New Zealand Society of Animal Production online archive

This paper is from the New Zealand Society for Animal Production online archive. NZSAP holds a regular annual conference in June or July each year for the presentation of technical and applied topics in animal production. NZSAP plays an important role as a forum fostering research in all areas of animal production including production systems, nutrition, meat science, animal welfare, wool science, animal breeding and genetics.

An invitation is extended to all those involved in the field of animal production to apply for membership of the New Zealand Society of Animal Production at our website www.nzsap.org.nz

View All Proceedings | Next Conference | Join NZSAP

The New Zealand Society of Animal Production in publishing the conference proceedings is engaged in disseminating information, not rendering professional advice or services. The views expressed herein do not necessarily represent the views of the New Zealand Society of Animal Production and the New Zealand Society of Animal Production expressly disclaims any form of liability with respect to anything done or omitted to be done in reliance upon the contents of these proceedings.

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

You are free to:

Share— copy and redistribute the material in any medium or format

Under the following terms:

Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

NonCommercial — You may not use the material for commercial purposes.

NoDerivatives — If you remix, transform, or build upon the material, you may not distribute the modified material.

http://creativecommons.org.nz/licences/licences-explained/

"DISTRICT AND SEASONAL INFLUENCE ON LACTATION CURVES IN NEW ZEALAND."

by A. H. Ward,
Technical Officer, Herd Recording Department,
New Zealand Dairy Board.

At last year's conference the purpose of field survey work was discussed and the author laid particular stress on the role to be played by the Herd Recording movement in obtaining a clearer definition of feeding, management, and disease problems as they exist on the farm. Lack of such information is often a considerable handicap to the research worker and at the present time it would appear that despite the tremendous amount of work by nutrition experts, plant breeders, and pasture authorities in stepping up the plane of nutrition of dairy cattle in New Zealand, there is only a minimum of available evidence to show exactly what has been the influence and economic result of the acceptance of that work. It does, therefore, seem opportune to present a brief study of some of the consequences of an almost wholly grassland scheme of dairying as reflected in lactation and production curves.

This paper, then, attempts to define certain peculiarities in the shape of the lactation curve and to finish most unsatisfactorily by putting forward only tentative and highly debatable conclusions. It is perhaps unfortunate that it has not been possible to present more conclusive data but the subject is such that only end results can at present be demonstrated - the reasons leading to these end results will only be understood when more information has been made available, particularly on grass growth curves for the various soil types in the different districts, according to the climatic conditions prevailing. It is, however, of considerable importance at the present time to present these end results, in the form of production curves, so that the problem of economic feeding of dairy cattle can be kept in proper perspective.

The first characteristic of lactation curves that needs to be discussed is the peculiar nature of the early part of the curve for cows calving in the early spring. Whilst admitting only a brief examination of the literature available on the shape of the lactation curve, I have been unable to find evidence for any exception to the general statement that a cow reaches her peak of production within the first 30 to 40 days of her lactation. Yet our New Zealand curves for cows calving in the early spring show a quite distinct lag in reaching this peak, the lag apparently depending on the month in which the cow calves. This is by no means true for all herds and there are numerous exceptions, but it does appear to be true as a general description of a typical New Zealand lactation curve for early spring calvers.

Now as the quality and quantity of food intake must be strongly related to the lactation curve, this brings the whole problem into sharp relief against a background of almost wholly grassland farming, and it appears advisable to discuss the general shape of these curves and the influence of district or season upon them.

Table 1 shows the monthly production (on a 30-day basis) of the highest producing cows in each Herd Improvement Association area and also the production of the highest producing cows in the herds with the lowest averages in each area. The latter should provide a good comparison with the first group because they represent the optimum of production under the worst feed conditions; in other words they are likely to represent curves for high producing cows which have probably been underfed to a considerable extent.

The first interpretation of the reason for this failure of the lactation curve to reach its peak in the first month after calving was that the average and indeed some of the best of New Zealand dairy cattle are underfed in the late winter and early spring months. Consequently they are unable to reach their potential peak of production until better grass growth increases the available food supply. This opinion appears to be well founded at least in theory, but there are some anomalies that still require explanation. Sanders (1) curves for high and low producing cows show no such distinction nor does Espe (2) make any exception. And the data shown on Table 1 of the best cows in poorly fed herds compared with the best cows in the better fed herds show no supporting evidence with the exception of the Manawatu district, where it is possible that winter saved grass is a practice followed to a greater extent than in other districts.

