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CRITICAL INPUTS INTO GISBORNE HILL COUNTRY

M.J.FITZHARRIS and D.F.WRIGHT*
Advisory Services Division, MA F, Gisborne.
**Agricultural Research Division, MA F, Palmerston North.*

Abstract

The results of an analysis of four years data, 1975/76-1978/79, from a farm management study of Gisborne-East Coast hill country farms were presented at the 1980 Grasslands Conference. Analysis of three more years data, 1979/80-1981/82, essentially confirms the association of fencing and fertiliser with high levels of animal production. Recent escalating costs of fertiliser have cast doubts on its profitability. High stocking rates (usually beyond 12 su/ha) and high proportions of cattle (usually up to 50% of su) have emerged as other factors consistently associated with greater productivity and frequently with profitability. It is suggested that manipulation of these factors would be worthy of farmers consideration. The practical implications for the future of these findings are discussed.

Keywords: Farm production, farm profit, Gisborne hill country

INTRODUCTION

A farm management study of hill and hard hill country properties north and north west of Gisborne has been conducted over the period 1975/76-1981/82. Major findings for the initial four year period 1975/76-1978/79, were that the most productive and profitable properties had higher levels of subdivision, superphosphate, and stock management (Fitzharris & Wright, 1981). This paper updates that information by including three more years data for 1979/80-1981/82, and reports changes that have occurred over the seven year period. The management inputs are reported for those farms with improving levels of production and profit over the seven year period.

METHODS AND RESULTS

Farmers in the Gisborne-East Coast district interested in taking part in the MAF's Farm Management Analysis Scheme have provided data which have been loosely classified into management, production and economic variables (Table 1). Some members of the study group changed between years.

The money remaining after expenditure on farming operations, repairs and maintenance, vehicles and standing charges, is called Economic Farm Surplus. It measures relative profitability per ha or per stock unit (su) without being influenced by level of indebtedness, capital expenditure, tax and personal drawings etc. The per ha production indices listed are considered to be more useful than the production per head equivalents of lambing percentage, wool weight/sheep stock unit, and calving percentage. Means of all variables are given for each year, 1975/76-1981/82, together with the median standard deviation (s.d.) (Table 2). Although the study group was not randomly chosen and hence may not be strictly representative of the district in terms of absolute figures, it is contended that changes through time and associations between factors on the participating farms, should fairly mirror what is happening.

Data have been analysed using a forward selection regression procedure (Draper & Smith, 1966). Whilst this analysis reduces the problem of spurious relationships which can arise from considering variables in a pairwise manner, its

Table 1: ECONOMIC, PRODUCTION AND MANAGEMENT FACTORS

ECONOMIC

Economic Farm Surplus (E.F.S.) per Effective Farm Area ($/ha)
Economic Farm Surplus per Livestock Unit (su) ($/su)

PRODUCTION

Per head Lambing Percentage
Wool Weight per Sheep Livestock Unit (kg/s.su)
Calving Percentage

Per hectare indices Lamb index per ha = Lambing percentage X Stocking rate
Wool Index per ha = (Wool weight/s.su) X Stocking rate
Calf Index per ha = Calving percentage X Stocking rate

MANAGEMENT

Number of paddocks
Fertiliser applied per Livestock Unit (kg/su)
Sheep:Cattle ratio (% s.su)
Effective Farm Area (ha)
Stocking Rate (su/ha)
'Percentage of farm consisting of cultivatable land (%)
[1] Distance from Gisborne (km)
'Percentage of farm covered with mudstone or sandstone (%)
[2] Age of farmer

[1] 1981 on only [2] 1982 only

results must be interpreted with caution. In an observational study of this nature (as opposed to an experiment where management factors would be controlled) factors should be considered as **associated with** each other and not linked in a **cause and effect** relationship. Factors that are significantly ($P < 0.05$) associated with production (Table 3) and profit (Table 4), are listed in descending order of association for each year. Multiple correlation coefficients are given. These measure the proportion of between farm variation that can be explained by the management factors considered,

Forty one farms remained in the study for at least five of the seven years and including 1982. These farms were ranked on performance (in terms of EFS/ha, lambs/ha, or wool/ha). Using similar analyses to those mentioned above, time trends in these ranks were tested for association with between year means of the big four management variables -- number of paddocks, fertiliser, stocking rate and sheep:cattle ratio. The analyses were repeated using time trends instead of means of these four management variables. Of the six analyses thus conducted, the only significant associations were --

