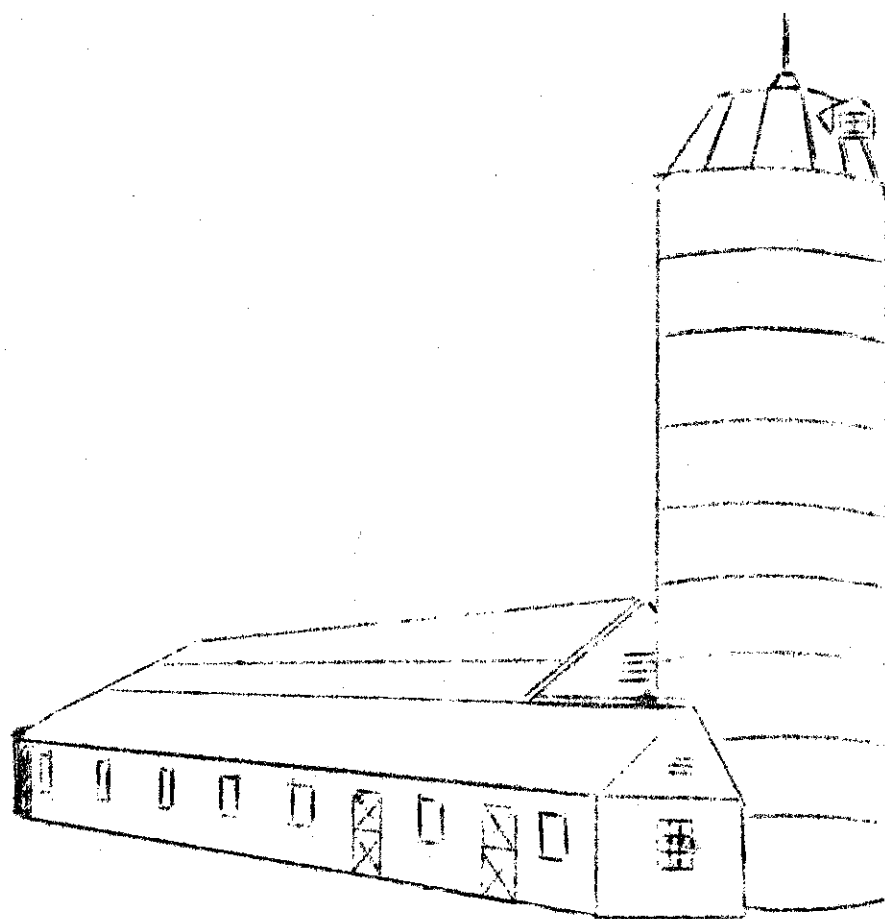


# COSTS IN HARVESTING HAY CROP SILAGE

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## COSTS IN HARVESTING HAY CROP SILAGE, 1947

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### INTRODUCTION

Considerable interest has been shown by farmers in recent years in hay crop silage as roughage feed for cows. Although the number of New York farmers harvesting hay crop silage has increased in recent years, by far the greater proportion of silage harvested by New York farmers is made from corn.

This report deals with the costs of moving hay-crop silage from the field to the silo. In addition, farmers also have the problems of producing as high quality silage as possible and of fitting in the work to be done in handling silage with other farm work. Actually, of course, hay crop silage should be handled before the rest of the hay crop is cut for field-curing, so this may not be a serious problem in most instances.

### Farms Studied

Information concerning the location of farmers who were putting up grass silage was quite limited when the study was undertaken. The farms were selected with the assistance of county agricultural agents.

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<sup>1/</sup> The records were taken in the summer of 1947 by Lloyd Davis. Dr. I. R. Bierly supervised the study. Clerical assistance was given by Leila Cohen and Margaret Solomon. The manuscript was typed by Leila Cohen.

An attempt was made to get about an equal number of records from farms on which field-harvesters and loaders and wagons were used to handle the hay-crop silage, so that certain comparisons could be made between these two groups. In table 1 is shown the number of records by counties. Most of them were in Central New York.

