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SIZE OF DAIRY COWS IN NEW YORK  
AND THE EFFECT OF SIZE OF COW ON PRODUCTION  
AND PROFITS

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## SUMMARY

During the summer of 1940, a survey crew measured with a "weight tape" over 10,000 cows on 558 New York State dairy farms in five counties. At the same time the enumerators obtained detailed information concerning the breed, breeding, age and origin of each cow, the 1939 milk production of the herd and the 1939 farm business.

The objectives of this study of cow weights were two:

1. To determine the actual sizes and variations in sizes existing among cows in New York State dairy herds.
2. To study the existence and extent of relationships between size of cow, milk production, farm value per cow, and labor income per farm.

The average weights for various breeds and classes of cows, and the variations in weights between comparable groups are indicated briefly in the following summary table and shown in more detail on pages 5-9. Extreme variation in weights was found to exist between groups of cows of the same breed, age, and origin.

Other factors being equal, larger cows produced more milk. An increase in live weight of one hundred pounds meant an increase in production of 500-800 pounds of milk. The rate of increase in production was greater for heavier weights and for registered stock.

Larger cows, with higher production, were valued by their owners almost exactly in proportion to their greater productivity. Cows giving 50 per cent more milk were valued 50 per cent higher.

Larger cows and consequent higher production were directly reflected in labor incomes. The one-fourth of farms in each county, which had the lightest weight cows showed lowest average production and lowest average labor incomes. The one-fourth with heaviest average live weight per cow showed highest average production and highest average labor income.

## SUMMARY OF IMPORTANT TOTALS AND AVERAGES

Number of areas surveyed . . . . .	5 (in 5 counties)
Number of herds measured . . . . .	558
Number of cows measured . . . . .	10,387
Average number cows per herd . . . . .	20
Per cent of cows that were Holstein . . . . .	75.2%
Average age of cows measured . . . . .	5.4 years

Per cent of cows that were registered purebreds . . . . . 14.8%

Per cent of cows raised on the farm . . . . . 60.6%

Weight per cow:

Average of all cows measured . . . . .	963 pounds
" " " Holsteins . . . . .	998 "
" " " Guernseys . . . . .	857 "
" " " Ayrshires . . . . .	909 "
" " " Jerseys . . . . .	793 "
" " " Brown Swiss . . . . .	983 "
-----	
Average weight 2-yr. old Holsteins . . . . .	824 "
" " 6-yr. old and older Holsteins . . . . .	1050 "
-----	
Average weight lightest 10% mature Holsteins . . . . .	820 "
" " heaviest 10% " " . . . . .	1305 "
	(difference 485 pounds)
-----	
Average weight all grade Holsteins . . . . .	978 "
" " all registered " . . . . .	1087 "
	(difference 109 pounds)
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Size - Production Relationship:

Average weight of cows in lightest 10% of herds . . . . .	792 pounds
" " " " " heaviest 10% of herds . . . . .	1140 "
	(difference 348 pounds)
" production of cows in lightest 10% of herds . . . . .	.5070 "3.7% milk
" " " " " heaviest 10% of herds . . . . .	.7886 " " "
	(difference 2816 pounds)
Additional milk per 100# increase in live weight -- 500-900 lbs. milk	

Size - Production - Value Relationship:

Per cent live weight increase between cows in lightest and heaviest 10% of herds . . . . .	44%
Per cent milk production increase between cows in lightest and heaviest 10% of herds . . . . .	55.5%
Per cent increase in operator's estimated farm value of cows between lightest and heaviest 10% of herds . . . . .	55.7%
Average estimated farm value of cows in lightest 10% of herds . . . . .	\$70
Average estimated farm value of cows in heaviest 10% of herds . . . . .	\$109

Size - Production - Labor Income Relationship:

Average labor income on one-fourth of farms with lowest average weight per cow (and lowest average production per cow) . . . . .	\$207
Average labor income on one-fourth of farms with highest average weight per cow (and highest average production per cow) . . . . .	\$944

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How large are dairy cows in New York State?

