A MODIFIED METHOD OF REPORTING RECORD OF PERFORMANCE IN CANADIAN AYRSHIRE CATTLE

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I. INTRODUCTION

Dairy farming is practised primarily for economic gain. Two main factors contribute towards production of milk and fat. These two factors are the hereditary material of the herd and the environment in which the herd lives. Inheritance and environment interact and determine production. The dairy farmer must, therefore, aim at establishing, maintaining, and improving the hereditary material in the herd. This can be achieved through the use of a planned scientific breeding program.

In order to enable cattle to produce to the capacity of their genetic potential, optimum environment must be provided, through proper management, feeding and freedom from disease.

Thus the following main factors, which condition the performance of the dairy cow, are of paramount importance to the dairyman:-

Breeding, management, feeding and freedom from disease.

It is essential that the farmer keep accurate accounts, of the record of performance, of all the cattle in the herd at all times. This is necessary so that he can assess at any time, the true value of the animals. This information serves to guide the breeding program, also the feeding practice, and can in some instances indicate the presence of disease in animals.

The record of performance of a bull in a herd is of greater importance than the record of performance of any one cow. This is illustrated by the old saying that - 'a good bull is half the herd, while a poor bull is the whole herd'. The performance of a bull is stated in terms of pounds milk,pounds fat, and percentage of fat. These figures represent the average transmitting ability of the bull to

the offspring, and, collectively the figures are referred to as the sire index. A sire index is calculated from a knowledge of the production in terms of, milk and fat, of the daughters of a bull and also the production of their respective dams.

Breed Associations are formed with the prime object of working in the best interests of the particular breed. The functions of a Breed Association include the encouraging and furthering of any project that may improve the individual herd and the breed as a whole. The place of Government in Democracy is to provide a framework within which the individual may prosper. Consequently through co-operation of the Department of Agriculture and the Breed Associations, a voluntary system for testing the performance of purebred cattle has been established. This system, which is termed The Canadian Record of Performance for Purebred Dairy Cattle, gives official recognition to the production of dairy cattle. These figures are made available to the farmer for his own use.

In order to promote the best use of these figures by the farmer, they must be presented in as simple a form as possible. This is necessary because most farmers have not the time, nor the patience, nor the desire, to detach themselves from their daily practical endeavours and engage themselves with calculations that even bear the slightest signs of complexity.

The present system does have value both to the individual dairyman and to the entire industry. However, if a more simple, and more readily applicable system were developed, it is felt that a greater degree of accuracy in selection and breeding practice would result.

It is important,therefore, that some research be carried out, with a view to developing a simple system of reporting

Record of Performance, which will be readily appreciated and used to advantage by the dairy farmer. Such is the aim of this endeavour.

II. A REVIEW OF CERTAIN CONSIDERATIONS ON MANNER AND MODE OF MILK AND FAT SECRETION.

Espe[6] has discussed at length several factors, which condition the quantity of milk and fat secreted by the dairy cow.

(1) Number of Times Milked per Day:

By milking at shorter intervals, from four to six hours, the pressure in the udder is relieved with a resulting increased rate of secretion, and a greater total yield. This relieving of pressure by frequent milking tends to increase the total fat yield relatively more than the total milk yield. At least, the fat test is usually higher when cows are milked frequently than when milked less often.

Experiments indicate that there is commonly a 10-15 per cent increase in milk production, resulting from milking a cow three times per day as compared with twice a day. Also a 15-25 per cent increase may be expected from four times per day milking as compared with twice a day. However, as the rate of secretion declines with advancing lactation, and the intra-alveolar pressure fails to rise as high between milkings as in the earlier part of the lactation period, the advantage of more frequent milking is less apparent.

(2) Age of Cow:

Although the total amount of milk produced tends to increase until the cow is about eight years of age, the increase after the fifth year is relatively unimportant.

Milk flow increases with increasing age, but at a constantly diminishing rate, until a maximum is reached. After the age of maximum flow is passed, the flow diminishes with advancing age and at an increasing rate. The rate of decrease after the maximum is much slower than the rate of increase preceding the maximum.

The increase of body weight contributes about twenty per cent to the total increase in fat production with age, while eighty per cent of the increase in fat production with age is due to the development of the mammary glands with recurring pregnancy.

There is also a slow but persistent decrease in the fat percentage of the milk as the cow becomes older. This drop is unimportant from a practical standpoint since the test usually fails to drop more than two to three tenths of one per cent during the entire life time of the cow.

(3) Stage of Lactation.

Following parturition the daily production of milk tends to increase with most cows for a period of fifteen to thirty days. The time required to reach maximum production with high producing animals is usually longer than that required for low producing animals. After a period of thirty to fifty days, the production usually begins to decline gradually. Factors besides individuality and breed, which affect the decline in milk production are frequency of milking, age, seasonal changes, state of nutrition, pregnancy and general management. During the lactation period the percentage of fat in the milk varies inversely with the amount of milk secreted, although not in direct proportion.

Eckles,[5] Combs, and Macy give the following figures to show the production trends in a normal lactation.

Month of Lactation	Av.Daily Milk Yield (Pounds)	Milk Yield Percentage of Highest Yield	Fat Content Percentage
1	32.9	99.6	4.07
2	33.0	100.0	3.94
3	30.3	92.0	4.06
4	28.4	86.0	4.00
5	27.0	82.0	4.10
6	24.7	75.0	4.10
7	23.4	71.0	4.17
8	22.7	69.0	4.20
9	21.1	64.0	4.20
10	17.1	52.0	4.50
11	11.3	34.0	4.59
12	3.8	11.5	4.70

(4) Season of Year.

Feed changes with season, hence there is a change in nutritional effect with change of season.

However, due to changes other than feeding, cows usually test from fifteen to twenty per cent lower in summer than in winter. Some experimental work indicates that there is an increase of at least 0.2 per cent in the fat test for every 10 degrees drop in temperature between 30^{0} and 70^{0} F. Cows normally testing high are influenced to a greater degree than cows with low fat tests. The exact reason for this change in fat content of the milk is not clear, although it is generally agreed that environmental temperature is largely responsible for seasonal variations in the percentage of fat in the milk, and that these variations are inversely proportional to the temperature. This inverse relationship may not hold true for excessively high temperatures.

The total yearly yield of milk is usually 10 to 20 per cent greater when the cow freshens in the Fall or Winter, than in the Spring or Summer. This increase is probably the result of more favourable environmental conditions in Winter and more digestible feeds.

II. (B) THE MODE OF INHERITANCE OF MILK AND FAT PRODUCING ABILITY.

Turner[18] discusses the main factors affecting milk and fat production, and later proceeds to suggest the manner in which these characteristics are inherited.

The expression of quantitative production is greatly influenced by environment. This is especially true of the ability of the dairy cow to secrete milk and fat during a lactation period. The production of the dairy cow is influenced by feed and management, not only during the lactation period, but also during the period of growth and development.

Such factors as pregnancy, seasonal temperature, season of freshening, and frequency of milking have an effect on maximum production. It is probable that only a few cows fully demonstrate their inheritance. Yet under official test conditions of feeding, management, and verification of records, there is a large group of production records which approach full demonstration of the inheritance of potential ability for milk and fat secretion.

Turner[18] states that a trait or characteristic which is visible in a physical sense is the resultant of the presence and activity of a gene or genes in the cells of the developing organism. A characteristic may be the resultant of one gene or of many genes acting together. On the other hand a single gene may influence many characteristics. The production of milk and fat is probably the resultant of many genes.

Many body characteristics relate to milk and fat production, namely, body size development of mammary gland, and favourable hormone balance. Thus milk and fat production results from the harmonious

functioning of many parts of the body.

The usual theory of multiple factors in blending inheritance assumes a lack of dominance, and that each gene is equal to every other gene in its influence on the characteristic affected. Shull[17] states that the postulation of lack of dominance, which has always been made the basis of the interpretation of multiple factor inheritance, may not be correct. It is doubtful whether the several genes involved express equal influences. Blending inheritance may be caused by genes of unequal influence, some of which may be dominant, others recessive, and some lacking dominance.

Turner[19] sets forth the following three point theory on the mode of milk and fat inheritance:-

1. Milk and fat secretion by the dairy cow is influenced by many genes.

   Since milk and fat production depends on the harmonious functioning of many parts of the body, it is very probable that many genes are involved. Also, the extreme variation in fat production in dairy cattle from about 100 pounds up to 1200 pounds is an exceptionally wide range, and indicates that many genes are concerned.

2. Many of the genes favouring high production are dominants.

   In the case of milk and fat production it has been suggested that while there may be some genes influencing this characteristic, which lack dominance, yet the great majority display at least partial dominance.

   Turner[19] cites the conclusion reached by Gowen, from a comparative study of four Angus cross-bred daughters with their dams, as well as from data taken from advanced Registry records, that high milk yield is dominant over low yield. This dominance is not complete, the yield of the crossbreeds really being intermediate, but nearer to that of the high yielding line. This

theory of dominance is opposed by some, especially the adherents to heterosis. Turner[19] concludes by saying that it seems reasonable to sum up the situation, by saying that it is not known whether the high yielding or low yielding factors are dominants or recessives; nor whether some of each kinds are dominants and some recessives.

3. All genes do not have the same effect.

From the nature of the widely varying characteristics, which in their summation result in milk and fat production, it seems improbable that all genes affecting all the associated characters would be equal in effect.

III. THE SIRE INDEX PROBLEM

(1) A Review of Present Sire Indexes.

A number of indexes have been suggested in recent years. These aim at making allowances for the unreliability of the production of the dams as a basis for estimating their contribution to their offspring, and for the tendency for regression towards the breed average.

Rice[16] states what a sire index should be and what it should do as follows. It should be:-

1) Sound from a genetic standpoint.
2) Easily arrived at and understandable.
3) Calculated in terms of the breed average.
4) Comparable in variability to groups of animals rather than to individuals.

It should do the following:-

5) Rank bulls in their proper order.
6) Provide a definite measuring stick for the bull's transmitting performance.
7) Provide a means for predicting future daughters' production.
8) Provide as accurate a means as possible for evaluating pedigrees.

At one time, dairy bulls were judged on the basis of their daughters' production alone. This cannot be correct, since it does not take into account the fact that the level of the dams' production influences their daughters' production. It is well established that the genetic make-up of the cows to which a bull is mated, will influence the production of his daughters.

Rice[16] points out that there is a definite correlation between records of daughters and dams.

The influence of environment has also to be considered. In most cases daughters and dams are tested in the same herd. If the environment of that herd is better than average, both records are likely to be raised, and vice versa. Thus the amount of environmental effect on daughter-dam correlation depends both on how widely the average environment differs from herd to herd in the material being studied, and on how much influence these environmental differences have on milk and fat production.

Some years ago H.W.Norton, Jr., in some unpublished work suggested an index based on the principle of regression. It has long been observed that the progeny of cows above the average productive ability of the breed tend to produce above the breed average but less than their dams, and that daughters of cows below the breed average tend to produce below the breed average but not as far below as their dams. Norton[14] proposed that the expected production of the daughters (from dams of given level) should be substituted for the dams' actual average production figure, and then proceed in the usual equal-parent fashion. This formula would be:-

$$\text{INDEX} = 2X - E$$

where X = daughters' average and E = daughters' average expectation.

Allen[1] proposed a modification of Norton's index for rating of sires. Twice the deviation of the sire's daughters' production from the expected is added to the breed average for potential performance of the sire. To estimate probable production of future daughters, the deviation of his daughters' from expected is added to the expected production estimated for daughters of the cows to which

he is mated. This method applies the equal-parent principle with an allowance for regression and general differences of environment.

Almost simultaneously, Rice[16], who studied the problem of daughter-dam correlations, published a method for evaluating progeny-tested sires, based on the same fundamental concepts. This method differs from Allen's, in that the deviation from expected production is not doubled before adding to the breed average. The basis of this new index is finding the difference between his daughters' actual and normally expected productions and adding this difference to the breed average. This index proposed by Rice[16] differs from the equal parent index, in that the latter system deals with the actual records of dams and daughters, without specific reference to the breed average.

Summary of indexes:-

EQUAL -PARENT	= X ∕ X - Y.	X= daughters' average production
NORTON	= X ∕ X - E.	Y= dam's average production
RICE	= W ∕ X - E.	E= daughters' expectation W= breed average

Lush[16] has pointed out that nearly all of the proposals for expressing numerically the transmitting ability of a dairy sire are special forms of the general equation:-

$$I = a \pm c (x - by)$$

where I = the index

a = a constant which brings the average of the whole group of indexes to the desired level, but does not alter the difference between any two sires.

c = a constant which can be used to expand or contract the variability of I without changing any correlation between it and other variables.

x = the average record of the daughters of the sire

Y = the average record of the dams of those daughters.

b = a constant which determines the relative emphasis on Y as compared with X.

The equal-parent index sets (a) equal to zero but (b) to 0.5 and (c) to 2; i.e. I = 2 (x - 0.5 Y)

Rice's index sets c= 1, b = 0.5 and a = b times the breed average; when I = 0.5 (breed average), ≠ X - 0.5 Y. Rice's index is the equal parent index regressed half-way towards the breed average. It is, therefore, half as variable, but has exactly the same accuracy.

(2) Predicting Future Daughters' Production.

Allen points out that the best prediction for a bull for continued use in the herd where he was proved should be the simple average of his daughters, since his future daughters will be largely from the same group of dams and under very similar environment.

On the other hand, for predicting his future daughters from dams in a different herd, less reliability might be expected. In this instance, a standard such as Allen's expectancy formula should have much greater value, as it applies the equal-parent principle with a simple and workable allowance for regression and general differences of environment; provided the records are arrived at in the same manner as in the case of those from which the standard is derived (i.e. lifetime average, Dairy Herd Improvement Association, 305-day, mature, twice-a-day milking basis.)

RELATIONSHIP OF PRODUCTION OF DAUGHTERS OF SIRES PROVED IN DAIRY HERD IMPROVEMENT ASSOCIATIONS TO PRODUCTION OF THEIR DAMS.

Breed	No.of Sires	Av.Perform. of Daughters	Av.Perform. of Dams.	Sires Av. Potential Performance	Formula for Expected Perform.of Daughters
Milk Yield. lbs.					
Ayrshire	214	7821	8103	6980	1752 + (0.749 x dam's)
Fat Percentage					
Ayrshire	214	4.035	3.964	4.144	1.658 +(0.5998 x dam's)
Fat Yield lbs.					
Ayrshire	214	316.1	320.9	292.4	49.2 + (0.8317 x dam's)

(3) Evaluating Pedigrees.

Rice[16] contends that the general custom in drawing up pedigrees is to include only the selected direct ancestors, and in most instances only the most favourable data on these animals. There is also in addition, the biological fact that inheritance is a halving and sampling process. Therefore even if complete records of direct and collateral relatives are known, it is only by testing and indexing that it may be revealed what sort of a sample half of each parents'inheritance the animal received and how they "nicked."

(4) The Sire Index in the light of Modern Genetics.

Lush[11] presents a comprehensive discussion of the sire index problem, in the light of modern genetics.

The related genetic principles are reviewed:-

1. Inheritance is Mendelian in the broadest sense of the word.

Inheritance is carried by units, called genes which are present in pairs and which maintain their identity, and later segregate out unchanged, and also can recombine. This is subject to such modifications as linkage and sex linkage.

2. The Genes are not adaptively modified by their environment.

This statement denies the inheritance of acquired characters, and is supported by many extensive and carefully conducted experiments, which have failed to detect the inheritance of adaptive modifications.

3. Observed yields are affected by environment.

Strictly speaking, the question of whether a characteristic is hereditary or environmental has no meaning, because the genes cannot possibly produce the characteristic without the proper environment; and even in the proper environment the characteristic cannot develop unless the necessary genes are present.

The characteristic is the end result of complicated interactions of genes among themselves, and with their environment.

4. The number of genes affecting each characteristic is large.

This is certainly true for such characteristics like milk and fat production, which are dependent on the combine d functioning of many organs and organ systems, and which might be raised or lowered by the altering of any one of many quite different physiological processes.

The existence of a large number of genes, and the general absence of intensive inbreeding within breeds has several other consequences:-

A. No animals have exactly the genes that the breeder desires, but

some have more nearly the ideal than others do. This makes it impossible to improve a herd or breed in all respects at once, simply by continually grading it up to a perfect individual, since the latter does not exist.

B. Entirely homozygous animals are so extraordinarily rare, that the search for those to be used continually as sires is doomed to but partial success at the most.

C. A high degree of homozygosity and the possession of a high proportion of the desired genes are uncorrelated, or nearly so. Indeed there is some evidence to show, that on the whole heterozygosity rather than homozygosity is correlated with individual excellence although not necessarily with breeding worth.

5. Gene frequency.

The proportion which a desired gene constitutes of all the genes which occupy that locus in the whole breed, is changed at a rate which would be appreciable within a breeder's lifetime only by selection. Namely, allowing those individuals possessing the desired genes to leave more offspring than those lacking the desired genes.

Mutation is so rare an event, that the practical breeder need not take it into account.

Random survival or extinction of genes, is too weak a force to be important in a practical breeder's lifetime except in extreme inbreeding systems.

6. Homozygosity of a breed.

The homozygosity of a breed or group of animals is changed to an appreciable extent, only as a result of changes in gene frequency; or much more powerfully, by some form of inbreeding or its opposite, the crossing of distant strains.

7. Genes often exhibit dominance.

This is not universal, but seems to be the tendency at least among genes for distinct differences in colour and gross anatomy.

There is no inherent tendency for dominant genes or recessive genes to replace each other in a population, except that undesired dominants are more exposed to the effects of selection than undesired recessives are. This has led to the general condition that undesired genes tend to be recessive and desired ones dominant, particularly if the traits which these genes affect have been the object of selection for many generations.

8. Genes interact with each other.

Many genetic factors require the presence and co-operation of others in order to manifest their effects. These are known in genetics under various terms such as inhibiting factors, complementary factors, and epistatic factors. They are most nearly summed up to the practical animal breeder in the term "nicking."

Genetic application to sire indexes.

Lush[11] points out that all reasonably accurate sire indexes start with the average production of the daughters as a basis. The difference among the indexes lies in the use and emphasis made of the difference between the production of daughters and dams.

Differences in herd environment affect all indexes since they enter into the daughter average, which is the base of all indexes.

Differences in the average genetic merit of the cows to which the bull was mated, are neglected in the daughter average, but are discounted in the equal parent index.

Errors due to random environment, and to the

part played by chance in inheritance are reduced by increasing the number of daughters tested. Errors due to dominance and to "nicking" are also thus reduced but not so effectively. Errors due to herd environment and to differences in the average merit of the dams are biased and do not trend toward zero as the number of daughters tested is increased.

Lush[11] concludes that no index is absolutely correct, but effort should be made to keep possible errors at a minimum. Lush[11] recommends the equal parent index as the soundest in principle, simple in application, freest from systematic error and having a range not very different from that of the actual records of cows.

(5) The Number of Daughters necessary to prove a Sire.

Lush[12] states that there is no number below which it can be said that the progeny test is inadequate, and above which it can be said that the test is certainly correct.

Reliance in the progeny test should increase as the number of daughters increases, but at an ever decreasing rate.

Let S represent the path coefficient from the sire's genotype to the daughter's record, and let E represent the path coefficient from the herd management or common environment to the daughter's record. Then, for what appears to be the most probable values of S and E, only a little increase in accuracy is to be gained by including more than about five to eight daughters in the progeny test although of course it is desirable to base an estimate upon all that are available no matter how many that may be. If a definite number must be adopted in order formally to define what a "proved sire" is, perhaps the number five, adopted by the Bureau of Dairy Industry, is as practical as any other.

In conclusion, Lush[12] draws attention to the fact that occasionally cases will be encountered, where a sire "proved" to be good in one herd will with equal certainty"prove" to be bad in another herd. Some sires will be "proved" to be poor ones merely because of chance variations, or because they were used in a herd where the care and management given their daughters were not adequate.

(6) The Use of First Records versus the Average of all records in Dam - Daughter comparisons, when proving sires.

Putnam[15] et al investigated the methods of reporting dam-daughter comparisons for calculating sire indexes.

A comparison was made of first dam-daughter 305 day mature equivalent records, and the averages of all records on a similar basis, in reporting dam-daughter comparisons for calculating sire indexes.

A comparison of these data for 169 Ayrshire sires and 3388 dam-daughter pairs shows that there is only a very small and insignificant difference in the results obtained by the two methods. The averages of dams' and daughters' records and the averages of sire indexes calculated by the use of both types of comparisons, show that the first records on a mature equivalent basis average slightly higher than the averages, of all records on the same basis.

It is suggested, therefore, that much labour can be saved by calculating sire indexes from the use of first records only.

(I V) THE CANADIAN SYSTEM OF RECORD OF PERFORMANCE IN DAIRY CATTLE.

1) Administration.

The Canadian Record of Performance for pure-bred dairy cattle is directed from Ottawa, Ontario, by the Director, Production Service, Department of Agriculture. Only pure-bred dairy cattle are eligible for entry in the Record of Performance testing scheme.

The Record of Performance testing scheme is entirely voluntary. It is up to the personal decision of the herd owner, as to whether or not to enter the herd. However, it is stated in the rules and regulations governing R.O.P. that once a herd is registered on R.O.P., all the cows in the herd must be tested and all records, whether favourable or unfavourable, must be duly reported.

It must be noted that unfortunately this provision has not been literally enforced, as a result of which all the records of all the cows in all the herds registered on R.O.P. have not been reported.

