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FREE—STALL—BARN, HERRINGBONE—PARLOR, HIGH—SILAGE—FEEDING DAIRY CHORE SYSTEMS

COMPARISON and ANALYSIS

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PUBLICATIONS ON FREE-STALL-BARN, HERRINGBONE-PARLOR, HIGH-SILAGE-FEEDING DAIRY CHORE SYSTEMS

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INTRODUCTION

Dairy chores consume more of the dairy farmer's time than any other single job and often more than all other jobs combined. Thus, the dairy chore system used is of paramount importance. Recent decreases in the farm price of milk have forced farmers to be more cost conscious, and rapidly rising wage rates have caused the labor requirements to be a very important cost factor.

The herringbone parlor, free-stall barns and use of silage as the only roughage have each been developed as a method of mechanizing dairy chores and reducing the labor requirements for handling dairy cows. Although they have been developed essentially separately, the combined use of the three developments on some farms has produced what appears to be a very efficient system of handling cows.

PREVIOUS RESEARCH

There has been no previous study of farms where the free-stall barn, herringbone parlor and all-silage roughage feeding were integrated in one system. Considerable research has been devoted to the separate study of each of the three parts of this dairy cow handling system.

All-Silage Feeding

Although it is still somewhat controversial, the use of silage as the only roughage has been found to be quite feasible. The feeding value of the hay crop is essentially the same when it is harvested either as hay or high-, or medium- or low-moisture silage. Although cows will consume somewhat less high- or medium-moisture silage the greater efficiency of utilization of these silages allows for production equal to that of hay or low-moisture silage. Cows on all high- or medium-moisture hay crop silage tend to gain less weight but have equal production and persistency as cows being fed low-moisture silage or hay. Low- or medium-moisture hay crop silage stored in conventional silos appears to provide the most economical source of nutrients from perennial forages.

Corn silage as the sole roughage for dairy cattle has been studied for over 20 years. Although corn silage is a good source of energy and certain vitamins, it is usually deficient in protein, often deficient in calcium and at times deficient in vitamins A and D. If properly supplemented, corn silage is not deficient in any nutrients which affect growth, health or reproduction. It appears that corn silage as well as high-moisture and medium-moisture hay crop silage has greater efficiency of utilization than hay.

Herringbone Parlors

A number of studies have found herringbone parlors to be more efficient than other types of parlors. One study found the cows milked per man hour for the different types of parlors to be as shown below.

Type of Parlor	Cows Milked per Man Hour
Double 5 herringbone	44
Double 4 herringbone	40
Double 3 walk through	35
Three-U side opening	31
Three-in-line side opening	26
Four-in-line side opening	26
Double 2 walk through	24

There is a considerable amount of variation in milking parlor costs and little agreement as to which type is the least expensive. There appears to be more difference in makes and areas than in types of parlors.

With the herringbone parlor the walking distance of the operator is reduced up to 50 feet per cow per milking over other types of parlors.

Cows have more time to eat grain in herringbone parlors than they do in other types. Cows milked in herringbone parlors have approximately 14 minutes to eat grain while cows in other types of parlors only have approximately seven minutes. Some studies show that a cow will eat up to 0.65 pound of dry grain per minute. This means that she can eat up to 9.1 pounds of grain per day in a side-opening parlor and 18.2 pounds in a herringbone parlor.

Free Stalls

The installation of free stalls has been found to reduce the labor requirement two and two-thirds hours per cow per year for those who had previously used stanchion barns. Over half of the time saved when switching from a stanchion barn was the result of reduced manure removal time. Most of the labor savings for farmers putting free stalls in former loose-housing sheds was caused by reduced bedding time.

The bedding required for free stalls is less than that for other systems. The approximate requirements are: one ton per cow per year for loose housing, one-half ton per cow in stanchion barns, and one-fourth ton per cow with free stalls.

An Indiana survey found that the milk, physical appearance of the cows and bedded areas were cleaner with free stalls than with either stanchion or loose housing. There were also considerably fewer cases of foot rot and stepped-on teats with free stalls than with either of the other two systems.

Another Indiana study showed that when comparing new structures the annual labor, bedding and building costs of free-stall barns are about $13 per head below that of loose-housing sheds and $22 below stanchion barns.

THE STUDY

The data for this study were obtained by making two surveys. For the first survey, all county agents and others connected with agriculture in New York State were contacted and asked for a list of all of the farmers in their area who used a free-stall-barn, herringbone-parlor, high- or all-silage dairy chore system. High silage was finally defined as feeding less than seven and one-half pounds of hay per cow per day, and all farmers feeding high or all silage were included in the survey.

Following this survey county agents were again contacted, given the name or names of farmers in their county who had been included in the survey and asked to choose another farmer to be used in a comparison survey. Requirements for the farmers included in the comparison were that he:

(1) have approximately, or as nearly as possible, the same size herd as the farmer included in the original survey,

(2) have a conventional stanchion or tie-stall barn and feed hay and silage,

(3) not use a milking parlor or around-the-barn pipeline (a dumping station and/or bulk tank was allowed but not required),

(4) be considered by the county agent to be the most efficient or one of the most efficient farmers in the county fitting the rest of the requirements.

The farmers chosen in this manner were included in the second survey. Similar questionnaires and interviewing procedures were used for both surveys except that farmers with the free-stall-barn, herringbone-parlor, high-silage feeding system were asked additional questions about their system and their experience with it.