TABLE 1.      NUMBER OF HAY CROP SILAGE RECORDS BY COUNTIES,  
                 34 FARMS, NEW YORK, 1947

County	Number of records
Cayuga	8
Cortland	3
Genesee	3
Ontario	1
Tioga	18
Tompkins	1
Total	<u>34</u>

Method of Study and Data Collected

The information was collected by the survey method. Farmers were asked to estimate crop acreage, numbers of livestock, labor force, machinery costs and use of machinery. The information concerning the harvesting of hay-crop silage was obtained for each field from which hay-crop silage was harvested. Farmers estimated acres and tons of silage, the number of hours taken in mowing, raking, and hauling and storing silage for each field separately. Operators also estimated the number of hours each machine was used in harvesting hay-crop silage for each field. The tons harvested were

estimated by using a silage table to estimate the total amount put into the silo, and then this quantity was divided among the fields by the farmer.

Cost rates came from various sources. Cash labor costs were obtained from farmers. The cost of unpaid family labor was estimated by farmers. The operator's time was valued at 65 cents an hour. These were combined into an average labor rate for the farm, which was applied to the total man hours spent in harvesting hay crop silage. Machinery costs were estimated and otherwise calculated. Depreciation, repairs, gas, oil, and electricity were estimated by the farmer. Interest was calculated at five percent on the average inventory value of each piece of equipment. Insurance was calculated at .4 percent of the average inventory value. Housing costs were those used by Ellis Lamborn in his thesis, Labor Used and the Cost of Harvesting Hay, New York State, 1944-1945. In table 2 is a schedule of housing costs charged.

TABLE 2. HOUSING COSTS CHARGED INDIVIDUAL MACHINES USED IN HARVESTING HAY CROP SILAGE, 34 FARMS, NEW YORK, 1947\*

Machine	Cost per machine
Horse mower	1.50
Tractor mower	1.00
Swather	0.50
Side Delivery Rake	3.50
Hay Loader	3.50
Wagons	2.00
Auto Buckrake	8.00
Stationary Chopper	4.00
Blower	4.00
Field Chopper	4.00
Unloaders	2.00

\* Taken from a study, Costs of Farm Power and Equipment, Cornell University Agricultural Experiment Station Bulletin 751, and adjusted because of increases in costs since then.

Power costs were based on data from Cost Account farms in New York. Tractors were charged at 50 cents per hour; trucks at 65 cents per hour; and horses at 35 cents per hour or 70 cents per team hour. The charge for jeeps was estimated at 65 cents per hour.

### DESCRIPTION OF FARMS

#### Crops

Only farms which harvested hay crop silage in 1947 were included in the study. The farms ranged in size from 111 to 1500 acres with an average of 321 acres (table 3). Twenty-six of the farms had less than 399 acres, and one-third of the farms had between 111 and 199 acres.

TABLE 3. ACRES OPERATED AND ACRES IN MAJOR CROPS,  
34 FARMS, NEW YORK, 1947

Crop	Acres per farm		
	Stationary Chopper	Field Chopper	All Farms
Acres operated	262	404	321
Corn for silage	8	15	11
Corn for grain	9	8	8
Oats	8	13	11
Oats and barley	7	5	6
Wheat	10	20	14
Hay (including hay crop silage)	62	70	65

Hay was, of course, the major roughage crop with an average of 65 acres per farm and was grown on all farms. Acres of hay ranged from 19 to 186, with 24 farms growing between 30 and 99 acres.

Farms on which field choppers were used had a larger acreage in crops. Wheat was the most important cash crop with an average of 14 acres per farm. There was an average of 19 acres of corn, and 32 acres of small grain per farm. Buckwheat, potatoes, cabbage, dry beans and soybeans were grown in small acreages on several farms.

### Livestock

Dairying was the major enterprise on all the farms. The average size of herd was 36 cows with a range of 16 to 80 cows. Fourteen farms had from 30 to 39 cows and nine farms had herds of more than 40 cows (table 4). Farms with field choppers had an average of 12 more cows than farms using stationary choppers. The average size of herd in the survey was 50 percent larger than the average dairy herd as reported in dairy farm management surveys.<sup>2/</sup>

TABLE 4. DAIRY CATTLE ON FARMS, 34 FARMS, NEW YORK, 1947

Class of livestock	Number per farm		
	Stationary chopper	Field chopper	All farms
Dairy cows	31	43	36
Dairy heifers	13	15	14

An average of 14 heifers were kept per farm and all but eight farms were raising heifers (table 4). The most important supplementary

<sup>2/</sup> The average size of herd in the Montgomery County dairy farm management survey was 22 cows as reported by L. C. Cunningham in The Cost of Producing Milk, Montgomery County, 1944-1945, AE 537.  
The average size of herd in the Madison County dairy farm management survey was 23 cows as reported by C. DelMar Kearn in a thesis, Factors Affecting Costs and Returns in Dairying in New York, 1945-46.

livestock enterprise was poultry which was a major enterprise on 12 farms. These farms averaged 324 hens and 368 pullets raised. Sheep were important on only three farms.