All reported records are made available to the respective Breed Associations. These Breed Associations publish qualifying records in their monthly periodicals, but the non-qualifying records are not given any publicity.

At the end of each year, the Production Service, Department of Agriculture, publishes a list of all the qualifying records under the heading of each pure breed. Here again, the non qualifying records are not given any publicity.

2) The Present Method of reporting Canadian Record of Performance in dairy cattle.

The annual report issued by The Production Service, Department of Agriculture, presents the qualifying records of the R.O.P. tested cows in the following manner:-

Each pure breed is considered separately. The records are presented in eight separate classes, namely,

Mature (365 day)	Mature (305 day)
2 years "	2 years "
3 years "	3 years "
4 years "	4 years "

Thus age and length of testing period are the deciding factors.

The actual record is presented along with allied data, in the following manner:-

(1) The R.O.P. number of the cow.

This is merely a permanent R.O.P. registration number alloted to each cow.

(2) Name of cow and Registration Number.

The names of the cows are listed alphabetically, and the Herd Book Registration number supplied alongside.

(3) Owner of cow and address of owner.

(4) Age of cow.

This is given in years and days as on the first day of testing.

(5) Date test commenced.

(6) Date calved after test.

(7) Number of times milked per day.

In those instances where an animal was milked

three times or four times a day, the number of days on three or four times a day milking is given.

(8) Production Required.

The production required to qualify for R.O.P. status is given in terms of pounds milk and pounds fat.

(9) Total Production.

The actual production of the animal is stated in terms of pounds milk and pounds fat.

(10) Days in milk.

The number of days that the animal actually produced milk while under test is given.

(11) Average percent fat.

This is the average percentage of fat in the total milk produced.

N.B. No information is given on the performance of sires.

The following is the method used in reporting the qualifying R.O.P. records in the Canadian Ayrshire Review - monthly periodical of the Ayrshire Breeders Association.

(1) Name of cow and registration number.

Here the names are not listed alphabetically,but are listed in order of pounds fat produced and by age and lactation length

(2) Owner of cow and address of owner.

(3) Number of times milked per day.

(4) Actual production in terms of pounds milk and pounds fat.

(5) Percentage fat.

(6) Number of days in milk.

N.B. No readily applicable information is given on the performance of sires. The name of the sire involved is indicated

against each record. But in order to use this information much time would have to be spent by the breeder in gathering these individual records and analysing them.

3) Canadian Ayrshire Record of Performance standards For Registration

In order that a bull or cow may qualify for R.O.P. the following specific standards for registration must be fulfilled.

Bulls.

Admitted after having four progeny which qualify on the Record of Performance, each from a different dam.

Cows.

Admitted after fulfilling the following requirements of production and breeding as supervised by the Live Stock Branch of the Department of Agriculture.

Three Hundred and Five Day Division, otherwise known as "Honour Roll".

All cows admitted must equal or exceed both the records specified below, and must drop a normal calf within 400 days after the date of calving at the beginning of the testing period.

	Lbs. Milk	Lbs. Butter Fat
Two-year-old class	5,500	220
Three-year-old class	6,500	260
Four-year-old class	7,500	300
Mature class	8,500	340

Milk Record

If the test be commenced the day the animal is two years old or previous to that day, she must produce within 305 consecutive days from that date 5,500 pounds of milk. For each day the animal is over two years old at the beginning of her year's test the amount of milk she will be required to produce in the year will be

determined by adding 2.74 pounds for each such day to the 5,500 pounds required when in the two-year-old class. This ratio is applicable until the animal is five years old, when the required amount will have reached 8,500 pounds, which will be the minimum amount of milk required of all cows five years old and over.

Butter Fat Record

The amount of butter fat will be determined in all classes on a four per cent basis.

Three Hundred and Sixty-Five Day Division.

All cows admitted must equal or exceed both the records specified:-

	Lbs. Milk.	Lbs. Butter Fat
Two-year-old class	7,000	280
Three-year-old class	8,000	320
Four-year-old class	9,000	360
Mature Class	10,000	400

Milk Record.

If the test be commenced the day the animal is two years old or previous to that day, she must produce within 365 consecutive days from that date, 7,000 pounds of milk. For each day the animal is over two years old at the beginning of her year's test, the amount of milk she will be required to produce in the year will be determined by adding 2.74 pounds for each such day to the 7,000 pounds required when in the two-year old class. This ratio is applicable until the animal is five years old, when the required amount will have reached 10,000 pounds, which will be the minimum amount of milk required of all cows five years old and over

Butter Fat Record.

The amount of butter fat will be determined in all classes on a four per cent basis.

4) Rules and Regulations governing Record of Performance Testing.

Although this dissertation is not directly concerned with this phase of R.O.P. work, it is nevertheless worthwhile to review some of the main features of the rules governing R.O.P. testing.

The following are the rules and regulations governing R.O.P. testing.

Scope of Tests.

All tests are held for a period not exceeding 365 consecutive days. No milk from a second freshening is considered in a test.

Eligibility of Animals.

1. All animals entered for the test must be registered in the Canadian Herd Book for the breed to which they belong.
2. Every cow under test must have calved at least six days before the inspector takes samples of her milk.
3. Every owner making application for entry of a cow, must agree to enter in the test all normal untested milking pure-bred cows in his herd, which freshen during the period that such cow is under test. The acceptance of an application for the entry of a cow will not bind the Department to continue the supervision of a test in the event of a change of ownership, unless the new owner complies with the above requirement.
4. The Department undertakes the testing of cows only on the premises on which there are at least three pure-bred cows of breeding age regularly kept.
5. Each breeder entering cows in the Record of Performance is charged a herd fee of five dollars, which is due each year, with the commencement of the first record in the herd after the first day in May.

Method of Testing.

The percent of butter fat is determined by the Babcock test.

Duties of Owner.

The owner is responsible for making application for the entry of cows within thirty days of calving.

The owner is also required to weigh, or cause to be weighed, each milking and to record same on a form furnished for the purpose and to keep this form posted in a conspicuous place in the dairy barn. At the end of each month a report on forms furnished for the purpose stating a record of the weights of each milking with the total yield of milk from each cow for the month, must be sent in to the Record of Performance headquarters at Ottawa.

Duties of Inspector.

An inspector is employed by the Dominion Government to visit dairy barns on test, as often as possible during the year. These visits are unannounced. Each visit lasts at least two days if necessary, and during this time the inspector checks on the weights of milk from each cow, and also performs butterfat tests on a composite milk sample from each cow.

Other duties of the inspector include, checking on accuracy of scale used by farmer for milk weighings, taking a copy of the owner's milk record for the two days immediately preceding the visit, and taking note of any illness among the cows on test.

The inspector is required to send in a report on each visit to a farm, to the Record of Performance Headquarters, at Ottawa.

5) Criticism of the present Canadian System of Record of Performance in Dairy Cattle.

Joubert[7] offers much constructive criticism of the present method of reporting records of performance in Canada. At present

an arbitrary scale for the "required production in the various age classes is used, and has been used for the past thirty years. Cows which do not qualify for this arbitrary level do not have their production record published, but instead are kept unused at Ottawa.This is not entirely fair and correct, and constitutes hiding of less desirable results. In the U.S.Ayrshire Breeders' Association, all records high and low are published and used in statistical analyses.

In comparing U.S.Ayrshire breed averages with Canadian Ayrshire R.O.P. arbitrary requirements, for age groups extending from 2 years to 15 years, a clear discrepancy is seen in the trend of the arbitrary figures favouring the younger cows and discriminating against the older cows. This variation extends from 3.7% to 23.9%.

Joubert[7] claims that many Ayrshire Breeders in Canada are against publication of the true breed average, on the grounds that, maybe, the figures would not come out as high as they wish. This attitude approaches one of self deception, and must merely serve a false sense of security and hinder progress.

Joubert[7] draws attention to the fact that U.S. Ayrshire statistics show that the laws of nature allow the same 15 per cent difference between a 305 and a 365 day lactation period for any age group; while the arbitrary Canadian figures require a difference in milk of 1,500 pounds, which represents a difference of from 21 per cent to 15 per cent according to age.

Joubert[7] concludes that the present Canadian R.O.P. system has operated very well to accumulate a mass of separate facts, but that it is far from having given results in supplying information of vital importance.

McKinnon[13] points out that the present method of reporting R.O.P. records does not allow accurate comparisons to be

made between records. This necessitates finding some basis which will allow comparisons to be made fully and accurately. To meet this requirement, McKinnon[13] advocates expressing Canadian R.O.P. records on a mature equivalent 365 day basis. McKinnon[13] states that in the United States the Ayrshire Breeders' Association have the following recognized classes of records:-

(A.R.) Advanced Registry Record

(R.H.) Roll of Honor Record

(R.H.L.) Roll of Honor Record (which does not qualify for a certificate)

(H.T.) Herd Test Record

(M.H.T.) Meritorious Herd Test Record.

(H.T.L.) The First Calf Lactation Record of Heifers.

(D.H.I.) Dairy Herd Improvement Association Records.

In the United States the Ayrshire Breeders' Association calculate their mature equivalent records to a 305 day basis, because it suits their special needs. On these grounds, McKinnon[13] suggests that Canadian mature equivalent records should be calculated, to a 365 day basis, especially since the requirements of a mature cow on a 365 day basis works out at exactly 10,000 pounds of milk and 400 pounds of fat. McKinnon[13] is well pleased with the present arbitrary requirements, for the different age, groups, set by the Canadian Ayrshire Breeders Association. It is claime d that these requirements have stood the test for eighteen years, and are still good. McKinnon supports this view by stating that in 1946 the spread between the average milk production in each class and the average of all classes, was only 4.26 per cent in the class with the greatest spread. The spread, between the average fat production in each class and the average of all classes, was only 5.43 per cent in the class with the greatest spread.

McKinnon[13] concludes that the R.O.P. requirements have been unchanged for eighteen years. They should remain as they are, and Canadian Ayrshire Breeders should have great confidence in them.

A M.E. 365 day index for Canadian R.O.P. sires.

McKinnon takes the view that it is possible and highly desirable to work out a mature equivalent index for every R.O.P. bull in Canada. In the calculation of these indexes, the average of the one best record from each of all of the qualified daughters, would be used. McKinnon[13] holds strongly to the idea that a cow make s its best record when it is at its peak of good health and when it has the best management conditions with the best food provided. Under such conditions a cow reflects her inheritance and therefore her inheritance is indicated in her best record. It is suggested on these grounds by McKinnon[13], that low records are usually the result of unfavourable environment, and should not therefore figure in any study which has for its aim the calculation of an "index" of milk and fat inheritance. McKinnon[13] admits that there is the occasional bull whose daughters are consistently low producers due to poor inheritance; but advises that in his experience these animals, have been especially few and far between. McKinnon[13] concludes that it is possible to obtain a good workable index for a proven Canadian Ayrshire bull, by using the one best record from each of all of the qualified daughters. Because each index is based on the one best record from each of all of the qualified daughters, each index is based on the inheritance factor to the maximum possible. Because unqualifying or low records are excluded, factors which cause poor records, and which have nothing to do with inheritance are excluded.

6) Suitability of high records as contrasted with unselected records and with average records as a basis for selecting cows.

Berry[2] studied the suitability of high records as contrasted with unselected records and with average records as a basis for selecting cows. The high correlation between a cow's highest record (or her lowest) and the average of the other records from which this one was selected results largely from the statistical effects of this

selection itself. This high correlation does not indicate superiority of the selected record for predicting future records or breeding value. When the highest record is correlated with other records from which it was not selected, the resulting coefficient (provided all cows have the same number of records) indicates that the high record is nearly as reliable as an unselected record, but less reliable than the average of all unselected records.

Differences in number of completed records, however is of so much practical importance in making selected records unfair that the use of the highest record, as an indication of a cow's lifetime producting ability, cannot be recommended.

In conclusion, Berry[2] states that averages appear to be more dependable than either selected or unselected single records for evaluating differences between cows.

7) Reliability of Averages of Different numbers of lactation records for comparing dairy cows.

Berry[3] studied the reliability of averagesof different numbers of lactation records for comparing dairy cows, and reported as follows:-

Cows can be fairly compared if they have a different number of records, by use of the following prediction qquations:-

1. Real producing ability (W)

$$W = \text{herd average} + \frac{n w^2}{1 + (n - 1)r} \times \text{cows average minus herd average}$$

2. Transmitting ability or breeding value (B)

$$B = \text{herd average} + \frac{2 n g}{1 + (n - 1)r} \times \text{cows average minus herd average.}$$

In these equations, n is the number of records in the cow's average, r is the average intra-herd repeatability of records of the same cow (usually of the order of 0.3 to 0.5) g is the average intra-herd correlation, between dam and daughter records (probably not far from 0.1

generally) and w^2, which is that part of r left after the effects of proximity are removed is believed to have a value of approximately 0.03 to 0.09 less than r.

Berry[3] concluded that the major increase in reliability occurs when a second record is added to the first. Addition of a third record adds considerably to the reliability of the estimate. Records beyond the third contribute more information, but so little that they are hardly worthwhile waiting for before estimating the worth of the animal.

8) Criticism, by the author, of the present method of reporting Record of Performance in Canada.

The method of reporting Canadian Record of Performance records has been governed by a static policy.

Such a policy cannot serve the best interests of dairy breeders, in a changing set of conditions in dairy husbandry.

A dynamic policy is required. The author desires to level the following specific criticism against the present method of reporting Canadian R.O.P. records:-

1. The non-qualifying records should receive equal consideration and equal publicity as the qualifying records.
2. The arbitrary standards set for qualifying on Record of Performance might be entirely discarded and each animal assessed on its own true individual merit.
3. Records should be expressed in such a form that they may be directly compared one with the other, even if they belong to different age and or lactation-length groups, and come from widely separated parts of the country.

   The present system does not allow direct comparison between animals of different age groups.
4. At present the R.O.P. reports do not publish any readily applic-

-able information on sires. This is deplorable. Equal or more attention should be given to reporting sire performance, as is given to dam performance.

5. McKinnon's idea of calculating Canadian sire indexes on a M.E. 365 day basis is sound in principle. However, in view of Berry's work, it does not seem advisable to use only the best records of dams and daughters for calculating sire indexes.

V. THE AMERICAN SYSTEM OF RECORD OF PERFORMANCE IN DAIRY CATTLE

1) The American System of Record of Performance in Dairy Cattle.

Conklin[4] mentions the following schemes as constituting the national dairy testing program in the United States:- Advanced Registry, Herd Test Plan, Dairy Herd Improvement, and Owner Sampler Plan.

The American Dairy Science Association attempts to co-ordinate this work, but it has no powers to require rule enforcement by its members. Those administering the testing programs may or may not be members of the A.D.S.A.

Furthermore, there is a wide variation in the extent to which Dairy Herd Improvement Associations are self-governing bodies, and broad differences as to the extent to which they write their own individual policies.

Thus the present degree of uniformity in supervision, is a tribute to the intelligence and spirit of co-operation of those administering the national testing program in the United States.

The American Ayrshire Breeders Association.

The American Ayrshire Breeders Association is located at Brandon, Vermont. The office of this Association is equipped with the most modern labour saving machines, which are worth while mentioning since they would serve as an asset to any Breed Association.

A complete set of office equipment has been leased from the International Business Machines Company. These now enable the staff to process records pertaining to the Herd Test, Progeny Studies, Type Classification, Auction Sales, averages, and herd production averages.

Standard punch cards on which all records are maintained, are the basis for keeping records. After the cards are punched, the records on them may be printed directly from the cards without resorting to the use of a typewriter. Columns may be added and serve as permanent records. Data on cards such as cow's records may be printed, sorted, or duplicated at high speed.

For the Association files the original lactation record card is produced. Four sets of each lactation card are produced. Three of these sets are made automatically by one duplicating machine and one set of these cards is filed according to the registration number of the animal. In another file all of the daughters of a sire are filed together, while in still another file all of the daughters of each dam are filed together.

A fourth set of these cards is in the Dairy Department of the University of West Virginia, where the data is used in a co-operative research program with that institution.

2) Policy of the National Testing Program of the United States.

Conklin[4] points out that the policy of the National Testing Program has not been static. Rules have been revised as objectives have changed. Early objectives of Advanced Registry in the United States were two-fold:-

1. Advertising advantages.
2. Aid in the selection of breeding stock.

Recent policy places emphasis on the following points:-

1. Identification and improvement of genetic material in breeding stock. Conklin advises that now a days the greatest service should come from a broader use of dependable sires, accompanied by a steady reduction in the use of young sires of unknown pedigree value.
2. Improvement of the economic management of the respective herds that are enrolled. This involves constant consideration of the relationship of cost of grain to price of milk.

   Maximum production has been and still is regarded by the majority as the ideal aim. Some think that economy of production deserves equal attention.

   Conklin[4] advises that it should be expected of the testing program to help economically raise the production of the so called "below average" herds. Feed records should also be kept by every dairyman, and these

would provide a wealth of information for the common benefit of all.

Conklin, speaking in his capacity as Secretary of the American Ayrshire Breeders Association, expresses the following points of view.

1. Low records and incomplete records are of first importance. Without considering records of performance of below average cows, there can be no true appraisal of the breeding value of their sires.
2. It is of paramount importance to develop a system where quick and full information on young sires can be readily obtained. A system should be developed which gives a progeny report within sixty to ninety days of the date that a sire's fifth or tenth daughter completes her first record, and promptly thereafter as additional groups of daughters are tested.
3. A system is required of issuing preliminary studies on sires with five or more daughters in milk, provided each of them has completed at least three months lactation. This should be strictly designated a preliminary report, and would involve the use of factors in estimating incomplete records to a 305 day basis.
4. Is it necessary to have butterfat tests throughout the lactating life of a cow ? It is necessary for cows on Advanced Registry; but in cases where the data is required merely for progeny reports, is it not sufficient to secure tests during the first few lactations and thereafter apply correction factors for the normal decline on aging.
5. Rules should be relaxed so as to make it optional as to whether cows producing 10 or 12 pounds of milk per day be tested for butterfat. The average for the previous months or lactation tests could be used.

3) The method used by the American Ayrshire Breeders' Association to report performance of dairy cattle.

Conklin[4] states that the American Ayrshire Breeders' Association took the initial step, several years ago, in standardizing their records of

production on a 305 -days, twice-a-day milking, mature equivalent basis (305 day 2 X M.E. basis).

The officers of the A.A.B.A. are of the opinion that it is of first importance to a breed to include all records in all sire and dam studies, regardless of size of record. Thus in proving their sires all records are used regardless of how low they may be.

The Ayrshire Digest, which is the monthly periodical, issued by the American Ayrshire Breeders Association uses the following method of reporting record of performance in dairy cattle.

Performance of cows:-

1. Name of cow and registration number.
2. Name of sire and registration number.
3. Name of owner and farm.
4. Age of cow.
5. Number of days if any on 3 X milking.
6. Actual production in terms of pounds milk, pounds fat and percentage fat.
7. Mature equivalent in terms of pounds milk and pounds fat.
8. Mature equivalent 4% fat corrected milk.
9. The Mature equivalent is corrected to a 305 day basis, and serves for the ranking of cows.

Each month the Ayrshire Digest gives the records, in the above prescribed manner, of the cows in the herds which averaged 25 pounds butterfat or over, inclusive of dry cows.

The annual report of the Ayrshire Breeders Association gives many comprehensive summeries of the performance of cows during the past year. For example:-

1. Leading herd test record herds completed in year - arranged by classes according to size of herd.
2. Leading meritorious herd test records for year - arranged by classes according to age.

3. Leading meritorious producers for all time.

Performance of sires:-

From time to time as a service to the Ayrshire breed, the Ayrshire Digest publishes a list of proved sires with five or more tested daughters that have produced or are estimated to produce an average of not less than 8,000 pounds milk and 340 pounds fat, in 305 days on a 2 X milking mature equivalent basis.

The following method of reporting this data is used:-

1. Name of sires, listed alphabetically with registration number; also sire and dam of eqch sire with their respective registration numbers.
2. Date of birth of sire.
3. Name and address of last owner.
4. Number of daughters tested.
5. Number of complete records.
6. Average production of daughters in terms of pounds milk and pounds fat, on a mature equivalent, 2 X a day, 305 day basis.
7. Average production of dams in terms of pounds milk and pounds fat, on a mature equivalent, 2 X a day, 305 day basis.

4) Criticism by the author, of the present method of reporting Record of Performance of Ayrshires in the United States.

The following features of the U.S.Ayrshire Breeders' Association are most commendable:-

1. The organization has a forward looking and dynamic policy.
2. The most modern office, equipment is in use.
3. There is research co-operation with the University of West Virginia.
4. All records, regardless of size are used in computing statistics on Ayrshire cattle.

5. The author agrees with the views expressed by Conklin,[4] that it would be of great advantage to develop a system, whereby a progeny report is given on a sire, within sixty to ninety days of the date that a sires fifth daughter completes her first record.

Also a method of making early and preliminary reports on young sires would be very helpful.

The present method of expressing records for comparative purposes is on a 305 M.E. 2 X basis. This involves the use of conversion factors.

It would be meritorious to find some new system, whereby the production of cows could be compard, without the use of conversion factors.

VI. A NEW SYSTEM OF REPORTING RECORD OF PERFORMANCE IN CANADIAN AYSHIRE CATTLE

It has been pointed out that the present method of reporting Ayrshire records in Canada does not allow direct comparisons to be made between cows of different ages and with different lactation periods.

It is in the interest of progress for the Ayrshire breed, that some suitable yardstick be found which can be used to measure Ayrshire production on a basis that will enable comparisons between cows of different age-lactation classes.