THE FARMS STUDIED

The farms in the study were located in 11 New York State counties. Because there was an effort to study all of the free-stall-barn, herringbone-parlor, high-silage system farms available the farms were spread over much of New York State except Long Island and the North County Adirondack Mountain area.

Table 1 compares the magnitude and importance of the various uses of land on conventional dairy chore system farms with that of free-stall-barn, herringbone-parlor, high-silage dairy chore system farms.

Table 1. LAND USE BY FARMS WITH DIFFERENT DAIRY CHORE SYSTEMS
34 Farms, New York State, Summer 1965

Use of land	Free-stall-barn, herringbone-parlor, high-silage farms		Conventional chore system farms	
	Acres	Percent of cropland	Acres	Percent of cropland
Corn silage	79	27	44	13
Hay	46	15	132	38
Hay crop silage	66	22	5	1
Oats	20	7	50	14
Corn grain	9	3	27	8
Wheat	16	5	22	6
Sudan-sorghum hybrids	5	2	4	1
Green chop	5	2	2	1
Other crops	13	4	20	6
Government programs	8	3	5	1
Pastured cropland	31	10	37	11
Total cropland	298	100	348	100
Woods	126		67	
Permanent pasture	48		72	
Farmstead, roads and waste	73		73	
	545		560	

The primary differences in land use by farms with the two different chore systems are found in the corn silage, hay and hay crop silage acreages. The high-silage farms used nearly twice as many acres of corn silage and only one-third as much hay as conventional farms. Four high-silage farms harvested no hay. The hay that was harvested on high-silage farms was primarily for young stock. The hay acreage on these farms will likely decline in the future as more of these farmers completely eliminate hay from the dairy cow diet.

The second most important crop on high-silage farms was hay crop silage. Eleven of the seventeen farmers harvested an average of 101 acres each or an average of 66 acres per farm for all farms. On conventional farms hay crop silage is a relatively unimportant crop.

Free-Stall-Barn, Herringbone-Parlor, High-Silage System Farms

The number of cows on the high-silage farms ranged from 42 to 200 with an average of 97 cows per farm. Sixteen farmers raised an average of 45 head of young stock. One farmer, in an effort to specialize further, purchased all of his replacements.

These farms had an average of 107 free stalls per farm with a range from 45 to 200. All stalls were four feet wide although there was some variation in length. Table 2 shows a frequency distribution for length of stall found. Farmers with 7'6" or longer stalls and some of those with 7'3" stalls indicated that they thought a shorter stall would be better.

Table 2. INSIDE LENGTH OF FREE STALLS
17 Farms, New York State, Summer 1965

Length	Number of farms
7'	10
7'3"	4
7'6"	2
7'8"	1

Only two of the 17 farms had insulated barns. Three of those with uninsulated barns fed their cows in an outside bunk. One of the three indicated preference for an inside bunk. One of those with uninsulated inside feeding was considering insulation. Insulation is generally defended on worker-comfort grounds rather than production or economic grounds. Many of those with uninsulated inside feeding areas felt that cold temperatures did not hurt production, but cold winds directly on the cows could.

All of the surveyed farms with over 120 free stalls had double-eight parlors. Double-four, double-five and double-six parlors were in use on farms with 120 or fewer free stalls.

These farms had one to five silos with an average silo capacity of 1,136 tons per farm or 11.7 tons per cow. Silo unloaders were in use on all farms. Auger feeders were used on 13 farms with the silo unloader depositing the silage directly in the auger on three farms. A cross conveyor which carried the silage to the feeder was found on ten others. A system involving a cross conveyor and shaker feeder was found on two farms. Two farms elevated the silage into an unloading wagon and distributed the silage in the bunk with the wagon.

Conventional System Farms

The number of cows on conventional farms averaged 77, with a range of 41 to 108. These farmers also raised 56 head of young stock per farm.

Although there was a definite attempt to get farms with conventional chore systems that had the same herd size as those with the newer system, this was found to be impossible. There were very few large farms (over 100 cows) with conventional chore systems. Many operators of large farms had their cows in more than one barn, and including these in the study would be similar to including two small farms.

Table 3 shows a frequency distribution for herd size for the two chore systems.

Table 3. SIZE OF MILKING HERD
34 Farms, New York State, Summer 1965

Number of cows	Free-stall-barn, herringbone-parlor, high-silage farms	Conventional chore system farms
	Number of farms	
50 and under	4	4
51 - 75	3	2
76 - 100	3	9
101- 125	3	2
126- 150	2	0
151 and over	2	0

Conventional chore system farms all used stanchion or tie-stall barns and regular bucket-type milkers. Table 4 shows the degree of dairy chore system mechanization of these farms relative to average New York State farms. The much higher degree of mechanization would be expected because only the more efficient farms were chosen. Of the three farmers who did not have a dumping station, two carried the milk to a bulk tank, and the other handled the milk in cans.

Table 4. DAIRY CHORE MECHANIZATION
New York State, 1964 and 1965

Item	17 conventional systems Summer, 1965	826 New York State* dairy farms, June 1964
	Percentage of farms	
Dumping station	82	7
Gutter cleaner	94	45
Silo unloader	82	16

* SOURCE: G. J. Conneman, Department of Agricultural Economics, New York State College of Agriculture, Cornell University, Ithaca, New York.

These farms had from one to five silos with an average silage capacity of 534 tons per farm or 6.9 tons per cow.