- Farms with improving profitability per ha tended to have a greater proportion of cattle ($R^2 = 0.27$)
- Farms with a lifting number of lambs/ha tended to have an increasing stocking rate ($R^2 = 0.63$)
- Farms with a lifting kg of wool/ha tended to have an increasing stocking rate ($R^2 = 0.43$)

Table 3: MANAGEMENT FACTORS ASSOCIATED WITH HIGHER PRODUCTION

A) PER HECTARE

Year Ending	Lamb Nos/ha	(R^2)	Wool wt/ha	(R^2)	Calf Nos/ha	(R^2)
1976	Higher stocking rate More Paddocks	(0.74)	Higher stocking rate Low Sheep:High Cattle ratio	**(0.77)**	Higher stocking rate More Paddocks	(0.79)
1977	Higher stocking rate More Fertiliser More Paddocks	**(0.82)**	Higher stocking rate More Fertiliser Low Sheep:High Cattle ratio	**(0.76)**	Higher stocking rate More Fertiliser	(0.79)
1978	Higher stocking rate More Fertiliser More Paddocks	(0.77)	Higher stocking rate Low Sheep:High Cattle ratio More Fertiliser	**(0.71)**	Higher stocking rate	**(0.83)**
1979	Higher stocking rate More Fertiliser More Paddocks	**(0.82)**	Higher stocking rate Bigger Farms More Fertiliser	**(0.57)**	Higher stocking rate More Paddocks	**(0.66)**
1980	Higher stocking rate More Fertiliser	(0.80)	Higher stocking rate Low Sheep High Cattle ratio	(0.69)	Higher stocking rate	**(0.72)**
1981	Higher stocking rate More Paddocks	(0.75)	Higher stocking rate Bigger Farms	(0.54)	Higher stocking rate High Sheep:Low Cattle ratio	(0.80)
1982	Higher stocking rate More Paddocks More Fertiliser Less Mudstone	(0.68)	Higher stocking rate Less Mudstone Low Sheep:High Cattle ratio	(0.73)	Higher stocking rate Less Mudstone High Sheep Low Cattle ratio	(0.85)

Table 2: MEANS AND STANDARD DEVIATIONS (s.d.) FOR FARMS IN THE STUDY.

Year	1975176	76/77	77/78	78/79	79/80	80/81	81 /82	s.d.[1]
No. of farms	71	92	79	55	102	109	105	
Economic								
EFS/ha	39.10	43.10	21.20	44.90	72.10	52.40	50.10	36.90
EFS/su	4.27	4.44	2.18	5.18	7.61	5.55	4.77	3.23
Production per head								
Lamb%	91.6	84.8	83.1	91.1	88.6	90.1	87.7	15.3
Wool/s.su	5.2	5.1	4.9	5.0	5.0	4.7	4.6	1.0
Calv. %	83.4	79.7	79.9	71.1	79.0	82.8	81.7	11.7
Per ha index								
Lamb index	8.6	8.3	8.2	8.4	8.4	8.7	8.7	2.6
Wool index	48.8	49.3	48.3	45.3	46.6	45.4	46.2	15.9
Calf index	7.7	7.7	8.0	6.4	7.4	8.0	8.3	2.3
Management								
No. paddocks	24.0	24.7	26.9	25.9	25.8	25.3	26.0	7.9
Fert. kg/su	12.1	14.7	13.9	16.0	17.8	13.6	15.0	9.0
Sheep/cattle	51.7	53.3	55.1	59.8	60.5	59.0	59.4	10.5
Farm Area	1193	1181	1228	1229	1124	1165	1055	1358
Stocking Rate	9.3	9.7	9.9	9.1	9.4	9.7	10.0	2.3
% cultivatable						6.2	6.4	1.8
Distance (km)						86	86	55
% mudstone							62.5	24.6
Age							42.7	7.1

[1] A between farm s.d. was calculated for each year. The median of these s.d.'s is given.

Table 4: MANAGEMENT FACTORS ASSOCIATED WITH HIGHER PROFIT

Year Ending	Per ha	(R^2)	Per su	(R^2)
1976	Smaller Farms More Paddocks	(0.23)	More Paddocks High Sheep:Low Cattle ratio	(0.21)
1977	More Fertiliser More Paddocks Higher stocking rate	(0.27)	More Fertiliser More Paddocks	(0.21)
1978	More Paddocks More Fertiliser	(0.18)	More Paddocks More Fertiliser	(0.19)
1979	More Fertiliser	(0.12)	More Fertiliser	(0.19)
1980	Higher stocking rate More Paddocks	(0.34)	More Paddocks	(0.11)
1981	Less Fertiliser More Paddocks	(0.16)	Less Fertiliser More Paddocks Low Sheep:High Cattle ratio	(0.17)
1982	Less Mudstone Higher stocking rate Low Sheep:High Cattle ratio	(0.42)	Less Mudstone Low Sheep:High Cattle ratio	(0.34)
Mean **197611982**	Low Sheep:High Cattle ratio Higher stocking rate More Paddocks More Fertiliser	(0.55)		