It must be remembered that in the United States the Ayrshire Breed Association has used a Mature Equivalent Basis for making comparisons between cows, and for calculating sire indexes. This system has been used successfully for a number of years, and has merit. However, it must be pointed out that Mature Equivalence expresses, by use of mathematical conversion factors, in terms of milk and fat, the forecast production of a cow at maturity. But this is open to criticism since the quantity of milk and fat stated was not actually produced, and the conversion factors are only absolutely accurate for that particular group of data from which they were calculated.

Jaubert[7] points out that for over thirty years an arbitrary scale of production has been used as the only criterion of performance. The annual statistics of the Ayrshire breed in Canada are calculated from the records which qualify above this arbitrary scale. No non-qualifying records are used in determining the breed average. These annual statistics are published and serve to advertise the Ayrshire breed, and are declared to represent the official production of all Canadian Ayrshire cattle tested in the Record of Performance for that year. Such statements are not true and can only mislead the public.

The time has arrived when the Ayrshire breeders, and indeed breeders of other purebred cattle in Canada, must be made to realise that it will be to their ultimate advantage to use and publish true figures with respect to breed averages.

Jaubert[7] has suggested the development of a modified system of reporting Canadian Ayrshire Records of Performance. This modified system is designed to overcome the inadequacies of the present method, and also to lay claim to certain advantages that it may well have over the present system of mature equivalence used in the United States.

Jaubert[7] suggests the following as the salient features of the modified method:

1. All records, regardless of size, will be used to calculate a true breed average.

2. Each individual production will be expressed as a percentage of the breed average. For example, instead of saying Bossie gave 8,980 pounds milk in 305 days at 5 years, and 9180 pounds milk (Mature Equivalent) under the modified system, it would be said Bossie gave 8,980 pounds milk, 104 percent at 5 years.

In similar manner it may be said that the daughters of a bull averaged 105 percent or 110 percent, as the case may be.

DETAILS OF THE NEW PERCENTAGE SYSTEM.

Accruing from the suggestions of Jaubert[7], the author has developed the following details for a modified method of reporting Canadian Ayrshire Records of Performance:

1. The R.O.P. testing plan must remain a voluntary plan. However, of all herds entered on R.O.P., all individual cows in each herd must be tested and all records, regardless of whether they are completed or not,

must be reported to R.O.P. headquarters.

2. In computing any age-lactation period class average, all records regardless of size must be used. Special consideration will have to be given to incomplete records. This will be dealt with later.

3. Individual records shall be expressed on a percentage basis. In order to do this, separate age-lactation period classes will be established. The average production for each age-lactation period class is established for a five-year period.

These five-year class averages will change from year to year. Thus a five-year moving average will be established. The moving average is calculated by adding in the production totals for the most recent year, and subtracting the production totals for the earliest year (of the five years involved) from the respective five-year totals.

VII. EXPERIMENTAL WORK

1. OBJECTIVE:

The following are the main objectives of the experimental work:

1. To establish five-year age-lactation period class averages for the periods 1941 to 1945 inclusive, and 1942 to 1946 inclusive.

2. To calculate the sire indexes of three sires of the Ayrshire herd at University of British Columbia, using records expressed on a percentage basis.

2. PROCEDURE:

ESTABLISHMENT OF FIVE-YEAR AVERAGES

The establishment of a proper and true breed age-lactation period class average depends on the averaging of all records, including both qualifiers and non-qualifiers.

More than one attempt was made to obtain the

non-qualifying records of Ayrshire R.O.P. tested cows for the period 1941 to 1946 inclusive, from the Ayrshire Breeders Association in Ottawa. However, a favourable response was not forthcoming from that organization.

The Secretary of the Association discussed the issue with the Executive Committee and also with the Breed Improvement Advisory Committee, and the following reasons were given for deciding to withhold the requested information:

1. The staff of the Association had been busy, on an overtime basis, in preparing data for projected approved Sire and Dam Plans. Any release of the non-qualifying records would have seriously interrupted the office routine.

2. The concensus of opinion among the members of these committees was that at present no particulars of non-qualifying records should be made available for publication. The basis for this feeling was that the Association had no authority to publish in any form the non-qualifying records.

3. The Secretary also intimated that there were other angles involved, namely, that consideration of the non-qualifying records would not put the Ayrshire records in very good light, especially since none of the other Associations take into consideration such non-qualifying records.

Also the Association intends to institute an Ayrshire R.O.P. Herd Test Plan, and at that time it would be convenient to commence giving more attention to non-qualifying records. The effect of not being able to obtain the non-qualifying records, on the projected work had to be immediately considered.

It was decided that although it was desirable and beneficial to have the non-qualifying records, nevertheless it did not in any way detract from the main theme of the work to proceed without them.

The mere fact that these records were not made available to a University Graduate for research work designed for the benefit of the Ayrshire breed, suggests that the Ayrshire Breed Association does not have a sense of confidence, and pleasure in the disclosure of all records to public view.

The effect of the absence of the non-qualifying records from the calculations will be twofold:

(1) The age-lactation period class averages will be higher than they should be.

(2) The percentage of performance of individual animals will be lower than they really are.

Immediately it will be asked: How much higher and lower, as the case may be, will these figures be? Will they be so much higher, or lower, as to lend unrealistic proportions to the results? It cannot be known how much these figures will be changed. However, it is reasonable to state that the five-year averages will only be slightly higher than the true averages would be, in view of the fact that there are always more qualifying cows than non-qualifying cows, and many of the non-qualifying will be just below the arbitrary level of production.

	Jr. 2 (305 days)			Jr. 2 (365 days)			Sr. 2 (305 days)			Sr. 2 (365 days)		
1941	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	233	1684566	69890	161	1427372	58765	316	2462844	102739	177	1645550	68182
Cor.		1664334	69071		1401541	57768		2435172	101591		1623027	67277
Avgs.			%fat			%fat			%fat			%fat
Unc.		7230	300 4.45		8866	365 4.12		7794	325 4.17		9297	385 4.14
Cor.		7143	296 4.15		8705	359 4.12		7706	321 4.17		9170	380 4.15
		87	4		161	6		88	4		127	5
1942												
Tot.												
Unc.	248	1804746	74783	171	1505887	62408	254	1954230	81539	236	2180193	90526
Cor.		1792233	74251		1495054	61966		1937673	80867		2157557	89603
Avgs.			%fat			%fat			%fat			%fat
Unc.		7277	302 4.14		8806	365 4.14		7694	321 4.17		9238	384 4.15
Cor.		7227	299 4.14		8743	362 4.14		7629	318 4.17		9142	380 4.15
		50	3		63	3		65	3		96	4
1943												
Tot.												
Unc.	261	1894187	78770	182	1637943	67211	257	1989195	81967	189	1765122	72690
Cor.		1888666	78539		1627200	66769		1978503	81522		1752293	72143
Avgs.			%fat			%fat			%fat			%fat
Unc.		7257	302 4.16		9000	369 4.10		7740	319 4.12		9339	385 4.12
Cor.		7236	301 4.16		8941	367 4.10		7698	317 4.12		9271	382 4.12
		2o	1		59	2		42	2		68	3
1944												
Tot.												
Unc.	232	1706197	71473	178	1604146	67138	347	2682466	112042	181	1666887	69548
Cor.		1700747	71245		1598872	66925		2676191	111779		1659990	69269
Avgs.			%fat			%fat			%fat			%fat
Unc.		7354	308 4.19		9012	377 4.18		7730	323 4.18		9209	384 4.17
Cor.		7331	307 4.19		8982	376 4.19		7712	322 4.18		9171	383 4.17
		23	1		30	1		18	1		38	1
1945												
Tot.												
Unc.	237	1720325	71744	167	1494387	61703	302	2365106	98139	241	2286710	94637
Cor.		1718610	71671		1488543	61455		2351940	97605		2274511	94131
Avgs.			%fat			%fat			%fat			%fat
Unc.		7259	303 4.17		8948	369 4.12		7831	325 4.15		9488	393 4.14
Cor.		7252	302 4.17		8913	368 4.13		7788	323 4.15		9438	391 4.14
		7	1		35	1		43	2		50	2

1946	Jr. 2 (305 days)			Jr. 2 (365 days)			Sr. 2 (305 days)			Sr. 2 (365 days)		
	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	274	2016664	83117	197	1768623	73046	350	2776671	114465	292	2775199	113439
Cor.		2008216	82760		1765288	72915		2771846	114271		2765189	113026
Avgs.			%fat			%fat			%fat			%fat
Unc.		7360	303 4.12		8978	370 4.13		7933	327 4.12		9504	388 4.09
Cor.		7329	302 4.12		8961	370 4.13		7919	326 4.12		9470	387 4.08
		31	1		17			14	1		34	1

1941	Jr. 3 (305 days) No.Cows	Milk (lbs.)	Fat (lbs)	Jr. 3 (365 days) Cows	Milk (lbs.)	Fat (lbs)	Sr. 3 (305 days) Cows	Milk (lbs)	Fat (lbs)	Sr. 3 (365 days) Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	150	1206875	49867	89	878251	35935	167	1493419	61587	80	842055	34621
Cor.		1191511	49234		863669	35356		1478210	60971		827130	34031
Avgs.			%fat			%fat			%fat			%fat
Unc.		8046	332 4.13		9867	404 4.09		8942	369		10526	433
Cor.		7943	328 4.13		9704	397 4.09		8852	365 4.12		10339	425 4.11
		103	4		163	7		90	4		187	8
1942												
Tot.												
Unc.	150	1246460	51411	89	889335	36475	158	1401253	57800	78	822270	33652
Cor.		1232694	50860		874135	36162		1397167	57635		818105	33478
Avgs.			%fat			%fat			%fat			%fat
Unc.		8310	343 4.12		9993	410 4.10		8869	366 4.12		10542	431 4.09
Cor.		8218	339 4.13		9822	406 4.14		8843	365 4.13		10489	429 4.09
		92	4		171	4		26	1		53	2
1943												
Tot.												
Unc.	174	1428102	58720	88	893377	36230	199	1741728	71493	92	946235	39423
Cor.		1420765	58414		893290	36227		1725778	70833		937013	39037
Avg.			%fat			%fat			%fat			%fat
Unc.		8207	337 4.11		10152	412 4.06		8752	359 4.10		10285	429 4.17
Cor.		8165	336 4.11		10151	412 4.06		8672	356 4.10		10185	424 4.17
		42	1		1	0		80	3		100	5
1944												
Tot.												
Unc.	172	1409131	58339	109	1084499	45163	169	1461718	60473	114	1161354	48000
Cor.		1404759	58153		1076390	44827		1458255	60326		1159576	47931
Avgs.			%fat			%fat			%fat			%fat
Unc.		8193	339 4.14		9950	414 4.16		8649	358 4.14		10187	421 4.13
Cor.		8167	338 4.14		9875	411 4.16		8629	357 4.14		10172	420 4.13
		26	1		75	3		20	1		15	1
1945												
Tot.												
Unc.	150	1237964	51432	101	1007693	42095	186	1615668	66558	93	972228	40446
Cor.		1230569	51113		1001014	41809		1606427	66178		962775	40042
Avg.			%fat			%fat			%fat			%fat
Unc.		8253	343 4.15		9977	417 4.18		8686	358 4.12		10454	435 4.16
Cor.		8204	341 4.15		9911	414 4.18		8636	356 4.12		10352	431 4.16
		49	2		66	3		50	2		102	4

1946	Jr. 3 (305 days)			Jr. 3 (365 days)			Sr. 3 (305 days)			Sr. 3 (365 days)		
	No. Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	174	1428018	58611	104	1043132	43044	227	2052119	84733	128	1321985	54263
Cor.		1421927	58395		1027893	42434		2037080	84110		1315261	53972
Avg.			%fat			%fat			%fat			%fat
Unc.		8207	337 4.10		10030	414 4.13		9040	373 4.13		10328	424 4.10
Cor.		8172	336 4.11		9883	408 4.13		8974	371 4.13		10275	422 4.10
		35	1		147	6		66	2		53	2

	Jr. 4 (305 days)			Jr. 4 (305 days)			Sr. 4 (305 days)			Sr. 4 (365 days)		
1941	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	102	927345	38272	67	726250	30342	93	913404	37497	49	567938	23548
Cor.		914829	37775		718565	30022		909962	37357		554945	23024
Avg.			%fat			%fat			%fat			%fat
Unc.		9092	375 4.12		10840	453 4.18		9822	403 4.10		11591	480 4.15
Cor.		8969	370 4.13		10725	448 4.17		9785	402 4.11		11325	470 4.15
		123	5		115	5		37	1		266	11
1942												
Tot.												
Unc.	105	945582	38670	77	851868	35305	96	938054	38351	59	710959	28824
Cor.		937453	38344		847167	35105		931723	38098		701680	28437
Avg.			%fat			%fat			%fat			%fat
Unc.		9006	368 4.09		11063	459 4.14		9771	399 4.09		12050	489 4.05
Cor.		8928	365 4.09		11002	456 4.14		9705	397 4.08		11893	482 4.05
		78	3		61	3		66	2		157	7
1943												
Tot.												
Unc.	87	793249	32452	53	586505	23964	102	984364	40100	54	642942	26375
Cor.		788977	32281		584196	23870		975822	39750		636716	26123
Avg.			%fat			%fat			%fat			%fat
Unc.		9118	373 4.09		11066	452 4.08		9651	393 4.07		11906	488 4.10
Cor.		9069	371 4.09		11023	450 4.08		9567	390 4.07		11791	484 4.10
		49	2		43	2		84	3		115	4
1944												
Tot.												
Unc.	127	1147396	47260	53	584001	24039	106	1026576	42432	60	692245	28813
Cor.		1141306	47011		581276	23939		1024114	42332		683444	28437
Avg.			%fat			%fat			%fat			%fat
Unc.		9035	372 4.12		11019	454 4.12		9685	400 4.13		11537	480 4.16
Cor.		8987	370 4.12		10967	452 4.12		9661	399 4.13		11391	474 4.16
		48	2		52	2		24	1		146	6
1945												
Tot.												
Unc.	105	976724	40005	47	509181	21039	105	1017851	41842	61	694989	28591
Cor.		969687	39710		505336	20878		1010641	41536		694339	28566
Avg.			%fat			%fat			%fat			%fat
Unc.		9302	381 4.10		10834	448 4.13		9694	398 4.11		11393	469 4.11
Cor.		9235	378 4.10	4.10	10752	444 4.13		9625	396 4.11		11383	468 4.11
		67	3		82	4		69	2		10	1

1946	Jr. 4 (305 days)			Jr. 4 (365 days)			Sr. 4 (305 days)			Sr. 4 (365 days)		
	No. Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	118	1114227	45142	78	860819	34685	134	1322935	53900	71	817496	33169
Cor.		1106141	44826		849842	34251		1311853	53427		808828	32821
Avg.			%fat			%fat			%fat			%fat
Unc.		9443	383 4.05		11036	445 4.03		9873	402 4.07		11514	467 4.06
Cor.		9374	380 4.05		10895	439 4.03	4.0	9873	402 4.07		11392	462 4.06
		69	3		141	6		83	3		122	5

	Mature (305)			5 Year (305)			6 Year (305)			7 Year (305)		
1941	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	429	4326525	176099	150	1488297	60817	101	1023408	42037	59	608653	24837
Cor.		4249071	173013		1464302	59826		1004559	41264		598814	24443
Avg.			%fat			%fat			%fat			%fat
Unc.		10085	410 4.07		9922	405 4.08		10133	416 4.11		10316	421 4.08
Cor.		9905	403 4.07		9762	399 4.09		9946	409 4.11		10149	414 4.08
		180	7		160	6		187	7		167	7
1942												
Tot.												
Unc.	416	4174508	169174	124	1214334	49820	101	1020004	41118	79	793100	32734
Cor.		4130860	167105		1199466	49207		1013540	40735		783534	32341
Avg.			%fat			%fat			%fat			%fat
Unc.		10035	407 4.06		9793	402 4.10		10099	407 4.03		10039	414 4.13
Cor.		9930	402 4.05		9673	397 4.10		10035	403 4.02		9918	409 4.13
		105	5		120	5		64	4		121	5
1943												
Tot.												
Unc.	515	5238597	212121	146	1459046	59805	106	1092967	43808	94	951808	38436
Cor.		5197936	210483		1450555	59460		1083004	43404		946598	38229
Avg.			%fat			%fat			%fat			%fat
Unc.		10172	412 4.05		9994	410 4.10		10311	413 4.01		10125	409 4.04
Cor.		10093	409 4.05		9935	407 4.10		10217	409 4.01		10070	407 4.04
		79	3		59	3		94	4		55	2
1944												
Tot.												
Unc.	470	4785148	194593	118	1174740	47486	110	1119150	45687	84	885257	36179
Cor.		4768022	193918		1173121	47421		1114726	45507		880374	35992
Avg.			%fat			%fat			%fat			%fat
Unc.		10181	414 4.07		9955	402 4.04		10174	415 4.08		10539	431 4.09
Cor.		10145	413 4.07		9942	402 4.04		10134	414 4.08		10481	428 4.09
		36	1		13	0		40	1		58	3
1945												
Tot.												
Unc.	517	5208862	211795	177	1771885	72949	98	988499	40534	97	985234	39584
Cor.		5182405	210677		1758313	72386		981995	40265		976504	39235
Avg.			%fat			%fat			%fat			%fat
Unc.		10095	410 4.06		10011	412 4.12		10076	413 4.09		10147	408 4.02
Cor.		10024	407 4.06		9934	409 4.12	4.12	10020	411 4.10	[illegible]	10067	404 4.02
		71	3		77	3		56	2		80	4

1946	Mature (305)			5 Year (305)			6 Year (305)			7 Year (305)		
	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	565	5738512	231724	166	1662366	67566	132	1338091	54316	80	799199	32373
Cor.		5687414	231305		1651516	67132		1327228	53886		794687	32192
Avg.			%fat			%fat			%fat			%fat
Unc.		10139	410 4.04		10014	407 4.06		10137	411 4.06		9990	403 4.04
Cor.		10066	409 4.06		9949	404 4.06		10055	408 4.06		9934	402 4.05
		73	1		65	3		82	3		56	1

	8 Year (305)			9 Year (305)			10 Year (305)			11 Year (305)		
1941	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	42	438444	17441	35	352557	14253	23	224567	9172	8	83740	3161
Cor.		425486	16985		346484	14013		221666	9052		82336	3109
Avg.			%fat			%fat			%fat			%fat
Unc.		10439	415 3.98		10073	407 4.04		9764	399		10468	395 3.77
Cor.		10131	404 3.99		9899	400 4.04		9638	394 4.08		10292	389 3.77
		308	1		174	7		126	5		176	6
1942												
Tot.												
Unc.	46	474382	19063	31	317333	12591	14	145824	5606	10	103732	4175
Cor.		466947	18769		317144	12402		143719	5524		101936	4102
Avg.			%fat			%fat			%fat			%fat
Unc.		10313	414 4.01		10237	406 3.97		10416	400 3.84		10373	418 4.02
Cor.		10151	408 4.02		10230	400 3.91		10266	395 3.84		10194	410 4.02
		162	6		7	6		150	5		179	8
1943												
Tot.												
Unc.	68	700866	28746	37	378615	15351	33	347321	13626	11	105998	4241
Cor.		694449	28482		375638	15234		341182	13382		105622	4226
Avg.			%fat			%fat			%fat			%fat
Unc.		10307	423 4.10		10233	415 4.05		10525	413 3.92		9636	386 4.0
Cor.		10212	419 4.10		10152	412 4.06		10339	406 3.92		9602	384 4.0
		95	4		81	3		186	7		34	2
1944												
Tot.												
Unc.	65	654678	26475	50	503822	20957	20	210270	8410	8	79384	3153
Cor.		653311	26420		503143	20930		206159	8251		79341	3151
Avg.			%fat			%fat			%fat			%fat
Unc.		10072	407 4.04		10076	419 4.16		10514	421 4.00		9923	394 3.97
Cor.		10051	406 4.04		10063	419 4.15		10307	413 4.00		9918	394 3.97
		21	1		13	0		207	8		5	0
1945												
Tot.												
Unc.	47	465755	18645	44	454781	18066	26	276061	11276	17	168231	6730
Cor.		465089	18621		453896	18031		272748	11133		164257	6576
Avg.			%fat			%fat			%fat			%fat
Unc.		9910	397 4.00		10336	411 3.98		10618	434 4.08		9896	396 4.00
Cor.		9896	396 4.00		10316	410 3.97		10490	428 4.08		9662	387 4.00
		14	1		20	1		128	6		234	9

1946	8 Year (305)			9 Year (305)			10 Year (305)			11 Year (305)		
	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	77	800730	32227	45	474732	18742	32	319922	12674	20	202031	8133
Cor.		792366	31887		472968	18671		319628	12663		199678	8033
Avg.			%fat			%fat			%fat			%fat
Unc.		10399	417 4.01		10550	416 3.94		9998	396 3.86		10102	407 4.03
Cor.		10290	414 4.02		10510	415 3.94		9988	396 3.96		9984	402 4.02
		109	3		40	1		10	0		118	5