#### Size and Labor Efficiency

As an average these farms were almost three-man farms. The average man equivalent was 2.7. Total work units ranged from 350 to 2020 with an average of 980 per farm. This ranks in the highest ten percent of the farms for which survey information has been obtained.<sup>3/</sup>

These farms were also considerably more efficient than the average New York farm on which surveys have been taken. Cows per man averaged 13 and work units per man 385. This is also among the highest ten percent of New York farms.

#### Hay Crop Silage

Hay crop silage was, of course, produced by all farmers in the study. Acreage per farm varied from 7 to 86 with an average of 22 acres. Fourteen farms had between 10 and 19 acres and more than three-fourths of the farms harvested less than 30 acres of silage.

Yields of silage varied widely on farms. The lowest yield was three tons and the highest yield was 14 tons per acre. All farms averaged seven tons per acre and three-fourths of the farms harvested from five to nine tons of silage per acre.

In 1947 farmers began harvesting hay crop silage as early as June 5 although the majority began between June 15 to June 25. This is

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<sup>3/</sup> Farm Business chart for New York farms.



somewhat earlier than hay harvest began on the same farms. The latest date for silage harvest to begin was July 11. More than one-half the farmers finished silage harvest the last week in June. For the rest of the farmers harvest continued into July.

#### Labor Force and Wage Rates

As an average the labor force on the farms consisted of the operator and almost two other full-time workers. The man equivalent was 2.7 for all farms. The range in man equivalent was from 1.1 to 5.0. Two-thirds of the farms had man equivalents of from 2.0 to 3.9.

The same wage per hour of 65 cents on operator's labor was used on all farms. This uniform rate was adopted because operators' estimates of the value of their time fluctuated from 30 cents to \$1.07. The average was 62 cents. Other surveys taken the same summer showed average rates of about the same amount. By adopting a uniform rate, it is possible to eliminate some of the variations in costs due to variation in operators' estimate of the value of their own labor.

This rate of 65 cents per hour for operators' time was combined with wage rates for hired men and unpaid labor where it occurred to obtain an average rate for each farm. The rate for all farms averaged 58 cents with a range from 42 cents to 75 cents. One-half the farms had wage rates from 60 cents to 69 cents.

#### Method of Harvest

There were two principal methods of harvest, based on the method

of chopping silage. These methods were with a field chopper and with a stationary chopper at the silo.

When field choppers were used in harvesting, hay was picked up from the windrow by the field chopper, chopped in the machine and hauled to the silo with either truck or wagons or both. Chopped hay was unloaded with home-made unloaders and blown into the silo. Field choppers were used on 14 farms.

On farms where hay was chopped with a stationary chopper, hay was picked up from the swath or windrow with a hayloader and hauled to the silo by wagon or truck. Hay was then chopped and blown into the silo. Stationary choppers were used on 20 farms. On one farm a buckrake was used to move hay from the field to the stationary chopper. Trucks were employed with stationary choppers on only two farms.

No breakdown in costs of harvesting with wagons and trucks was made. The number of records was not sufficiently large for more detailed analysis.

#### COSTS IN HARVESTING GRASS SILAGE

Costs in harvesting grass silage may be classified under three headings. They are:

1. Labor.
2. Power.
3. Machinery.

Labor costs were incurred in mowing, raking, and hauling and

storing grass silage. Rates per hour were discussed above. Power costs were those costs incurred in supplying power for an implement and include the cost of using tractor, horses, trucks, and jeeps. The rates charged for power were given above. Machinery cost include depreciation, repairs, gas and oil for those machines with a motor, interest, insurance, and housing. The method of computing these costs has been discussed.

Operations in making hay crop silage fall into two groups. The first of these is preparing hay for hauling which includes mowing and raking. The second is hauling and storing and includes picking up hay from the windrow or swath, hauling to the silo and blowing into the silo. Chopping is done either in the field with a field chopper or at the silo with a stationary chopper. Raking was an operation which many farmers omitted. They successfully picked up hay from the swath with a hay loader.

