Proceedings of the New Zealand Grassland Association, 47: 63-69 (1986)

THE IMPORTANCE OF SUBDIVISION AND MANAGEMENT PRACTICES IN IMPROVING HILL COUNTRY PRODUCTIVITY

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Abstract

The association between subdivision and other management resource inputs and levels of hill country sheep productive performance are reported in this paper. An analysis of computer simulated grazing systems and practices adopted by a sample of thirty farmers in North-East Wairarapa indicates that high levels of production were achieved with variable levels of subdivision. Appropriate grazing systems were often limited by poor planning and implementation rather than inadequate permanent fencing. Although subdivision was associated with higher autumn sheep liveweights on the survey farms, similar or larger increases could be achieved by refining existing management systems. Further increases in subdivision therefore may not lead to increases in productivity on many hill country farms.

Keywords: Subdivision, hill country, management, computer simulation, survey, grazing systems.

INTRODUCTION

Increased on farm costs and a predicted downturn in returns for meat and wool will force hill country farmers to carefully evaluate how management resources contribute to production. Subdivision was identified as being a "critical" input on North Island East Coast hill country by Fitzharris and Wright (1984) because time series farm survey data showed between farm trends for increased subdivision to be associated with improved production per hectare.

While factors such as the type of farming system, ease of stock movement and topography need to be considered, the primary concern when planning subdivision is that there are sufficient paddocks to allow the manager to efficiently match pasture production with animal requirements in a manner which will maximise profitability. Thus subdivision should enable the manager to control grazing decisions by:

(i) varying the intensity and frequency of defoliation.
(ii) transferring pasture reserves through time and
(iii) imposing special purpose grazing regimes such as for gorse control or pasture establishment.

It is apparent from Fitzharris and Wright (1984) that farmers can achieve high levels of profitability with different levels of permanent subdivision. Consequently additional subdivision may in many instances only serve to increase costs, as discussed by Squire (1985).

There is a need to identify the manner in which management inputs affect levels of animal performance, particularly sheep liveweights, on hill country. Better informed decisions on the appropriateness of additional expenditure of capital and time on inputs such as subdivision, water supplies, fertiliser and equipment can then be made. In this paper the results of a simulation model (McCall 1984) and a survey of thirty Wairarapa farmers (Parker 1984) are used to address the problem outlined above.

METHODS

The computer model was used to identify grazing strategies which achieve high

levels of ewe performance on hill country by simulating outcomes for a range of decisions for a representative year at the DSIR hill country research area at Ballantrae, near Woodville. Grazing management decisions for four periods of the year were simulated at a stocking rate of 14 ewes/ha. Winter commenced three weeks after ram introduction on April 7 and ended at lambing. Ewes were set stocked from lambing until weaning on November 22. Summer continued from weaning until four weeks prior to ram introduction and autumn was the seven week period of flushing. Model output included ewe fleece weight and weight of lamb sold on January 20.

Survey farmers were interviewed in 1983 and values for a large number of variables describing farm physical characteristics, farmer attributes and management decisions were collected. Measures of productive performance included records of sample Autumn liveweights of ewe lambs, two-tooth and mixed age (MA) ewes, and the 1980-1983 lambing records.

Survey farms were stratified into four groups according to farm size (to reduce the confounding effects between size of farm and level of subdivision) and compared in terms of performance level, state variables (those which are not under direct management control e.g. topography) and management variables (those subject to farmer decision) using multiple discriminant analysis (Klecka 1975). Multivariate regression analysis was used to investigate the relative importance of subdivision and other management variables on 1983 autumn liveweights of ewe lambs and two-tooth ewes (Parker 1984).

RESULTS

Simulation Results

The results of a selected series of simulated grazing strategies are presented in Table 1. In strategy 1 (S1) a relatively fast (60 day) ewe winter rotation, followed by set stocking over lactation and a 45 day post-weaning rotation to 'clean up' pastures and provide high quality feed for lambs and flushing was adopted. Lambs were set stocked over the remainder of the farm and flushing involved a 15 day rotation. Strategy 2 was the same as S1 except ewes and lambs remained set stocked until mid-January and then commenced a 30 day rotation until flushing. In S3 a long winter rotation (120 days) was introduced and in S4 a 60 day autumn rotation for ewes rather than flushing was adopted.

