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A STUDY OF THE COST
AND OPERATION OF MECHANICAL
BARN CLEANERS

By

Sheldon Butlien and J. L. McGurk

Department of Agricultural Economics
New York State College of Agriculture
Cornell University
Ithaca, New York

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PURPOSE

The number of barn cleaners on New York farms has increased rapidly in recent years. Many dairy farmers have raised questions in regard to their cost and use. This report contains up-to-date information on some cleaners now in operation. Included in this discussion are facts on initial cost, cost of operation and maintenance, frequency of breakdowns, amount of labor saved and degree of satisfaction.

METHOD OF STUDY

The data for this study was obtained by personal interview with 48 dairy farmers in Central New York (Table 1). An area near Ithaca was chosen to save time and travel in collecting data. The names of farmers with barn cleaners were obtained from county agricultural agents, district agricultural engineers and rural electrification representatives. The farm operators visited reported 43 commercial cleaners and 6 homemade cleaners. One farm had 2 commercial cleaners. Although the survey is believed to indicate the experience of farmers in this area, it's not necessarily representative of conditions throughout New York State.

Table 1. DISTRIBUTION OF BARN CLEANERS BY COUNTY
48 Farms, Central New York - 1952

County	Number
Cortland	19
Tompkins	10
Tioga	10
Cayuga	8
Onondaga	1
Broome	<u>1</u>
Total	49

*This study was made by Sheldon Butlien while enrolled in Agricultural Economics 195 - a course in research methods for undergraduates. The records were obtained and summarized during the spring of 1952. The study was made under the direction of J. L. McGurk.

SIZE OF BUSINESS

The farms included in this study were much larger than the average. The farms surveyed had an average of 251 acres and 40 cows. This is double the number of cows on the average New York State farm.* Man equivalent averaged 2.5 compared with 1.6 on the typical New York farm. Cow numbers were double the New York State average, while the labor force was only 50 per cent larger. Cows per man averaged 16 compared with a state average of 12.5. (Table 2.)

Table 2. AVERAGE SIZE OF FARM BUSINESS
48 Farms with Barn Cleaners, Central New York - 1952

Factors	Average
Acres per farm	251
Cows per farm	40
Cows and heifers per farm	68
Man equivalent	2.5
Cows per man	16

More than half of the farms visited reported 25 to 49 cows (Table 3). On 10 farms fewer than 25 cows were kept.

Table 3. DISTRIBUTION OF FARMS BY NUMBER OF COWS
48 Farms with Barn Cleaners, Central New York - 1952

Number of Cows	Average Number of Cows	Number of Farms
Less than 25	18	10
25 - 49	37	25
50 or more	63	13
All farms	40	48

The average farm had 68 head of cattle at the time the survey was made. This number included 2 more cows and 4 more heifers than before the cleaners were installed (Table 4). Not all of the change in cattle numbers can be attributed to the installation of barn cleaners. However, on the majority of farms where cattle numbers increased, operators indicated that the barn cleaner was an important factor in their decision to keep more cattle.

*State average based on Farm Business Chart prepared by Department of Agricultural Economics, New York State College of Agriculture, Ithaca, New York

Table 4. AVERAGE NUMBER OF CATTLE
48 Farms with Barn Cleaners, Central New York - 1952

	Before buying cleaner	At time of survey	Increase in numbers	Per cent increase
Cows	38	40	2	7
Heifers	14	16	2	14
Calves	10	12	2	20
Total	62	68	6	10

DESCRIPTION OF CLEANERS

For the purpose of this study, commercial cleaners were classified into 6 groups, according to type of operation. Records were obtained for only 6 homemade cleaners and, because they differ in many ways from the commercial cleaners, they were omitted from some of the tabulations.

Commercial Cleaners

1. Continuous chain without pit cleaner travels through all the gutters as one unit by utilizing cross gutters at the end of the barn and false alleys to make an uninterrupted gutter. This chain continues out the end of the barn, up an incline to the spreader and then returns to the barn, the entire unit consisting of one chain that rides the side of the gutter with rigid paddles attached. One motor usually operates the entire system. This cleaner was the most popular type. Twenty-one operators had this kind of cleaner.

