AN ASSESSMENT OF THE EFFECT OF FEED SUPPLEMENTATION AND AREAS UNDER IMPROVED PASTURES AND CROPS ON MILK PRODUCTION IN SOUTH-EASTERN QUEENSLAND

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ABSTRACT

A sample of sixty farms in the East Moreton district of Queensland was surveyed over two years, with the aim of assessing the relative effects of improved pastures, crops and supplements on the annual milk production, the first two being estimated in terms of areas established. Milk production and feed variables were reduced to a "per productive acre" basis to facilitate inter-farm comparisons and subjected to analysis of variance using a linear model. Increases in milk production of some 16 lb per productive acre were found per unit increase in the percentage acreage under improved pastures. For crops, the analogous result was 24 lb per acre. Estimated production responses to supplementary feeds are also given.

INTRODUCTION

In the sub-tropical environment of South-eastern Queensland, growth in the range of available pasture species, both temperate and tropical (Ostrowski, 1969), has revolutionised the economics of providing a continuous feed supply for the dairy cow. Between 1960 and 1967 there was a sixfold increase in the area of fertilized improved pastures on Queensland dairy farms (Anon. 1969). In the same period the average production per cow has increased some thirty per cent but this improvement is small compared with corresponding gains in Victoria and South Australia (Anon. 1965, Anon. 1968). Following the introduction of a government subsidy (Anon. 1970) to those Queensland dairy farmers who wish to establish improved pastures, attention has been focused on the relative contribution of such pastures to dairy production when compared with natural pastures, crops and feed supplements.

Considerable problems are involved in trying to isolate and estimate the effect on dairy production of just one out of many influential factors. Even in a carefully designed and controlled experiment the establishment of a quantitative relationship between pasture species and dairy production would not be a straightforward undertaking. On a farming scale, extra complications stem from the multiplicity of factors (rainfall, soil-type, acreage, herd size, fodders, fertilizers, etc.), the lack of control over any of these variables and the dependence of the accuracy of data on the co-operator's powers of recall.

The results of a preliminary survey into the effects on milk production of improved pastures, cropping and supplementation are presented here. The estimates were reached by extracting from detailed interview data four major variables and subjecting these to statistical analysis under certain simplifying assumptions.

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COLLECTION AND ANALYSIS OF DATA

The survey was conducted in the East Moreton district of South-eastern Queensland, a district lying mostly between the 35 in. and 55 in. isohyets and comprising a variety of soil types, predominantly infertile coastal soils. The farms surveyed, which included both milk and cream producers, were selected by the regional officers of the Division of Dairying, Department of Primary Industries as being representative of farms from the respective regions within the East Moreton district. For practical reasons, the survey was limited to sixty of the 1557 dairy farms in this district.

Each farm was visited by one of the authors and a detailed questionnaire form completed during an interview with the farmer. The information sought related to:

(a) uses made of all areas comprising the total acreage including disposition of the land between improved pasture, natural pasture, and crops. Improved pasture was defined to be any permanent or semi-permanent sward containing at least one improved grass or legume species (Ostrowski 1969) or having received substantial fertilizer treatment. Temporary swards such as *Dolichos lablab,* oats, pure stands of lucerne etc. were regarded as crops.

(b) size and composition of the dairy herd and its consumption of feed supplements.

(c) history of the establishment and maintenance of pastures.

(d) annual milk production, obtained by adding factory receipt figures to estimates of milk used domestically, or, in the case of cream producers, the milk equivalent of the amounts of butterfat supplied to the factory (using a 4% milk fat content).

In the few instances when detailed information indicated that animal fattening and sales assumed a major proportion of the dairying enterprise the farm was not included in the analysis.

Analysis

The main components of the dairy cow's feed intake are natural pasture, improved pasture, crops and supplements. In the absence of farmers' nutrition records, it was impossible to obtain accurate retrospective data on the actual utilization of each of the first three components. Therefore, availability rather than utilization was adopted as a criterion for the significance of pastures and crops. To facilitate inter-herd comparison the availability of improved pasture or crops was expressed as a percentage of the total productive area, the latter being any part of the farm which, according to the farmer, contributed to the up-keep of his dairy herd. It was always exclusive of area covered by buildings, yards, and dense scrub.