It will be noticed, however, that as the calving date advances into the season (that is, the cows calving in late August and early September) the lactation curve gradually conforms more closely with the curve recognised as the normal physiological curve of production. Analysis of a considerable number of lactation curves for cows calving from October on to the end of the milking season shows a uniform peak of production within the first 4 or 5 weeks. This appears to be strongly suggestive of an association between the peak of butterfat production and the peak of grass production and the inability of supplementary feed in the shape of hay, silage and root crops to make up the feeding value of grass. Furthermore, late August and early September calvers start their lactation at a higher point and keep up a higher plane of production throughout the season and this has been found to be true when lactation curves have been constructed for the same cows calving in the two periods in different years. This in turn leads to the question of whether any general attempt to restore the curve for cows calving in the early spring to its normal physiological shape by feeding greater amounts of better quality supplementary feed is likely to be economic. Or are we to regard the present curve as the economically desirable curve and ignore attempts to make it conform to the normal physiological curve?

SEASONAL INFLUENCE:

In order better to study the influence of seasonal conditions within a district, and differences between districts, a method of converting production averages for cows in milk has been used. This consists of multiplying the actual number of cows in milk by the average production for those cows and dividing by the total number of cows. The resultant figure is termed the "unit" production per cow.

A simple illustration might be helpful in fixing this definition - a farm normally carrying 100 cows would have say only 40 of them in milk in August. If each of those 40 is producing an average of 30 lbs. fat for the month then the total production for August is 40 x 30 = 1,200 lbs. fat. As there is a total of 100 cows on the farm this amounts to 12 lbs. per cow for all cows. This is the "unit" production for all cows in the herd. Consequently the "unit" measure of production automatically adjusts the figure for cows in milk in any one month or longer period to a figure representing the production per cow for the entire herd. Between districts with similar per acre carrying capacities this would be as comparable as a production "per acre" basis, and for that reason is a better measure to use when comparing total food supply with total production.

Using this figure then, let us compare the difference caused by seasonal conditions in the past four seasons in the Auckland Herd Improvement Association district. These four seasons include the worst and the best season experienced for many years - the details are shown in Table II.

It will be seen that seasonal influence on total production occurs mainly in September, October and November and later in March, April and May. This again seems to be expressive of a variation closely linked with the months of greatest variation in grass growth, and the conclusion seems reasonable that these are the months in which particular care should be taken to have supplementary feed available to offset adverse seasonal conditions.

DISTRICT INFLUENCE:

The data in Table I has already shown that the main influence of district is upon the shape of the curve from the peak onwards and suggests that in order to bring our poorer producing districts up to the level of the higher producing districts better feeding must occur in the late summer and autumn months. If any general statement is possible on the relationship of the shape of the lactation curve to poor feeding it is that the shape of the curve from the peak on is a particularly sound indication.

But there is a much more important district difference still to be discussed - and this deals not so much with lactation curves as with total production curves, or, as we have termed them, "unit" production curves. The latter are, after all, far more important economically, than lactation curves because they take into consideration the number of cows being milked in any one month in relation to the total number of cows carried and express the production of the farm or district in terms of butterfat per cow for all cows carried. As mentioned earlier, if all districts had the same carrying capacity per acre, this "unit" figure would enable a comparison to be made of production per acre as between districts.

The "unit" production curve is, therefore, a combination of two factors:-

(a) The number of cows being milked expressed as a percentage of all cows carried.

(b) The average production per cow for cows in milk.

This method now enables us to divide the difference in production between districts into two sections:-

(a) That due to a difference in the percentage of cows being milked.

(b) That due to efficiency per cow of the cows being milked.

In order better to bring out this distinction Table III has been constructed using the Northland area (which on the average is least advanced in the application of supplementary feeding to an all year round grassland farming - on paspalum dominant pastures) as a base from which to compare the superiority (or inferiority) of other districts for the various months of the season according to:-

(a) The gain in any one month through milking a larger percentage of the total cows.

(b) The gain in any one month due to a better production per cow of those cows which are milking.

Thus the Auckland Association area, in which calving commences much earlier than in other districts, has an advantage over Northland of 8.1 lbs. fat per cow, for all cows in August due purely to the extra per cent. of cows in milk. The figures for any district are also comparable with the

other districts so that Auckland has an advantage in August through earlier calving over its nearest rival Taranaki of 2.6 lbs. fat per cow for all cows in August, again due purely to the larger percentage of cows milking in that month.

It is, however, in the autumn months that the greatest differences occur and Table IV shows a summary of the differences in "unit" production between districts according to the spring, summer, or autumn period. Again Northland "unit" production is used as the base from which to calculate these differences. Taranaki's advantage both in percentage of cows being milked and in actual production per cow is very obvious in the autumn with Wellington Association district in close second place.