2. Continuous chain with pit type is essentially like the first, but involves the use of a pit to collect the manure and then a separate elevator to place the manure in the spreader. This cleaner uses 2 motors. Eight of the cleaners were of this type.

3. Reciprocating cleaner operates in one gutter. The flights or paddles are hinged on angle iron or on steel piping. On the forward stroke, the paddle swings out across the gutter and pulls the manure forward the length of the forward stroke (about 7 feet). Then the motion is reversed. The paddle drops back and catches the load of manure brought forward by the next paddle. The forward motion is then repeated. The manure is so pulled to the end of the barn where a cross elevator dumps the manure directly into the spreader. This cleaner has a motor on each gutter unit and one on the elevator. Six farmers had reciprocating cleaners.

4. Flat belt cleaner uses a special heavy duty rubber belt that lies in the gutter. This operates by winding on a reel and utilizes a return winch to pull the belt back into the gutter. There are variations of this cleaner but they are all essentially the same. Five flat belt cleaners are included in the survey.

5. Straight pull-out type consists of 2 chains with cross flights of steel attached to both chains. The pull-out reel and loading chute are located at the end of the gutter on the outside of the barn. The power unit is also located at this point. The chain winds on the drum and is returned to the barn by use of a small winch. Only 1 cleaner of this type was found.

6. Endless chain with pit cleaner has an endless chain in the gutter working much the same as an endless conveyor belt. The manure is dumped into a pit at the end of the gutter and a separate elevator brings it up to spreader height. There was 1 cleaner of this type.

Homemade Cleaners

Three of the homemade cleaners embodied the same principles as the fourth and fifth types discussed above. Two were tractor operated cleaners requiring false gutters at the end of the barn. The manure is pushed out of the gutters with a tractor and up an incline into the spreader. The final homemade cleaner was a very ingenious one which might be termed "the power shovel". This type was manually operated and involved a winch to pull the shovel forward. Each shovel removed the manure from behind 4 or 5 cows. It was then pulled up an elevator into the spreader. Upon reaching the spreader, the power was cut off, the shovel dumped and then pulled back into the barn by hand to take on another load.

WHY FARMERS BUY BARN CLEANERS

One of the questions asked of each farmer was: Why did you buy a barn cleaner? The most common reason (reported by 20 farmers) was the difficulty in obtaining labor. Ten farmers said that old age demanded an easier means of cleaning gutters. On 9 farms, the barn had been remodeled and the cleaner had been installed as part of the remodeling operation. Four farmers admitted that they were high-pressured into buying a cleaner by a salesman and 2 farms reported that the cleaners had been installed in their barns for experimental purposes.

AMOUNT OF LABOR

On the average farm there was 1.2 months less labor in 1951 than before installing a cleaner (Table 5). The decrease in the average labor force was greater on those farms where the cleaner had been installed within the last year than on those where it had been in for a year or more.

Table 5. RELATION OF CHANGE IN LABOR FORCE TO CHANGE IN COW NUMBERS
48 Farms with Barn Cleaners, Central New York - 1952

Length of time installed at time survey was taken	Number of farms	Average Yearly Labor Force		Change (months)
		Before buying cleaner (months)	1951 (months)	
One year or more	31	30.7	30.1	- .6
Within last year	17	28.1	25.8*	- 2.3
Average or total	48	29.8	28.6	- 1.2

*Where cleaner was installed for less than a year, labor force at time that record was taken was considered to be typical for 1951.

Relation Between Change in Labor and Cattle Numbers

On 8 farms there was an increase in labor after purchasing the cleaner. This increase averaged 5.8 months. These farms averaged 9.9 more cows after the cleaner was installed.

On 29 farms (60 per cent) the same amount of labor was used before and after installing the cleaner. Ten of these farms reported an average increase of 5.9 cows. One farm had a decrease of 10 cows. Eighteen of these farms had the same number of cows.