What effect does size of cow have on milk production and farm incomes?

These two questions are frequently asked by dairymen. A knowledge of the range and average of cow weights in an area will enable a farmer to more accurately appraise his own animals. Information as to any relationship between size of cow and milk production per cow will aid in the determination of replacement policies.

In order to obtain answers to the two questions the Agricultural Economics department, as part of a survey of milk production costs, obtained the "measured weights" of 10,387 cows on 558 New York dairy farms in five counties.<sup>1/</sup> At the same time information was obtained as to the breed, age and origin of each cow, and likewise complete farm business and dairy enterprise reports were taken. These data were summarized and analyzed during the winter of 1940-41. A summary of the results dealing with size of cow, production and returns is given in this report.

I. How Large Are New York State Dairy Cows?

Breed, age, and source of cow measured:

Somewhat more than 100 herds were "measured" in each of the five counties. Orange County herds contained the largest number of cows per herd, Cayuga County herds the least (table 1). Seventy-five per cent of the cows were Holstein, 11 per cent Guernseys, 7 per cent Ayrshires, 6 per cent Jerseys, and 1 per cent other breeds.

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<sup>1/</sup>Dr. W. M. Curtiss, Assistant Professor of Marketing, and Dr. L. C. Cunningham, Extension Associate Professor of Farm Management, planned and supervised this survey. The field work was done from June to September, 1940, in Cattaraugus, Cayuga, Chenango, Orange, and St. Lawrence counties by a crew led by Ivan R. Bierly.

TABLE 1.  
THE NUMBERS OF HERDS AND OF COWS MEASURED  
558 New York Dairy Farms, 1940

County	Number of herds measured	Number of cows measured	Average number cows measured per herd	Actual average number cows per herd 1939-40
Cattaraugus	108	2,081	19	19
Cayuga	106	1,045	13	14
Chenango	107	1,961	18	20
Orange	119	2,756	23	28
St. Lawrence	118	2,184	18	19
Total	558	10,387	19	20

Chenango County contained the highest percentage of Holstein cows, nearly 91 per cent, and Cattaraugus the lowest with 65 per cent. Cayuga County led in the proportion of Guernseys with about 22 per cent (table 2).

TABLE 2.  
PER CENT OF COWS OF EACH BREED  
10,387 Cows in 558 New York Dairy Herds, 1940

Breed	Per cent of cows of each breed					
	Cattaraugus	Cayuga	Chenango	Orange	St. Lawrence	All areas
Holstein	65.0	68.8	90.8	73.1	77.8	75.2
Guernsey	14.5	21.7	4.2	13.8	2.8	10.9
Ayrshire	10.7	4.0	1.2	5.8	10.8	6.7
Jersey	9.2	3.9	3.7	5.1	8.1	6.1
Brown Swiss	—	1.4	—	1.8	—	0.7
Others	0.6	0.3	0.1	0.3	0.5	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

There was little variation between areas surveyed as to the average age of cows (table 4). Orange County cows averaged oldest with 5.6 years, and Chenango County cows the youngest with 5.1 years. The average age per cow in Cattaraugus County was 5.4 years, in Cayuga 5.3 years, in St. Lawrence 5.4 years. The average for all areas was 5.4 years.

About 25 per cent of the cows measured were 2 or 3 years of age, about 30 per cent were 4 or 5 years of age, and 45 per cent were 6 years or older. This was true for the major breeds represented and for the various counties.

Nearly 15 per cent of the cows were registered purebreds, the remaining 85 per cent classed as grades. By counties the per cent registered were: Cattaraugus 10 per cent, Cayuga 16 per cent, Chenango 31 per cent, Orange 4 per cent, and St. Lawrence 16 per cent. About 17 per cent of the Holsteins were registered in the entire area but in Chenango County 34 per cent were registered. Seven per cent of the Guernseys were registered in the entire sample but 21 per cent of the Guernseys in Cattaraugus County were registered.