The question which now requires an answer is what factors influence dairy-farmers in calving their cows early or late in the spring months. Is there, for instance, a tendency for Bay of Plenty farmers to calve cows too early in relation to the feed available or is the poorer production per cow in the spring months due to other reasons? Also, is the production per cow for cows in milk a reflection of quality of feed, or of both quality and quantity? Quality of dairy stock will, of course, play some part, but it is not likely to be a major one.

If the reason is related purely to available feed supply then the question arises as to what extent this must be in terms of (a) supplementary feed (root crops, hay, ensilage, etc.,) and, (b), pasture. Evidence on the shape of the lactation curve for early calving cows is strongly suggestive of the inability of supplementary feed to replace pasture, and further evidence on the production of July as against August calving cows in the Waikato would suggest little advantage in calving cows earlier than August. On the other hand late calving in the Northland district, whatever its cause, and earlier drying off in the autumn is responsible for a considerable loss in production as compared with other districts.

Finally the table showing "unit" production and also the table showing actual lactation curves emphasise the need for greater attention to feed supply, particularly in the late summer and autumn months, and, to the extent that early spring feed supply controls peak production, it is obvious that considerable emphasis must also be placed on the necessity for an increased food supply in the winter months.

At the same time it can be tentatively suggested that a lactation curve which most closely corresponds with the curve of grass production will probably prove to be the most economic curve under New Zealand conditions, and any extension of the available feed supply in the form of fresh grass to enable earlier calving and later drying off should increase present levels of production. This method may well prove to be better economically than any attempt to achieve the same end by utilisation of large reserves of supplementary feed, although this statement should not in any sense be interpreted to mean that less reserves of such feed are necessary.

REFERENCES:

(1) Sanders, H.G.: Journ. of Agric. Sc. Vol. XVII, Pt. III.

(2) Espe, D.L.: "Secretion of Milk", 1938.

TABLE I.

ANALYSIS OF LACTATION CURVES FOR:

*A. COWS UNDER GOOD NUTRITIONAL CONDITIONS. **B. COWS UNDER POOR NUTRITIONAL CONDITIONS.

	NORTHLAND ASSOCIATION				AUCKLAND ASSOCIATION					BAY OF PLENTY ASSOCIATION				
	Monthly Butterfat					Monthly Butterfat					Monthly Butterfat			
	A	B	A	B		A	B	A	B		A	B	A	B
Aug.	53.7	37.4			Aug.	56.5	39.1			Aug.	50.7	37.1		
Sep.	58.4	41.2	58.9	41.6	Sep.	62.6	42.4	66.2	42.7	Sep.	57.7	39.6	59.8	41.0
Oct.	61.3	43.2	63.9	47.2	Oct.	65.6	45.8	73.3	49.3	Oct.	63.2	43.6	66.1	45.4
Nov.	60.7	42.3	67.4	46.5	Nov.	62.1	43.3	72.3	46.6	Nov.	59.5	42.3	66.0	45.5
Dec.	55.1	39.1	63.3	45.0	Dec.	58.3	41.6	66.6	45.4	Dec.	56.5	40.3	61.7	44.0
Jan.	44.9	34.1	51.8	37.4	Jan.	51.0	35.5	55.9	36.7	Jan.	49.6	36.6	54.6	37.7
Feb.	44.6	32.1	49.8	35.0	Feb.	49.9	34.2	55.5	35.5	Feb.	49.2	35.1	53.4	37.1
Mar.	37.8	25.2	42.5	27.0	Mar.	42.2	28.0	48.5	29.8	Mar.	43.5	29.1	46.9	29.4
Apr.	34.4	21.1	38.0	23.5	Apr.	41.4	24.5	45.2	26.9	Apr.	39.8	24.7	44.6	25.6
May	24.2	13.4	27.7	15.6	May	34.1	18.2	36.9	19.1	May	30.6	16.9	34.8	19.4
No. of Cows.	54	53	36	68	No. of Cows.	190	110	72	111	No. of Cows.	74	56	37	59
Lact. Prodn.	480	331	475	321	Lact. Prodn.	534	354	533	340	Lact. Prodn.	509	349	511	331
	TARANAKI ASSOCIATION				WELLINGTON-HAWKE'S BAY ASSOCIATION					SOUTH ISLAND ASSOCIATION				
Aug.	53.0	33.7			Aug.	62.3	36.3			Aug.				
Sep.	60.2	39.7	63.4	39.3	Sep.	66.9	40.7	65.6	40.9	Sep.	53.7	38.6		
Oct.	63.8	42.0	71.6	45.3	Oct.	66.8	44.6	72.6	44.9	Oct.	65.4	42.9	70.1	44.4
Nov.	61.7	41.7	72.3	43.5	Nov.	65.2	43.5	70.3	45.5	Nov.	64.7	46.5	77.5	48.9
Dec.	58.4	40.5	67.6	44.4	Dec.	59.3	40.4	63.5	43.2	Dec.	63.0	44.1	74.9	45.3
Jan.	50.6	32.0	53.4	35.0	Jan.	47.6	32.2	50.8	33.9	Jan.	51.6	36.2	61.4	39.9
Feb.	51.9	31.8	53.9	34.3	Feb.	48.5	31.9	53.8	31.8	Feb.	52.6	33.1	61.6	36.1
Mar.	47.3	26.9	49.1	30.4	Mar.	46.7	26.3	50.9	28.4	Mar.	48.9	30.7	57.5	33.6
Apr.	45.1	22.9	46.3	27.8	Apr.	44.6	24.3	48.4	26.4	Apr.	46.5	26.9	48.6	28.2
May	36.5	16.2	36.8	19.2	May	33.9	16.7	40.1	20.0	May	38.1	20.4	38.5	19.2
No. of Cows.	71	44	43	63	No. of Cows.	75	52	45	84	No. of Cows.	45	54	40	68
Lact. Prodn.	535	329	533	324	Lact. Prodn.	545	337	528	316	Lact. Prodn.	512	329	520	302