Comparison of Physical Quantities for the Systems

The quantities of feed fed and milk sold with both chore systems are shown in Table 5.

Table 5. QUANTITIES OF FEED FED AND MILK SOLD
34 Farms, New York State, 1964-65 Year

Item	Free-stall-barn, herringbone-parlor, high-silage farms	Conventional chore system farms
	Quantity per cow per year	
Corn silage (tons)	8.2	5.6
Hay crop silage (tons)	3.9	0.6
Total tonnage of silage	12.1	6.2
Hay (tons)	0.9	2.5
Green chop (tons)	1.7	1.1
Grain (pounds)	4,553	4,494
Milk sold (pounds)	11,671	12,527

High-silage farmers fed approximately twice as much silage as the conventional system farmers. They fed about 50 percent more corn silage and considerably more hay crop silage. The greater corn silage acreage was made possible by a reduction in the acreage of perennial forage and corn for grain. Although somewhat less perennial forage was fed, the main difference was that it was harvested predominantly as hay crop silage rather than hay. The silage ration fed was approximately two-thirds corn silage and one-third hay crop silage. The amount of hay fed on high-silage farms is higher than it will be in future years because six farmers fed considerable amounts of hay during the summer of 1964 while their new system was still under construction. This hay will likely be replaced by hay crop silage in the future.

These data show a somewhat higher hay-equivalent intake by the high-silage farms. However, this should not be accepted as an indication of increased feed requirements. A larger acreage of pasture was utilized on conventional farms than on high-silage farms, an undetermined amount of which was used by heifers on both groups of farms. This provides an indefinite and undeterminable factor which makes the calculation and comparison of the total feed requirements from the data for the two systems virtually impossible.

The amount of grain fed per cow on these two groups of farms was for all practical purposes equal.

The conventional system farms sold approximately 850 more pounds of milk per cow than the high-silage farms. At least part of this difference can be explained by the fact that 12 of the high-silage systems had not been in operation for one complete year. Six of these farmers had moved into completely new barns during the summer of 1964, and the other six changed to all silage, added free stalls or changed the milking parlor. Six farmers experienced 52 to 86 percent increases in herd size during the summer and early fall of 1964. The high-silage system farms had been in operation as such an average of approximately 14 months.

EXPERIENCE OF FARMERS WITH FREE-STALL-BARN, HERRINGBONE-PARLOR AND HIGH-SILAGE SYSTEM

Grain Feeding in the Parlor

On all farms grain was fed in the parlor. Ten farmers fed a pelleted feed, five a ground feed and the other two fed pelleted part of the year and the ground the remaining part of the year. On ten farms D.H.I.A. records were used as a basis for determining the amount of grain fed to each cow while in the parlor. On four farms weigh jars were used for this purpose, although one of these fed grain free choice in the parlor during the summer. An automatic feeder which fed cows grain at a three-to-one ratio was found on one farm. One farmer fed grain according to his estimate of milk production and cow condition but indicated that he "had to do something about weighing the milk." On the remaining farm cows were allowed free choice of grain while in the parlor. This farmer was satisfied with this method of grain feeding.

The grain fed in the parlor at the time of the interview ranged from 10 to 24 percent protein with an average of 16 percent. Nine farmers indicated that they fed grain containing the same protein content year round. Although the protein content of this grain was 16 percent on the majority of these farms, it ranged from 14 to 18 percent. Eight of these farmers either fed hay crop silage or a small amount of hay when feeding corn silage. The other fed hay crop silage most of the year and thus fed all corn silage for only a short period of time.

Of the eight farmers who indicated that they changed the protein concentration of the grain, six fed all corn silage for at least part of the year, at which time they raised the protein level to 18 to 24 (mean 21) percent. One farmer raised the protein level from 14 to 16 percent when feeding all corn silage but also added a 40 percent protein supplement and high-moisture corn to the bunk. The other farmer changed his protein level from nine percent to 16 percent when changing from low-moisture hay crop silage to corn silage plus a small amount (6#/cow/day) of hay.

Ten of the 17 farmers indicated that high-producing cows did not have enough time in the parlor to eat the grain they required to maintain milk production. Of those indicating no trouble along this line, three were feeding grain or high-moisture corn on the silage so that only part of the concentrate requirement had to be met while the cows were in the parlor.

Outside the Parlor

A total of eight farmers fed grain outside of the parlor. Three farmers fed Government corn for the part of the year that it was available. This was fed by shoveling the ground corn into the silage auger at the base of the silo. The amount fed ranged from four to five pounds per day and was determined by allocating the government corn from one allotment period to the next. Good results with this has caused one dairyman to consider adding ground corn to the silage as a regular practice.

Two farmers fed high-moisture corn. This was stored in conventional silos on one farm and an airtight silo on the other, both with good results. The corn was unloaded into a meter or holding bin, run through a crimper and then augered into the feeding auger. Ten to 15 pounds were fed per cow per day. Four pounds per cow of 40 percent protein supplement were added on one farm when the cows were on all-corn silage. The regular dairy ration was augered into the silaged auger at the rate of four to six pounds per cow per day on one farm. Another farm had a grain-holding bin over the silage bunk and dropped from four to 12 pounds of ground corn and oats per cow per day into the silage feeder. The amount fed per cow on both of these farms depended upon the stage of lactation of the majority of the cows.