Approximately 61 per cent of the cows had been raised on the farms where measured and 39 per cent purchased. By counties, the per cent raised on the farm was: Cattaraugus 77 per cent, Cayuga 70 per cent, Chenango 72 per cent, Orange 32 per cent, and St. Lawrence 70 per cent. By breeds the proportions of cows raised on the farm and purchased were about the same though a slightly higher percentage of Guernseys had been purchased.

The cows measured were in commercial dairy herds containing generally from 11 to 40 cows. Only 5 per cent of the cows were in herds of ten or less; 34 per cent were in herds of 11 to 20; 34 per cent were in herds of 21 to 30; 16 per cent were in herds of 31 to 40; and only 11 per cent were in larger herds.

The "typical cow" of the survey was a grade Holstein, about five years old, raised on the farm where she was being milked in a 20-cow herd — and she weighed 998 pounds!

#### Weights of the cows:-

The average weight of all cows measured was 963 pounds. Chenango County had the heaviest average with 1,011 pounds, Cattaraugus the lightest with 902 pounds (table 3). The Holstein cows averaged 998 pounds and Guernseys 857 pounds in weight. The differences between these averages represented differences in breed, age, and proportion of registered cows.

TABLE 3.

#### AVERAGE WEIGHT PER COW BY BREEDS 10,387 Cows in 558 New York Dairy Herds, 1940

County	Average weight in pounds per cow					
	All breeds	Holstein	Guernsey	Ayrshire	Jersey	Brown Swiss
Cattaraugus	902	956	806	842	754	---
Cayuga	974	1,016	882	947	797	972
Chenango	1,011	1,030	836	915	815	---
Orange	981	1,011	902	955	825	1,008
St. Lawrence	946	976	860	885	783	890
All	963	998	857	909	793	983

One-half of the Holstein cows weighed between 900 and 1,100 pounds. About one-fourth weighed less than 900 pounds, about one-fourth weighed more than 1,100 pounds. Approximately one-half of the Guernseys were between 800 and 1,000 pounds. Somewhat more than one-fourth weighed less than 800 pounds, only 17 per cent weighed more than 1,000 pounds.

The average weights for cows of specific breeds and age groups were as given in Table 4. The mature Holsteins averaged 1,050 pounds, Guernseys 913 pounds, Ayrshires 954 pounds, and Jerseys 845 pounds.

TABLE 4. AVERAGE WEIGHTS OF COWS BY BREEDS BY AGE GROUPS  
10,128 Cows in 5 New York Counties, 1940 <sup>2/</sup>

Age in years	Average weight in pounds per cow			
	Holstein	Guernsey	Ayrshire	Jersey
2	824	712	761	686
3	929	791	860	739
4	979	870	925	784
5	1,015	864	914	807
6 and more	1,050	913	954	845

Within the breed and age groups there was extreme variation. A difference of more than 500 pounds existed between the average weight per cow in the lightest and heaviest tenths of 5-year-old Holsteins (table 5). About the same variation was found within other age groups and for each breed and/or area.

<sup>2/</sup>Due to certain inadequacies in the data concerning a few cows in a few herds, the numbers of cows and of herds on which the various tables are based varies somewhat as will be noted in this report. However, the data for all animals and herds on which the required information was available were included in each tabulation. There was no selection.



TABLE 5. DISTRIBUTION OF WEIGHTS OF ALL HOLSTEIN COWS  
WITHIN AGE GROUPS  
7713 Holstein Cows in 5 New York Counties, 1940

	Average weight in pounds per cow				
	2 years old	3 years old	4 years old	5 years old	6 years and older
1. Lightest 10% of cows	626	700	737	774	820
2. Next heavier 10% of cows	711	782	831	867	904
3. " " " " "	751	832	886	922	953
4. " " " " "	791	871	925	962	991
5. " " " " "	827	907	961	999	1,024
6. " " " " "	857	946	998	1,031	1,060
7. " " " " "	901	981	1,033	1,066	1,097
8. " " " " "	947	1,019	1,077	1,108	1,137
9. " " " " "	994	1,072	1,131	1,162	1,196
10. Heaviest 10% of cows	1,098	1,182	1,250	1,282	1,305
Range between extremes	472	482	513	508	485

The variations in weight within age and breed groups were considerably greater than the variations between areas (table 6). The extreme range between average weights for 4 and 5 year old Holsteins in the 5 areas was only 78 pounds, while the range within the age groups as previously mentioned was about 500 pounds.