The herd's annual intake of supplement was converted to lb T.D.N. per productive acre and its annual milk production to lb milk per productive acre. The four resulting parameters constitute the summarised data displayed in Table 1.

TABLE 1

Summarized data for sixty farms showing milk production (P) (lb per annum per productive acre), percentage area of improved pasture (I), percentage area of crops (C), supplement (S) (lb T.D.N. per productive acre)

Farm No.	1965/66				1966/67				Farm No.	1965/66				1966/67			
	P	I	C	S	P	I	C	S		P	I	C	S	P	I	C	S
1	1090	9	0	190	1210	14	0	280	31	510	5	0	380	750	5	0	0
2	600	6	0	90	740	6	0	90	32	600	1	13	200	800	1	5	220
3	1100	11	13	165	1430	9	14	215	33	1260	35	6	690	1210	35	6	610
4	1960	19	23	230	2460	24	32	310	34	780	0	0	180	690	0	0	180
5	2780	95	0	215	3120	95	0	215	35	960	3	2	130	1120	3	2	150
6	2070	8	10	270	2390	4	10	470	36	1530	17	5	160	1920	24	5	200
7	700	14	12	180	890	14	8	300	37	1280	2	20	250	1440	2	20	250
8	1030	10	6	50	1170	20	6	90	38	550	2	6	0	640	5	4	0
9	430	0	6	75	480	0	8	80	39	630	0	8	0	720	0	6	0
10	1060	4	7	90	1360	11	8	55	40	1300	73	8	260	1570	73	8	380
11	2130	0	11	510	2660	11	0	510	41	2100	59	9	430	2940	64	9	595
12	1370	0	8	45	1360	2	8	45	42	625	0	7	145	800	5	10	180
13	1850	0	2	320	2090	6	0	410	43	1225	0	5	120	1625	5	5	90
14	360	0	1	260	820	0	1	175	44	1360	6	18	860	1680	10	26	560
15	1980	22	14	260	2330	30	2	260	45	1260	4	19	530	1630	5	32	49
16	560	0	11	240	500	8	0	130	46	525	0	7	0	950	1	7	0
17	1100	0	10	350	1420	0	10	380	47	1200	18	18	550	1360	20	18	420
18	390	0	12	190	490	1	12	150	48	790	4	2	505	760	8	7	480
19	2080	13	26	600	2690	18	31	860	49	525	3	2	0	500	3	2	0
20	1290	19	22	470	1550	22	24	395	50	410	3	0	45	550	3	1	45
21	1360	0	22	740	1640	5	16	695	51	1140	0	0	245	1650	0	0	245
22	740	8	4	335	810	14	4	265	52	2240	8	8	375	2940	8	8	400
23	1050	0	0	500	880	7	0	305	53	550	0	0	145	480	0	0	135
24	810	0	2	205	820	0	2	185	54	800	2	4	250	1150	2	3	250
25	480	0	8	70	720	0	7	205	55	1150	1	9	200	1270	3	12	230
26	1350	0	4	80	1350	0	0	95	56	1570	0	11	405	1890	3	11	515
27	580	6	5	10	710	10	5	40	57	1850	7	12	1250	2060	18	5	1700
28	1820	10	19	295	2260	12	7	420	58	930	10	11	1125	810	8	13	55
29	1170	43	0	195	1660	58	7	245	59	1540	13	23	580	2490	13	33	615
30	2750	16	21	285	3800	16	21	200	60	770	1	21	120	910	1	25	150
									Annual Means	1167	9.9	8.9	294	1419	12.4	8.8	280

The following linear statistical model was postulated: $P = m + aI + bC + cS + e$, where m, a, b and c are parameters to be estimated; e is a normally distributed error term with zero mean, and P, I, C and S are the four variables defined above.

The model implies that P is a linear function of I, C and S. This appears to be a reasonable assumption for all herds which are not satiated, for if the stocking-rate were very low the response to additional food increments would tend to diminish and the graph would appear non-linear. Using this model, estimates of the coefficients and their confidence intervals were obtained.