By far the largest part of the total cost of harvesting hay crop silage was incurred in the hauling and storing phase of the task. For 34 farms hauling and storing made up 73 percent to 94 percent of the total costs. One-half the farms had from 80 to 89 percent of the total cost incurred in hauling and storing. For all farms the average was 87 percent (table 5). For farms on which no raking was done 12 percent of total costs was incurred in mowing and raking; for farms on which raking was done 14 percent of total costs was incurred in mowing and raking.

TABLE 5. MOWING AND RAKING AND HAULING AND STORING AS A PROPORTION OF TOTAL COSTS IN HARVESTING HAY CROP SILAGE, 34 FARMS, NEW YORK, 1947

Operation	Percent of total cost
Mowing and raking	13
Hauling and storing	87
Total	<u>100</u>

Labor was the largest item of expense in harvesting hay crop silage making up a little more than two-fifths of the total cost for all farms (table 6). Power and machinery costs each averaged almost 30 percent of total costs.

TABLE 6. LABOR, HORSE, POWER AND MACHINERY COSTS AS A PROPORTION OF TOTAL COSTS IN HARVESTING HAY CROP SILAGE, 34 FARMS, NEW YORK, 1947

Kind of cost	Percent of total cost
Labor	43
Horse	1
Other power (tractor and truck)	27
Machinery	29
Total	<u>100</u>

Machine power was used almost exclusively in the harvest of hay crop silage on these farms. Horses were used on only four farms. Only one farmer used horses in the hauling and storing operation. Thus, horses accounted for only one percent of total costs. Other power, including tractors and trucks (jeeps were also used on two farms), averaged 27 percent of total costs (table 6). Total power as a percent of total costs ranged from 13 to 40 percent as among the

different farms.

Machinery accounted for a little less than one-third of total costs (table 6). The fluctuation was very wide, ranging from 13 to 60 percent. This wide variation in machinery costs was due largely to the use of new, high priced machinery such as field choppers on some farms.

Labor costs, the largest item of expense, varied from 24 to 60 percent of total costs and averaged 43 percent on all farms. Fluctuation in this item of expense was due to the various degrees of mechanization on these farms.

As between the two main operations - mowing and raking and hauling and storing - there was some difference in the proportion each item of cost was of the total costs. Labor made up a smaller percentage and machinery a larger percentage of total costs in the mowing and raking operation than in the hauling and storing operation (table 7). This is to be expected since the mowing and raking operation is fully mechanized while considerable hand labor remains in the hauling and storing operation on some farms.

TABLE 7. LABOR, HORSE, POWER, AND MACHINERY COSTS AS A PROPORTION OF TOTAL COSTS IN MOWING AND RAKING AND HAULING AND STORING OPERATIONS IN HARVESTING HAY CROP SILAGE, 34 FARMS, NEW YORK, 1947

Cost Item	Operations	
	Mowing and Raking	Hauling and Storing
	Percent	
Labor	36	44
Horse	3	*
Power	25	28
Machinery	36	28
Total	100	100

\* Less than .5 percent.

The total cost of harvesting hay crop silage amounted to an average of \$12.95 per acre on an average acreage of 21.8 per farm (table 8). Cost per acre varied from \$3.50 to \$25.65 but 26 farms had costs between \$10.00 and \$20.00 per acre. Mowing and raking costs amounted, as an average, to only \$1.68 per acre on the 34 farms.

TABLE 8. COST PER ACRE AND COST PER TON TO HARVEST HAY CROP SILAGE, 34 FARMS, NEW YORK, 1947.

	Cost
Cost per acre to mow and rake	\$ 1.68
Cost per acre to haul and store	11.27
Total	12.95
Cost per ton to mow and rake	.24
Cost per ton to haul and store	1.58
Total	1.82

The total cost per ton averaged \$1.82 on the 34 farms (table 8). Individual farms ranged from 78 cents to \$4.15 but 30 farms had costs per ton from \$1.00 to \$3.00. For the hauling and storing operations alone the cost per ton averaged \$1.58 on the 34 farms.

A total of 210 man hours per farm were used in harvesting hay crop silage of which 22 hours were employed in the mowing and raking operations and 188 hours or 90 percent in the hauling and storing operations.

Mowing and raking were performed at an average rate of 1.0 acre per man hour. Silage was hauled and stored, as an average, at the rate of 0.8 ton per man hour.

Method of Harvest and Costs

As stated above there were two methods of harvest - with field choppers, used on 14 farms, and with stationary choppers, used on 20 farms. There was little difference in the proportion of total costs made up by the two main operations of mowing and raking and hauling and storing (table 9).

