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FACTORS AFFECTING PROFIT IN DAIRYING: CONCLUSIONS FROM NATAL STUDY GROUP RESULTS

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In 1978/79 seventy-seven Natal dairy farmers belonged to study groups which submit data to the "Mail-in-Record" scheme of the division of Agricultural Production Economics of the Department of Agriculture and Fisheries. These farmers were scattered throughout the province, but were concentrated in the cooler higher lying areas.

Further, the distribution of study group members is not a true sample of Natal dairy farmers as they tend to be in areas where particular extension officers, university economists or dairy co-operative field officers have been most active. Nevertheless, their data represents the only reasonably reliable sample of dairy farm physical and financial data numerically large enough for statistical analysis. Fuller details on the study groups are given by Berry & Whitehead (1979).

Procedure

Twenty-three variables thought to be the most important in determining profit were chosen for analysis. A multiple regression program was then used to find those independant variables which made the greatest contribution to a particular dependant variable. The program tests each independant variable against the dependant variable and selects the variable with the highest "t" test value. It then tests each of the remaining variables again selecting the one with the highest "t" test value and including it in the equation and so on in a stepwise fashion until the remaining variables have "t" test values less than a preselected value. A variable selected in an early step may be discarded later if a higher "r" value (co-efficient of correlation) can be obtained without it. For this analysis a "t" value of "2" was selected which with the available degrees of freedom is a level of significance greater than 0,1%.

The Variables

The term animal unit or large stock unit (A.U. or M.L.U.) has many deficiencies as a biological measure (Jones, Arnott & Klug, 1980) not least of which is that dairy farmers tend to talk of "per cow" and "per litre" and seldom "per A.U.". Therefore, all the study group were converted from an A.U. basis and expressed as per cow. The variables (with the abbreviations in brackets) were: -

Gross margin per cow in herd	(GM/COW)	Rands/cow/annum
Total dairy animal units	(TOTAU)	
Total amount of milk produced	(TOTKG)	Litres milk per day
Product income	(MILKSL)	Rands/annum
Purchased feeds	(PURFD)	Rands/cow/annum
Home grown concentrates	(CONHGR)	Rands/cow/annum
Hay	(HAY)	Rands/cow/annum
Greenfeed	(GRNFD)	Rands/cow/annum
Silage	(SILAGE)	Rands/cow/annum
Pastures	(PAST)	Rands/cow/annum
Total feed costs	(TOTFD)	Rands/cow/annum
Litres milk/cow in herd	(KG/CIH)	Litres/cow in herd/annum
Litres milk/cow in milk	(KG/CIM)	Litres/cow in milk/annum
Hectares feed crop	(FDHA)	Hectares/cow in herd
Cows as percentage of TOTAU	(% COW)	
Heifers as % of TOTAU	(% HEF)	

By transformation of simple arithmetic certain other variables were derived. Some of those were:–

Percentage dry cows (% DRYCOW) =

$$\frac{\text{COWSIH} - \text{COWSIM}}{\text{COWSIH} \times 0{,}01}$$

Total concentrate costs (CONCS) =

PURFD + CONHGR Rands/cow/annum

Total roughage costs (ROUGHS) =

HAY + GRNFD + SILAGE + PAST Rands/cow/annum

Milk price per litre (MILKPR) =

$$\frac{\text{MILKSL} \times \text{COWSIH}}{\text{TOTKG}} \quad \text{cents/litre}$$

In addition, in order to try and find curvilinear relationships a 2 x 2 plot of all the variables was done and squared, logarithmic and square root transformations were tried on likely variables.

Results

Two equations with the best 'r' values of the many derived are presented in Tables 1 and 2.

The equation of Table 1 (Gross margin/cow/annum) can be explained as follows:–

0,864 CAPINC: For every extra rand of capital income the margin increases by 86 cents. Herds with a high capital income per cow are likely to be herds with good fertility. Capital income is the value of the increase in the herd plus the value of sales of surplus and cull animals. Therefore, the higher the fertility the more calves that are born and the higher the rate of increase or number of surplus animals. There is no way of finding out from the data what proportion of capital income came from sales of surplus stock or from cull cows or from increase in herd size. However, as the study group values are considerably lower than market values it may be safe to conclude that a high capital income per cow is associated with stable herds with good fertility.