Continued overleaf.

* A = Cows producing over 450, 470 or 500 lbs. fat depending upon the general level for all cows in that Association.

** B = The highest producing cows in herds which averaged less than the average for all cows in that Association.

NOTE:- Cows which are shown as having been tested in August are cows calving in July or early August.
Cows which are shown with first test in September are cows calving in late August or early September.

TABLE II.

CURVE OF "UNIT" PRODUCTION (BUTTERFAT) PER COW FOR FOUR SUCCESSIVE SEASONS.
(AUCKLAND ASSOCIATION)

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	May.	Apr.	May	Total Production per cow.	Total Cows.
1937 - 38	16.4	27.7	34.2	36.6	36.0	30.6	28.4	25.3	15.7	9.2	260.1	105,929.
1938 - 39	14.9	22.8	29.5	32.8	33.1	30.6	27.6	22.0	12.2	5.1	230.6	89.031.
1939 - 40	14.1	23.6	32.3	35.8	36.1	31.7	31.4	28.2	21.7	12.9	267.8	84,538.
1940 - 41	17.2	30.0	37.1	38.6	37.3	31.8	30.3	24.3	20.0	12.1	278.7	117,015

TABLE III

ANALYSIS OF SUPERIORITY (OR INFERIORITY) IN MONTHLY "UNIT" PRODUCTION FOR ALL HERD IMPROVEMENT ASSOCIATIONS, USING NORTHLAND AS A BASE.

SEASON 1940 - 41.

	NORTHLAND		AUCKLAND			BAY OF PLENTY			TARANAKI			WELLINGTON		
	% of cows in milk	"Unit" Prodn. lbs.B/fat.	"Unit" Prodn. Lbs.B/fat.	x Inc. or Dec.* Due to Prodn. per Cow	Due to % of Cows	"Unit" Prodn. Lbs.B/fat	Inc. of Dec.* Due to Prodn. per Cow	Due to % of Cows	"Unit" Prodn. Lbs.B/fat.	Inc. or Dec.* Due to Prodn. per Cow	Due to % of Cows	"Unit" Prodn. Lbs.B/fat	Inc. or Dec.* Due to Prodn. per Cow	Due to % of Cows
Aug.	26.6	9.0	17.2	+0.1	+8.1	12.2	-1.0	+4.2	14.2	-0.3	+5.5	11.5	+0.0	+2.5
Sep.	68.3	25.3	30.1	+0.5	+4.3	25.7	-1.2	+1.6	30.2	+0.9	+4.0	28.4	+1.1	+2.0
Oct.	86.6	34.4	37.1	+0.5	+2.2	34.2	-0.8	+0.6	38.0	+2.0	+1.6	37.8	+1.8	+1.6
Nov.	96.0	37.5	38.6	-0.1	+1.2	37.3	-0.6	+0.4	40.5	+1.8	+1.2	41.2	+2.4	+1.3
Dec.	98.0	36.7	37.3	-0.1	+0.7	37.1	+0.3	+0.1	39.0	+1.6	+0.7	39.5	+2.1	+0.7
Jan.	100.0	31.4	31.8	+0.5	-0.1	33.5	+2.1	+0.0	33.1	+2.0	-0.3	31.7	+0.3	+0.0
Feb.	98.0	28.7	30.3	+1.6	+0.0	31.4	+2.7	+0.0	32.2	+3.7	-0.2	30.0	+1.3	+0.0
Mar.	91.0	21.4	24.3	+2.1	+0.8	25.6	+3.2	+1.0	27.9	+5.3	+1.2	26.4	+3.8	+1.2
Apr.	77.0	15.7	20.0	+2.6	+1.7	19.9	+2.6	+1.6	23.4	+5.0	+2.7	22.9	+4.7	+2.5
May	42.2	7.1	12.1	+2.0	+3.0	10.9	+1.8	+2.0	14.7	+3.1	+4.5	14.6	+3.6	+3.9
TOTAL	78.4	247.2	278.8	+9.7	+21.9	267.8	+9.1	+11.5	293.2	+25.1	+20.9	284.0	+21.1	+15.7