On 11 farms (23 per cent) the labor force was reduced an average of 9.6 months. Five of these farms dropped 1 man entirely. Only one of the farms had an increase in cow numbers while another farm decreased the number of cows. The remainder kept the same number of animals before and after installation of the cleaner.

Table 6. RELATION OF LABOR AFTER INSTALLING CLEANER AND NUMBER OF COWS MILKED
48 Farms with Barn Cleaners, Central New York - 1952

Labor force after installing cleaner	Per cent of farms	Changes in	
		Labor (months)	Cows
Decreased	23	- 9.6	0
Same	60	0	+ 4.9
Increased	17	+ 5.8	+ 9.9

On 18 farms the number of cows increased. The average increase was 8 cows. Of these 18 farms, 7 reported using more labor (average 4.9 months). Ten reported using the same labor and only 1 farm reduced its labor force.

It appears that there is a tendency for farmers who install barn cleaners to increase the amount of livestock kept rather than to reduce the labor force. In other words, the farm operators have given their existing labor force more to do than they were formerly able to handle. Men are on the fields earlier in the morning or they are able to milk more cows.

A cleaner saves more total time on large operations than on small ones, but the time saved does not increase in proportion with the size of the operation. Most dairymen felt that the most important saving was not time. Rather the cleaner relieved them of a tedious job. In many cases the cleaner enables the farmer to keep his labor force better occupied. Many farmers reported that a barn cleaner made it easier to get and hold a hired man.

Before installation of the cleaner, there were 10 farms on which the gutters were cleaned by one man (Table 7). After installation, 24 farmers were able to clean their gutters with one man. Before the cleaner was installed, 26 farms used 2 men to clean their barns and 3 farms used 3 men to do this job. After installation, 14 farms required 2 men while only 1 farm used 3 men to remove the manure from behind the cows.

Table 7. NUMBER OF MEN USED TO CLEAN BARN
*39 Farms with Barn Cleaners, Central New York - 1952

Number of men cleaning	Before buying cleaners	After buying cleaners
	Number of farms	Number of farms
1 man	10	24
2 men	26	14
3 men	3	1
Total	39	39

*Nine records were omitted because of incomplete data.

The average time used in cleaning gutters after cleaners were installed was less than half the time needed to do the job before cleaners were installed (Table 8). The times given in Table 8 include the time for scraping up the floor and doing the other work associated with the job of barn cleaning. For farms with less than 25 cows the average number of minutes to clean the barn declined from 54 to 24 after a cleaner was installed. On farms which had 50 or more cows the average time dropped from 113 minutes to 56 minutes.

Table 8. RELATION OF COW NUMBERS TO TIME REQUIRED FOR CLEANING GUTTERS
39 Farms* with Barn Cleaners, Central New York - 1952

Number of cows at time of survey	Number of farms	Minutes to clean barn	
		Before buying cleaner	After buying cleaner
Less than 25	9	54	24
25 to 49	20	77	34
50 or more	10	113	56
All farms	39	81	37

*Nine farms were omitted because of incomplete data.

COST OF THE CLEANERS

One of the important factors that a farmer considers when purchasing a cleaner is the cost of it. The cost of installing the cleaner varies more with the barn arrangement than with the type of cleaner itself. Gutters must be straight and level for the cleaner to operate effectively. Several farmers reported having to straighten the gutters before installing the cleaner. Of the farmers surveyed, 40 reported some type of remodeling necessary to install the cleaners. Cleaners were installed in the other 8 barns in conjunction with remodeling for expansion purposes. Usually both gutters had to be connected and alleys had to be cut through to make a continuous gutter.

The pit type cleaner was the most expensive to install, requiring a relatively large pit, lined with concrete, while the belt and reciprocating cleaners usually required the least work and expense in installation, since the gutters are not connected. The average commercial cleaner cost about \$1600 installed (Table 9). The average cost per cow for commercial cleaners was \$38.