B) PER HEAD

Year Ending	Lambing %	(R^2)	Wool wt/s.su	(R^2)	Calving %	(R^2)
1976	More Paddocks	(0.14)	Low Sheep:High Cattle ratio	(0.26)	More Paddocks	(0.10)
1977	More Fertiliser Higher stocking rate	(0.22)	Low Sheep:High Cattle ratio More Fertiliser	(0.25)	More Fertiliser	(0.12)
1978	More Fertiliser	(0.30)	Low Sheep: High Cattle ratio More Fertiliser	(0.25)	-	(0.07)
1979	Higher stocking rate More Fertiliser	(0.31)	Bigger Farms More Fertiliser	(0.38)	More Paddocks	(0.19)
1980	More Fertiliser Higher stocking rate	(0.19)	Low Sheep: High Cattle ratio	(0.18)	-	(0.04)
1981	More Paddocks	(0.15)	Bigger Farms	(0.14)	High Sheep:Low Cattle ratio	(0.08)
1982	More Paddocks More Fertiliser Less Mudstone Lower stocking rate	(0.30)	Less Mudstone Low Sheep:High Cattle ratio	(0.41)	Less Mudstone	(0.14)

DISCUSSION

Stocking Rate

Stocking rate has always been important in per ha production and profitability in this study. We have under-rated its importance in the past because, until recently, we have looked only at production on a per head basis viz wool weight/su, lambing percentage, and calving percentage. Recently conducted analyses of per ha production indices have highlighted the importance of stocking rate. It has a dominating influence on all forms of per ha production (Table 3) and features in three out of the seven years for per ha profitability (Table 4), narrowly failing to achieve a significant association in two other years. Asstocking rate is increased, per ha production and profitability increase also, with the benefits diminishing until eventually detrimental effects can be expected from further stocking rate increases.

This study indicates that benefits can exist on most farms beyond stocking rates of 12 su/ha. Farms with improving lamb and wool productivity per ha also had increasing stocking rates.

As an illustration of the importance of stocking rate in per ha production, 1982 data and the consequent lines of best fit are given in Figures 1-3 to display how lambs/ha and wool/ha are associated with stocking rate and other factors. The steepness of the lines illustrates the importance of stocking rate.

Experience in the district suggests that certain management changes are necessary to take advantage of increased stocking rates (these changes occur at about 8% and 12 su/ha). Both per head and especially per ha increases are often accompanied by changes in grazing systems and by changing lambing and calving dates.

Subdivision

As indicated previously (Fitzharris & Wright, 1981) number of paddocks remains as one of the most important considerations in improving the performance of this hill country. A mean number of paddocks of 24 in 1976 has changed to 26 in 1982, not particularly rapid progress, but there are signs that following a considerable advisory push this figure could be 30 to 35 within the next two years. The importance of a high number of paddocks is demonstrated by its appearance in Table 3, as being significantly associated with lamb numbers/ha in six of seven years – and in Table 4, with high E.F.S./ha in five years. Interestingly, it does not feature in association with wool production. The role of fencing, in the past and at the present, has been considerably under-rated, both from an overall return point of view, and a cost benefit point of view. Subdivision therefore, is one of the major keys to pasture utilisation, animal performance, and hence profitability.

Using 1982 data Fig. 1 illustrates how the number of paddocks and stocking rate are associated with lambs/ha. The importance of number of paddocks is related to the width between the diagonal lines.

Fertiliser

Like subdivision, fertiliser remains as a key factor associated with high levels of production although its profitable use, at least in the short term, has become questionable in recent years since its price has risen dramatically. Analysis of 1981 data indicated for the first time that farms with higher E.F.S. used less fertiliser whereas for the three earlier years (1977-79) high E.F.S. farms used more fertiliser (Table 4). Higher lambing percentage and to a lesser extent wool production have been associated with greater rates of fertiliser use (Table 3).