Fast **winter** rotations resulted in less pasture being transferred through to lambing (e.g. S1 and S2, Table 1). This resulted in lower ewe liveweights in spring and significantly lower lamb weights in mid-January. The longer summer rotation in S1 also significantly reduced autumn ewe liveweight. This resulted from hard grazing by ewes which, as a consequence, meant that pastures on the rest of the farm rapidly lost quality before being grazed. Allowing ewes to gain weight over this period (S2 compared to S1) increased autumn ewe liveweight, wool weights and the lambing percentage. Pastures in S2 were cleaned-up in late January and February.

Flushing ewes in autumn did not improve overall performance where a long winter rotation was used (e.g. S4 versus S3). Where flushing was foregone to build up feed for the winter rotation, ewe liveweights in spring were improved, and consequently so were autumn liveweights. The net result was slightly improved lamb and fleeceweights without penalising lambing percentage.

Survey Results

1. Intensity of Subdivision

Numbers of "main" paddocks (i.e. those used for general grazing purposes) per farm ranged from 10 to 95, with a mean of 34. The average area of "main" paddocks ranged from 6 to 37ha between farms. Only two farms had any paddocks which exceeded 90ha. Subdivision had not been increased on only

four properties in the five year period prior to 1983. Nearly half of the farmers had increased subdivision by more than 30% but none had achieved what the farmers themselves considered to be the "ideal" level. Under "ideal" circumstances the average farm would have 46 paddocks and paddock size would be reduced by 25% from their current size.

Electric fencing had widespread acceptance with two thirds of the farmers using it for permanent subdivision purposes. A quarter of the farmers used temporary electric fencing during the winter period, mainly for cattle.

The majority of farmers who had increased subdivision between 1978 and 1983 identified improvement in pasture utilisation and production and easier stock management as the major benefits of increased subdivision. Increased fencing maintenance was identified as the greatest disadvantage (Table 2).

In general, farmers who already had relatively high levels of subdivision wished to increase subdivision levels further than those who had fewer paddocks, suggesting that farmers' perspective of the impact/role of subdivision differs. However most had the notion that more subdivision would be beneficial.

TABLE 2: Perceived advantages and disadvantages realised from increasing subdivision on the survey farms during the period 1978-1983.

	% of Farmers
Advantages	
Improved pasture utilisation	77
Better rationing of pasture to livestock Improved stock performance	69
Improved pasture species and production	38
Easier stock management	46
Differential management of slopes, gullies, less developed areas	31
Disadvantages	
Increased fencing maintenance	69
Increased risk of smothering stock (sheep)	23
Additional work shifting stock, opening gates	31
Increased associated capital expenditure for water supply, stock lanes, gateways	15
Other pugging, electric fence failures, greater risk of underfeeding, more disease, reduced mustering pleasure	6

2. *Effects of Subdivision on Productive Performance*

Farms with higher levels of subdivision (Groups 2 and 4) did not have significantly higher autumn ewe and ewe lamb weights or lambing percentages (Table 3). Group 3 farms, although similar in terms of their management and performance characteristics to the other groups were significantly steeper and less well developed, as is demonstrated by the low average winter stocking rate (which is a measure of productive potential) on these farms. Group 4 farmers had increased subdivision at a faster rate since 1978, and despite having potentially larger mob sizes aimed to achieve a similar intensity of subdivision to those on smaller properties.

A wide variation in ewe winter rotation lengths existed, reflecting different useage of existing levels of subdivision, as well as the grazing system employed. In 1983, ewe winter rotation lengths exceeded 80 days on only 18% of the farms, and were less than 40 days on 46% of the properties surveyed. Ewes were set stocked during winter by 7% of the farmers. On average longer rotations, both in winter and early summer were achieved on farms with more paddocks.

TABLE 1: Simulated outcomes for selected grazing strategies.

Strategy	Description			Performance Criteria					
	Summer Rotation Length			Pasture cover at lambing (kg DM/ha)	Minimum ewe lwt (kg) 20 October	Lamb lwt (kg) 20 January	Lambing %	Ewe fleece wt (kg)	Autumn ewe lwt (kg) 10 March
	Summer	Winter	Flushing						
S1	Long	Short	Yes	920	42.6	25.8	103.0	4.48	47.0
S2	Short	Short	Yes	926	43.8	25.4	108.7	4.63	50.0
S3	Short	Long	Yes	1160	44.6	27.7	109/0	4.55	50.8
S4	Short	Long	No	1192	46.7	28.1	109.0	4.61	52.0

TABLE 3: Comparison between groups of farms with different levels of subdivision (Group means and population mean ± standard deviation).