Eighteen of the 48 farmers surveyed reported installing the cleaner themselves. Six of these were homemade cleaners. Each of the farmers who installed his own commercial cleaner was satisfied with the installation. Five of the 30 farmers that hired installation reported dissatisfaction. Those who installed their own cleaners averaged between 40 and 45 hours of total work to get the cleaner into operation. Many farmers complained that crews took several weeks to install the cleaner when the work could have been done in about a week if it had been continuous.

The majority of the cleaners were installed during the fall months, presumably because the harvest season was over and farmers were beginning to think about shoveling manure during the winter months.

Table 9. COST OF CLEANER INSTALLED AND COST PER COW
Average 48 Farms with Barn Cleaners, Central New York - 1952

Type of cleaner	Number of cleaners	Average number of cows	Total cost installed	Cost per cow
Continuous chain without pit	22	39	\$1567	\$40
Continuous chain with pit	8	47	1633	35
Reciprocating	6	35	1984	57
Flat Belt	5	36	1105	28
Straight pull-out	1	75	1400	19
Endless chain with pit	1	54	1750	32
Homemade	6	32	326	10
Average for commercial cleaners		41	\$1573	\$38

OPERATION

This section deals with several phases of the operation of barn cleaners. The speed and cost of operation are discussed along with some of the things that influence the effectiveness of barn cleaners.

Speed of operation

Cleaners were operated an average of 16 minutes a day (Table 10). The belt cleaners were operated an average of only 10 minutes each day. The continuous chain and the reciprocating type cleaners required a longer time to remove the manure than the single-gutter type cleaners.

Table 10. RELATION OF TYPE OF CLEANER TO SPEED OF OPERATION
43 Commercial Barn Cleaners, Central New York - 1952

Type of cleaner	Number of cleaners	Average minutes of operation per farm	Minutes per cow
Continuous chain without pit	22	21	.5
Continuous chain with pit	8	18	.4
Reciprocating	6	22	.6
Belt	5	10	.3
Straight pull-out	1	15	.2
Endless chain with pit	1	8	.2
Total or average	43	16	.4

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Cost

The cost calculations in this survey are very general and are intended to be only a guide on cost of operation. The number, size and length of operation of each motor on the cleaner was obtained for each farm. Power factors* for each size of motor were applied and a figure representing the total amount of power in watts was obtained. Finally, cost factors# were used to obtain the cost of operating each type of cleaner.

Table 11. RELATION OF TYPE OF CLEANER TO COST OF OPERATION
45 Barn Cleaners, Central New York - 1952

Type of cleaner	Number of cleaners	Average cost per month	Cost per cow per month (cents)
Continuous chain without pit	22	\$2.65	6.6
Continuous chain with pit	8	1.99	4.2
Reciprocating	6	1.64	4.6
Flat Belt	5	1.25	3.5
Homemade	4	1.80	5.7
Total or average	45	\$1.87	4.9

Since no actual test was made on each individual cleaner, the figures in Table 11 do not take into account the extra power required to start the cleaner. This varies considerably between cleaners. The average cost for all cleaners was \$1.87 per month. The cost varied from \$1.25 for the flat belt cleaner to \$2.65 for the continuous-chain-without-pit cleaner. These same two types had the lowest and the highest cost per cow.

Weather

The difficulties in operation encountered during the winter were a problem to 22 farmers out of the 48 reporting. The remainder said that the weather had no effect on the operation or efficiency of their cleaner. Most of this trouble was due to elevators freezing and paddle cleaners failing to work properly because the manure had become frozen to them. To combat this, 9 of the farmers reported building a shed in which the spreader could be loaded, and 21 farmers planned to build these sheds. These, with 4 farmers who installed their cleaners in sheds already in existence, made a total of 34 farms, or 71 per cent, having sheds or planning to have them. These sheds were also used as a place to store the spreader. Other advantages of the shed were,

- (1) blowing of straw during loading was eliminated
- (2) loading area was kept cleaner

*Power factors furnished by Department of Agricultural Engineering,
N. Y. S. College of Agriculture.
#New York State Electric and Gas Corporation.