If the comparison is limited to the same breed and age group, there would seem to be little foundation for the opinion held in some areas that cows from other areas average considerably smaller.

TABLE 6. AVERAGE WEIGHTS OF DIFFERENT AGE GROUPS OF HOLSTEINS  
7,713 Holstein Cows in 5 New York Counties, 1940

Area in:	Weight in pounds per cow for ages		
	2 and 3 years	4 and 5 years	6 years and older
Cattaraugus	866	959	1,003
Cayuga	836	998	1,083
Chenango	932	1,037	1,090
Orange	882	1,004	1,050
St. Lawrence	836	983	1,023
All areas	890	1,000	1,050
Extreme range, pounds	96	78	87

Purebred Holsteins averaged more than 100 pounds heavier per cow than the grade Holsteins, although slightly younger than the grade cows (table 7). Purebred cows of the other breeds did not average substantially heavier than the grades, probably because the grades were in many cases part Holstein.

TABLE 7. AVERAGE WEIGHTS OF GRADE AND REGISTERED COWS, BY BREEDS  
10,225 Cows in 5 New York Counties, 1940

Class	Weight in pounds per cow			
	Holstein	Guernsey	Ayrshire	Jersey
Grade	978	857	898	791
Registered	1,087	866	962	789

Raised and purchased cows of the same breed weighed about the same for the entire groups studied. While there was some variation between areas, there seemed to be no significant difference in weight due to origin. In some areas the home-raised cows were slightly younger than the purchased animals.

Herds containing rather large numbers of cows averaged heavier than herds of fewer cows. In general, herds of 31 to 40 cows averaged heaviest but in Orange County the heaviest average weight per cow was in herds of 51 to 60 cows (table 8).

TABLE 8. AVERAGE WEIGHT PER COW BY SIZE OF HERDS  
10,387 Cows in 558 Dairy Herds in 5 New York Counties, 1940

Size of herd	Weight in pounds per cow for areas in:					Five areas
	Cattaraugus	Cayuga	Chenango	Orange	St. Lawrence	
0 - 10	805	952	955	979	893	917
11 - 20	854	970	958	950	949	936
21 - 30	934	975	1,022	980	941	970
31 - 40	969	<u>1,077</u>	<u>1,107</u>	976	<u>1,015</u>	<u>1,029</u>
41 - 50	<u>972</u>	900	1,047	1,029	871	964
51 - 60	925	---	1,079	<u>1,031</u>	---	1,012
61 and more	---	---	---	984	---	984

#### Comparison of weights with "standards"

The average weights per cow obtained on this survey were considerably lighter than the weights recommended by breed associations and which are obtainable under ideal conditions (table 9). Standards for a breed are to some extent "goals" and farm conditions are not ideal so the fact that the cows measured averaged lighter than desired should not occasion surprise.

TABLE 9. COMPARISON OF SURVEY AVERAGES OF COW WEIGHTS  
WITH "STANDARD" WEIGHTS FOR MATURE COWS\*

Breed	Mature cows should be: (pounds)	Ideal or very desirable for mature cows (pounds)	Average for all cows 6 years old or more in 5 areas surveyed (pounds)	Difference between survey average and standard
Holstein	1,250	1,450 - 1,500	1,050	-200
Guernsey	1,100	not given	913	-187
Ayrshire	1,000	not given	954	- 46
Jersey	900	900 - 1,100	845	- 55

\* "Standard weights" as given by Henry W. Vaughn in Breeds of Livestock in America (R. G. Adams & Company, 1931).