One farmer had a large ten-stanchion isolation area in which he hand fed high-producing cows the extra grain they needed after they were milked. In view of the labor requirements for this farm, it would appear that this is an excessively time-consuming method of increasing grain consumption.

Farmers who are considering feeding part of the grain requirements outside of the parlor are confronted with two major problems. One is that, because of the wide variation in the individual concentrate requirements of the herd at any one time, a blanket feeding of "x" pounds per cow per day tends to either overfeed some cows that are dry or in the latter stages of lactation or not provide sufficient additional grain for some cows that are in the early stages of lactation, or both. The other problem is what concentrate to feed in the bunk and how to add it to the silage.

One method of allowing for the wide variation in the grain requirements is to divide the herd into two or more groups based upon grain requirements and feed different levels of grain to each group. With this method all the cows in any particular group get a certain minimum of grain in the silage bunk, and any remaining individual requirements can be met by grain feeding in the parlor. Farmers initiating the practice of feeding grain outside the parlor must remember to change the grain levels fed in the parlor correspondingly. One farmer who was dissatisfied with the production response when he tried feeding grain outside the parlor had not adjusted the grain feeding levels in the parlor.

The number and size of the groups needed for group feeding of grain will depend upon the size of herd and the number of different levels of "outside-the-parlor feeding" necessary. Too many groups will make the size of the groups so small that the increased labor involved in handling the groups will be excessive. Too few groups will not allow enough variation in grain feeding levels to supply each individual cow with the amount of grain needed. An optimum size of group may be approximately 40 cows, the size commonly found in Central Arizona dry-lot dairies. It is probably more realistic to determine the number of groups needed to provide the range in grain feeding necessary. If this makes groups that are too small, the number of groups can be reduced until both the number of groups and the size of each group is as near the ideal as possible. The physical facilities available may limit the number of groups on some farms.

What concentrate to feed in the bunk will vary somewhat depending upon whether corn silage, or hay crop silage or a combination of both is fed. Corn silage is very low in protein; thus, whenever corn silage provides a significant portion of the roughage requirements, a protein supplement needs to be fed. One

method of providing the nutrients needed for the different levels is to have a high energy source such as high-moisture corn or ground corn and a source of protein such as 50 percent supplement, soybean oil meal or urea and, for each group fed, feed enough of each of these in the bunk so that the remaining requirement of individual cows in the group can be met by parlor feeding. Only one level of protein will likely be fed in the parlor. In some situations the use of one supplement containing both energy and protein may be feasible. Supplemental feeds can be added to the silage in the cross conveyor between the silo and the end of the feed bunk or put on the silage after it is in the feed bunk.

Feeding Hay

Although all 17 of the farmers fed some hay at some time during the year, only four fed it as a regular and planned practice. Of these four, three felt that a little hay helped milk production. One of these had been feeding some hay, and when he changed to all-corn silage his test went down. Another felt that hay provided a variety of feed, bulk in the rumen and kept cows from getting too loose. The third felt that a little hay was necessary to maintain production when feeding corn silage. A fourth farmer felt that a little hay may help milk production, but that the cost of producing that hay exceeded the value of the extra milk produced.

Table 6 shows why the other 13 farmers felt that a small amount of hay would not increase the level of milk production above that achieved with all silage.

Table 6. FARMERS' REASONS FOR STATING THAT A SMALL AMOUNT OF HAY WILL NOT INCREASE MILK YIELD ABOVE ALL SILAGE LEVELS
13 Farms, New York State, Summer 1965

Reason	Number of farmers
Tried feeding a little hay and got no production response	7
Feeds at least part hay crop silage so hay not needed	4
Milk production higher than when feeding hay	1
Corn silage, protein and minerals provide a complete ration	1
Total of all farmers	13

The amount of hay fed on the farms that regularly fed hay ranged from 4.5 to 6 pounds per cow per day. Two farmers fed more hay when the cows were on all-corn silage than they did when they were also receiving hay crop silage. It is this author's opinion that in all likelihood the farmers who considered feeding a small amount of hay a necessity either had not tried all-silage feeding or did not completely balance their ration when hay was not fed.

Breeding

Many farmers considering the adoption of a free-stall barn feel that catching cows in heat will be much more difficult and breeding problems will ensue. Some feel that regular pregnancy checks and post-calving reproductive tract examinations will be needed in order to get good breeding results with large herds. In order to get farmer opinion on this problem the farmers were asked a series of questions about their experience. Only one farmer had experienced some problems in catching cows in heat. He indicated no problem getting cows bred on time. Some farmers indicated that it was easier to notice heat because the cows were loose and could be observed twice a day at milking time or whenever a worker was in the barn, rather than once per day as in the case with stanchion barns. Most farmers felt that as long as a time was set aside specifically for observing cows, and cows were observed during that time, catching cows in heat was no more, if as much, of a problem than it was in a stanchion barn. One farmer felt that the best results were obtained by having an exercise lot into which the cows were turned to be observed for heat. Only one farmer indicated trouble in getting cows bred on time. This problem started while the cows were in a stanchion barn and was caused by a low conception rate. Although the conception rate was improving, neither the problem nor its solution was caused by the chore system.

The practice of having regular pregnancy checks was found on three farms. General practice on most other farms was to have only problem cows checked. A number of farmers indicated that they thought regular pregnancy checks advisable. The degree to which this statement was precipitated by a felt need, rather than its public acceptance as a beneficial practice, is questionable.