	12 Year (305)			13 Year (305)			14 Yr. (305)			15 Yr. (305)		
1941	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	5	48069	1982	5	50044	2059	--	--	--	1	8686	340
Cor.		48069	1982		48609	1999					8686	340
Avg.			%fat			%fat						%fat
Unc.		9614	396 4.12		10009	412 4.12					8686	340 3.91
Cor.		9614	396 412		9722	400 4.11					8686	340 3.91
					277	12						
1942												
Tot.												
Unc.	4	38641	1465	4	39131	1494	2	18607	758	1	9420	350
Cor.		38641	1465		37906	1452		18607	758		9420	350
Avge.			%fat			%fat			%fat			%fat
Unc.		9660	366 3.79		9783	374 3.82		9304	379 4.07		9420	350 3.71
Cor.		9660	366 3.79		9476	363 3.83		9304	379 4.07		9420	350 3.71
		0	0		7	11		0	0		0	0
1943												
Tot.												
Unc.	10	103361	4085	7	69204	2814	3	29411	1209			
Cor.		102273	4043		69204	2814		29411	1209			
Avg.			%fat			%fat			%fat			
Unc.		10336	409 3.95		9886	402 4.07		9804	403 4.11			
Cor.		10227	404 3.95		9886	402 4.07		9804	403 4.11			
		109	5					0	0			
1944												
Tot.												
Unc.	7	76606	2993	4	41997	1664	2	20852	850	2	18392	739
Cor.		76606	2993		41997	1664		20852	850		18392	739
Avg.			%fat			%fat			%fat			%fat
Unc.		10944	426 3.89		10499	416 3.96		10426	425 4.08		9196	370 4.02
Cor.		10944	426 3.89		10499	416 3.96		10426	425 4.08		9196	370 4.02
		0	0		0	0		0	0		0	0
1945												
Tot.												
Unc.	4	41930	1614	4	37464	1579	2	19022	818			
Cor.		41930	1614		37464	1579		19022	818			
Avg.			%fat			%fat			%fat			
Unc.		10483	404 3.85		9366	395 4.21		9511	409 4.30			
Cor.		10483	404 3.85		9366	395 4.21		9511	409 4.30			
		0	0		0	0		0	0			

1946	12 Yr. (305) No.Cows	Milk (lbs.)	Fat (lbs)	13 Yr. (305) Cows	Milk (lbs.)	Fat (lbs)	14 Yr. (305) Cows	Milk (lbs)	Fat (lbs)	15 Yr. (305) Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	9	93084	3695	4	37170	1579						
Cor.		92734	3680		36609	1557						
Avg.			%fat			%fat						
Unc.		10342	410 3.97		9293	395 4.25						
Cor.		10304	409 3.97		9152	389 4.25						
		38	1		141	6						

1945	16 Yr. (305)		
Tot.			
Unc.	1	11187	419
Cor.		11187	419

	Mature (365)			5 Yrs. (365)			6 Yr. (365)			7 Yr. (365)		
1941	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	351	4216887	171744	81	948615	39051	61	737780	30611	61	718008	29300
Cor.		4127409	168131		932284	38379		730067	30297		701950	28656
Avg.			%fat			%fat			%fat			%fat
Unc.		12014	489 4.07		11711	482 4.12		12095	502 4.15		11771	480 4.08
Cor.		11759	479 4.07		11510	474 4.12		11968	497 4.15		11507	470 4.08
		255	10		201	8		127	5		264	10
1942												
Tot.												
Unc.	353	4223572	170977	72	847575	34701	71	850048	34004	55	668606	27114
Cor.		4167112	168697		842465	34498		839510	33598		663831	26923
Avg.			%fat			%fat			%fat			%fat
Unc.		11965	484 4.05		11772	482 4.09		11973	479 4.00		12156	493 4.06
Cor.		11804	478 4.05		11701	479 4.09		11824	473 4.00		12070	490 4.06
		161	6		71	3		149	6		86	3
1943												
Tot.												
Unc.	359	4238959	171536	89	1056410	42993	86	1004007	40981	51	595388	23703
Cor.		4202005	169561		1044124	42486		989941	40407		589822	23480
Avg.			%fat			%fat			%fat			%fat
Unc.		11808	478 4.05		11870	483 4.07		11675	477 4.09		11674	465 3.98
Cor.		11705	472 4.03		11732	477 4.07		11511	470 4.08		11565	460 3.98
		103	6		138	6		164	7		109	5
1944												
Tot.												
Unc.	390	4676137	189835	96	1145318	46853	75	908367	36907	64	757851	30716
Cor.		4648457	188735		1135191	46432		900933	36628		752224	30499
Avg.			%fat			%fat			%fat			%fat
Unc.		11990	487 4.06		11930	488 4.09		12112	492 4.06		11841	480 4.05
Cor.		11919	484 4.06		11825	484 4.09		12012	488 4.07		11754	476 4.05
		71	3		105	4		100	4		87	4
1945												
Tot.												
Unc.	387	4595046	187634	92	1077681	44762	84	996227	41092	63	747418	30913
Cor.		4560291	186168		1069518	44405		990408	40848		735774	30420
Avg.			%fat			%fat			%fat			%fat
Unc.		11874	485 4.08		11714	487 4.16		11860	489 4.12		11864	491 4.14
Cor.		11784	481 4.08		11625	483 4.15		11791	486 4.12		11679	483 4.13
		90	4		89	4		69	3		185	8

1946	Mature (365)			5 Yrs. (365)			6 Yrs. (365)			7 Yrs. (365)		
	No. Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	444	5358934	216335	122	1433042	58092	92	1096524	44641	71	861322	34557
Cor.		5324196	214919		1428211	57896		1091487	44425		853141	34241
Avg.			%fat			%fat			%fat			%fat
Unc.		12070	487 4.03		11746	476 4.05		11919	485 4.07		12131	487 4.01
Cor.		11991	484 4.04		11707	475 4.05		11864	483 4.07		12016	482 4.01
		79	3		39	1		55	2		115	5

1941	8 yr. (365) No.Cows	Milk (lbs.)	Fat (lbs)	9 yr. (365) Cows	Milk (lbs.)	Fat (lbs)	10 yr. (365) Cows	Milk (lbs)	Fat (lbs)	11 Yr. (365) Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	54	676787	27174	30	351433	14079	24	296841	11913	26	322958	12976
Cor.		656678	26368		341106	13660		289946	11639		314774	12649
Avg.			%fat			%fat			%fat			%fat
Unc.		12533	503 4.01		11714	469 4.00		12368	496 4.01		12421	499 4.02
Cor.		12161	488 4.02		11370	455 4.00		12081	485 4.01		12107	487 4.01
		372	15		344	14		287	11		314	12
1942												
Tot.												
Unc.	47	566263	23101	34	407758	16443	20	241249	9808	23	274811	11066
Cor.		559600	22830		396592	15985		239867	9748		265031	10667
Avg.			%fat			%fat			%fat			%fat
Unc.		12048	492 4.08		11993	484 4.04		12062	490 4.06		11948	481 4.03
Cor.		11906	486 4.08		11664	470 4.03		11993	487 4.06		11523	464 4.02
		142	6		329	14		69	3		425	17
1943												
Tot.												
Unc.	42	507875	20534	40	484871	19389	17	203600	8136	9	98510	3910
Cor.		506115	20468		479679	19174		200851	8023		98327	3905
Avg.			%fat			%fat			%fat			%fat
Unc.		12092	489 4.04		12122	485 4.0		11976	479 4.0		10946	434 3.96
Cor.		12050	487 4.04		11992	479 3.99		11815	472 3.99		10925	434 3.97
		42	2		130	6		161	7		21	0
1944												
Tot.												
Unc.	46	553476	22410	35	417512	16934	31	370730	14954	23	286525	11535
Cor.		552389	22366		416951	16911		369486	14903		285334	11487
Avg.			%fat			%fat			%fat			%fat
Unc.		12032	487 4.08		11929	484 4.06		11959	482 4.03		12458	502 4.03
Cor.		12008	486 4.05		11913	483 4.06		11919	481 4.03		12406	499 4.03
		24	1		16	1		40	1		52	3
1945												
Tot.												
Unc.	46	564190	22281	34	407886	16491	25	295039	11893	15	182109	7208
Cor.		563016	22233		404181	16331		293250	11824		182109	7208
Avge			%fat			%fat			%fat			%fat
Unc.		12265	484 3.95		11997	485 4.04		11802	476 4.03		12141	481 3.96
Cor.		12239	483 3.94		11888	480 4.04		11730	473 4.03		12141	481 3.96
		26	1		109	5		72	3		0	0

1946	8 yr. (365)			9 yr. (365)			10 yr. (365)			11 Yr. (365)		
	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	48	608183	24811	35	434117	17326	20	246869	9794	23	285707	11506
Cor.		600606	24491		430280	17175		246761	9788		283562	11421
Avg.			%fat			%fat			%fat			%fat
Unc.		12670	517 4.08		12403	495 3.99		12343	490 3.97		12422	500 4.03
Cor.		12513	510 4.08		12293	491 3.99		12338	489 3.97		12329	497 4.03
		157	7		110	4		5	1		93	3

	12 yr. (365)			13 yr. (365)			14 yr. (365)			15 yr. (365)		
1941	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	8	88541	3584	3	39165	1581	2	23073	903	1	13686	572
Cor.		88541	3584		35304	1424		23073	903		13686	572
Avg.			%fat			%fat			%fat			%fat
Unc.		11068	448 4.05		13055	527 4.04		11536	452 3.91		13686	572 4.17
Cor.		11068	448 4.05		11768	475 4.03		11536	452 3.91		13686	572 4.17
					287	52						
1942												
Tot.												
Unc.	17	204933	8239	6	67946	2723	6	72979	2913	1	10568	415
Cor.		202464	8143		67946	2723		68727	2730		10568	415
Avg.			%fat			%fat			%fat			%fat
Unc.		12055	485 4.02		11324	454 4.01		12163	486 4.0		10568	415 3.93
Cor.		11910	479 4.02	1	11324	454 4.01		11455	455 3.97		10568	415 3.93
		145	6		0	0		708	31		0	0
1943												
Tot.												
Unc.	12	143357	5662	10	121291	4787				1	11871	459
Cor.		142215	5620		117722	4649					11871	459
Avg.			%fat			%fat						%fat
Unc.		11946	472 3.95		12129	479 3.95					11871	459 3.87
Cor.		11851	468 3.95		11772	465 3.95					11871	459 3.87
		95	4		7						0	0
1944												
Tot.												
Unc.	7	82260	3339	7	87467	3481	2	23433	905	3	31877	1299
Cor.		82083	3332		87467	3481		23201	895		31877	1299
Avg.			%fat			%fat			%fat			%fat
Unc.		11751	477 4.06		12495	497 3.98		11717	453 3.87		10626	433 4.07
Cor.		11726	476 4.06		12495	497 3.98		11600	447 3.86		10626	433 4.07
		25	1		0	0		117	6		0	0
1945												
Tot.												
Unc.	11	126073	5109	6	68062	2692	8	94309	3807	2	23941	933
Cor.		125368	5080		68062	2692		94309	3807		23941	933
Avg.			%fat			%fat			%fat			%fat
Unc.		11461	464 4.05		11344	449 3.96		11789	476 4.04		11971	467 3.90
Cor.		11397	462 4.05		11344	449 3.96		11788	476 4.04		11971	467 3.90
		64	2		0	0		1	0		0	0

	16 yr. (365)			17 yr. (365)								
1942	No.Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs.)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs)	Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	1	10836	450									
Cor.		10511	437									
Avg.			%fat									
Unc.		10836	450 4.15									
Cor.		10511	437 4.15									
		325	13									
										T		
1943												
Tot.												
Unc.	2	23558	982									
Cor.		21338	890									
Avg.			%fat									
Unc.		11779	491 4.17									
Cor.		10669	445 4.17									
		1110	46									
1944												
Tot.												
Unc.				1	11321	502						
Cor.												
Avg.						%fat						
Unc.					11321	502 4.43						
Cor.					11321	502 4.43						
					0	0						
1945												
Tot.												
Unc.	1	12111	453									
Cor.		10355	387									
Avg.			%fat									
Unc.		12111	453 3.74									
Cor.		10355	387 3.74									
		1756	66									
1946												
Tot.												
Unc.	1	10300	426	1	10085	431						
Cor.		10300	426		10085	431						
Avg.			%fat			%fat						
Unc.		10300	426 4.14		10085	431 4.27						
Cor.		10300	426 4.14		10085	431 4.27						
		0	0		0	0						

1946	12 yr. (365) No.Cows	Milk (lbs.)	Fat (lbs)	13 yr. (365) Cows	Milk (lbs.)	Fat (lbs)	14 yr. (365) Cows	Milk (lbs)	Fat (lbs)	15 yr. (365) Cows	Milk (lbs)	Fat (lbs.)
Tot.												
Unc.	19	219765	8624	8	103707	4284	1	11747	467	3	37566	1376
Cor.		218729	8582		101721	4200		11747	467		37566	1376
Avg.			%fat			%fat			%fat			%fat
Unc.		11567	454 3.92		12963	536 4.13		11747	467 3.98		12522	459 3.67
Cor.		11512	452 3.93		12715	525 4.13		11747	467 3.98		12522	459 3.67
		55	2		248	11		0	0		0	0

METHOD USED FOR CORRECTING RECORDS MADE PARTLY ON 3x AND PARTLY ON 2x A DAY MILKING, TO AN ENTIRE 2x A DAY MILKING BASIS

Some cows were milked for a certain portion of their lactation period on a 3x a day milking system. For the remainder of the lactation period, the usual 2x a day milking was undertaken. The number of days on 3x a day milking is given in each case and also the total length of lactation period, but no mention is made of the actual quantity of milk produced while on 3x a day milking.

Thus a method based on the normal lactation curve was devised for determining in each case how much extra milk was produced over and above that which would have been produced had the cow been on a 2x a day milking instead of a 3x a day milking.

This method was calculated as follows:

1. The monthly figures for the normal lactation curve on a 2x a day milking covering a twelve-month period were used.

2. These monthly production figures were also calculated on a 3x a day milking basis, by dividing by the correction factor 0.833.

3. Considering each consecutive month, in a twelve-month lactation period, as being on a 3x a day milking with the remainder on a 2x a day milking, the length of time on 3x a day milking was expressed as a percentage of the entire lactation length.

4. Using the normal lactation curve figures, for each consecutive month on 3x milking, the quantity of milk produced on 3x milking was expressed as a percentage of the total yield.

5. Thus a graph with the following two factors was drawn up and used for all corrections:

abscissa - length of time on 3x a day milking as percentage of total lactation length.

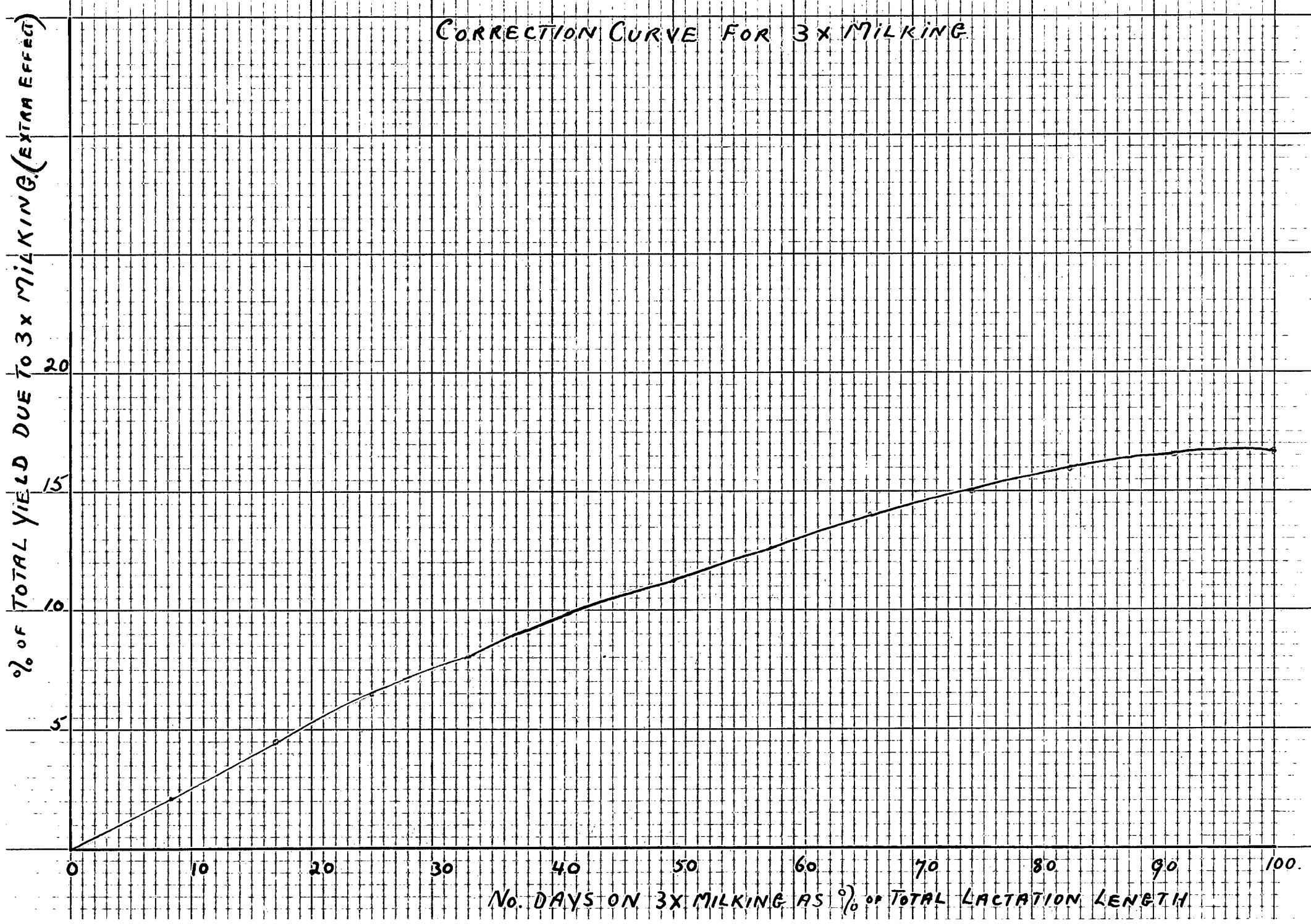
ordinate - extra milk due to 3x a day milking as percentage of total lactation yield.

6. In each case the extra milk produced due to 3x milking was subtracted from the total milk yield, so as to give the corrected milk yield for 2x a day milking.

To Correct Lactations Partially on 3x a Day Milking to Entire 2x a Day Milking

NORMAL LACTATION CURVE FIGURES

Month of Lactation	Avge. Dly. Milk Yield (lbs.) (2xMilking)	In Terms of % of Highest Yield	Fat Content %	Monthly Milk Yld. as a % of Tot.Lactation Yield (2xMilking)	Avge. Daily Milk Yield (lbs.) (3xMilkg.)	Milk Produced on 3x as %of Milk Prod. in Entire Lact.Period	Milk Prod. on 3x Corr.to 2x as % Entire Lactation	Extra Milk Due to 3x as a % of Entire Yield	Time on 3x Milking as % Total Lactation Time
1	32.9	99.6	4.07	11.93	39.5	14.0	11.65	2.35	8.33
2	33.0	100.0	3.94	23.90	39.6	27.38	22.81	4.57	16.66
3	30.3	92.0	4.06	34.89	36.4	39.15	32.61	6.54	25.00
4	28.4	86.0	4.00	45.19	34.1	49.70	41.44	8.26	33.32
5	27.0	82.0	4.10	54.98	32.4	59.46	49.52	9.94	41.65
6	24.7	75.0	4.10	63.94	29.7	68.05	56.67	11.38	50.00
7	23.4	71.0	4.17	72.43	28.1	75.93	63.24	12.69	58.31
8	22.7	69.0	4.20	80.67	27.3	83.38	69.41	13.97	66.64
9	21.1	64.0	4.20	88.32	25.3	90.08	75.02	15.06	75.00
10	17.1	52.0	4.50	94.52	20.5	95.39	79.45	15.94	83.30
11	11.3	34.0	4.59	98.62	13.5	98.85	82.34	16.51	91.63
12	3.8	11.5	4.70	100.00	4.6	100.00	83.29	16.71	100


CORRECTION CURVE FOR 3x MILKING
% OF TOTAL YIELD DUE TO 3x MILKING (EXTRA EFFECT)
20
15
10
5
0
10
20
30
40
50
60
70
80
90
100.
NO. DAYS ON 3X MILKING AS % OF TOTAL LACTATION LENGTH

TO TEST THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN THE MILK AND FAT AVERAGES CORRECTED AND UNCORRECTED FOR 3x DAY MILKING

Milk Averages:	Uncorrected	Corrected
Σx	806358	799869
N	84	84
$\bar{x}$	9599.50	9522.25
$\bar{x}_u - \bar{x}_c$	77.25	
$\frac{(\Sigma x)^2}{N}$ or C.F.	7740633000	7616553000
Σx^2	7889574628	7760015902
$\sigma = \sqrt{\frac{\Sigma x^2 - C.F.}{N-1}}$	1339.5	1314.7
E_m	$= \frac{1339.5}{9.2}$	$E_c = \frac{1314.7}{9.2}$
	$= 145.6$	$= 142.9$

$$E_D = \sqrt{(145.6)^2 + (142.9)^2}$$

$$= 204$$

$$\frac{D}{E_D} = \frac{77.25}{204} = 0.37$$

For P = 0.05 and N = 84, observed value of X = 2.

Therefore: $\frac{D}{E_D}$ is less than 2, therefore there is no significant difference between uncorrected and corrected milk averages.