Well fed dairy cows of good quality can attain and exceed the weight standards set up by the breed associations. In experiments at various state experiment stations and at the federal research farm at Beltsville, Maryland, groups of mature Holstein cows averaged about 1,400 pounds as compared with the 1,250 pound "standard" and the survey average of 1,050 pounds.

Approximately 10 per cent of the mature Holsteins and 4 per cent of the mature Guernseys measured on the survey equalled or bettered the standard weights given in column one of table 9.

There is no reason to believe that cows on New York dairy farms are lighter than those in other dairy areas. However, by good breeding and feeding practices, the average size of cows could be considerably increased.

## II. What Effect Has Size of Cow on Milk Production and Labor Income?

The "typical cow" of the survey was grade Holstein, 5 years old, home raised, in a 20 cow herd. She weighed 998 pounds, valued at \$84, produced about 6,500 pounds of milk in 1939-40 . . . and if she had weighed 1,098 pounds, she would have produced about 7,250 pounds of milk!

Earlier studies based principally on D.H.I.A. records and purebred herds had clearly indicated the existence of a direct relationship between size of cow and milk production. While such studies had been confined to selected samples of small numbers of high quality cows, they had indicated that other factors being equal, an increase of 100 pounds in average size of cow meant 500 to 900 pounds additional milk per cow per year.

This survey was designed to study the existence of such relationship between size and production in a large number of dairy herds under actual farm conditions. The "measured" weight of each cow, the total milk production of each herd, the operator's estimate of value per cow, and the 1939-40 labor income per farm were available for analysis.

#### Relation between size and production

One hundred pounds increase in weight per cow meant about 500-900 pounds more milk per cow annually. While it was difficult to specify the exact amount of the increased production, the relationship was apparent for all portions of the sample, for all areas, and for various methods of analysis (table 10). Larger cows, other factors being equal, produced more milk.

TABLE 10. RELATIONSHIP BETWEEN SIZE OF COW AND MILK PRODUCTION PER COW  
554 Herds in Five New York Counties, 1940.

	Average		Difference		Pounds milk per 100 weight increase	Average farm value per cow (dollars)
	Weight per cow (pounds)	Milk produced per cow (3.7% milk)	In weight of cows	In Production per cow		
1. 10% of herds with lowest average weight per cow	792	5,070	---	---	---	70
2. Next heavier 10% of herds	842	5,535	50	465	930	76
3. " " " " "	876	5,737	32	202	631	82
4. " " " " "	908	5,935	32	198	620	82
5. " " " " "	935	6,123	27	188	696	80
6. " " " " "	964	6,654	29	531	1,831	87
7. " " " " "	992	6,439	28	-215	-768	84
8. " " " " "	1,026	6,948	34	509	1,497	88
9. " " " " "	1,061	7,614	35	666	1,903	93
10. 10% of herds with highest average weight per cow	1,140	7,886	79	272	344	109
Range between groups 1 and 10	343	2,816	---	---	821	---
Per cent increase from lightest to heaviest	43.9	55.5	---	---	---	55.7
Average of rates of increase between 10% groups	---	---	---	---	854	---

The survey samples of breeds other than Holstein were inadequate to permit study of differences between breeds as to the effect of size on production. The direct relationship seemed to hold true for all breeds in the sample.

Within each age group, increased size of cow meant increased production. The large "5-year-olds" produced more than the small "5-year-olds" and other age groups likewise (table 11).