The conclusions therefore depend on the validity of the assumptions made to simplify the analysis, namely:

(a) that allowance for size of farm be made by reducing the main variables to a "per productive acre" basis;

(b) that one of the main variables, milk production, is a linear function of the other three (all feed components);

(c) that reduction of the problem from the full data to the four variables, whilst determining the size of the error and confidence intervals, does not bias the estimates obtained.

RESULTS

The results of the analyses of variance performed on the summarised data of Table 1 are displayed in Table 2.

TABLE 2

Point estimates and 95% confidence intervals by years for the four coefficients m, a, b, c in the production equation

Year		m	a	b	c
1965/66	Point Estimate 95% Conf. interval	690 (570, 820)	16** (9, 23)	26** (8, 44)	0.44 (—0.1, 1.0)
1966/67	Point Estimate 95% Conf. interval	770 (610, 920)	17** (8, 26)	22* (4, 40)	0.9** (0.3, 1.5)

*denotes significance at the $P<0.05$ level.
**denotes significance at the $P<0.01$ level.

INTERPRETATION AND DISCUSSION

From Table 2 it is apparent that, under the assumptions of the model, each one per cent of improved pasture in 1965/66 contributed approximately 16 lb of milk to the total production on a "per productive acre" basis. There is a probability of 0.95 that this contribution has lower and upper limits of 9 lb and 23 lb respectively. Indeed, there is a probability of 0.99 that the value of a is positive; or, in other words, that improved pastures do result in increased production.

In the same year, increases in milk of about 26 lb per productive acre were found per unit increase in the percentage area under crops, but the response was more variable as is shown by the wider confidence interval. This result has important implications in relation to the farmer's "quota". The quota is the portion of a whole milk supplier's output for which he is paid at the rates appropriate to milk for human consumption (as opposed to "manufacture" milk). It is assessed on the basis of production in the winter months. Since crops grow mainly at this time, and the winter climate is not conducive to good pastures, fodder cropping could obviously be important in determining quota size.

As an aid in interpretation, let us consider a 220 acre farm. Suppose that 20 acres are covered by yards, buildings, water, dense scrub etc. and that the total productive area is 200 acres. Let the area of improved pasture be 8 acres, the area under crops be 14 acres and the total supplement fed to the herd during 1965/66 be 18000 lb T.D.N.

$$\text{Then } I = 4\%$$
$$C = 7\%$$
$$\text{and } S = \frac{18000}{200} = 90 \text{ lb T.D.N. per productive acre.}$$
$$P = 690 + (16 \times 4) + (26 \times 7) + (0.44 \times 90)$$
$$= 976 \text{ lb per productive acre.}$$

Thus, the predicted total annual production is 195200 lb, compared with 182400 lb in the case I = 0, and 138000 lb when I, C and S are all zero. This latter figure can be regarded as the mean production of a 200 acre farm with unimproved natural pasture and no crops or supplements.

It will be observed that the only coefficient which is not significantly positive is the c-value of 0.44 in 1965/66, but that in the following year the c-value of 0.9 is highly significant. This is a rather unexpected result because in 1965/66 the two feed parameters measuring availability do significantly affect production, whereas the one measuring actual consumption is non-significant. The explanation may be that amounts of supplement fed have been recalled less accurately by co-operating farmers in the case of the earlier data. Certainly experience gained during interviews did emphasise the need for a system of nutrition recording to guarantee the accuracy of data in surveys of this nature.

With the exception noted above, agreement between the sets of estimated coefficients and their confidence intervals from year to year is close.

CONCLUSION

The implications drawn from the results of this survey are that in south-eastern Queensland, the material return from improved pastures is more certain than that from fodder crops, but the magnitude of the crop return on a per acre basis will be in most cases greater than pasture return. However, economics and the individual situation will be the final determinants as to the more desirable practice with respect to net financial return.

It is difficult to draw conclusions from the supplementary feeding results, but indications are that significant results can only be expected from supplement when adequate feed is provided from other sources as was the case in 1966/67.

It will be apparent that this approach could prove useful in future work in practical species evaluation, provided that accurate accounts of animal product (not necessarily milk), species area, other pasture area, crop area and supplement fed are available.

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[Accepted for publication March 25, 1970]