* Above or below Northland "Unit" Production.

x Increase or Decrease.

TABLE IV.

SUMMARY OF TABLE III.

SEASON	NORTHLAND	AUCKLAND		BAY OF PLENTY		TARANAKI		WELLINGTON.	
		Inc. or Dec.		Inc. or Dec.		Inc. or Dec.		Inc. or Dec.	
	"Unit" Prodn. Lbs.B/fat	Due to Prodn. Per Cow	Due to % of Cows	Due to Prodn. Per Cow	Due to % of Cows	Due to Prodn. Per Cow	Due to % of Cows	Due to Prodn. Per Cow	Due to % of Cow
Spring: Aug. Sep. Oct.	68.7	+1.1	+14.6	-3.0	+6.4	+2.6	+11.1	+2.9	+6.1
Summer: Nov. Dec. Jan. Feb.	134.3	+1.9	+1.8	+4.5	+0.5	+9.1	+1.4	+6.1	+2.0
Autumn: Mar. Apr.	44.2	+6.7	+5.5	+7.6	+4.6	+13.4	+8.4	+12.1	+7.6
TOTAL	274.2	+9.7	+21.9	+9.1	+11.5	+25.1	+20.9	+21.1	+15.7

MR. E. BRUCE LEVY: In discussing comparisons of production between districts and according to seasonal influence, I would like to emphasize the importance of per acre production as against the basis which has been used by Mr. Ward of per cow production. I would regard it as giving a much more descriptive result if these comparisons were based on per acrew production.

MR. WARD: The unit production figure which has been used in the paper actually does take the place of per acrew production unless there are wide variations in carrying capacity. It is for the very reason which Mr. Bruce Levy mentions that the unit production figure is used in preference to the actual cows in milk production. Actual carrying capacity is, of course, very important, but this figure is almost impossible to obtain on account of the difficulty in assessing the carrying capacity of unimproved portions of the farm, particularly in areas such as Northland.

MR. R.E.R. GRIMMETT: Has Mr. Ward any data on shape of lactation curve on farms where pampas grass is used for winter and spring feeding?

MR. WARD: Not at present, but we hope to have in the near future.

DR. I. CUNNINGHAM: In view of the fact that it is commonly believed that feeding is more scientifically controlled in Britain, is it possible that the shape of the lactation curve might be employed to measure the adequacy of nutrition?

In connection with the different shape of curves in August and September calvers, is the difference nutritional, or could it be due to a longer dry period?

MR. WARD: Dr. Cunningham's first question actually sums up the question asked by this paper on lactation curves. It must be true to a very considerable extent that the shape of the lactation curve does measure the adequacy of nutrition, but the question that arises is how to interpret variations in the early part of the lactation curve. For instance, can the use of feed supplementary to pasture be economically fed and at the same time completely correct the lag shown in the early part of the lactation curve under normal New Zealand conditions?

In answer to the second question, it is possible that the early peak for September calvers might be influenced by a longer dry period, but it is not a correct inference that the September calvers have necessarily had any longer dry period than the August calvers. There are grounds for believing that this might only be true to a limited extent.

MR. M. M. COOPER: At Massey College, work has been proceeding during the last season to determine the influence of concentrate feeding on the shape and dimensions of the lactation curve. No differences of any magnitude were obtained between the two treatments but undue importance should not be attached to this result which is based on only one season. Judged on a physiological criterion, the shape of the curve is particularly good. On an average all cows reached their maximum butterfat production within a month of calving. The peak of milk production was a week later than it was for butterfat, while the butterfat percentage test fell for six weeks, remained relatively stationary for a month to six weeks, and then rose steadily.