Two farmers used regular post-calving reproductive tract examinations. Seven others had cows examined that were having or had had trouble. A few farmers indicated the need for better breeding records, but this mainly required additional attention to existing records.

Bedding

Table 7 shows the frequency of bedding in the winter and the type of bedding used. It appears that farmers using straw must bed more frequently than those using sawdust.

Table 7. WINTER BEDDING FREQUENCY AND MATERIALS USED
17 Farms, New York State, Winter 1964-1965

Bedding frequency	Number of farms using straw	Number of farms using sawdust
Every day	1	-
Once per week	2	-
Twice per month	1	2
Once every three weeks	1	3
Once per month	-	4
Once every six weeks	-	1
Once every two months	-	1
Once every three months	-	1*

* On this farm the bedding was dug up and shaken once per week.

Table 8 shows the summer bedding frequency and the type of bedding used.

Table 8. SUMMER BEDDING FREQUENCY AND MATERIALS USED
17 Farms, New York State, Summer 1965

Bedding frequency	Number of farms using straw	Number of farms using sawdust
Once every three weeks	-	2
Once every month	-	3
Once every six weeks	-	1
Once every three months	-	1
Twice per summer	-	1
Once per summer	-	4
Not at all	4	1

Of the four farmers using straw, three used pasture or large exercise lots during the summer. This caused use of the free stalls to be very limited. The other used a paved barnyard. The farmer using sawdust and not bedding during the summer, used a predominantly pasture summer feeding program.

High-Silage Feeding

High-silage feeding in this paper is represented by 12 farmers who fed all silage (corn and/or hay crop) and five farmers who fed silage plus 4.5 to 6 pounds of hay per cow per day.

Four farmers found no problems with high-silage feeding. The problems found by the other 13 are shown in Table 9.

Table 9. PROBLEMS WITH A HIGH-SILAGE FEEDING PROGRAM
17 Farms, New York State, Summer 1965

Problem	Number of farmers mentioning
Getting equipment to do the job without breaking down	4
Getting the correct amount of grain into the cows balancing the ration	3
Run out of silage	3
Cows lack appetite once or twice per winter	2
Low test	2
Cows ate and licked dirt	1
Lack of nutrition data	1
Power failure	1
Insufficient silo space	1
Getting the silo filled on time	1

It appears that some equipment designed and advertised to perform a particular task will not actually do a satisfactory job. Difficulty in getting silo

unloaders and augers to handle hay crop silage at satisfactory rates was the main complaint of farmers who were having trouble with equipment.

Insufficient silo space, getting the silo filled on time, running out of silage and balancing the ration are problems which should become of less concern as farmers gain more experience with high- and all-silage feeding.

A number of advantages of high-silage feeding were given by each farmer. Table 10 shows the advantages given and the frequency that they were mentioned.

Table 10. ADVANTAGES OF A HIGH-SILAGE FEEDING PROGRAM
17 Farms, New York State, Summer 1965

Advantage	Number of farmers mentioning
Labor	
Mechanized—requires less physical strain	16
Efficiency--saves time	14
Can use lower cost labor to meet extra labor requirements	1
Harvest	
Less trouble with the weather	9
Harvest is easier	9
Lower harvest cost	4
More efficient use of land	4
Lower field machinery investment	4
Less field loss	3
Fewer trips over the field—second cutting recovers faster	2
No hay dust to work in	1
No daily chopping	1
Storage	
Easy to store	1
Need less storage space	1
Lower cost storage	1
Fewer rodents	1
Feeding	
Higher quality forage	6
Less waste	5
Better job of feeding	3
Weeds ruin less forage	1
Works better in manure pit	1
Cows and Production	
Cows in better condition	3
Higher test	2
Cows hold up on milk better	2
Heifers grow more and milk better	1

The two farmers indicating that a higher test was an advantage of a high-silage program were feeding all-corn silage. This response was in contrast to that of the two farmers mentioning lower test as a problem with high silage. Although sufficient data were not collected to make a thorough analysis of this question, it appeared that the farmers experiencing a higher test did a more complete job of supplementing the silage. Some farmers feel that stage of maturity of corn silage will influence the butterfat test.

Seven farmers indicated that they had found no disadvantages of an all-silage system. The disadvantages cited by the other 10 farmers are shown in Table 11.

Table 11. DISADVANTAGES OF A HIGH-SILAGE FEEDING PROGRAM
17 Farms, New York State, Summer 1965

Disadvantages	Number of farmers mentioning
Equipment	
Equipment breakdown causes critical problems	3
Power failure causes critical problems	1
Increased equipment maintenance required	1
Cows and Production	
Cows go off feed once or twice per winter	2
More difficult to balance diet	2
Some corn passes through the cow whole	1
Other	
Smell; when moisture content of hay crop silage is too high	2
High moisture hay crop silage deteriorates concrete silos	1
High cost of protein	1
Quality and quantity of management required increases	1

The Complete System

All farmers mentioned at least three advantages to the free-stall-barn, herringbone-parlor, high-silage feeding system. The advantages and the frequency that they were mentioned are shown in Table 12.

Time saving and the reduction of physical strain are the two most important advantages of this system. Many of the 17 farmers were very emphatic about this point.