Fat Averages:	Uncorrected	Corrected
Σx	33155	32893
N	84	84
$\bar{x}$	394.7	391.6
$\bar{x}_u - \bar{x}_c$	3.1	
$(\Sigma x)^2$	1099254025	1081949449
$\frac{(\Sigma x)^2}{N}$ or C.F.	13086350	12880350
Σx^2	13321773	13196867
$\sigma = \sqrt{\frac{\Sigma x^2 - C.F.}{N-1}}$	53.2	52.2

$$E_u = \frac{53.2}{9.2} = 5.78 \qquad E_c = \frac{52.2}{9.2} = 5.67$$

$$E_D = \sqrt{(5.78)^2 + (5.67)^2}$$

$$= 8.1$$

$$\frac{D}{E_D} = \frac{3.1}{8.1} = 0.38$$

For P = 0.05 and N = 84, observed value of X = 2.

Therefore $\frac{D}{E_D}$ is less than 2, therefore there is no significant difference between uncorrected and corrected fat averages.

Method of Reporting Five Year Averages

The records were treated under the following fourteen main classes:

Mature 305 day and mature 365 day.

4 yr. olds 305 day, Jrs., 305 day, Srs. 365 day, Jrs. 365 day, Srs.

3 " " " " " " " " " " " " " "

2 " " " " " " " " " " " " " "

In the immature classes six month periods were used to determine class ranges. This provides more accuracy than using animal class ranges.

The mature classes were extended and treated separately, according to individual years.

Each class, for the five years concerned, was treated as follows:

1. The total number of cows obtained.
2. The total number of pounds of milk actually produced.
3. The total number of pounds of fat actually produced.
4. The percentage of fat in the milk was found by dividing the total quantity of fat by the total quantity of milk, multiplied by one hundred.
5. The average production for each class was found by dividing the total number of pounds of milk and fat by the total number of cows.

CLASS	305 DAY DIVISION				365 DAY DIVISION				% DIFFERENCE BETWEEN 365 and 305 DIVISION RECORDS			
	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	Milk	Fat		
Jr.2 Totals												
1941-45	1211	8764590	364777		859	7611210	314883					
1942-46	1252	9108472	378466		895	7974957	330030					
Avgs.												
1941-45		7237	301	4.16		8861	367	4.14				
1942-46		7275	302	4.16		8911	369	4.14	18.34	18.16		
Difference		≠ 38	≠ 1			≠ 50	≠ 2					
% "		0.53	0.33			0.57	0.55					
F.C.M.		7440				9099						
Sr.2 Totals												
1941-45	1476	11379479	473364		1024	9467378	392423					
1942-46	1510	11716153	486044		1139	10609540	438172					
Avgs.												
1941-45		7710	321	4.16		9245	383	4.15				
1942-46		7759	322	4.15		9315	385	4.13	16.70	16.36		
Difference		≠ 49	≠ 1			≠ 70	≠ 2					
% "		0.64	0.31			0.76	0.52					
F.C.M.		7934				9501						
Jr.3 Totals												
1941-45	796	6480298	267774		476	4708498	194381					
1942-46	820	6710714	276935		491	4872722	201459					
Avgs.												
1941-45		8141	336	4.13		9892	408	4.13				
1942-46		8184	338	4.13		9924	410	4.13	17.53	17.56		
Difference		≠ 43	≠ 2			≠ 32	≠ 2					
% "		0.53	0.60			0.32	0.49					
F.C.M.		8344				10120						

CLASS	305 DAY DIVISION				365 DAY DIVISION				% DIFFERENCE BETWEEN 365 and 305 DIVISION RECORDS			
	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	Milk	Fat		
Sr.3 Totals												
1941-45	879	7665837	315943		457	4704599	194519					
1942-46	939	8224707	339082		505	5192730	214460					
Avgs.												
1941-45		8721	359	4.12		10295	426	4.13				
1942-46		8759	361	4.12		10283	425	4.13	14.82	15.06		
Difference		∠ 38	∠ 2			- 12	- 1					
% "		0.44	0.56			- 0.12	- 0.24					
F.C.M.		8919				10488						
Jr.4 Totals												
1941-45	526	4752252	195121		297	3236540	133814					
1942-46	542	4943564	202172		308	3367817	138043					
Avgs.												
1941-45		9035	371	4.11		10897	451	4.13				
1942-46		9121	373	4.09		10934	448	4.10	16.58	16.74		
Difference		∠ 86	∠ 2			∠ 37	- 3					
% "		0.95	0.54			0.34	- 0.67					
F.C.M.		9243				11094						
Sr.4 Totals												
1941-45	502	4852262	199073		283	3271124	134587					
1942-46	543	5254153	215143		305	3525007	144384					
Avgs.												
1941-45		9666	397	4.10		11559	476	4.11				
1942-46		9676	396	4.09		11557	473	4.10	16.28	16.28		
Difference		∠ 10	- 1			- 2	- 3					
% "		0.10	- 0.25			- .02	- 0.63					
F.C.M.		9810				11718						

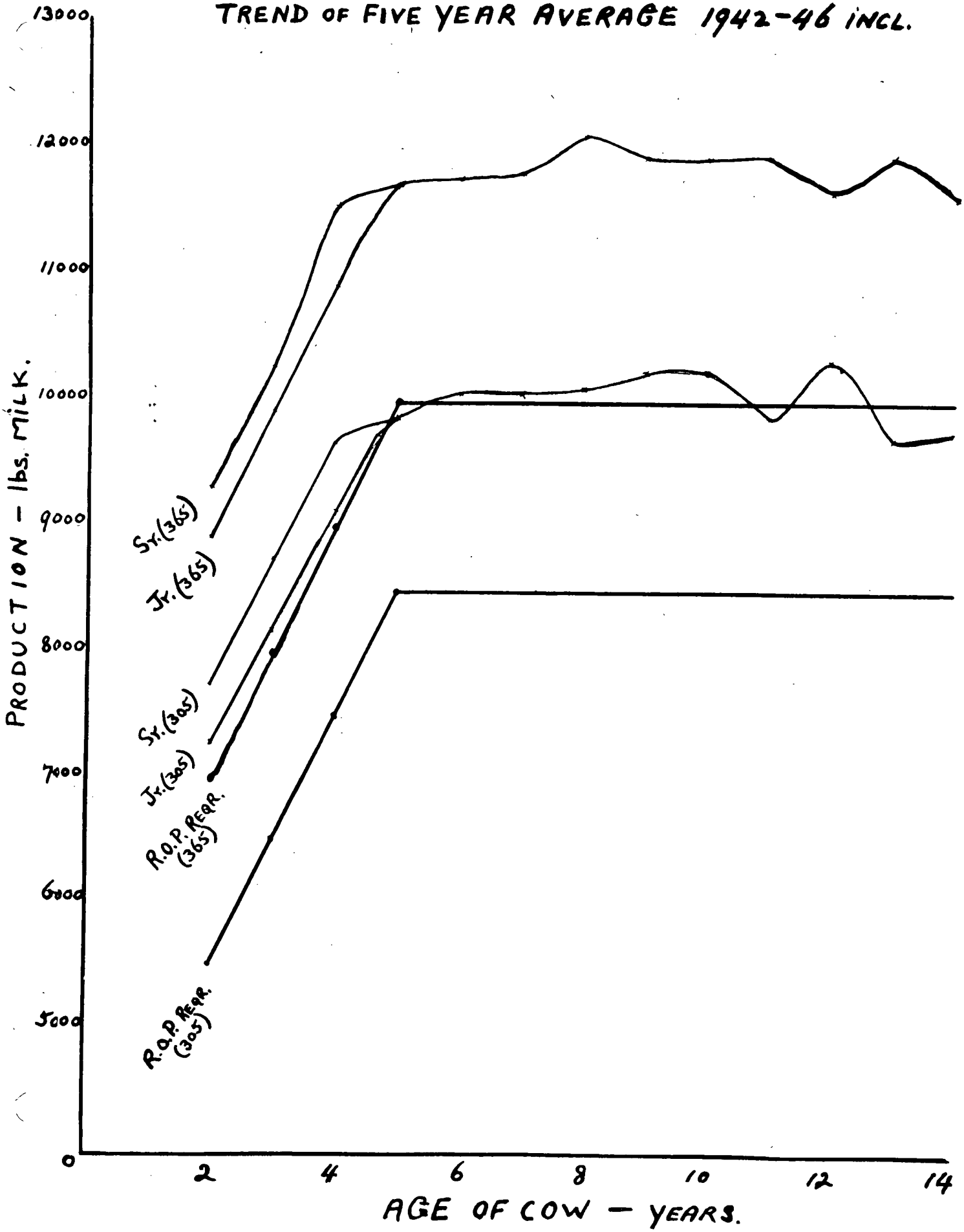
CLASS	Mature 305 DAY DIVISION No. Cows	Milk (lbs)	Fat (lbs)	% Fat	Mature 365 DAY DIVISION No. Cows	Milk (lbs)	Fat (lbs)	% Fat	% DIFFERENCE BETWEEN 365 and 305 DIVISION RECORDS Milk	Fat
1941 Total	429	4249071	173013		351	4127409	168131			
Avge.		9905	403			11759	479			
1942 Total	416	4130860	167105		353	4167112	168697			
Avge.		9930	402			11804	478			
1943 Total	515	5197936	210483		359	4202005	169561			
Avge.		10093	409			11705	472			
1944 Total	470	4768022	193918		390	4648457	188735			
Avge.		10145	413			11919	484			
1945 Total	517	5182405	210677		387	4560291	186168			
Avge.		10024	407			11784	481			
1946 Total	565	5687414	231305		444	5324196	214919			
Avge.		10066	409			11991	484			
1941-1945 Inc.) Total	2347	23528294	955196		1840	21705274	881292			
Avge.		10025	407	4.06		11796	479	4.06		
F.C.M.		10115				11903				
1942-1946 Inc.) Total	2483	24966637	1013488		1933	22902061	928080			
Avge.		10055	408	4.06		11848	480	4.05	15.13	15.00
Difference		∕ 30	∕ 1			∕ 52	∕ 1			
% "		0.30	0.24			0.44	0.21			

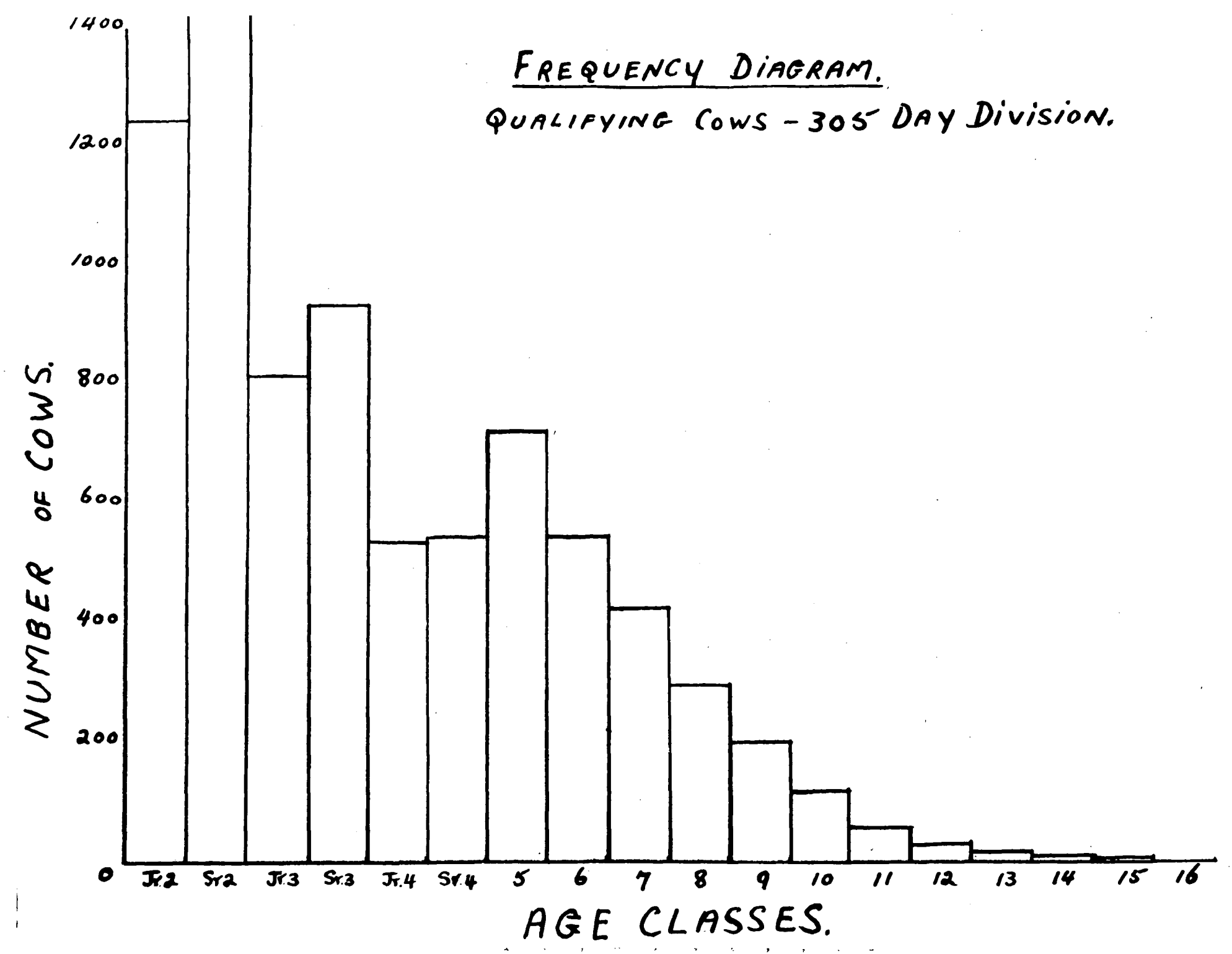
CLASS	305 DAY DIVISION				365 DAY DIVISION				% DIFFERENCE BETWEEN 365 and 305 DIVISION RECORDS			
	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	Milk	Fat		
5yr. Totals												
1941-45	715	7045817	288300		430	5023582	206200					
1942-46	731	7232971	295606		471	5519509	225717					
Avgs.												
1941-45		9854	403	4.09		11683	480	4.10				
1942-46		9895	404	4.09		11719	479	4.09	15.56	15.66		
Difference		∕ 41	∕ 1			∕ 36	- 1					
% "		0.42	0.25			0.31	- 0.21					
6yr. Totals												
1941-45	516	5197824	211175		377	4450859	181778					
1942-46	547	5520493	223797		408	4812279	195906					
Avgs.												
1941-45		10073	409	4.06		11806	482	4.08				
1942-46		10092	409	4.05		11795	480	4.07	14.44	14.79		
Difference		∕ 19	0			- 11	- 2					
% "		0.19				- 0.09	- 0.42					
7yr. Totals												
1941-45	413	4185824	170240		294	3443601	139978					
1942-46	434	4381697	177989		304	3594792	145563					
Avgs.												
1941-45		10135	412	4.07		11713	476	4.06				
1942-46		10096	410	4.06		11825	479	4.05	14.62	14.41		
Difference		- 39	- 2			∕ 112	∕ 3					
% "		- 0.38	- 0.49			0.96	0.63					

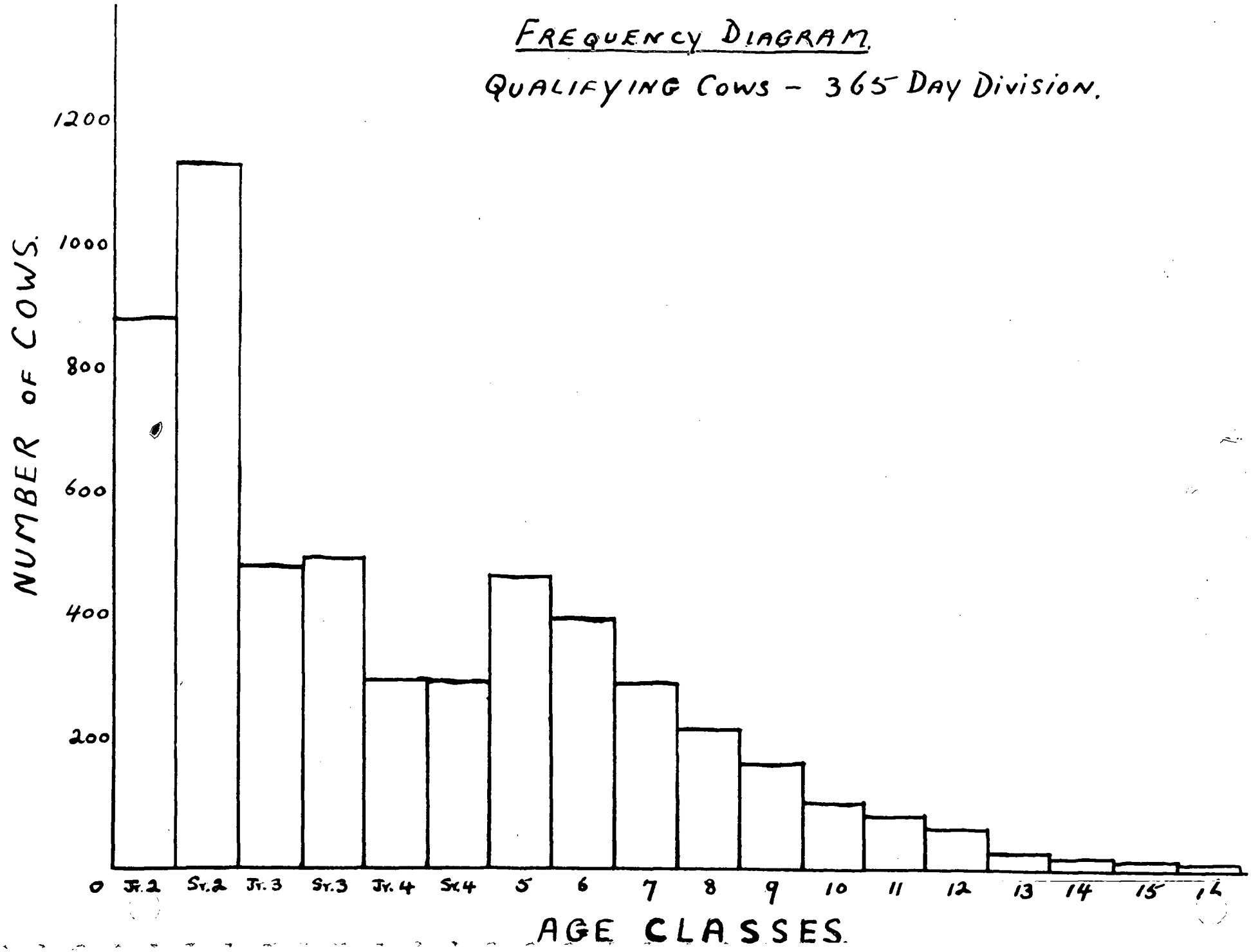
CLASS	305 DAY DIVISION				365 DAY DIVISION				% DIFFERENCE BETWEEN 365 and 305 DIVISION RECORDS			
	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	Milk	Fat		
8yr. Totals 1941-45	268	2705282	109277		235	2837798	114265					
1942-46	303	3072162	124179		229	2781726	112388					
Avgs. 1941-45		10094	408	4.04		12076	486	4.03				
1942-46		10139	410	4.04		12147	491	4.04	16.53	16.50		
Difference		↗ 45	↗ 2			↗ 71	↗ 5					
% "		0.45	0.49			0.58	1.03					
9yr. Totals 1941-45	197	1996305	80610		173	2038509	82061					
1942-46	207	2122789	85268		178	2127683	85576					
Avgs. 1941-45		10134	409	4.04		11783	474	4.03				
1942-46		10255	412	4.02		11953	481	4.02	14.21	14.35		
Difference		↗ 121	↗ 3			↗ 170	↗ 7					
% "		1.19	0.74			1.45	1.48					
10yr. Totals 1941-45	116	1185474	47342		117	1393400	56137					
1942-46	125	1283436	50953		113	1350215	54286					
Avgs. 1941-45		10220	408	3.99		11909	480	4.03				
1942-46		10267	408	3.97		11949	480	4.02	14.08	15.00		
Difference		↗ 47	0			↗ 40	0					
% "		0.46				0.34						

CLASS	305 DAY DIVISION				365 DAY DIVISION				% DIFFERENCE BETWEEN 365 and 305 DIVISION RECORDS			
	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	Milk	Fat		
11yr. Totals												
1941-45	54	533492	21164		96	1145575	45916					
1942-46	66	650834	26088		93	1114363	44688					
Avgs.												
1941-45		9879	392	3.97		11933	478	4.01				
1942-46		9861	395	4.01		11982	481	4.01	17.70	17.88		
Difference		- 18	≠ 3			≠ 49	≠ 3					
% "		- 0.18	0.77			0.41	0.63					
12yr. Totals												
1941-45	30	307519	12097		55	640671	25759					
1942-46	34	352184	13795		66	770859	30757					
Avgs.												
1941-45		10251	403	3.93		11649	468	4.02				
1942-46		10358	406	3.92		11680	466	3.99	11.32	12.88		
Difference		≠ 107	≠ 3			≠ 31	- 2					
% "		104	0.74			0.26	- 0.43					
13yr. Totals												
1941-45	24	235180	9508		32	376501	14969					
1942-46	23	223180	9066		37	442918	17745					
Avgs.												
1941-45		9799	396	4.04		11766	468	3.98				
1942-46		9703	394	4.06		11971	480	4.01	18.95	17.92		
Difference		- 96	- 2			≠ 205	≠ 12					
% "		- 0.97	- 0.51			1.78	2.67					

CLASS	305 DAY DIVISION				365 DAY DIVISION				% DIFFERENCE BETWEEN 365 and 305 DIVISION RECORDS			
	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	No. Cows	Milk (lbs)	Fat (lbs)	% Fat	Milk	Fat		
14Yr. Totals.												
41-45	9	87892	3635		18	209310	8335					
42-46	9	87892	3635		17	197984	7899					
Avgs.												
41-45		9766	404	4.14		11628	463	3.98				
42-46		9766	404	4.14		11646	465	3.99				
Difference		0	0			≠ 18	≠ 2					
% "						0.15	0.43					
15yr. Totals												
41-45	4	36498	1429		8	91943	3678					
42-46	4	36498	1429			115823	4482					
Avgs.												
41-45		9125	357	3.92		11493	460	4.00				
42-46		9125	357	3.92		11582	448	3.87				
Difference		0	0			≠ 89	- 12					
% "						0.78	- 2.61					
16yr. Totals												
41-45	1	11187	419		4	42204	1714					
42-46	1	11187	419		5	52504	2140					
Avgs.												
41-45		11187	419	3.74		10551	429	4.06				
42-46		11187	419	3.74		10501	428	4.08				
Difference		0	0			- 50	- 1					
% "						- 0.47	- 0.23					
17yr. Totals					1	11321	502					
					2	21406	933					
Avgs.						11321	502	4.43				
						10703	467	4.36				
Difference						- 618	-35					
						- 5.45	- 6.97					


TREND OF FIVE YEAR AVERAGE 1942-46 INCL.
PRODUCTION - lbs. MILK.
13000
12000
11000
10000
9000
8000
7000
6000
5000
0
Sr.(365)
Jr.(365)
Sr.(305)
Jr.(305)
R.O.P. REAR. (365)
R.O.P. REAR. (305)
2
4
6
8
10
12
14
AGE OF COW - YEARS.