TABLE 11. RELATIONSHIP BETWEEN SIZE OF COWS AND PRODUCTION PER COW  
BY AGE GROUPS  
462 Herds in Five New York Counties, 1940

Class	Average weight per cow	Average production per cow (3.7% milk)	Average farm value per cow
<u>4 years average age (74 herds)</u>			
1. 1/3 of herds with lightest average weight per cow	804	5,528	\$77
2. Middle 1/3 of herds	918	6,375	83
3. 1/3 of herds with heaviest average weight per cow	1,040	7,631	100
<u>5 years average age (201 herds)</u>			
1. 1/3 of herds with lightest average weight per cow	837	5,575	75
2. Middle 1/3 of herds	946	6,484	86
3. 1/3 of herds with heaviest average weight per cow	1,076	7,676	98
<u>6 years average age (187 herds)</u>			
1. 1/3 of herds with lightest average weight per cow	863	5,484	79
2. Middle 1/3 of herds	965	6,309	82
3. 1/3 of herds with heaviest average weight per cow	1,071	7,137	94

The rate of increase in production per 100 pounds extra live weight increased with average size of cow. That is, an additional 100 pounds weight meant a greater production increase if added to 1,000 pound cows than if added to 800 pound cows. This fact may in part at least explain why registered cows (which were larger) showed a greater increase in production per increase in size than did grade cows.

The important conclusion was that, other factors being equal, increased size meant increased production.

### Relationship of Size, Production, and Farm Value per Cow

The owners of the herds surveyed were evidently aware that larger cows produce more milk, for the operators' estimates of values on their cows were closely related to differences in size and production. The tenth of the herds containing the heaviest cows were 44 per cent heavier than the lightest ten per cent group, produced 55.5 per cent more milk, and were valued at 55.7 per cent more per cow (table 10).

This increase in value per cow proportionate to increased size and production was evident whether the herds were classified by age, breeding, origin, size of herds, or areas (see table 11).

Since many of the costs of keeping cows do not vary directly with increased size of cow, or with increased production, the larger, higher-producing cows were the most efficient producers, even though they were priced in proportion to the physical quantities of milk produced.

### Effect of Size-Production Relationship on Labor Income

Milk production per cow is one of the major factors affecting incomes on New York State dairy farms. Professor L. C. Cunningham in Cornell Bulletin 307, lists five major factors: "production per cow, crop yields, size of business, labor efficiency, and the relative importance of the cow enterprise." Therefore, as size of cow affects production per cow, production in turn affects income. This was shown by the results for the entire group of 535 dairy farms. Cows in herds averaging less than 900 pounds live weight produced 5,404 pounds milk each annually and the farms showed an average annual labor income of \$128. Herds of heavier cows produced more milk and the farms showed larger labor incomes. The groups of farms with the heaviest herds showed an average milk production of 7,870 pounds per cow, and an average labor income of \$1,194 (table 12).

A similar relationship between size - production - income was evident for each county in the sample.

TABLE 12. SIZE OF COW, MILK PRODUCTION PER COW, AND LABOR INCOME  
PER FARM FOR ENTIRE SURVEY SAMPLE  
535 Dairy Farms in Five New York Counties, 1939-40

Group	Number of herds	Average weight per cow (Pounds)	Average milk production per cow (Pounds)	Average labor income per farm
Herds containing cows averaging less than 900 pounds	156	832	5,404	\$128
Herds containing cows averaging 900-1,000 pounds	194	944	6,269	451
Herds containing cows averaging 1,000-1,100 pounds	143	1,041	7,225	638
Herds containing cows averaging more than 1,100 pounds	42	1,152	7,870	1,194

Breeding, feeding, and care of growing heifers and cows all affect the size of cows and to some extent affect milk production independent of size of cow. Nothing in this report should be construed to minimize the importance of such factors. However, other factors being equal, it would seem that the dairymen in determining his policies of cow selection and/or heifer growing should consider among other points the following items:

1. Important variations exist as to size of cows within age and breed groups. The difference may be more than 500 pounds between animals of similar ages, breeds, breeding, and origin.
2. Other factors being equal the larger cow will produce 500 to 800 pounds more milk annually for each extra 100 pounds body weight.
3. Milk production per cow is one of the major factors affecting dairy farm income. There is a direct relationship between production per cow and labor income. Generally better than average production is responsible for better than average income.