Table 12. ADVANTAGES OF THE HIGH-SILAGE-FEEDING, FREE-STALL-BARN, HERRINGBONE PARLOR SYSTEM
17 Farms, New Yor Stat , Summer 1965

Ad antages	Number of farmers mentioning
Labor	
Saves time	17
Less physical strain	15
Easier handling of materials	8
More cows per man	3
Young and old laborers can do more productive work	3
A sick worker causes less of a problem	2
Safer milking	1
Hired help like this system	1
Systematized labor requirements	1
Herd Health	
Greater cow comfort	8
Less teat injury	7
Less foot trouble	6
Less mastitis	5
Cleaner cows	5
Better herd health	3
Greater cow longevity	2
Less fly problem	1
Cow Handling and Production	
Cleaner milk	5
Quieter cows	4
Better milking system	3
Heifers break in easier	1
Higher milk production	1
Easier to detect heat	1
Costs	
Less bedding	7
Lower building costs	2
Less feed waste	2
Less permanent fencing	2
Other	
More flexible	4
Efficient operation on a smaller acreage	3
Weather less of a problem	1

Farmers who indicated that the young and old are more productive with this system, either had young school age sons who were now able to do much more productive work, or aging employees or fathers who previously could not milk but now can and do.

Table 13 shows what these farmers considered were the disadvantages of the high-silage system.

Table 13. DISADVANTAGES OF THE HIGH-SILAGE-FEEDING, FREE-STALL-BARN, HERRINGBONE-PARLOR SYSTEM
17 Farms, New York State, Summer 1965

Disadvantages	Number of farmers mentioning
Manure	
Manure sloppy and hard to handle	5
Must wear boots all the time	3
Cows sometimes slip on the concrete	3
Must clean barn every day	1
Cow Handling	
Less individual attention	5
Bulling or boss cows cause a problem	4
Timid cows cannot be kept	2
Must have separate hospital and maternity area	2
Horns must be removed	1
Hard to catch one cow	1
Dry cows should be separated from milkers	1
Equipment	
Equipment breakdown causes critical problems	2
Higher equipment costs	1
Feeding	
Need a separate feed for young stock	1
Protein cost is high	1
Some cows do not get enough grain	1
Other	
Requires more management	2
High capital investment	1
Barn uncomfortable for workers in cold weather	1

A number of farmers indicated that cows slipping on the concrete is a problem until the cows learn how to walk on the wet concrete. On the farms where this system had been used for a reasonable length of time, slipping was a problem only when fresh heifers were added to the herd.

Individual attention was a subject mentioned by several farmers. As Table 13 indicates, five farmers felt that cows received less individual attention and that this was a disadvantage of the system. Some other farmers felt that somewhat less individual attention was given but that it did not pay to give more. Others felt that the cows received just as much individual attention but that it was given at different times and in other ways.

In order to determine what aspects of their system these farmers were really dissatisfied with, they were asked what they would change if they were starting over. All changes which were mentioned by more than one dairyman are shown on Table 14.

Table 14. CHANGES FARMERS WOULD MAKE IN THEIR DAIRY CHORE SYSTEM IF STARTING OVER
17 Farms, New York State, Summer 1965

Change	Number of farmers mentioning
Manure Handling System	
Install different manure handling system	4
Labor	
Not have side entrance to parlor	3
Have no steps leading into parlor	2
Install six stalls per side in parlor	2
Buildings	
Use concrete water trough rather than water buckets	2
Build no hay storage	2
Arrange barn for fewer corners	2
Do more careful concrete work	2

Several farmers indicated dissatisfaction with the manure handling system. One of these farmers was scraping the manure into a gutter cleaner running perpendicular to the barn between the free-stall bunk area and the milking parlor. The gutter cleaner was on a slight incline between the edge of the barn and the end of the cleaner. The capacity of the gutter cleaner on this incline was limited and caused a bottleneck in manure handling. This farmer indicated that he would install a liquid manure system. One other farm had a cross gutter cleaner which greatly limited the speed with which the manure could be removed. This cleaner emptied into a liquid manure pit. The farmer indicated that the liquid manure system had many problems and he would not install the pit if he were starting over.

The other two farmers who indicated they would change their manure system used manure-loading ramps. On both of these farms the manure exit door was placed in the middle of one side of the barn. This required the manure to be

pushed down the alley, around the corner and out through the side of the barn. The major problem was caused by the fact that all of the manure had to be pushed around the corner. The sloppy consistency of the manure from this type of system made this difficult.

A manure handling system which involves pushing the manure straight down the alleys and letting it drop down into the spreader at the end of each alley appears to be the most satisfactory method of handling manure. One method of accomplishing this is to place a door at the end of each alley. Each alley floor is extended about four feet out through the door by a platform which allows the spreader to be driven underneath. The manure is pushed down the alley, over the end of the platform and drops down into the spreader. Another method used is to place a manure loading shed under the end of the barn and let the manure drop down into the spreader through holes in the end of each alley. This latter method has the disadvantage of higher installation cost.

The primary reason cited for wanting a liquid manure system is the possibility of not hauling manure every day or in bad weather. However, anyone considering installing a pit must decide just when the manure is going to be hauled out and whether there are enough good days in which to draw the manure and do all of the other jobs which must be done. Hauling the manure can be delayed only until the pit is full. If the pit is so small that it must be cleaned too frequently, or if it has to be cleaned at the time more important jobs should be done, the advantage of delayed hauling may be slight. It could even become a disadvantage. In the final analysis the advantage of delayed hauling plus any other advantages that may be found must be balanced against the cost of installing the system and any disadvantages such as disagreeable odors and increased water requirements.