FREQUENCY DIAGRAM.
QUALIFYING COWS - 305 DAY DIVISION.
NUMBER OF COWS.
1400
1200
1000
800
600
400
200
0
Jr.2
Sr.2
Jr.3
Sr.3
Jr.4
Sr.4
5
6
7
8
9
10
11
12
13
14
15
16
AGE CLASSES.


FREQUENCY DIAGRAM.
QUALIFYING COWS - 365 DAY DIVISION.
NUMBER OF COWS.
1200
1000
800
600
400
200
0
Jr. 2
Sr. 2
Jr. 3
Sr. 3
Jr. 4
Sr. 4
5
6
7
8
9
10
11
12
13
14
15
16
AGE CLASSES.

3. DISCUSSION OF FOREGOING CALCULATIONS.

1. Five-year moving averages were established for the two periods 1941 to 1945 inclusive, and 1942 to 1946 inclusive.

2. These averages were calculated with disregard to the fact that some cows were milked 3x a day for part of the lactation. The averages were also calculated with appropriate corrections being made for all cases where 3x a day milking occurred.

A test of significance showed that the effect of a 3x a day milking did not make any significant difference to the five-year moving averages.

3. The Ayrshire cow, as represented by the five-year moving averages, appears to reach maturity between five and six years of age. The production rises very slightly between six and ten years of age. After ten years, a slight decrease in production seems to occur, but beyond twelve years the number of cows on test is so small as to render the figures unreliable.

4. A frequency diagram of the number of cows qualifying on R.O.P. during the period 1942 to 1946 inclusive, indicates a steady decline in the number of qualifying cows as the age increases. There is , however, a sharper decline between the number of two-year olds and three-year olds, than between any other groups.

5. Taking the immature classes separately and the combined mature classes, there was some difference between the two five-year averages.

These differences were as follows:

	MILK		FAT	
	lbs.	%	lbs.	%
Range of diff.	2 to 86	0.02 to 0.95	1 to 3	0.21 to 0.67

Thus there is not much change in the two five-year averages.

The author takes the view that if the percentage system were adopted each new five-year average should be used, irrespective of how small it might differ from the previous five-year average. The reason being that these figures would represent the latest true averages as they exist, and thus must be retained and used as such.

6. Taking the immature classes separately and the combined mature classes, the differences between the 365-day and 305-day five-year averages for the period 1942 - 1946, ranged as follows:

	MILK	FAT
Range of diff.	14.82% to 18.34%	15.06% to 18.16%

The present Canadian Ayrshire R.O.P. standards for qualification, show a difference between 365-day and 305-day requirements of 1500 pounds milk, which represents a difference of 21% to 15% according to age.

Joubert[7] points out that the U.S. Ayrshire breed average shows a 15% difference between 365 and 305 day records regardless of age.

U.B.C. ROSALINDS ADMIRAL

Name of Daughter & Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
1. 246799 LADY	2	198	305 Sr. 2	305	8954	420	4.69	9882	115	130	124	10655	500	1
2. 246801 LUCY	2	324	365 Sr. 2	365	9375	386	4.12	9540	101	100	100	9706	399	
	4	-	305 Jr. 4	305	8097	337	4.16	8291	89	90	90	8502	347	
	5	-	365 5	365	10009	424	4.24	10364	84	88	87	8986	381	3
3. 256689 MARGARET	2	192	365 Sr. 2	365	13368	485	3.63	12622	144	126	133	13840	502	1
4. 251281 MARIGOLD	2	225	365 Sr. 2	365	8323	318	3.82	8099	89	83	85	8616	329	4
	3	263	305 Sr. 3	229	5613	269	4.79	6280	64	75	70	6062	291	
	4	310	305 Sr. 4	244	6885	271	3.93	6819	71	68	70	7092	279	
	5	-	305 5	228	7299	294	4.03	7330	73	72	72	7533	303	
5. 251282 MARJORIE	2	224	365 Sr. 2	278	6171	288	4.67	6788	66	75	71	6388	298	1
6. 251280 MILDRED	2	199	365 Sr. 2	365	9361	385	4.11	9519	100	100	100	9692	398	
	4	34	305 Jr. 4	246	7310	284	3.88	7184	80	76	78	7676	293	
	5	-	305 5	293	8532	386	4.52	9203	85	95	91	8805	398	3

U.B.C. ROSALINDS ADMIRAL (2)

Name of Daughter & Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
7. 251279 MOIRA	2	327	365 Sr. 2	365	8922	367	4.11	9074	96	95	96	9237	380	
	4	47	305 Jr. 4	211	5978	261	4.37	6306	66	70	68	6277	274	
	5	-	305 5	293	8532	386	4.52	9203	85	95	91	8805	398	3
8. 256690 MYRA	2	330	365 Sr. 2	365	9211	526	5.71	11574	99	136	122	9536	545	
	4	287	365 Sr. 4	365	10815	598	5.53	13296	94	126	113	9691	536	2
9. 269052 NANCY	2	160	365 Jr. 2	365	10682	376	3.52	9913	120	102	109	11709	412	
	3	280	305 Sr. 3	222	8139	257	3.16	7111	93	71	80	8790	278	2
10. 283920 ORCHID	2	214	365 Sr. 2	365	10488	454	4.33	11005	113	118	116	10858	470	1
11. 292516 PRIMROSE	2	192	365 Sr. 2	365	8946	426	4.76	9968	96	111	105	9262	441	1
12. 292515 PRINCESS	2	171	365 Jr. 2	365	10662	443	4.15	10910	120	120	120	11688	486	1

U.B.C. ROSALINDS ADMIRAL

Name of Dam And Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
1. 226524 JACQUELINE	2	215	365 Sr. 2	365	7149	278	3.89	7030	80	75	74	7401	288	
	3	320	365 Sr. 3	234	6089	262	4.30	6366	59	62	61	6576	283	
	5	-	305 5	277	8789	338	3.85	8586	87	83	85	9070	349	
	6	-	305 6	239	7382	269	3.64	6988	73	66	69	7448	271	
	7	-	305 7	221	6366	240	3.77	6146	63	59	61	6366	240	
	8	-	305 8	210	6454	263	4.07	6527	64	64	64	6467	264	6
2. 226520 JOANNE	2	285	365 Sr. 2	365	8349	345	4.13	8515	90	90	90	8643	357	
	4	6	365 Jr. 4	335	9008	402	4.46	9633	82	90	87	8721	389	
	5	-	305 5	305	8381	338	4.03	8422	83	83	83	8649	340	
	6	-	365 6	315	7937	325	4.09	8050	67	68	67	7848	321	4
3. 208515 HEATHER	2	12	365 Jr. 2	365	6273	240	3.83	6109	70	65	67	6876	263	
	3	187	305 Sr. 3	292	9612	335	3.49	8870	110	93	99	10381	362	
	4	204	305 Sr. 4	253	7191	248	3.45	6596	74	63	67	7407	255	
	5	-	365 5	313	8141	304	3.73	7816	69	63	65	9031	307	
	6	-	305 6	231	6938	248	3.57	6495	69	61	64	7000	250	
	7	-	305 7	246	7051	276	3.91	6960	70	68	69	7051	276	

U.B.C. ROSALINDS ADMIRAL (2)

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
3. 208515 HEATHER	8	-	305 8	258	6527	250	3.83	6361	64	61	63	6540	251	
	9	-	305 9	214	4605	154	3.34	4152	46	38	41	4651	155	8
4. 202515 GARDENIA	2	77	305 Jr. 2	305	4847	197	4.06	4894	67	65	66	6107	248	
	3	113	365 Jr. 3	294	5528	211	3.82	5376	56	51	53	6247	238	
	4	156	305 Jr. 4	305	8123	318	3.91	8019	89	85	87	8529	334	
	5	-	305 5	305	8280	287	3.47	7617	82	70	75	8545	296	
	6	-	305 6	265	6856	281	4.10	6957	68	69	69	6918	284	5
5. 155757 ROYAL BELLE	2	235	305 Sr. 2	305	7546	283	3.74	7263	97	88	92	8980	337	
	3	235	365 Sr. 3	365	8776	339	3.86	8595	85	80	82	8246	319	
	5	-	305 5	305	8740	332	3.80	8476	87	81	84	9020	343	
	6	-	305 6	305	12101	511	4.22	12505	120	125	123	12210	516	
	7	-	305 7	305	9611	392	4.08	9724	96	96	96	9611	392	
	8	-	365 8	365	12266	522	4.26	12736	104	109	107	10693	455	
	9	-	305 9	305	12600	497	3.94	12495	125	122	123	12726	502	
	10	0	365 10	365	11903	462	3.88	11691	100	96	98	10625	412	8

U.B.C. ROSALINDS ADMIRAL (3)

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
6. 208517 HATTIE	2	33	305 Jr. 2	292	4362	139	3.19	3830	60	46	51	5496	175	
	3	-	305 Jr. 3	305	5854	180	3.07	5042	72	53	60	6615	203	
	4	122	305 Jr. 4	221	5148	164	3.19	4519	56	44	49	5405	172	3
7. 218126 ILLEEN	2	31	305 Jr. 2	305	6614	260	3.93	6546	91	86	88	8334	328	
	3	36	365 Jr. 3	317	5707	226	3.96	5673	58	55	56	6256	247	
	4	245	305 Sr. 4	291	5746	240	4.18	5898	59	61	60	5918	247	3
8. 130282 ARDGOWAN GLADNESS	3	232	365 Sr. 3	365	9720	438	4.51	10458	95	103	100	9133	411	
	4	-	305 Jr. 4	305	11027	499	4.53	11896	121	134	129	11578	524	
	6	-	365 6	324	12231	533	4.36	12887	103	111	108	10737	468	
	7	-	365 7	365	13493	579	4.29	14082	114	121	118	11739	504	
	8	-	365 8	365	16133	675	4.18	16578	136	141	139	14064	588	
	9	-	365 9	308	11843	527	4.45	12642	100	110	106	10406	463	
	10	-	365 10	365	13145	532	4.05	13238	111	111	111	11733	475	
	12	-	365 12	365	11731	452	3.85	11472	99	94	96	11043	425	
	14	-	365 14	365	7610	294	3.86	7454	64	61	62	7826	302	9

U.B.C. ROSALINDS ADMIRAL (4)

Name of Dam And Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
9. 218120 ISOBEL	2	24	365 Jr. 2	342	6406	199	3.11	5547	72	54	61	7426	231	
	3	101	305 Jr. 3	188	4181	108	2.58	3292	51	32	39	4725	122	
	4	157	365 Jr. 4	230	5882	190	3.23	5203	54	42	47	6176	200	3
10. 256689 MARGARET	2	192	365 Sr. 2	365	13368	485	3.63	12622	144	126	133	13840	502	1
11. 236408 KATHY	2	143	365 Jr. 2	338	7751	309	3.99	7735	87	84	85	9083	362	
	3	269	305 Sr. 3	207	5694	215	3.78	5503	65	60	62	6150	232	
	4	326	305 Sr. 4	288	6650	263	3.95	6605	69	66	67	6850	271	
	6	-	305 6	231	6019	228	3.79	5828	60	56	57	6073	230	4
12. 130269 LOCHINCH LASSIE	2	-	365 Jr. 2	335	8777	379	4.32	9196	98	103	101	10395	449	
	3	261	305 Sr. 3	305	9547	399	4.18	9804	109	111	110	10311	431	
	5	-	365 5	365	9894	440	4.45	10558	84	92	88	8883	395	
	6	-	305 6	305	10294	421	4.09	10433	102	103	103	10387	425	
	8	-	365 8	365	10145	414	4.08	10268	86	86	86	8844	361	
	9	-	305 9	305	10608	406	3.83	10333	105	100	102	10714	410	

U.B.C. ROSALINDS ADMIRAL (5)

Name of Dam And Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.	
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT		
12.130269 LOCHINCH LASSIE			305												
	10	-	10 365	305	10418	411	3.95	10332	104	101	102	10689	422		
	11	-	11 365	365	10824	438	4.05	10900	91	91	91	9878	400		
	12	-	12 365	365	10456	423	4.05	10527	88	88	88	9843	398		
	13	-	13 365	365	10900	431	3.95	10825	92	90	91	10659	421		
	14	-	14 305	365	9776	375	3.84	9535	83	78	82	10053	385		
	16	-	16 305	305	7656	297	3.88	7517	76	73	74	9187	356		
	17	-	17 305	305	8712	332	3.81	8465	87	81	83	10454	398		
	18	-	18 365	305	6972	260	3.73	6689	69	64	66	8366	312		
	19	-	19	309	4482	203	4.53	4838	38	42	41	5324	241	15	

U.B.C. GOVERNORS SPITFIRE

Name of Daughter & Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
1. 269045 NANETTE	3	1	305 Jr. 3	305	10172	395	3.88	9994	124	117	120	11494	446	
	4	7	365 Jr. 4	365	9087	348	3.83	8855	83	78	80	8301	318	2
2. 269049 NAOMI	2	142	305 Jr. 2	305	7340	316	4.31	7676	101	105	103	9248	398	
	3	173	365 Jr. 3	332	6825	309	4.53	7365	69	75	73	6709	304	
	4	225	365 Sr. 4	365	10097	438	4.34	10609	87	93	90	9048	392	3
3. 269048 NATALIE	2	168	305 Jr. 2	305	10678	540	5.06	12371	147	179	166	13454	680	
	3	198	365 Sr. 3	365	12773	606	4.75	14199	124	143	135	12002	569	2
4. 269046 NELLIE	2	223	305 Sr. 2	305	9176	333	3.63	8665	118	103	109	10919	396	
	3	255	365 Sr. 3	365	8614	349	4.05	8681	84	82	83	8094	328	2
5. 269050 NETTIE	2	168	365 Jr. 2	365	7880	327	4.15	8057	88	89	89	8638	358	
	3	226	305 Sr. 3	305	8740	352	4.03	8776	100	98	98	9439	380	2
6. 275663 NORA	2	179	305 Jr. 2	305	5959	283	4.75	6629	82	94	89	7508	357	
	3	196	365 Sr. 3	365	5863	273	4.66	6440	57	64	61	5509	257	2

U.B.C. GOVERNORS SPITFIRE (2)

Name of Daughter & Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
7. 283916 OCTAVIA	2	177	365 Jr. 2	365	12968	572	4.41	13767	145	155	151	14216	627	1
8. 275667 ONA	2	199	365 Sr. 2	365	11180	439	3.93	11057	120	114	116	11574	454	1
9. 275670 OMEGA	2	257	365 Sr. 2	365	8979	421	4.68	9907	96	109	104	10685	436	1
10. 275666 OLIVE	3	57	365 Jr. 3	365	10727	375	3.50	9916	108	91	98	10546	372	1
11. 292513 OLIVIA	2	160	365 Jr. 2	365	8406	329	3.91	8297	94	89	91	9215	361	1
12. 283919 OPHELIA	2	126	365 Jr. 2	365	9001	441	4.90	10215	101	120	112	9867	483	1
13. 275665 OLGA	3	273	305 Jr. 3	305	9290	379	4.07	9401	114	112	113	10498	428	1

U.B.C. GOVERNORS SPITFIRE

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
1. 226520 JOANNE	2	285	365 Sr. 2	365	8349	345	4.13	8515	90	90	90	8643	357	
	4	6	365 Jr. 4	335	9008	402	4.46	9633	82	90	87	8721	389	
	5	-	305 5	305	8381	338	4.03	8422	83	83	83	8849	349	
	6	-	365 6	315	7937	325	4.09	8050	67	68	67	7848	321	4
2. 218119 ISLAY	2	156	305 Jr. 2	287	6074	244	4.02	6090	83	81	82	7653	307	
	3	165	305 Jr. 3	243	5670	212	3.74	5448	69	63	65	6407	240	
	4	157	305 Jr. 4	230	5390	257	4.77	6011	59	69	65	5660	270	3
3. 236406 JEZEBEL	2	39	365 Jr. 2	365	8844	337	3.81	8593	99	91	94	9695	369	
	3	240	365 Sr. 3	365	6342	241	3.8	6152	62	57	59	5959	226	
	4	195	365 Sr. 4	365	5498	198	3.6	5169	48	42	44	4927	177	3
4. 226523 JOYCE	2	357	365 Sr. 2	354	9595	287	2.99	8143	103	75	86	10276	307	
	4	28	305 Jr. 4	273	7652	262	3.42	6991	84	70	76	8035	275	
	5	-	365 5	306	9897	321	3.24	8774	84	67	73	10112	328	
	6	-	305 6	295	9560	374	3.91	9434	95	92	93	9646	377	
	7	-	305 7	242	7008	234	3.34	6313	70	57	62	7008	234	

U.B.C. GOVERNORS SPITFIRE (2)

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
4. 226523 HOYCE	8	-	365 8	364	10419	355	3.41	9493	88	74	80	9083	309	6
5. 202515 GARDENIA	2	77	305 Jr. 2	305	4847	197	4.06	4894	67	65	66	6107	248	
	3	113	365 Jr. 3	294	5528	211	3.82	5376	56	51	53	6247	238	
	4	156	305 Jr. 4	305	8123	318	3.91	8019	89	85	87	8529	334	
	5	-	305 5	305	8280	287	3.47	7617	82	70	75	8545	296	
	6	-	305 6	265	6856	281	4.10	6957	68	69	69	6918	284	5
6. 218118 IONA	2	56	365 Jr. 2	365	8119	328	4.04	8168	91	89	90	8900	360	
	3	-	305 Jr. 3	220	4812	178	3.70	4595	59	53	55	5438	201	
	5	-	305 5	230	5922	256	4.32	6209	59	63	61	6112	264	
	6	-	365 6	345	9191	354	3.85	8986	78	74	75	8532	329	
	7	-	365 7	335	8580	349	4.07	8667	72	73	73	8065	328	
	8	-	365 8	337	9052	363	4.01	9066	76	76	76	8435	338	6
7. 236405 JEMIMA	3	110	305 Jr. 3	263	7034	303	4.31	7359	86	90	88	7948	342	
	4	115	305 Jr. 4	187	6034	254	4.21	6224	66	68	67	6336	267	
	5	-	305 5	244	7971	387	4.86	8993	79	95	89	8226	399	3

U.B.C. GOVERNORS SPITFIRE (3)

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
8. 226520 JOANNE	2	285	365 Sr. 2	365	8349	345	4.13	8515	90	90	90	8643	357	
	4	6	365 Jr. 4	335	9008	402	4.46	9633	82	90	87	8721	389	
	5	-	305 5	305	8381	338	4.03	8422	83	83	83	8649	349	
	6	-	365 6	315	7937	325	4.09	8050	67	68	67	7848	321	4
9. 130269 LOCHINCH LASSIE	2	-	365 Jr. 2	335	8777	379	4.32	9196	98	103	101	10395	449	
	3	261	305 Sr. 3	305	9547	399	4.18	9804	109	111	110	10311	431	
	5	-	365 5	365	9894	440	4.45	10558	84	92	88	8883	395	
	6	-	305 6	305	10294	421	4.09	10433	102	103	103	10387	425	
	8	-	365 8	365	10145	414	4.08	10268	86	86	86	8844	361	
	9	-	305 9	305	10608	406	3.83	10333	105	100	102	10714	410	
	10	-	305 10	305	10418	411	3.95	10332	104	101	102	10689	422	
	11	-	365 11	365	10824	438	4.05	10900	91	91	91	9878	400	
	12	-	365 12	365	10456	423	4.05	10527	88	88	88	9843	398	
	13	-	365 13	365	10900	431	3.95	10825	92	90	91	10659	421	
	14	-	365 14	365	9776	375	3.84	9535	83	78	82	10053	385	
	16	-	305 16	305	7656	297	3.88	7517	76	73	74	9187	356	

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
9. 130269 LOCHINCH LASSIE	17	-	305 17	305	8712	332	3.81	8465	87	81	83	10454	398	
	18	-	305 18	305	6972	260	3.73	6689	69	64	66	8366	312	
	19	-	365 19	309	4482	203	4.53	4838	38	42	41	5324	241	15
10. JUANITA	2	250	365 Sr. 2	356	7550	275	3.64	7145	81	71	75	7996	291	
	3	320	365 Sr. 3	348	8441	320	3.79	8176	82	75	78	8296	314	2
11. MOIRA	2	327	365 Sr. 2	365	8922	367	4.11	9074	96	95	96	9237	379	
	4	47	305 Jr. 4	211	5978	261	4.37	6306	66	70	68	6277	274	
	5		305 5	293	8532	386	4.52	9203	85	95	91	8805	398	3
12. MARIGOLD	2	225	365 Sr. 2	365	8323	318	3.82	8099	89	83	85	8617	329	
	3	263	305 Sr. 3	229	5613	269	4.79	6280	64	75	70	6062	291	
	4	310	305 Sr. 4	244	6885	271	3.93	6819	71	68	70	7092	279	
	5	-	305 5	228	7299	294	4.03	7330	73	73	72	7533	303	4
13. 226524 JACQUELINE	2	215	365 Sr. 2	365	7149	278	3.89	7030	77	72	74	7401	288	
	3	320	365 Sr. 3	234	6089	262	4.30	6366	59	62	61	6576	283	
	5	-	305 5	277	8789	338	3.85	8586	87	83	85	9070	349	
	6	-	305 6	239	7382	269	3.64	6988	73	66	69	7448	271	

U.B.C. GOVERNORS SPITFIRE (5)

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
13. 226524 JACQUELINE	7	-	305 7	221	6366	240	3.77	6146	63	59	61	6366	240	
	8	-	305 8	210	6454	263	4.07	6527	64	64	64	6467	264	6

U.B.C. WHITE COCKADE

Name of Daughter & Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
1. 292519 PAMELA	2	92	365 Jr. 2	365	12102	516	4.26	12581	136	140	138	13266	566	1
2. 292518 PRECIOUS	2	233	365 Sr. 2	365	9993	435	4.35	10522	107	113	111	10346	450	1
3. 292517 PENELOPE	2	231	365 Sr. 2	365	11883	486	4.09	12043	128	126	127	12302	503	1
4. 298432 PATRICIA	2	240	305 Sr. 2	305	10091	434	430	10546	130	135	133	12008	516	1
5. 307555 QUAKER	2	60	305 Jr. 2	305	✱ 8835	389	4.40	9369	121	129	126	11132	490	1
6. 307552 QUEST	2	150	305 Jr. 2	305	✱ 8520	409	4.80	9543	117	135	128	10735	515	1

✱ Records in process of being made, and final production figures estimated.

