267 pounds when hay supplied all of the roughage. These results do not indicate that silage influenced the production of the cows in any way.

The four spring-freshening cows averaged 45 pounds more fat and 739 pounds more milk during the first year, the year when silage was fed. This difference was no greater than was observed between these two seasons in the other two groups and was probably due to the pasture failure during the second summer.

FIG. 3. A FIELD OF ALFALFA ON THE FRANK POHL AND SON FARM AT REMER, MINNESOTA

A good stand of alfalfa has no equal for yielding nutrients for milk production.

No difference in health, appetite, or general condition which could be attributed to the feeding of silage was observed in the cows.

In the fall-freshening groups, an average of 17 pounds more of total digestible nutrients, 96 pounds more of digestible protein, and 133 pounds more of dry matter were fed during the lactation when no silage was fed. During the silage feeding periods, however, the cows averaged 8 days more on pasture, which will more than make up for the difference in dry matter and total digestible nutrients. The 96 pounds difference in protein consumption was due to the fact that the cows ate more alfalfa when no silage was fed, the alfalfa being relatively high in protein. While 96 pounds more protein and 17 pounds more total digestible nutrients were fed, when alfalfa was the sole source of roughage, this was done with a saving of 157 pounds of grain per cow. When silage was fed, 5,519 pounds of silage and 157 pounds of grain replaced 1,756 pounds of alfalfa hay. Using prevailing local prices for grain and hay, the silage had a cash value of about $2.25 per ton on the basis of the hay replaced.

Table 1. Summary of Average Production and Feed Consumption for 13 Fall-Freshening Cows During First 300 Days of Successive Lactation Periods With and Without Silage

	Without silage	With silage
Average live weight	940	957
Carried calf, days	185	195
Milk production, pounds	6,356	6,429
Fat percentage	4.20	4.14
Fat production, pounds	267.0	266.1
Days on pasture	95	103
Grain fed, pounds	1,868	2,025
Alfalfa fed, pounds	5,428	3,672
Silage fed, pounds	None	5,519
Dry matter consumed, pounds	6,668	6,535
Digestible protein consumed, pounds	756	660
Total digestible nutrients consumed, pounds	4,170	4,153
Water in feed, pounds	628	4,681

Feeding the silage and hay according to the usual practice of 3 pounds of silage per 100 pounds live weight and allowing as much hay as the cows would clean up readily, the silage supplied only 11 per cent of the protein and 18 per cent of the total digestible nutrients required, as contrasted to the alfalfa which supplied 58 per cent of the protein and 46 per cent of the total digestible nutrients. When silage was omitted, with the resulting increase in hay consumption, the alfalfa furnished 75 per cent of the protein needed and 73 per cent of the total digestible nutrients. This brings out rather strikingly the relative possibilities of legume hay and silage in supplying nutrients for milk production. Even if the silage were fed to the limits of the cows' capacity, it could not supply more than a third of the protein and half the total nutrients needed.

In an experiment at the Connecticut (Storrs) Experiment Station, reported in Bulletin 198 of that station, White and Johnson found no advantage in feeding corn silage when water was kept constantly before the cows. When they were watered only once daily, however, greater production was secured with the feeding of silage, due to the water which it supplied.

The importance of a plentiful supply of water for milking cows has been shown repeatedly. Many cows do not received an adequate supply of water, particularly during the winter months. The practice of turning cows out once daily to drink freezing water through a hole in the ice is still all too common. There is probably no more expensive way of watering cows, if we consider the sacrifice in milk production. Under such conditions the water contained in the silage eaten by the cow might materially increase production. In the experiment at Grand Rapids, the silage provided an average of 20 pounds or about 2½ gallons of water per day during the barn feeding period.

This should not be interpreted as meaning that a silo will replace a good water supply, for while 2½ gallons of water might increase production when cows are not adequately watered, it obviously is not nearly enough to supply their needs. Even if a considerable cost is involved in providing a water supply, the investment undoubtedly will pay dividends.

SOME SUGGESTIONS FOR NORTHERN MINNESOTA

With full appreciation of the fact that the silo may be a valuable asset to the cornbelt dairyman, it probably should not be recommended to most dairymen of Northern Minnesota where an attempt to provide silage is likely to result in an increased cost of milk production.

Very satisfactory and economical milk production may be secured with good legume hay as the sole winter roughage. At least an acre of alfalfa for every cow, or an equivalent amount of other legumes, should be the aim of every dairyman.

A plentiful supply of water protected from freezing temperatures should be provided. If this can not be kept before the cows, they should be watered frequently.

With plenty of good alfalfa hay for winter roughage and a plentiful supply of water, a succulent feed is not necessary and probably will not increase milk production nor improve the health of the cow. The importance of succulent feeds has probably been over-emphasized and feeding of silage has been recommended too generally, without sufficient regard for differences in climate and other conditions.

MORE DAIRY BULLETINS

This bulletin on "Sunflower Silage" is only one of several informative publications that are available to dairymen through the Minnesota Agricultural Extension Service. Here are the titles of some that may interest you:

Judging Dairy Cattle	Special Bulletin 92
Raising Dairy Calves on Skimmilk	Special Bulletin 108
The Trench Silo	Folder 47
The Corn-Crib or Slat-Fence Silo	Folder 49
The Cow Testing Association	Folder 55
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Published in furtherance of Agricultural Extension, Acts of May 8 and June 30, 1914. F. W. Peck, Director, Agricultural Extension Division, Department of Agriculture, University of Minnesota, Co-operating with U. S. Department of Agriculture. 11-36-7500