Group (number of farms)	1(n=6)	2(n=10)	3(n=6)	4 (n=8)	Total (n=30)		Significance
Farm Area (ha)	500	500	500	500			of group
Number of main paddocks	25	25	35	35			differences4
STATE VARIABLES							
Topography (% steep)	66	74	89	49	69	25	***
Proportion unimproved pasture %	0	2.0	7.7	1.3	2.6	5.7	*
SUBDIVISION							
Paddock areas — average (ha)	13.8	17.7	22.6	13.0	16.6	8.2	N S
largest (ha)	39.8	47.2	55.3	37.6	44.8	24.3	N S
— ideal (ha)	11.4	12.3	15.7	10.5	12.3	5.8	N S
Extra paddocks fences 1978-83	3.6	7.5	8.2	12.6	8.2	6.4	*
Ideal number of paddocks	41	46	45	49	46	18	N S
MANAGEMENT							
Fertiliser (kg P/SU)	2.09	1.97	2.07	1.88	1.99	0.62	N S
Labour (SU/labour unit)	3346	3611	3146	3277	3376	1140	N S
Age of farmer (years)	43	39	41	42	41	11	N S
Years on present farm	12	17	10	14	14	11	N S
Post-weaning ewe rotation length (days)	26	31	30	33	31	19	NS
Winter ewe rotation length (days)[2]	35	59	39	62	51	26	NS
Cattle:Sheep ratio (csu/ssu)	0.14	0.18	0.26	0.07	0.16	0.15	*
PERFORMANCE							
Winter stocking rate 1982 (su/eff ha)	11.9	11.0	9.8	12.1	11.3	1.8	*
MA and two-tooth 1983 autumn liveweight (kg)	53.2	52.4	50.0	49.7	51.4	5.3	NS
Ewe lamb 1983 autumn liveweight	30.0	30.6	29.7	29.7	30.1	4.6	NS
1982 lambing percentage	104.3	103.2	97.0	96.7	100.5	13.5	N S
1983 lambing percentage3	95.7	100.8	92.8	97.4	97.3	14.8	NS

1 Dummy variables also included for farm location, summer water supply and use of electric fencing
2 26 farms
3 29 farms
4 NS non significant*, *** significant at P 0.1 and P 0.01 respectively.

TABLE 4: Management practices associated with high 1983 ewe lamb and two-tooth autumn liveweight (listed in order of importance).

Ewe Lambs	Two-tooths
1. Younger farmers	1. Weighing practised
2. No summer water problems	2. More labour
3. More main paddocks	3. Higher grazing priority to non-replacement lambs immediately after weaning
4. Higher proportion of farm closed-up for lamb feed prior to weaning	4. Younger farmers
5. Higher cattle to sheep ratio	5. Surplus two tooths sold in January
6. Weighing practised	6. More main paddocks
7. Surplus two-tooths sold in January	7. MA ewes grazed hard in first 6 weeks post-weaning.
	8. Later lamb weaning
	9. Flushing practised
	10. Lambs set stocked post-weaning

3. Factors Contributing to Higher Autumn Sheep Liveweights

Regression analysis indicated that although higher levels of subdivision influenced autumn liveweights of both ewe lambs and two-tooths, other management practices had similar or larger effects (Table 4). For example, ewe lambs benefited from the absence of summer stock water problems and where farmers were younger, (possibly because their lower equity, on average, leads to heavier emphasis being placed on improving liveweights as a means of increasing production and hence profitability). Heavier two-tooths were achieved where weighing was practised, non-replacement lambs were given high priority immediately after weaning (to allow earlier sale and thereby a lower summer/autumn stocking rate) and more labour was available. The results indicate that competition between stock classes existed. Thus two-tooths were heavier after late weaning and hard post-weaning grazing by ewes because of both of these policies usually increase the amount of pasture available to two-tooths.