U.B.C. WHITE COCKADE

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
1. 226526 JANICE	2	155	365 Jr. 2	365	7849	313	3.99	7835	88	85	86	8604	343	
	3	228	365 Sr. 3	306	9432	379	4.02	9458	92	89	90	10085	405	
	4	295	365 Sr. 4	324	9522	393	4.13	9704	82	83	83	9415	389	
	5	-	305 5	292	9536	381	4.00	9529	95	93	94	9841	393	
	6	-	305 6	272	7718	325	4.21	7962	77	80	79	7787	328	
	7	-	305 7	242	6731	235	3.49	6217	67	58	61	6731	235	6
2. 246802 LENORA	2	170	365 Jr. 2	304	8793	340	3.87	8617	99	92	95	11079	428	
	3	181	305 Jr. 3	271	8660	352	4.06	8744	106	104	105	9786	398	
	4	206	365 Sr. 4	308	9889	392	3.96	9836	86	83	84	10084	400	
	5	-	365 5	359	11517	457	3.97	11462	97	95	96	10578	420	4
3. 256690 MYRA	2	330	365 Sr. 2	365	9211	526	5.71	11574	99	136	122	9536	545	
	4	287	365 Sr. 4	365	10815	598	5.53	13296	94	126	113	9691	536	2
4. 218118 IONA	2	56	365 Jr. 2	365	8119	328	4.04	8168	91	89	90	8900	360	
	3	-	305 Jr. 3	220	4812	178	3.70	4595	59	53	55	5438	201	
	4	-	305 5	230	5922	256	4.32	6209	59	63	61	6112	264	

U.B.C. WHITE COCKADE (2)

Name of Dam and Registered Number	AGE		CLASS	DAYS IN MILK	PRODUCTION				PRODUCTION EXPRESSED AS A PERCENTAGE OF THE CLASS AVERAGE			PRODUCTION CALCULATED ON A MATURE EQUIV. BASIS		No. RECORDS.
	Yrs	Days			MILK	FAT	% FAT	FAT CORR. MILK	MILK	FAT	FAT CORR. MILK	MILK	FAT	
4. 218118 IONA			365											
	6	-	6	345	9191	354	3.85	8986	78	74	75	8532	329	
			365											
	7	-	7	335	8580	349	4.07	8667	72	73	73	8065	328	
			365											
	8	-	8	337	9052	363	4.01	9066	76	76	76	8435	338	6
5. 236408 KATHY			365											
	2	143	Jr. 2	338	7751	309	3.99	7735	87	84	85	9083	362	
			305											
	3	269	Sr. 3	207	5694	215	3.78	5503	65	60	62	6150	232	
			305											
	4	326	Sr. 4	288	6650	263	3.95	6605	68	66	67	6850	271	
			305											
	6	-	6	231	6019	228	3.79	5828	60	56	57	6073	230	4
6. 246797 LOIS			365											
	2	144	Jr. 2	365	7786	340	4.37	8214	87	92	90	8535	373	
			305											
	3	242	Sr. 3	294	7168	347	4.84	8072	82	96	91	7741	375	
			365											
	4	267	Sr. 4	309	5992	268	4.47	6417	52	57	55	6110	273	3

DAUGHTER - DAM COMPARISONS OF THREE U.B.C. AYRSHIRE BULLS

Percentage System		DAUGHTERS Milk	Fat	F.C.M.	No. Records	No. Records	DAMS Milk	Fat	F.C.M.	DIFFERENCE Milk	Fat	F.C.M.
Spitfire	All Records	102	106	104	20	64	79	77	78	23	29	26
	1st Records	111	114	112	13	13	89	84	86	22	30	26
Admiral	All Records	92	95	94	23	69	83	80	82	9	15	12
	1st Records	105	108	107	12	12	88	82	84	17	26	23
White Cockade	All Records	123	130	127	6	25	81	83	82	42	47	45
	1st Records	123	130	127	6	6	92	96	95	31	34	32
Mature Equivalence												
Spitfire	All records	9848	417		20	64	8184	326		1664	91	
	1st Records	10605	446		13	13	8578	337		2027	109	
Admiral	All Records	8960	381		23	69	8626	339		334	42	
	1st Records	10099	430		12	12	8476	329		1623	101	
White Cockade	All Records	11632	507		6	25	8370	350		3262	157	
	1st Records	11632	507		6	6	9290	402		2342	105	

SIRE INDEXES OF THREE U.B.C. AYRSHIRE BULLS

The indexes of the three U.B.C. Ayrshire Bulls, namely Spitfire, Admiral and White Cockade were calculated on a percentage and mature equivalent basis. The equal parent index was used.

	PERCENTAGE BASIS			MATURE EQUIVALENCE		INDEX FROM PERCENTAGES	
	Milk	Fat	F.C.M.	Milk	Fat	Milk	Fat
Spitfire All Records	125	135	130	11512	508	12531	549
Spitfire 1st Records	133	144	138	12632	555	13333	586
Admiral All Records	101	110	106	9294	423	10125	448
Admiral 1st Records	122	134	130	11722	531	12231	545
White Cockade-All Records	165	177	172	14894	664	16541	720
White Cockade 1st Records	154	164	159	13974	612	15439	667

DISCUSSION OF THE THREE UBYSSEY SIRE INDEXES

The indexes of the bulls rate in the following ascending order, Admiral, Spitfire and White Cockade.

DIFFERENCES BETWEEN INDEXES CALCULATED OFF ALL RECORDS AND FIRST RECORDS ONLY

The first records indexes of Admiral and Spitfire are higher than the all records indexes. While with White Cockade, the first records index is lower than the all records index.

SPITFIRE:

The daughters of Spitfire show a ratio of 1:1.54 for number of first records to number of all records, and a drop of 8% F.C.M. between the average first records production and the average all records production.

The dams of the daughters sired by Spitfire, show a ratio of 1:4.92 for number of first records, and a drop of 8% F.C.M. between the average first records production and the average all records production.

ADMIRAL:

The daughters of Admiral show a ratio of 1:1.92 for number of first records to number of all records, and a drop of 13% F.C.M. between the average first records production and the average all records production.

The dams of the daughters sired by Admiral, show a ratio of 1:5.75 for number of first records to number of all records, and a drop of 2% F.C.M. between the average first records production and the average all records production.

WHITE COCKADE:

The daughters of White Cockade have only made or are making their first record, therefore there is a ratio of 1:1 for

number of first records to number of all records.

The dams of the daughters sired by White Cockade, show a ratio of 1:4.17 for number of first records to number of all records, and a drop of 13% F.C.M. between the average first records production and the average all records production.

THE SIRE INDEXES:

The two sires, whose daughters show a ratio equal to or greater than 1:1.54 for number of first records to number of all records, have a lower all records index than first records index.

The sire, whose daughters have only made or are making their first records, has a higher all records index than first records index.

RELATIVE MERITS OF ALL RECORDS INDEXES AND FIRST RECORDS INDEXES

The author wishes to point out that indexes calculated from all available records can claim a greater degree of representation of the facts as they exist than can indexes calculated from the use of first records only. The greater the number of records made by dams and daughters, the longer will be the exposure to the vicissitudes of environment and disease, which will have some effect on their percentage production.

Where all records are used to calculate a sire index, there will always be more records made by the dams than the daughters. Thus there will be a greater chance for the effect of environment and disease on the records of the dams, than on those of the daughters.

Where only first records are used, the records of both dams and daughters will be exposed more equally in time, to the effects of environment and disease.

The end result is that all records indexes will tend to be lower than first records indexes, with one type of exception as illustrated in the case of White Cockade.

Where a sire has daughters who have made or are making only their first lactation, the all records index can be expected to be greater than the first records index, the reason being that there will be more chance for a greater difference in dam-daughter comparisons, when all the records of the dams are used.

The author takes the view that in all cases where the daughters of a sire have made an average of more than 1.5 to 2 lactations each, it is more reliable to calculate the sire index using all records.

However, in the case of a sire, whose daughters have made or are making only their first lactations, it is more reliable to

calculate the sire index using first records only. Nevertheless it must be expected that this index will be reduced to some extent when more records are made by the daughters. As in the case of White Cockade it can be expected that his index will be reduced to some extent when his daughters make more records.

The author is of the opinion that there is much scope for future work on this important subject of indexes based on different numbers of dam-daughter records; and especially on developing a system for accurately estimating the index of young sires, whose daughters are in theprocess of making their first lactation.

THE THREE UBYSSEY SIRE INDEXES CALCUIATED ON A MATURE EQUIVALENT BASIS

The indexes of Admiral, Spitfire, and White Cockade, calculated on the Mature Equivalent basis, show a similar trend to those calculated on the percentage basis.

The Mature Equivalent indexes can be directly compared one with the other. However, the Mature Equivalent indexes took slightly longer to calculate, and in the opinion of the author, are not as simple to understand or as easy to remember as the percentage indexes.

VIII. AYRSHIRE HERD TEST PLAN

Writing in the January 1949 issue of the Canadian Ayrshire Review, the editor outlines the past and present aspects of an Ayrshire Herd Test Plan. Many Executive Committees of the Association have from time to time recommended the adoption of an Ayrshire Herd Test Plan. This recommendation has been unanimously approved in principle by successive Boards of Directors and Annual Meetings of the Association. However, it did not find practical application, because the Department of Agriculture felt that all rules and regulations governing R.O.P. should be formulated as a result of joint co-operation between all dairy breeds concerned, and the other dairy breeds have not been willing to institute a Herd Test Plan as desired by the Ayrshire Breed.

The editor goes on to point out that since these early recommendations, the Ayrshire Breeders have recently renewed their request coupled with the intention of instituting approved Sire and Dam plans. The Department of Agriculture has now given favourable consideration to the establishment of a Herd Test Plan for Ayrshires, in view of its necessity for the institution of approved Sire and Dam Plans.

The editor concludes by regretting that full details of the regulations are not yet available, but the following main features are known:

1. All cows and heifers must be put on test as they freshen each year, with but three exceptions: cows twelve years old or over; nurse cows; cows which have lost two or more quarters.

2. Whilst the owner may maintain "stable sheets" for his own information, these will not be taken into consideration when computing the records of a cow on test.

The production of milk credited to a cow will be computed by multiplying the average of the weights taken by inspectors at time of their visits, by the number of days on test. Similar treatment will be given to fat tests.

3. On this Herd Test Plan, all that the Ayrshire breeder will be required to file will be the initial list of eligible animals in the herd. Subsequent addition to the list will be added by the inspector at the time of each visit. The owner will not now be required to file any other statement of monthly or annual reports.

4. This new Plan will probably become effective as from 1st May 1949.

PROPOSED APPROVED SIRE PLAN FOR CANADIAN AYRSHIRES

Joubert[8] outlines the main features of the proposed approved Sire Plan as follows:

1. The record of every daughter that was ever milked in the herd, while that herd was enrolled in the Ayrshire R.O.P. test, must be included in this study.

2. First lactation records shall be used as the basis of all approved Sire studies. However, if a Sire fails to qualify on the basis of first lactations, upon request a second study will be made using the average of all records of each tested daughter and her dam.

3. Incomplete lactation records shall be computed to 305 days in length, and shall be included in the average of the daughters. However, no sire shall be considered for approval unless at least 70 percent of the tested daughters have complete records.

4. All records used in studying sires for "approval" shall be converted to a twice-a-day milking, mature equivalent, 305 day lactation basis.

5. No sire shall be considered unless a minimum of 50 percent of his registered daughters, of three years of age or older, have been under test.

6. A complete sample of the dam-daughter combinations must be considered. A sire must have at least ten daughters forming dam-daughter combinations in order to be eligible for consideration.

QUALIFICATIONS REQUIRED FOR APPROVAL

1. FOR SIRES:

A sire must have a Regression Index of not less than 8,500 lbs. of milk and 340 lbs. of fat for approval.

The Regression Index is the mid-point

between the Equal Parent Index and the breed average.

2. FOR HIS DAUGHTERS:

(a) Group Requirements: - The group of all the daughters of a sire, as well as the group of all the daughters included in dam-daughter combinations, must have given an average of 9,000 lbs. of milk and 360 lbs. of fat, with a fat test of not lower than 3.9 percent; or else they must have given an average of 10,000 lbs. of milk and 400 lbs. of fat.

(b) Individual Requirements: - At least 60 percent of the daughters of an approved sire must have given each 9,000 lbs. of milk, or else at least 60 percent must have given each 360 lbs. of fat.

CLASSIFICATION OF AYRSHIRE COWS ON PERFORMANCE

Jaubert[9] points out that there is a classification plan for type, which rates cows in the following categories:

CATEGORIES	SCORE
Excellent	90- 100
Very Good	85- 89
Good Plus	80- 84
Good	75- 79
Fair	65- 75
Poor	below 65

Jaubert[9] goes on to express the view, that it would be of advantage to the breeder to have cows similarly classified on a performance basis. Further it would be rendering a great service to the individual breeder to give a complete classification of cows on the following main factors: - Type, milk production, fat production, persistency and breeding ability. Such complete information would provide full opportunity to the breeder to practice selection and formulate a breeding program to best advantage.

Jaubert[9] suggests that all the statistical information accumulated by the Ayrshire Breeders Association over many years of testing, should be used to formulate a scale of classification for the factors above mentioned.

Assuming that individual records are expressed as a percentage of the age-lactation period class average, the following measures could be taken to set up scales for classification.

MILK PRODUCTION:

All accumulated data should be represented graphically as follows:

ABSCISSA: - Pounds of milk produced or milk production as percent of age-lactation period class average.

ORDINATE: - Number of cows.

The resulting curve could be sectioned uniformly, so as to establish grades of classification.

FAT PRODUCTION:

A similar procedure could be used for fat production (weight) and also percentage of fat in milk.

PERSISTENCY:

Persistency of production in a given lactation could be assessed by considering the last three months of production as a percentage of the total lactation yield.

The author takes the view that persistency in terms of number of lactation periods in the lifetime of a cow, is of much importance. Grades of classification on number of lactations in a lifetime could be established, and reported on together with the lifetime production of the cow.

BREEDING ABILITY:

Classifications could be based on facility or difficulty to breed, based on the number of days between calvings for a given number of calvings.

INCOMPLETE RECORDS

The author takes the view that all incomplete records should be reported, and the cause of incompletion stated in each case.

The Ayrshire Breeders Association should use all accumulated data to formulate factors, which may be applied to incomplete records, so as to indicate what they would have been, had they been carried to completion.

The certificate of performance of each incomplete record should carry three main items:-

1. Production up to time of incompletion.
2. Calculated production if record had been completed.
3. Cause of incompletion.

In each case the R.O.P. Inspector should certify the cause of incompletion, when the owner reports the record to R.O.P. headquarters.

In the annual R.O.P. reports and also the monthly Ayrshire Review, the calculated production if record had been completed should be reported, but against each record a certain sign or letter must be inserted denoting the cause of incompletion.

IX. RECOMMENDATIONS

1. Every effort should be made to stimulate interest in, and increase membership in the Ayrshire Breeders Association.
2. A larger Central Office, fully equipped with modern I.B.M. machines, be instituted as soon as conditions permit.
3. Every effort should be made to encourage Ayrshire Breeders to enter their herds on the Ayrshire R.O.P. Herd Test Plan, so as to make the R.O.P. records more representative of the population of Ayrshires in Canada.
4. In computing statistics of the Ayrshire Breed, all the records of all cows on test should be used, including incomplete records (corrected to completion) in cases where no previously complete records are available for the cow.
5. The modified method of reporting records as a percentage of the appropriate age - lactation period class average, should be brought to the attention of the Executive, Board of Directors and the Annual General Meeting of the Ayrshire Breeders Association. The subject should also receive some publicity in the press and Breed Magazine.
6. If it were decided to institute this modified system the following approach should be taken:-
   (a) The present arbitrary scale for qualification should no longer be used to distinguish between a "qualifying" and a "non-qualifying" cow. And the record of each cow should be given equal consideration.
   (b) Five year moving averages for age - lactation period classes, should be established.
   (c) Individual records should be expressed as a percentage of

the latest five year average.

(d) In reporting records they should be grouped according to age and lactation period length, and all the allied data should be presented as is now customary, except that "percentage production of the average" should replace the present "production required" column.

(3) The records should be grouped under the name of the farm concerned. The farms should be listed alphabetically.

(f) Under each farm, the records should be grouped as for daughters under the sire concerned.

7. The Proposed Approved Sire Plan should be instituted, and special annual publications should be made on sire indexes, and interim reports should be made in the monthly breed magazine.

8. A system for quickly and accurately estimating the index of young sires, with a minimum of five daughters in the latter half of their first lactation, should be developed.

9. Consideration should be given by the appropriate authorities to Joubert's suggestion for developing grades of classification of Ayrshires to parallel as it were the present system of type classification.

X. SUMMARY

1. A total of 16136 R.O.P. qualifying records of Canadian Ayrshire cows, for the period 1941 to 1946 inclusive, were studied. It was hoped to include the non-qualifying records in this study, but the Ayrshire Breeders Association declined to release these figures.

2. Age - lactation period classes were set up as follows:-

Immature Classes

Jr. 2 (305 days); Sr. 2 (305 days); Jr. 2 (365 days); Sr.2 (365 days).

Jr. 3 (305 days); Sr. 3 (305 days); Jr. 3 (365 days); Sr.3 "

Jr. 4 (305 days); Sr. 4 (305 days); Jr. 4 (365 days); Sr. 4 "

Mature Classes

Mature (305 days); Mature (365 days).

These fourteen main classes were used in all related calculations.

The mature classes were also further broken down into separate years, but none of these were individually used in any calculations.

3. Two five year averages of qualifying records were calculated for each of the fourteen main classes, for the periods

1941 to 1945 inclusive, and

1942 to 1946 inclusive.

4. A total of 1400 records were made by cows on 3 x a day milking for part of their lactation. These records were corrected to 2 x a day milking basis by an appropriate correction curve.

5. The five year averages were calculated without correction for 3 x a day milking, and with correction for 3 x a day milking. A test of significance between these two sets of figures, showed that there was no significant different, due to the quantity of 3 x a day milking records for the 1941 to 1946 period.

6. The five year averages calculated from the 2 x a day records and corrected 3 x a day records were used in all related calculations.
7. There were small differences between the two five year averages. The differences expressed as a percentage of the first average, showed a range over the fourteen classes of from 0.02% to 0.95% for milk, and 0.21% to 0.67% for fat.
8. Differences between corresponding class averages for 365 day and 305 day periods, for the years 1942 to 1946 inclusive, were expressed graphically. These differences range from 14.82% to 18.34% for milk, and 15.06% to 18.16% for fat.
9. Dam - daughter comparisons were made for three University of B.C. Ayrshire Sires. The individual records of the dams and daughters, were calculated as a percentage of the appropriate five year class average for 1942 to 1946 inclusive. Equal parent indexes of these sires were calculated from these percentages. Individual records were also corrected to mature equivalence by the use of conversion factors developed at Iowa State College, and equal parent indexes were calculated on a mature equivalent basis.
10. The indexes calculated by these two methods, showed similar trends placing as follows in ascending order: Admiral, Spitfire, White Cockade. In all cases the percentage index showed a higher figure than the M.E. index.
11. These indexes were calculated using all records available to date, and also by using only first records made by daughters and dams.
12. The two sires, Admiral and Spitfire, showed a lower all records index than first records index. The daughters of these two

sires had made on the average at least 1.54 records each.