0,021 TOTKG: For every litre of milk produced per day the margin per cow per annum improves by 2,1 cents. Thus, the larger the herd the greater the profit

Table 1

Multiple Regression Equation for Gross Margin per Cow per Annum

	Factor	Variable	't' value	Mean	S.E.
GM/COW =	3,75				
	+ 0,864	CAPINC	5,18	64,1	36,4
	+ 0,021	TOTKG	2,20	1411,0	706,9
	+ 0,124	KGCIH	13,69	3947,2	954,5
	– 0,800	CONCS	9,99	258,0	54,2
	– 0,530	ROUGHS	3,36	84,96	38,7

$r = 0{,}91$ $\quad r^2 = 0{,}83$

Table 2

Multiple Regression Equation for Milk Yield per Cow per Annum (kgs)

	Factor	Variable	't' value	Mean	S.E.
KGCIH =	1481				
	+ 2,26	TOTAU	2,76	189,4	79,25
	+ 5,11	CONCS	7,15	258,0	54,2
	+ 1137,0	FDHA	4,15	0,67	0,24
	– 21,28	% DRYCOW	2,25	22,8	7,41
	+ 11,3	PAST	4,75	39,56	27,25

$r = 0{,}83$ $\quad r^2 = 0{,}69$

per cow. This factor almost certainly has a limit, but this was not found in the range of data analysed. Further, there must be an interaction with yield per cow per day. The magnitude of this interaction was not found in the transformations which were tried.

0,124 KGCIH: For every extra litre per cow per year the margin improves by 12 cents. This factor had the highest 't' value. An attempt was made to force the program to select KGCIM by leaving out KGCIH, but the 'r' value dropped very considerably and KGCIM was still not selected. Thus, perhaps the most important conclusion of the analysis can be made viz: milk yield per cow per year is a far more important determinant of profit than milk yield per cow per lactation.

–0,800 CONCS: For each rand spent on concentrates the margin per cow dropped by 80 cents. However, as yield is itself an important contributer to margin the interaction between feed and yield cannot be ignored as shown by the equation of Table 2.

–0,530 ROUGHS: For each rand spent on roughages the margin per cow dropped by 53 cents. The better the quality of roughages the less the amount of concentrates needed for a given milk production (Bredon & Stewart, 1979). Therefore, this equation demonstrates that under the cost structure prevailing for the analysis greater profits were achieved where the ratio of concentrate to roughage costs decreased. In other words, assuming the same amount of milk is produced it is better to spend money on roughages than concentrates.

In view of the importance of KGCIH in determining margin per cow the second equation (Table 2) was derived. This can be interpreted as follows:–

2,26 TOTAU: For every extra A.U. on the farm the yield per cow per year (KGCIH) increased by 2,26 litres. Thus, the larger the herd the higher the yield per cow. In the 2 x 2 plot of KGCIH vs TOTAU there was a tremendous scatter of points and nonsignificant 'r' .

5,11 CONCS: Every rand spent on concentrates increases KGCIH by 5,11 litres (cf. comment under CONCS above).

11,3 PAST: Every rand spent on pastures increases KGCIH by 11 litres. Thus, pastures are twice as effective as concentrates in improving yield.

1137 FDHA: As is evident from Table 2, the range of this variable is small. Therefore, it is most easily interpreted by saying that for every extra one-tenth hectare per cow devoted to home grown feeds the KGCIH increased by 113,7 litres.

–21,28 % DRYCOW: For every 1% increase in the number of dry cows the KGCIH dropped by 21,28 litres per cow. This is a reflection of the importance of fertility. The better the fertility the fewer dry cows. It is also a reflection of yield because higher yielding cows would tend to be in milk until deliberately dried off in anticipation of a subsequent lactation.

It should be noted that in determining the equation for KGCIH the program was not permitted to select for KGCIM because the regression of KGCIH on KGCIM was:

$$KGCIH = 2486{,}5 + 0{,}8254\,KGCIM \quad r = 0{,}931$$

Therefore, nearly all of the variation in KGCIH could be explained by saying that the higher the yield per cow in milk the higher the yield per cow in herd. This is an obvious and unhelpful statement and hence in deriving the equation for KGCIH the program was not permitted to select for KGCIM.

Conclusions

Three conclusions are possible from the data:–

* Farmers must pay particular attention to factors affecting capital income. These are fertility and heifer rearing.
* Farmers must make every effort to improve yield per cow per year and not necessarily yield per cow per lactation. The aspects affecting this are fertility and feeding.
* Farmers must make as much use as possible of quality home grown feeds and area of feed crop per cow can be increased.

In view of the important role played by fertility it was a pity that no reasonable measure of this aspect was available from the "Mail-in-record" results. It would also have been helpful if the areas (not just the money) devoted to the different feed crops had been available.

To sum up, it may be true to say that farmers who were running large stable herds with excellent fertility, plenty of good quality home grown feeds and high milk yields made the greatest profit per cow.

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