In considering the complaints about manure handling it should be remembered that the time required for manure removal is decreased, and the flexibility in frequency and time of removal is increased with the free-stall-barn, high-silage-feeding system. This would lead one to believe that the manure handling methods with a high-silage, free-stall system are not worse than those used with conventional barns. The real problem is that compared to the forward strides made in milking, feeding and bedding, very little progress has been made in manure handling.

Among the other complaints were those of three farmers, or 50 percent of the farmers with side-entrance parlors, who indicated that they were dissatisfied with side entrance. This is supported by another study which found that side entry doubled the time required for cow entry into the parlor.

The two farmers who indicated they would put six stalls on a side in the parlor were operating double-four parlors with two men. They felt that the double-four parlor was too much for one man to operate but not enough for two.

LABOR REQUIREMENTS

There are a number of reasons why a farmer would change to the free-stall-barn, herringbone-parlor, high-silage-feeding system, but the greatest motivating force in most cases will be the savings in time. In 1963 the average cost

account farmer spent 70 hours of labor per cow on his dairy herd. The farm business chart indicates that the average New York State farmer spends 90 hours per cow per year. One of the primary objectives of this study was to determine the labor requirements for farms with herringbone-parlor, free-stall-barn, high-silage-feeding dairy chore systems and compare this with efficient conventional farms.

Table 15 shows the labor requirements for both systems as found on the 34 farms visited in this study.

Table 15. LABOR REQUIREMENTS FOR TWO CHORE SYSTEMS
34 Farms, New York State, 1964-65

Farm size group	Conventional chore system	Herringbone-parlor, free-stall-barn, high-silage chore system
Hours per cow per year		
84-200 cow farms* (9)	73	39
41-83 cow farms** (8)	79	48
All farms (17)	76	43
Minutes per cow per day--summer		
84-200 cow farms	9.8	6.0
41-83 cow farms	9.3	6.6
All farms	9.5	6.3
Minutes per cow per day--winter		
84-200 cow farms	13.6	6.8
41-83 cow farms	15.8	8.7
All farms	14.6	7.7

* An average of 95 cows with the conventional system and 132 cows with the high-silage system.
** An average of 58 cows per farm for each system.

The 84 to 200-cow conventional farms used eight percent less labor per cow than 41 to 83-cow farms. This suggests that there are some economies of scale at this level, but that they are not great. Considerably greater economies of scale are indicated with the free-stall-barn, herringbone-parlor, high-silage farms where the 84 to 200-cow farms used 19 percent less labor per cow than the 41 to 83-cow farms. These economies are likely caused by the fact that it requires no more time to prepare the parlor for milking, get the scraper into the barn or press the silo unloader switches for 100 cows than it does for 40. Also for many other tasks the increase in labor requirement is not commensurate with the increase in cow numbers.

The average conventional farmer spent 54 percent more time with the dairy herd during the winter than he did during the summer. Smaller conventional farms

with 41 to 83 cows averaged 58 cows per farm and spent 70 percent more time during the winter while 84 to 200-cow farms spent only 39 percent more time. The average herd size on the large farms was 95 cows.

The average farmer with a free-stall-barn, herringbone-parlor, high-silage-feeding system spent only 22 percent more time during the winter with the dairy herd than he did during the summer. Although many large farms had nearly the same labor requirements per cow, both summer and winter, the average 84 to 200-cow farm spent 13 percent more time during the winter. Large farms averaged 132 cows per farm. The average smaller farm had 58 cows and spent 32 percent more time on the dairy herd during the winter.

The above data indicate that farmers changing to the high-silage system will not only have a change in total labor requirements, but the relative summer and winter requirements will also change. Instead of the winter requirements being 50 percent greater than summer they would be only 20 percent greater.

The most significant difference between the two systems, as shown on Table 15, is that the total labor requirements for the high-silage system is only 43 hours per cow compared to 76 hours for the conventional system. This reduces the labor requirements to only 57 percent of the previous requirement, for a reduction of 33 hours per cow per year. The farms with 84 to 200 cows used 34 fewer hours of labor per cow, and 41 to 83-cow farms used 31 fewer hours per cow. Table 16 shows the value of the reduced labor requirement for a 60- and 100-cow herd at different wage rates.

Table 16. LABOR SAVING AT VARIOUS WAGE RATES
Free-Stall-Barn, Herringbone-Parlor,
High-Silage-Feeding System

Wage rate	60-cow herd	100-cow herd
Dollars per hour	Dollars	Dollars
1.00	1,860	3,400
1.25	2,325	4,250
1.50	2,790	5,100
1.75*	3,255	5,950
2.00	3,720	6,800
2.25	4,185	7,650
2.50	4,650	8,500

* The average cost per hour of labor on New York Cost Account Farms was $1.69 in 1963, and for the last four years had increased three to six cents per year. C. D. Kearl, Overhead Costs from Farm Cost Accounts, Cornell University Agricultural Experiment Station, Department of Agricultural Economics, Research Bulletin 159, December 1964.

If the labor is hired and this cost can be eliminated or if it can be diverted to another enterprise, the value of the labor eliminated or the labor

return from the alternate enterprise, will determine the savings. Many farmers will make use of the labor savings by increased herd size. Regardless of the use made of the labor saved, in order to determine the desirability of changing chore systems for any particular farm the saving must be contrasted to the cost of changing to this system.