13. White Cockade, whose daughters were making or had just completed only their first lactation, showed a lower first records index than all records index.

14. This data is too limited to justify any general conclusions. However, on the basis of the three sires studied, it seems advisable to consider the all records index in cases of sires whose daughters have made an average of 1.5 records each or more. However, in the case of a young sire whose daughters are making their first lactation, it would be more accurate to consider the first records index. This first records index if very high or very low must be expected to regress towards to breed average as the daughters make more records.

15. A suggested scheme for using all the accumulated Ayrshire statistics, so as to set up grades of classification for Ayrshires on the following main factors is outlined:
Milk production, fat production, persistency, and breeding ability.

16. All incomplete records should be reported to R.O.P. headquarters together with the certified cause of incompletion.

17. It is expected that a Herd Test Plan will be instituted for R.O.P. Ayrshires in Canada commencing May 1st, 1949. The main feature of this plan is that it will be made compulsory that all cows in an Ayrshire herd, registered on R.O.P., must be tested and all these records reported to R.O.P. Headquarters at Ottawa.

18. The main features of the Proposed Approved Sire Plan for Ayrshires in Canada are stated.

(a) The record of every daughter that has ever been milked in the herd, while that herd has been enrolled in the Ayrshire R.O.P. System must be included in the study, regardless of ownership.

(b) First lactation records shall be used as the basis of all Approved Sire studies.

(c) A sire must have at least ten daughters forming dam - daughter combinations, in order to be eligible for Approval.

Qualifications Required

The Regression Index of a sire that can qualify for approval shall not be less than 8,500 lbs. of milk and 340 lbs. of fat. In order to qualify a sire does not have to meet any special fat test requirements.

19. The present method of reporting record of performance in Canadian Ayrshire cattle is serving a useful purpose. However, in view of recent advances made in the science of genetics, and its application to animal breeding, it is important that some modification of the present system be instituted. This modification should provide more complete, simple, and readily applicable information. Such a service would aid the individual dairy farmer to practise more careful selection, and formulate a more successful breeding program.

20. The present method of reporting record of performance in United States Ayrshire cattle, makes use of mature equivalence. This system has been used successfully for many years and has proven merit.

21. The suggested modified system, gives more complete and directly comparable information than the present system. It is also

reasonable to claim that it is more simple to understand and yet as complete as the Mature Equivalence method, and it avoids the use of conversion factors.

Correction for 3x a Day Milking

Report No. 33. Year 1941

Cows Milked on 3x basis Part.

% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
	Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
				Jr. 4 (305)					
9	139069	5522	12516	497	3.97	4252	1623	38	14
				Sr. 4 (305)					
6	57377	2332	3442	140	4.06	1525	357	23	5
				Jr. 3 (305)					
10	153643	6325	15364	633	4.12	5337	2187	41	18
				Sr. 3 (305)					
10	152099	6165	15209	516	4.05	4612	1940	42	16
				Jr. 2 (305)					
10	202322	8192	20232	819	4.05	7830	3373	43	26
				Sr. 2 (305)					
9	307469	12764	27672	1148	4.15	11386	4299	38	38
				Jr. 4 (365)					
12	64043	2673	7685	320	4.17	2075	1106	53	6
				Sr. 4 (365)					
13	99953	4026	12993	524	4.03	2846	1699	60	8
				Jr. 3 (365)					
12.5	116662	4627	14582	579	3.97	4380	2534	58	12
				Sr. 3 (365)					
12	124378	4928	14925	591	3.96	3947	2094	53	11
				Jr. 2 (365)					
12	215263	8316	25831	997	3.86	8664	4485	52	24
				Sr. 2 (365)					
8	281539	11311	22523	905	4.02	10773	3490	32	30
				5 yr. (305)					
10.5	227957	9428	23935	991	4.14	6747	2976	44	23
				6 yr. (305)					
9.5	199042	8148	18909	773	4.09	5300	2102	40	18
				7 yr. (305)					
9	109330	4375	9839	394	4.00	2951	1083	37	10
				8 yr. (305)					
13.5	95983	3378	12958	456	3.52	2683	1693	63	9

Report No. 33, Year 1941

% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
	Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
			9 yr. (305)						
8	75915	3008	6073	240	3.96	2103	678	32	7
			10 yr. (305)						
15	19344	803	2901	120	4.15	610	450	74	2
			11 yr. (305)						
7.5	18724	697	1404	52	3.72	610	181	30	2
			13 yr. (305)						
16.5	8700	365	1435	60	4.20	305	305	100	1
			5 yr. (365)						
12	136090	5601	16331	672	4.12	3779	2088	55	11
			6 yr. (365)						
7	110191	4489	7713	314	4.07	3226	905	28	9
			7 yr. (365)						
11.5	139639	5596	16058	644	4.01	3958	2029	51	11
			8 yr. (365)						
11.5	174859	7018	20109	806	4.01	4591	2334	51	13
			9 yr. (365)						
12.5	82619	3360	10327	419	4.06	2555	1467	57	7
			10 yr. (365)						
7	98493	3909	6895	274	3.97	2484	671	27	7
			11 yr. (365)						
8	102299	4096	8184	327	4.00	2973	994	33	8
			13 yr. (365)						
15.5	24908	1017	3861	157	4.08	701	549	78	2

Report No. 34, Year 1942

% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
	Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
				Jr. 4 (305)					
6.5	125067	5085	8129	326	4.06	3813	978	26	13
				Sr. 4 (305)					
8.5	74479	2977	6331	253	4.00	1990	684	34	7
				Jr. 3 (305)					
9	152964	6130	13766	551	4.00	5127	1909	37	17
				Sr. 3 (305)					
4	102160	4115	4086	165	4.03	3527	512	15	11
				Jr. 2 (305)					
8	156788	6652	12543	532	4.24	6636	2076	31	22
				Sr. 2 (305)					
7	236535	9599	16557	672	4.06	8426	2294	27	28
				Jr. 4 (365)					
6	78348	3333	4701	200	4.25	2447	573	23	7
				Sr. 4 (365)					
8.5	109159	4557	9279	387	4.17	2755	973	35	8
				Jr. 3 (365)					
8	95003	3915	7600	313	4.12	3456	1146	33	10
				Sr. 3 (365)					
10.5	39671	1662	4165	174	4.18	1082	478	44	3
				Jr. 2 (365)					
7	154757	6311	10833	442	4.08	6477	1753	27	18
				Sr. 2 (365)					
7.5	301819	12339	22636	923	4.08	10571	3188	30	31
				5 yr. (305)					
9.5	156502	6444	14868	613	4.12	4677	1811	39	16
				6 yr. (305)					
6.5	99445	3812	6464	248	3.83	2673	659	25	9
				7 yr. (305)					
11	86968	3577	9566	393	4.11	2404	1124	47	8
				8 yr. (305)					
10	74351	2951	7435	294	3.96	2070	855	41	7

Report No. 34. Year 1942

% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
	Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
7.5	68262	2524	5120	9 yr. (305) 189	3.70	1777	523	29	6
9	23390	951	2105	10 yr. (305) 82	4.07	573	216	37	2
8	22450	917	1796	11 yr. (305) 73	4.08	580	191	33	2
12	10208	355	1225	13 yr. (305) 42	3.42	305	168	55	1
9	56778	2264	5110	5 yr. (365) 203	3.98	1732	664	38	5
8.5	123981	4772	10538	6 yr. (365) 406	3.85	3250	1124	35	9
8	59688	2389	4775	7 yr. (365) 191	4.00	1669	526	32	5
8.5	78393	3198	6663	8 yr. (365) 271	4.07	2113	732	35	6
11	101505	4159	11166	9 yr. (365) 458	4.10	2885	1407	49	8
6	23039	998	1382	10 Yr. (365) 60	4.33	703	158	22	2
10.5	93146	3798	9780	11 yr. (365) 399	4.08	2555	1161	45	7
9	27430	1067	2469	12 yr. (365) 96	3.88	728	276	38	2
15.5	27430	1132	4252	14 yr. (365) 175	4.12	721	568	79	2
3	10836	450	325	16 yr. (365) 13	4.15	365	45	12	1

Report No. 35, Year 1943

Cows Milked on 3xBasis Part.

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
Jr.4(305)	9	47475	1872	4272	171	4.00	1496	540	36	5
Sr.4 "	8.5	100489	4117	8542	350	4.10	3243	1150	35	11
Jr.3 "	8	91708	3827	7337	306	4.17	3309	1074	32	11
Sr.3 "	8	199372	8245	15950	660	4.14	6266	2107	33	21
Tr.2 "	5.5	100385	4196	5521	231	4.18	4231	892	21	14
Jr.2 "	6	178203	7422	10692	445	4.16	6939	1679	24	23
Jr.4(365)	5	46176	1891	2309	94	4.09	1389	247	18	4
Sr.4 "	8	77826	3157	6226	252	4.05	2175	684	31	6
r.3 "	1	8736	362	87	3	4.14	3.65	12	3	1
Sr.3 "	6	153697	6434	9222	386	4.19	4406	1054	24	13
Sr. 2 "	7	153466	6308	10743	442	4.11	5665	1610	28	16
Sr.2 "	6.5	197376	8416	12829	547	4.26	7518	1939	26	21
5yr.(305)	8	106142	4307	8491	345	4.06	2918	922	32	10
6yr. "	8	124534	5048	9963	404	4.05	3301	1068	32	11
7yr. "	7.5	69462	2756	5210	207	3.97	1779	537	30	6
8yr. "	8	80213	3298	6417	264	4.11	2113	706	33	7
9yr. "	5	59535	2344	2977	117	3.93	1742	335	19	6
10yr. "	6.5	94448	3801	6139	244	4.02	2361	584	25	8
11yr. "	2	18815	765	376	15	4.07	593	43	7	2
12yr. "	5	21763	846	1088	42	3.89	610	114	19	2
5yr (365)	8	153570	6341	12286	507	4.13	4292	1327	31	12
6yr. "	8	175820	7167	14066	574	4.08	4760	1465	31	14
7yr. "	6.5	85633	3432	5566	223	4.01	2453	607	25	7
8yr. "	4.5	39130	1473	1760	66	3.76	1095	181	17	3
9yr. "	13.5	38456	1593	5192	215	4.14	1079	679	63	3

Report No. 35, Year 1943 (Cont'd.2)

Cows Milked on 3x Basis Part.

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
10yr(365)	5.5	49979	2052	2749	113	4.11	1317	270	21	4
11yr. "	1.5	12174	500	183	5	4.11	353	22	6	1
12yr. "	3	38075	1485	1142	42	3.90	1083	122	11	3
13yr."	9	39652	1542	3569	138	3.88	952	350	37	3
16yr."	16.5	13452	555	2220	92	4.13	332	332	100	1

Report No. 36, Year 1944

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
Jr.4(305)	6	101508	4151	6090	249	4.09	3291	785	24	11
Sr.4 "	10.5	23444	953	2462	100	4.07	598	271	45	2
Jr.3 "	7.5	58296	2484	4372	186	4.26	2120	639	30	7
Sr.3 "	3.5	98957	4202	3463	147	4.25	3291	443	13	11
Jr.2 "	5	109002	4566	5450	228	4.18	4244	782	18	14
Sr.2 "	5	125494	5254	6275	263	4.19	4856	882	18	16
Jr.4(365)	10.5	25949	960	2725	100	3.69	730	327	45	2
Sr.4 "	9	97794	4185	8801	376	4.27	2744	1029	38	8
Jr.3 "	7.5	108116	4535	8109	336	4.19	3928	1135	29	11
Sr.3 "	5	35560	1384	1778	69	3.89	1096	219	20	3
Jr.2 "	6.5	81131	3272	5274	213	4.03	3154	825	26	9
Sr.2 "	6	114947	4651	6897	279	4.05	4190	970	23	12
5yr.(305)	4	40480	1637	1619	65	4.04	1186	184	15	4
6yr.(305)	9.5	46573	1897	4424	180	4.07	1489	579	39	5
7yr. "	7.5	65106	2498	4883	187	3.83	1811	526	29	5
8yr. "	3	45560	1825	1367	55	4.03	1207	127	11	4
9yr. "	3.5	19428	783	679	27	4.00	609	85	14	2
10yr. "	12.5	32884	1303	4111	159	3.96	825	476	58	3
11yr. "	0.5	8754	411	43	2	4.69	305	5	2	1
5yr.(365)	8.5	119142	5013	10127	421	4.20	3232	1125	35	9
6yr "	13	57188	2146	7434	279	3.75	1345	807	60	4
7yr. "	9	62522	2416	5627	217	3.86	1679	605	36	5
8yr. "	4.5	24159	982	1087	44	4.06	730	130	17	2
9yr. "	2.5	22456	930	561	23	4.14	730	73	10	2

Report No. 36. Year 1944 (Contd.)

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
10yr.(365)	6	20738	852	1244	51	4.11	737	170	23	2
11yr. "	3.5	34040	1375	1191	48	4.04	1021	133	13	3
12yr. "	1.5	11806	513	177	7	4.35	365	22	6	1
14yr. "	2	11591	400	232	10	3.45	365	29	8	1

Report No. 37 Year 1945

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
Jr.4(305)	8.5	82794	3474	7037	295	4.19	2635	914	35	9
Sr.4(305)	8.5	84825	3596	7210	306	4.24	2431	826	34	8
Jr.3 "	7.5	98595	4255	7395	319	4.32	3277	986	30	11
Sr.3 "	10	92413	3798	9241	380	4.11	2723	1196	43	9
Jr.2 "	3	57178	2444	1715	73	4.27	2304	258	11	7
Sr.2 "	8.5	154892	6331	13166	534	4.09	5490	1918	35	18
Jr.4(365)	11	34950	1468	3845	161	4.20	1091	517	49	3
Sr.4 "	2.5	25980	1029	650	25	3.96	730	66	9	2
Jr.3 "	8	83488	3577	6679	286	4.28	2895	891	31	8
Sr.3 "	8.5	111217	4744	9453	404	4.27	3823	1331	35	11
Jr.2 "	5	116881	4955	5844	248	4.24	4698	848	18	13
Sr.2 "	8	152489	6369	12199	506	4.18	5151	1723	33	15
5yr.(305)	7.5	180972	7511	13572	563	4.15	5146	1556	30	17
6r. "	7	92910	3835	6504	269	4.13	2604	756	29	9
7yr. "	7	124709	4992	8730	349	4.00	3512	1010	29	12
8yr. "	3	22194	826	666	24	3.72	602	68	11	2
9yr. "	4.5	19664	784	885	35	3.98	519	88	17	2
10yr. "	7.5	44169	1902	3313	143	4.31	1175	357	30	4
11yr. "	12	33118	1286	3974	154	3.88	898	492	55	3
5yr.(365)	7	116611	5150	8163	357	4.42	3588	968	27	10
6yr. "	6	96986	4063	5819	244	4.19	2756	671	24	8
7yr. "	9	129375	5474	11644	493	4.23	3371	1234	37	10
8yr. "	2	58669	2413	1174	48	4.11	1698	139	8	5
9yr. "	10.5	35283	1521	3705	160	4.31	1048	481	46	3

Report No. 37, Year 1945 (Cont.2)

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
10yr.(365)	8	22362	863	1789	69	3.86	730	229	31	2
12yr. "	3	23499	968	705	29	4.12	730	78	11	2
16yr. "	14.5	12111	453	1756	66	3.74	365	251	69	1

Report No. 38, Year 1946

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
Jr.4(305)	10.5	77012	3014	8086	316	3.91	2024	931	46	7
Sr.4 "	9.5	116653	4975	11082	473	4.27	3089	1242	40	10
Jr.3 "	9	67676	2404	6091	216	3.55	2436	870	36	8
Sr.3 "	9.5	158307	6557	15039	623	4.14	4808	1938	40	16
Jr.2 "	8.5	99388	4207	8448	357	4.23	3629	1245	34	12
Sr.2 "	5	96509	3877	4825	194	4.02	3302	614	19	11
Jr.4(365)	10	109771	4334	10977	434	3.95	3092	1273	41	9
Sr.4 "	10	86683	3482	8668	348	4.02	2378	1003	42	7
Jr.3 "	12	126992	5080	15239	610	4.00	3821	2118	55	11
Sr.3 "	10.5	64037	2770	6724	291	4.33	1979	888	45	6
Jr.2 "	4	83383	3267	3335	131	3.92	3270	480	15	9
Sr.2 "	6.5	154009	6355	10010	413	4.13	5329	1383	26	15
5yr.(305)	9	120561	4827	10850	434	4.00	3273	1259	38	11
6yr. "	9	120704	4781	10863	430	3.96	3480	1302	37	11
7yr. "	4.5	100275	4031	4512	181	4.02	2901	492	17	10
8yr. "	9	92934	3779	8364	340	4.06	2368	859	36	8
9yr. "	3	58807	2372	1764	71	4.03	1508	188	12	5
10yr. "	3	9815	370	294	11	3.77	297	37	12	1
11yr. "	7	33614	1423	2353	100	4.23	894	267	29	3
12yr. "	3.5	10014	424	350	15	4.23	305	41	13	1
13yr. "	5.5	10191	401	561	22	3.93	305	63	21	1
5yr.(365)	10.5	46011	1871	4831	196	4.06	1279	559	44	4
6yr. "	6.5	77496	3325	5037	216	4.29	2160	569	26	6
7yr. "	10.5	77910	3009	8181	316	3.86	1993	876	44	6

Report No. 38, Year 1946 (Cont.2)

	% Total Milk produced on 3X Milking	TOTAL PRODUCTION of cows on 3X Basis		ACTUAL PRODUCTION due to 3X Milkings			TOTAL DAYS LACTATION	DAYS ACTUALLY ON 3X MILKING	DAYS MILKED 3X as % Total Days	No. Cows
		Milk lbs	Fat lbs.	Milk lbs	Fat lbs.	% Fat				
8yr.(365)	10	75777	3199	7577	320	4.22	1825	782	43	5
9yr. "	5.5	69764	2753	3837	151	3.95	1825	379	21	5
10yr. "	1	10833	480	108	5	4.43	365	13	4	1
11yr. "	3.5	61299	2553	2145	85	4.16	1738	247	14	5
12yr. "	10	10369	421	1036	42	4.06	365	159	43	1
13yr. "	5	39717	1689	1986	84	4.25	1027	183	18	3

APPENDIX

CALCUIATION OF MATURE EQUIVALENTS

The following correction factors which are in use at Iowa State College, were used in calculating mature equivalents.

Corrections for Age

Age	Factor
Jr. Two	1.26
Sr. Two	1.19
Jr. Three	1.13
Sr. Three	1.08
Jr. Four	1.05
Sr. Four	1.03
Five	1.032
Six	1.009
Seven	1.000
Eight	1.002
Nine	1.010
Ten	1.026
Eleven	1.049
Twelve	1.082
Thirteen	1.124
Fourteen	1.182

Correction for length of lactation.

Days	Factor
365	.87
361-364	.88
356-360	.89
351-355	.90
346-350	.91
341-345	.92
336-340	.93
331-335	.94
326-330	.95
321-325	.96
316-320	.97
311-315	.98
306-310	.99

CORRECTIONS FOR MILKING FREQUENCY

Three times per day ----------0.833

ABSTRACT

The present system of reporting record of performance in Canadian Ayrshire cattle, does not allow direct comparisons to be made between cows of different ages and lactation lengths. In the United States the Ayrshire Breeders Association corrects individual records to Mature Equivalence by the use of conversion factors. These M.E. records allow direct comparisons between all cows, and are also used in the calculation of sire indexes. This system has been used successfully in the United States for a long period of time, and has proven merit. However, it depends on the use of conversion factors, which are mathematically accurate only for the group of data from which they were calculated.

The M.E. system forecasts the expected production of a cow at maturity. This expected production is almost certainly never exactly made when the cow does reach maturity. The deviation from this expected production may often be slight, but sometimes large deviations can occur. Farmers do not like to deal in any other terms than actual production terms. The proposed modified system described below, deals only in actual production terms.

A modification of the present Canadian system is suggested, which allows direct comparisons to be made between all cows, and also is simple to understand and easy to remember and apply. The main points of this modified method are:

1. The setting up of fourteen age-lactation period classes.
2. Five year moving averages would then be calculated for these classes.

3. The present arbitrary scale for qualification in R.O.P. is abandoned, and all records are used in computing class averages.
4. The individual record is expressed as a percentage of the class average to which it belongs.
5. Dam-daughter comparisons are made between percentage production of class averages, and sire indexes are reported in terms of percentages.

In this study all the qualifying records of Ayrshires on Record of Performance for the period 1941 to 1946 inclusive were studied. An attempt was made to obtain the non-qualifying records, for the same period, from the Ayrshire Breeders Association but they decided not to release them for research purposes.

Two five year moving averages were calculated for the following fourteen classes:

Jr. 2 (305 days); Sr. 2 (305 days); Jr. 2 (365 days); Sr.2 (365 days); Jr. 3 (305 days); Sr. 3 (305 days); Jr. 3 (365 days); Sr.3 (365 days); Jr. 4 (305 days); Sr. 4 (305 days); Jr. 4 (365 days); Sr.4 (365 days); Mature (305 days); Mature (365 days).

The individual records of the daughters of three University of B.C.Ayrshire sires and the dams of those daughters were expressed as percentages of the five year averages for 1942 to 1946 inclusive.

Dam-daughter comparisons were made and equal parent indexes calculated for these three sires, using the percentage system.

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