TABLE 9.      MOWING AND RAKING AND HAULING AND STORING AS A  
PROPORTION OF TOTAL COSTS IN HARVESTING HAY CROP  
SILAGE WITH FIELD CHOPPERS AND STATIONARY  
CHOPPERS, 34 FARMS, NEW YORK, 1947

Operation	Percent of total cost	
	Field chopper	Stationary chopper
Mowing and raking	14	12
Hauling and storing	86	88
Total	100	100

Power costs were about the same for each method but machinery costs averaged higher, and labor costs lower for the field chopper method (table 10). The difference in proportion of total costs charged to machinery was due to the use of the field chopper which required a large investment. Field choppers are relatively new machines compared to stationary choppers so that depreciation, interest, and insurance are high during early years of use. In addition some makes of field choppers have motors requiring expenditures for gas and oil. Labor costs represented a considerably larger proportion of total costs in harvesting with stationary choppers than with field choppers (table 10). The added labor was

in the hauling and storing operation.

TABLE 10. LABOR, POWER, AND MACHINERY COSTS AS A PROPORTION OF TOTAL COSTS IN HARVESTING HAY CROP SILAGE WITH FIELD CHOPPERS AND STATIONARY CHOPPERS, 34 FARMS, NEW YORK, 1947

Operation	Percent of total costs	
	Field choppers	Stationary
Mowing and raking		
Labor	38	35
Power	30	27
Machinery	32	38
Total	100	100
Hauling and storing		
Labor	35	49
Power	29	27
Machinery	36	24
Total	100	100

Field choppers were used on larger farms than were stationary choppers. Total work units averaged 1169 on farms harvesting grass silage with field choppers and 852 on farms with stationary choppers. Labor efficiency for the entire farm operation was approximately the same (table 11).

TABLE 11. SIZE OF BUSINESS AND LABOR EFFICIENCY ON FARMS HARVESTING HAY CROP SILAGE WITH FIELD CHOPPER AND STATIONARY CHOPPER, 34 FARMS, NEW YORK, 1947

Method of harvest	Number of farms	Total work units	Work units per man
Field chopper	14	1169	397
Stationary chopper	20	852	378



Although they had larger farms, those farms using field choppers harvested fewer acres of grass silage than those farmers using stationary choppers (table 12). Yields were 1.0 ton per acre higher for farms employing field choppers. Silage was hauled an average 0.3 mile on farms with field choppers and 0.2 mile on farms with stationary choppers.

TABLE 12. ACRES, TONS, YIELDS AND DISTANCE TO BARN IN HARVESTING HAY CROP SILAGE FOR FIELD CHOPPER AND STATIONARY CHOPPER, 34 FARMS, NEW YORK, 1947

Method of harvest	Number of farms	Acres per farm	Tons per farm	Yields of hay crop-silage	Distance to barn
		<u>Acres</u>	<u>Tons</u>	<u>Tons / acre</u>	<u>Miles</u>
Field choppers	14	18	142	7.7	.3
Stationary choppers	20	24	164	6.8	.2

Total costs per acre and per ton were not greatly different for those farms using stationary choppers or field choppers (table 13). Cost per ton averaged \$1.84 on farms using field choppers and \$1.81 on farms using stationary choppers. Man hours per ton harvested averaged 1.2 on farms with field choppers and 1.4 on farms with stationary choppers.

TABLE 13. COST PER ACRE, PER TON, LABOR COST PER TON, AND MACHINERY COST PER TON FOR HARVESTING HAY CROP SILAGE WITH FIELD CHOPPERS AND STATIONARY CHOPPERS, 34 FARMS, NEW YORK, 1947

Method of harvest	Number of farms	Cost per acre	Cost per ton	Labor cost per ton	Machinery cost per ton
Field chopper	14	\$14.22	\$1.84	\$.66	\$.65
Stationary chopper	20	12.30	1.81	.85	.47

Labor costs per ton averaged 66 cents for farms using field choppers and 85 cents for farms using stationary choppers. This was offset by higher machinery costs of 65 cents per ton for farms using field choppers compared with only 47 cents per ton on farms using stationary choppers. Thus, field choppers, while reducing labor costs in harvesting hay crop silage, offset this reduction with higher machinery costs. Of course, there is no question but what the work was easier to do when the field chopper was used.