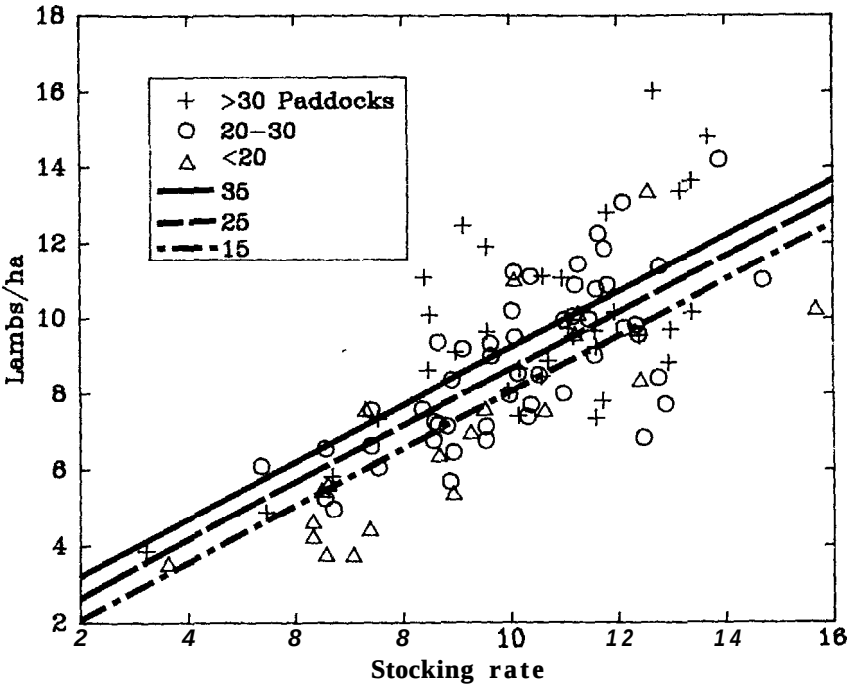

Figure I: Association between lambs/ha, stocking rate and number of paddocks for 1982.

Although recent escalating costs of superphosphate may have reduced its benefits in the short term, the effects of reduced or no fertiliser on long term profitability could well be more disastrous than this analysis shows. This highlights the difficulty the hill country farmer has in choosing between short and long term profitability. Farms with submaintenance rates of applied fertiliser mine the soils of fertility but improve the current cash situation, whereas those maintaining or increasing soil fertility avoid a morecostly programme of rebuilding fertility at a later date, whilst accepting reduced profit in the interim. It is suggested that the lesser of two evils would involve a cash short fall, or alternatively a programme of borrowing for fertiliser application. Fig. 2 uses 1982 data to illustrate how the use of fertiliser and stocking rate are associated with lambs/ha. The importance of fertiliser is represented by the width between the diagonal lines.

Cattle

The importance of cattle on east coast hill country has been reinforced in our recent analyses. Higher wool production consistently occurs on those farms with a greater proportion of cattle, No doubt this is because of better grazing flexibility and hence pasture control and dilution of animal health challenges such as those presented by parasites. In 1981 and 1982, those farms with a greater proportion of cattle have been making higher profit (Table 4). This is despite S.M.P. inputs which favoured sheep relative to cattle (approximately 17.5% of sheep income cf 11.2% of cattle income in 1981-82) (Stephens pers. comm.). It is therefore of

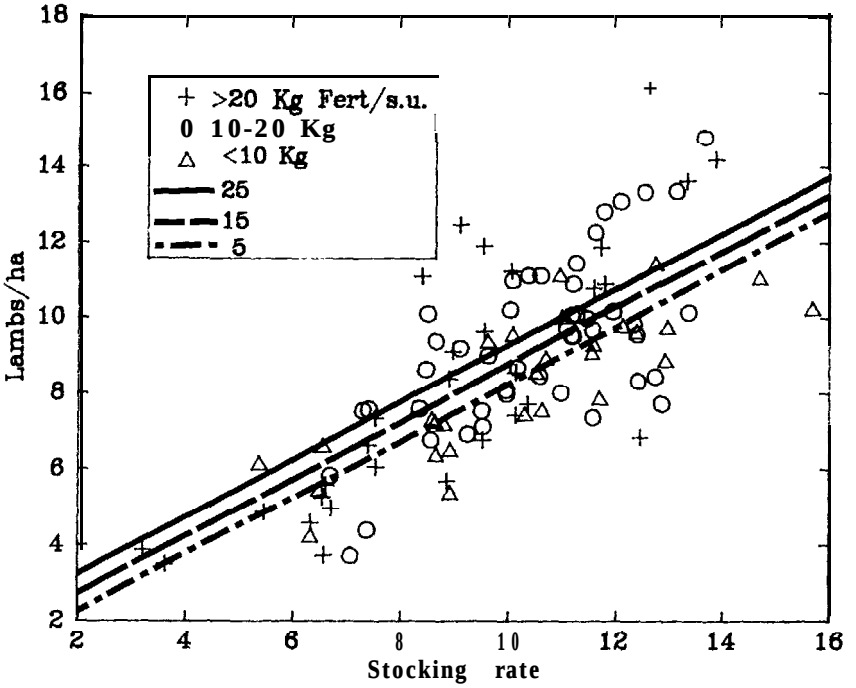

Figure 2: Association between lambs/ha, stocking rate and fertiliser for 1982.