The primary factors causing the free-stall-barn, herringbone-parlor, high-silage-feeding systems to be much more efficient than conventional systems are: that free stalls save a considerable amount of bedding time, that the herringbone parlor greatly reduces the time required for milking and that high-silage allows faster feeding. In addition to this there is some complementarity of the parts of the system. Because silage feeding generally requires only pushing the start and stop button plus limited supervision while the equipment is running, other jobs can be accomplished at the same time.

The tasks that were most frequently accomplished while the silage feeding system was running were:

1. Observe cows for heat
2. Scrape the barn
3. Remove droppings from free stalls
4. Clean machines and parlor
5. Get cows into the holding area
6. Feed young stock

A few farmers ran the silage feeding system while milking, but this was generally unacceptable because the milking routine was interrupted whenever the silage feeding system had to be started, stopped or checked.

Cows were fed from one to four times per day. Although the majority of farmers fed silage twice per day, once per day appears to be sufficient if the bunk has a capacity great enough for a complete day's feed requirements. Feeding more than twice per day can be justified only if bunk capacity is limited. Because filling the bunk more frequently increases the labor requirements, new bunks should have sufficient capacity for one day's complete feed.

Herd Size Increases Possible

Most farmers changing from a conventional dairy chore system to the herringbone-parlor, free-stall-barn, high-silage-feeding system will increase the herd size to provide additional income and make use of the present labor force. The additional income will be used to pay the expense involved in conversion.

A farmer changing to the high-silage system and maintaining his present total dairy chore labor requirements would be forced to transfer some of his winter labor requirements to the summer. This may be possible on some farms, but most farmers will likely hold either the summer or the winter requirements constant. If the summer dairy chore requirements are held constant, there will be an excess of winter labor to be diverted to another enterprise, laid off or converted to leisure time. If the winter requirements are held constant, there

will be an increase in the summer labor requirements. In addition, the summer labor requirements may increase because of increased roughage needs. The amount of this increase will depend upon the extent to which forage crops replace previously grown cash or grain crops.

Table 17 shows the increased cow numbers possible with various original herd sizes, holding different labor requirements constant, and the change in summer or winter requirements which this would bring about. This includes only dairy chore time. Dairy chores consist of all tasks connected with the milking herd, including cleaning and loading the manure on the spreader but not spreading the manure.

Table 17. INCREASE IN HERD SIZE POSSIBLE AND RESULTANT LABOR REQUIREMENT CHANGES WITH VARIOUS LABOR REQUIREMENTS HELD CONSTANT

Labor requirement held constant	Conventional-system herd size	Herringbone-parlor, free-stall-barn, high-silage system herd size	Increase in summer requirement	Decrease in winter requirement
	Number of cows		Hours per day	
Summer	40	56	---	2.6
Winter	40	82	1.8	---
Complete year	40	66	1.1	1.0
Summer	60	89	---	4.4
Winter	60	139	4.6	---
Complete year	60	117	2.2	1.3
Summer	80	127	---	5.1
Winter	80	172	4.5	---
Complete year	80	156	2.9	1.8

Table 17 indicates that a farmer striving to maintain constant summer labor requirements can increase his herd size approximately 50 percent. A farmer holding winter labor requirements constant can increase his herd size approximately 100 percent.

SUMMARY AND CONCLUSIONS

Previous research has indicated that high levels of milk production can be maintained with silage as the only roughage. Herringbone parlors have been found more efficient, in terms of cows milked per man hour, than other types of parlors. Compared to loose housing and stanchion barns, free stalls reduce the amount of bedding required and decrease the time required for bedding and manure removal.

The purpose of this study was to compare free-stall-barn, herringbone-parlor, high-silage feeding dairy chore systems with efficient conventional dairy chore systems. It was found that:

1. The free-stall-barn, herringbone-parlor, high-silage-feeding dairy chore system required an average of only 43 hours of dairy chore labor per cow per year compared to 76 hours for efficient conventional systems. This is 33 fewer hours per cow or a 43 percent reduction in the dairy chore labor requirement.

2. There appears to be no significant difference in roughage or grain consumption or milk production that could be attributed to the type of chore system used.

3. The most efficient size of herd is larger with a free-stall-barn, herringbone-parlor, high-silage system than with a conventional dairy chore system.

4. With the high silage system winter chore labor requirements were only about 20 percent greater than summer requirements. This is in contrast to about a 50 percent higher winter labor requirement for the conventional systems.

5. If a farmer changes from a conventional system to a high-silage system and does not alter the amount of time spent doing chores during the summer, he can increase herd size 50 percent. If he holds his winter labor constant he can increase his herd size 100 percent.

6. Next to time saved the most important advantage of the free-stall-barn, herringbone-parlor, high-silage-feeding system is the reduction in physical strain. The amount of deep-knee bending, back-breaking work is considerably reduced. Other advantages include better herd health and cleaner milk.

7. No method of handling manure was found which was completely satisfactory and economical.

8. The main advantages of a high-silage feeding program appear to be easier harvest with fewer weather problems, higher quality forage and reduced feed waste.

9. Getting equipment that will handle hay crop silage at acceptable rates appears to be the greatest problem of a high-silage feeding program.

10. Most farmers experienced difficulty in getting sufficient grain into the cows while they were in the parlor. Dividing the herd into groups and feeding grain with the silage is one way in which this problem may be corrected.