Cleanliness

Thirty-seven of the farmers visited reported that the gutter cleaner did a better job than their former method of cleaning. Ten farmers said that it did just as good a job and only one farmer reported a cleaner doing a poorer job. This cleaner never operated correctly and had to be removed from the barn.

Bedding requirements remained the same for the most part. Seven farmers reported that they were using more bedding but this was because the barn was cleaned twice daily. Six farmers reported using sawdust or chopped straw, which prevented heavy manure from sticking to the paddle cleaners and prevented slippage of the belt cleaners from under the manure.

Eleven farmers reported that their cows are cleaner since installation of the gutter cleaner. Some farmers said their barns are cleaner now because none of the liquid manure is spilled on the drive from the spreader.

On 10 of the farms, barns were cleaned twice daily. The reasons given were:

- (1) The cows were cleaner.
- (2) It was a necessary precaution to divide the load in order to

reduce the starting power-load for fear of blowing fuses.

Some farmers reported that the first thing they do when coming into the barn in the morning is to start the cleaner and move the manure ahead one-half the width of the stall.

Obstructions

Seven of the 48 farmers reported that the cleaner obstructed normal operations in or outside the barn. The pit which was located in the main drive accounted for two of these cases. Four farmers placed the blame on the elevator chute which was in the way of the cows and created confusion when they were turned out. One farmer stated that the cows slipped on the steel plates covering the end gutters.

Box Stalls

Wherever possible the cleaner was used to facilitate removal of the manure from the box stalls. This meant that the cleaner had to run relatively close to the stall.

BREAKDOWNS AND REPAIRS

An effort was made to determine the frequency of breakdowns. A breakdown was considered as any stoppage that resulted from mechanical difficulties that held up operation of the cleaner. Some of these breakdowns were minor and required no expense. Others were important enough to cause serious delays.

One cleaner had never operated properly and was being removed at the time of the survey. Another cleaner had required 4 new gutter chains at a total repair cost of \$2400. This machine had been installed more than 4 years. Both of these cleaners were of the continuous-chain-with-pit type. One other farmer with the same type cleaner reported "many" breakdowns but could give no estimate of the actual number. His repair costs had amounted to \$200 in the 43 months the cleaner had been in operation. Another cleaner of a different type was out of operation for 30 days due to breakage of elevator chains shortly after installation.

Of the remaining 39 cleaners, breakdowns had occurred on 23 of them since installation. These cleaners were out of operation a total of 23 days -- less than one day per cleaner. The majority of these breakdowns were of minor importance. Cash expenses for repairs were needed for only 10 of them. The average expense per cleaner for these 10 was \$30 since installation. For the 39 cleaners the average cash expense for repairs was \$7.70.

For all cleaners installed less than a year at the time of the survey, the average cash outlay for repairs was less than a dollar. For those that had been used between 1 and 2 years repair costs averaged \$2.86 and for cleaners installed between 2 and 3 years the average amount spent on repairs amounted to \$29.58.

The length of time cleaners had been installed varied with the type of cleaner. The continuous-chain-with-pit type of cleaners had been in operation for the longest period (32 months). Continuous-chain-without-pit cleaners had been in operation for an average of only 11.5 months. The recent trend has been toward cleaners without pits. In general, farmers with this type of cleaner were more satisfied with the operation than those having continuous chain cleaners with pits. Repair costs in general were highest on the pit type cleaner.

The homemade cleaners all needed a considerable amount of adjustment before they operated properly. One homemade cleaner had never worked satisfactorily. Cash outlays were made for repairs on 4 homemade cleaners. The average amount spent on all 6 cleaners since installation was \$33.50. Three of the homemade cleaners were chain type cleaners and they required the greatest cash outlay for repairs.

MAINTENANCE

The biggest problem in regard to maintenance of barn cleaners appears to be the frequency and manner of oiling. Farmers expressed varying opinions on this matter.