DISCUSSION

This study supports the data presented by Fitzharris and Wright (1984) that farmers are able to utilise subdivision to different degrees. Thus, some farmers demonstrated that high levels of production can be achieved with minimum levels of subdivision, possibly because they have simple management systems and/or abetter appreciation of grazing management. These results confirm the view that increased subdivision in the absence of other management changes will not increase levels of production.

Large improvements in sheep performance could be made on many properties through farmer education. For example, despite having adopted rotational grazing, few of the survey farmers had ewe winter rotation lengths that the model indicated would be long enough (90-100 days) for the region. Further, twenty-one of the farmers set stocked ewes six days or longer before lambing, reducing the amount of feed available to ewes in early lactation. Hence, 53% of the farmers in 1982 and 47% of the farmers in 1983 had average pasture heights of 2.50cm (about 650kg DM/ha) or less at the start of lambing (Parker 1984). Inadequate long-term planning and poor implementation of the winter grazing system, rather than insufficient permanent subdivision were the main factors contributing to poor pasture cover at lambing (Parker 1984). Similarly early summer rotation lengths for ewes tended to be too long for effective pasture control to be achieved over a high proportion of the farm (Sheath et al. 1984).

The survey results also support the view that farmers can learn by monitoring farm performance. Thus farmers who weighed, even at relatively infrequent intervals (1-2 times per year), on average had heavier sheep and consequently higher lambing performance. Ewe lambs, for example, were 3.8kg heavier ($P = 0.033$) in autumn 1983 on farms where weighing was practised at various times of the year. They also had a better appreciation of how liveweight could be influenced through management. Thus major emphasis was placed on increasing ewe liveweights immediately after weaning rather than prior to flushing and high priority was given to replacement stock during the summer months. To achieve maximum liveweight increases, lax-grazing systems (residual pasture height > 3.0cm) of either a fast rotation (< 30 days) or a form of set stocking were most commonly adopted.

The model results confirm these decisions and lend support to the view that except during the winter period set stocking or relatively fast rotations are likely to give the highest levels of pasture and animal performance on hill country sheep farms (Clark and Lambert 1982, Chapman and Clark 1984, Sheath et. ***al.*** 1984). Intensive subdivision is therefore only required to implement a long winter rotation (dependent upon pasture growth rates, stocking rate and pre-winter pasture cover). Many farmers should therefore consider the wider use of less expensive and more flexible

temporary electric fencing systems rather than erecting further permanent subdivision,

CONCLUSION

The solution to overcoming low productivity on most hill country involves the improvement of ewe and lamb bodyweights. Improved management skills, particularly in relation to the planning and implementation of grazing systems in many cases will lead to greater increases in sheep liveweights, through more efficient use of existing resources, than further capital expenditure on items such as permanent subdivision, water supply and fertiliser. Intensive subdivision, which is primarily required to implement a long winter rotation, can be achieved by using cheaper and more flexible temporary electric fence systems. One method by which farmers can improve their managerial ability is to objectively monitor their farming systems such as by weighing and feed budgeting, to identify the strategies which improve/depress animal performance on their farms.

Acknowledgments

To Professor R.J. Townsley and Dr A. Wright (Agricultural Economics and Farm Management Department) and Dr T.H. Hassard (Mathematics and Statistics), Massey University.

References

Chapman, D.F.; Clark, D.A. 1984. *Proc. N.Z.* Grossld Ass. 45: 168-176

Clark, D.A.; Lambert, D.G. 1982. Ibid 42: 173-175.

Fitzharris, M.J.; Wright, D.F. 1984. ***Ibid 45: 2737.***

Klecka, W.R. In "SPSS -Statistical Package for Social Sciences" Ed. N.H. Nie et al. 434-467, McGraw Hill Co. New York.

McCall, D.G. 1984. A Systems Approach to Research Planning for North Island Hill Country, Ph. D. Thesis, Massey University.

Parker, W.J. 1984. A Study of Management Practices and Productive Performance on a Sample of Hill Country Farms in North-East Wairarapa, M.Agr.Sc. Thesis, Massey University.

Sheath, G.W.; Webby, R.W.; Pengelly, W.J. 1984. *Proc. N.Z. Grossld Ass. 45:* 199-206.

Squire, J.D. 1985. Form Management News No. 38: 29-39.