Of the 14 farms using field choppers seven had unloaders at the silo for unloading hay crop silage into the blower. The unloaders were of four types. On two farms unloaders with a false end in the front of the wagon or truck were used. The false end was pulled back toward the end forcing silage out into the blower. On two farms a canvas unloader was placed in the bed of the truck or wagon. A motor attached to a roller at the back of the wagon rolled up the canvas pulling silage out into the blower. On another two farms a continuous chain powered by a motor was employed. The chain was placed on the bed of the wagon or truck and operated similar to the chain on a manure spreader. On the seventh farm three posts were placed across the bed of the wagon or truck and pulled back toward the end forcing silage into the blower.

Costs of using the different types were studied, although the records were too few to give reliable comparisons. Man hours per ton harvested and labor costs per ton were lower on those farms using unloaders. These lower labor costs were more than offset by higher

machinery costs so that total cost per ton averaged slightly higher on farms where unloaders were used.

Acres of Hay Crop Silage and Costs

Farms were divided into two groups on the basis of the number of acres of hay crop silage harvested. Twenty farms harvested less than 20 acres and 14 farms harvested more than 20 acres. Although there are fewer than the desired number of records for this sort, the data are probably reliable.

The farms with larger enterprises harvested  $3\frac{1}{4}$  acres, more than twice as much hay crop silage as the farms with less than 20 acres of silage. Costs per acre and per ton on the farms with larger acreages were slightly less than on those farms with fewer than 20 acres of silage (table 14).

TABLE 14. NUMBER OF ACRES OF HAY CROP SILAGE HARVESTED AND COSTS PER ACRE AND PER TON,  $3\frac{1}{4}$  FARMS, NEW YORK, 1947

Number of acres of hay crop silage	Number of records	Acres of hay crop silage	Costs	
			Per Acre	Per Ton
Fewer than 20	20	13	\$14.81	\$2.03
20 or more	14	$3\frac{1}{4}$	13.33	1.90

The farms with smaller acreages had yields of about one ton per acre more than the larger farms and also harvested a slightly higher tonnage per man hour of labor (table 15).

TABLE 15. NUMBER OF ACRES OF HAY CROP SILAGE HARVESTED AND YIELD PER ACRE AND TONS HARVESTED PER MAN HOUR, 34 FARMS, NEW YORK, 1947

Number of acres of hay crop silage	Number of records	Acres of hay crop silage	Tons per acre	Tons harvested per man hour
Fewer than 20	20	13	7.8	.8
20 or more	14	34	6.7	.7

Comparison of Hay Crop Silage and Hay

On a dry matter basis one ton of field cured hay is considered to be equivalent to about three tons hay crop silage. In comparing labor used and costs for silage with field cured hay the data for silage was multiplied by three to obtain comparable figures on a dry matter basis to compare with field cured hay. The data for hay are taken from the study, Labor Used and the Cost of Harvesting Hay, New York State, 1944-1945, a Ph.D. thesis written by Ellis W. Lamborn. Although the data were collected two years apart, the comparisons give some indication of the relative amounts of labor used and costs in harvesting hay as field cured hay and as hay crop silage.

To move the equivalent of one ton of hay as hay crop silage (from standing crop to the silo) took 3.6 man hours with a field chopper, and 4.2 man hours with a stationary chopper. This was more labor than was required for many methods of harvesting field cured

hay (table 16). To harvest field cured hay with a loader and stationary chopper took 3.9 man hours per ton, as compared with 4.2 man hours to harvest an amount of hay crop silage that was equivalent in dry matter content with a stationary chopper. To harvest hay with a field chopper took only 2.0 man hours per ton.

TABLE 16. TOTAL COST AND MAN HOURS PER TON FOR HARVESTING HAY\*  
First Cutting, 410 Farms, New York, 1945

Method	Man hours per ton	Total cost per ton
Pitched on by hand	5.0	\$4.89
Loader and wagon	3.5	4.01
Loader and stationary chopper	3.9	4.69
Auto buckrake and blower	3.0	3.48
One man baler	2.7	4.29
Field chopper	2.0	4.37

\* From a Ph. D. thesis, Labor Used and the Cost of Harvesting Hay, New York State, 1944-1945, Ellis W. Lamborn, 1947.

The cost of harvesting the equivalent of one ton of field cured hay as hay crop silage would amount to \$5.43 with a loader and \$5.52 with a field chopper. This was somewhat more expensive than any of the methods of harvesting field cured hay (table 16). Of course, much of hay crop silage could not have been harvested as field cured hay of comparable quality.