Of the 33 farmers reporting chain cleaners, 21 reported that they oiled the chain -- 12 of them did not oil their chain at all. Of those reporting oiling, 7 oiled the chain once a week, the others varying from every day to twice a year.

The reason for oiling also varied. Several farmers felt that they were adding to the life of the chain. Another farmer stated that the chain did not freeze in the winter when oiled daily.

Those farmers not oiling the chain felt that since the chain was always in the wet gutter, this served the same purpose as oiling. They also stated that oil on the chain is removed by the straw and manure passing over it. However, the farmers who did not oil the chains on the cleaners experienced twice as many breakdowns as the farmers who did infrequent oiling and 3 times as many breakdowns as the farmers who oiled frequently.

EXPECTED LIFE OF CLEANERS

Farmers were asked to make an estimate of the total life of the cleaner from the time it was installed. One farmer predicted that his cleaner would last only 2 years while another estimated a 20 year life for his cleaner. The average cleaner was estimated to last about 9 years (Table 12). The most frequent estimates were for 10 years and 5 years.

Table 12. RELATION OF YEARS OF USE TO ESTIMATED LIFE
37* Farms with Barn Cleaners, Central New York - 1952

Age	Estimated total life (years)	Number of cleaners
Up to 1 year	8.4	14
1 year to 2 years	8.2	11
2 years to 3 years	8.1	7
3 years and over	10.8	6
Average	8.9	38

* 11 records omitted because of incomplete data

The reciprocating cleaner, the most expensive type, was estimated to last about 3 years longer than the chain type cleaners and about 2 years longer than the belt cleaner.

SUMMARY AND CONCLUSIONS

The majority of farmers surveyed expressed satisfaction with their barn cleaners. Only 4 of the 42 farmers with commercial cleaners expressed any real dissatisfaction. In 3 of these cases the unit was too light for the job. Forty of the 42 farmers with commercial cleaners felt that the cleaner was worth its cost to them. The other 2 felt that a cleaner which worked properly would be worth its cost.

Most of the serious mechanical difficulties in barn cleaners have been eliminated. Cleaners now being installed in barns are less complex than earlier models. Breakdowns are few and repairs are usually simple and inexpensive.

Farmers were strong in their feelings that an enclosed area for loading is desirable. Most of the farmers who didn't have an enclosed shed planned to build one.

Most of the suggestions for improving cleaners had to do with making them stronger and better constructed, particularly the chains. The power unit and the transmission gave little difficulty on any of the commercial cleaners.

Other conclusions resulting from this survey:

1. The average farm in this study had twice as many cows as the state average.
2. Farmers buy barn cleaners to make the job easier and to help them get and keep good farm help.
3. There was a tendency for farmers to increase their livestock numbers after buying a cleaner but less tendency toward reducing the labor force.
4. Six types of commercial cleaners were found. Nearly half of the cleaners were of the continuous-chain-without-pit type.
5. Average time required to clean gutters was cut in half by use of a gutter cleaner.
6. The average cost of commercial cleaners installed was about \$1600.
7. The majority of farmers reported that their barns were kept cleaner after a gutter cleaner was installed.
8. The average cleaner was in operation about 16 minutes a day.

9. The average cost of operation based on rough calculations was \$1.87 per month, or about 5 cents per cow per month.
10. Excepting the 4 cleaners which had serious breakdowns, the average cost of repairs per cleaner since installation amounted to \$7.70. The average cleaner had been installed a little less than 20 months.
11. Farmers estimated the average length of life of cleaners at about 9 years.

The installation of barn cleaners has been particularly rapid in the last 2 or 3 years. Part of the reason is probably accounted for by the relatively favorable incomes of recent years. Will barn cleaners continue to gain favor? We think they will. They represent a part of the general trend toward more mechanization on our farms. For the first time the dairy farmer has a machine that eliminates the job of shoveling manure in the barn. A decline in prices might slow up the trend toward mechanical barn cleaners the same as it would slow up mechanization of other farm jobs. There's a possibility of cheaper barn cleaners as more of them are produced. This would make them more readily available to small and average size operations.