concern that breeding cow numbers have reduced from 27.0% of all stock units in 1976 to 21.6% in 1982. It is estimated that a further reduction of 18% in cow numbers and 28% in cattle stock units has occurred as a result of the drought.

Although it is true that on a direct comparison of profitability per stock unit, sheep have been the preferred species, it is probable that for some time now some of that profit has been contributed by the presence of cattle. The policy of grazing hill country pastures with both has many advantages. Except at times of severe competition for food, cattle grazing is beneficial to sheep under our present level of subdivision and pastoral development. As stocking rates recover from the drought situation, they don't therefore have to be exclusively with sheep.

Because wool is of major importance to the profitability of this hill country, and since wool production per sheep su has been consistently higher on farms with a greater proportion of cattle, farmers should take care to avoid low cattle proportions. In this study, particularly in recent years, farms with 45% cattle have tended to be more profitable than farms with 35% cattle. In 1982 at the mean stocking rate of 10 su/ha, an increase of about 0.5 kg of wool/su was equivalent in profitability to an increase of about 15 in lambing percentage. It is contended that the increase in wool weight would have been easier to achieve. How cattle proportions and stocking rate are associated with the wool production index is illustrated in Fig. 3 using 1982 data, the importance of cattle proportions being demonstrated by the width between the diagonal lines.

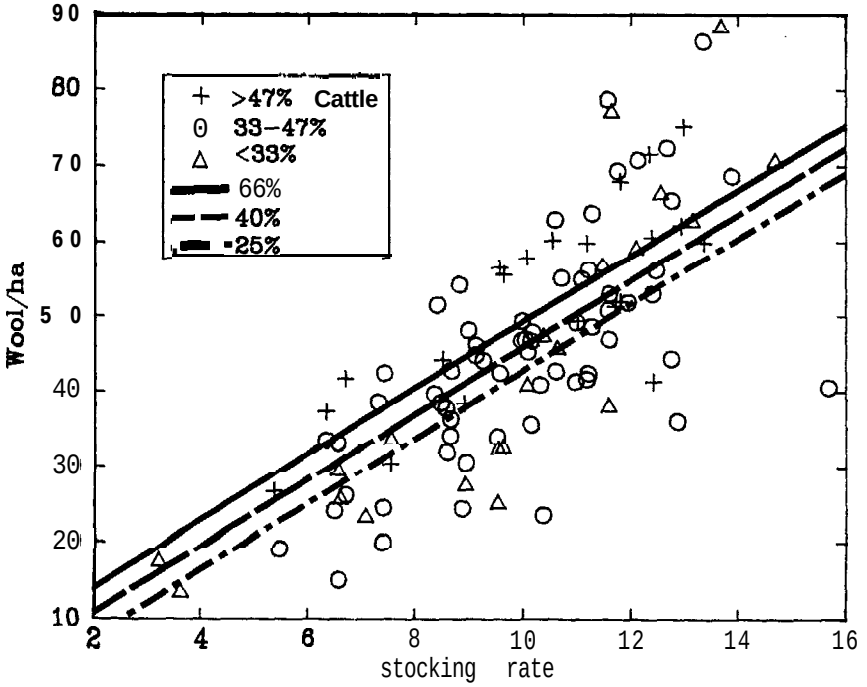

Figure 3: Association between wool/ha, stocking rate and sheep:cattle ratio for 1982.

CONCLUSION

We consider profit/ha to be the most useful measure of farm performance. A summary analysis (bottom of Table 4) very neatly highlighted the importance of the four inputs – cattle, stocking rate, subdivision, and fertiliser – when considering mean profitability over the seven year period of the study. We recommend that farmers concentrate their attention on the inputs critical to achieve high levels of production and profitability in this hill country, viz the five "S's" –

- stocking rate
- subdivision
- superphosphate
- sheep:cattle ratio
- stock management

because they occur consistently with the two "P's" –

- production
- profit