

FERTILIZER AND STOCKING RATE STRATEGIES
FOR SUSTAINED PROFITABILITY

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Summary

Application of super. and sub. clover has doubled sheep carrying capacity of non-arable hills on a demonstration site at Mumbil (east of Wellington) in the Central Western Slopes of NSW.

As a result lambs weaned and gross wool value per hectare were doubled.

Despite two droughts during the demonstration period, all costs, including interest on money outlaid were recouped 5-6 years after the commencement of the improvement programme.

The results have practical implications for a grazier wishing to expand his enterprise. For a moderate outlay (\$80-120/ha) to improve this type of country and purchase stock similar carrying capacities can be achieved as buying extra land (at \$65-70/dse).

Method

A site at Mumbil (near Wellington) on shallow skeletal soil, pH of range 5.3-6.2 (1:5 water) was selected and fenced into three 8 ha plots. Plant species present at commencement were Rat's-tail fescue, (*Vulpia bromoides*) rough wheatgrass (*Agropyron scabrum*), wallaby grass (*Danthonia spp.*), red grass (*Bothriochloa macra*), spear grass (*Stipa spp.*), yellow suckling clover (*Trifolium dubium*) and narrow leaf clover (*T. augustifolium*).

Molybdenised (0.04%) superphosphate (9.1%P) was first applied aerially in 1979 at rates of nil, 123 & 246 kg/ha. Clover seed (*Trifolium subterraneum* cv. *Woogenellup*) was flown on in two applications of 3.3 kg/ha in May and July 1979. Super. was applied annually to the fertilized blocks until the phosphorus level reached 35ppm (Colwell, 1963) or greater for longer than 12 months. To simulate farmer use of soil testing, it was decided to cease super. application when soil test results rose above 35ppm (AFL and Department of Agriculture recommendation).

Originally, exclusion cages were placed in each plot and samples were cut to determine seasonal dry matter production. The cages were relocated after each sampling. More recently, this

techniques has been dispensed with in favour of a more realistic method and pasture availability determination.

Drought conditions delayed grazing until August 1980 when shorn, pregnant two year old ewes were set stocked on the plots at 2.5 ewes/ha. This rate was increased to 3.25 ewes/ha in 1981 and 5 ewes/ha in 1982 on the fertilized plots, as increased feed became available. The stocking rate 2.5 ewes/ha on the nil plot, was thought to be an accepted maximum rate for this locality on natural pasture. Lambs were kept on the plots until weaning. In November 1984 a total replacement of ewes was made. These ewes were of the same bloodline and breeding as previous but were not pregnant at the time.

Sheep production measurements

Ewes were weighed at joining and lamb marking each year and wool was weighed from each ewe at shearing. The samples were bulked and typed for each treatment and the whole sample was tested by the Australian Wool Testing Authority for fibre diameter and clean yield. The wool values for each plot were estimated on the average price received for that wool type for the year of shearing.

Records were taken at lamb marking of dry ewes, ewes rearing lambs and ewes that lambed but lost all lambs.

Results

Soil phosphorus

Phosphorus levels (ppm) (Table 1) rose steadily on the fertilized plots in accordance with the super. application rate until tests following the drought in 1982.

(Table 1: Soil phosphorus levels [ppm P Colwell])

	Nil	123 kg/ha	246 kg/ha
1979	15.0	13.5	11.8
1981	7.5	18.5	23.5
1982	12.0	22.0	40.0
1983	13.0	58.0	46.0
1984	12.0	38.0	36.0

At this time, phosphorus readings rose rapidly during drought conditions. A level of 40 ppm was reached before the drought on the 246 kg/ha treatment. It was therefore decided to cease fertilizing this area until soil phosphorus levels, dry matter production or animal production fell.

Pasture production

Total dry matter production (Table 2) was not related to sheep production. It became obvious that sheep production was related to legume production, and a modified sampling technique was adopted in 1984.

Table 2: Dry matter produced for each super treatment, 1980/83 (kg/ha/day)

Super. (kg/ha)	MEAN		
	0	123	246
April/May	2	2	2
June/July	13	25	30
Aug/Sept.	8	77	45

Pasture production is currently assessed by cutting representative areas of high (5), medium (3) and low (1) areas in each treatment. In addition 20 random visual assessments are scored in each treatment. Yields determined by cutting are later applied to the visual scores. Visual estimation of botanical composition is done in each treatment at the location of each assessment.

Sheep body weight was related to clover percentage (Table 3) and this is reflected in the feed value (Table 4).

Table 3: Sheep bodyweight, pasture botanical composition

Treatment	Super. (kg/ha)	Ewe Body Weight (kgs)	Pasture Total Dry Matter Avail. (kg/ha)	% Clover (Native & Sub)	% Green Grass	% Dry Grass	% Weeds		% Bare Ground/Inedib.
							Edib.	Inedib.	
8.3.85	0	34.5	752	0	5	14	13	68	
	123	36.2	962	0	2	13	27	57	
	246	33.7	1022	0	2	23	14	61	
31.7.85	0	36.5	1677	1	29	29	5	36	
	123	45.0	876	27	51	6	15	1	
	246	42.2	782	21	58	10	8	3	
10.10.85	0	33.2	1728	17	50	7	15	11	
	123	40.3	2217	58	29	4	7	2	
	246	40.7	3202	65	25	1	7.5	1.5	
Feb 86	0	40.7	2819	0	13	65	0	23	
	123	42.1	3182	0	3	96	1	0	
	246	44.2	2655	0	5	95	0	0	

Table 4: Pasture feed value October 1985 (dry basis)

Fertilizer treatment (Super.)	Ewe Body Weight (kg)	Crude Protein (%)	Metabolizable Energy (MJ/kg)	Dry Matter Digestibility (%)
Nil	33.2	6.0	6.7	44.8
123kg/ha	40.3	15.1	8.7	57.8
246kg/ha	40.7	13.6	8.4	56.1

Wool production

The wool production (kg/ha) (Table 5) was consistently better on the more highly stocked fertilized treatments, despite the effect of severe drought in 1982.

Table 5: Wool production (kg/ha)

Fertilizer Treatment (Super.)	1981	1982	1983	1984	Mean
Nil	8.9	12.6	9.7	11.9	10.8
123kg/ha	10.0	25.3	18.2	25.0	19.6
246kg/ha	11.1	28.1	19.5	26.4	21.3

Mean fibre diameter was not greatly affected by treatment and was 21.6, 22.3 and 22.6 micrometers for the nil, 123 and 246 kg/ha treatments, respectively.

Gross wool value per hectare (Table 6) showed a positive response to fertilizer (increased stocking rate and increased wool production per ewe).

Table 6: Wool value per hectare (\$)

Fertilizer Treatment (Super.)	1981	1982	1983	1984
Nil	33.10	45.96	41.66	49.95
123	35.34	87.82	73.43	101.32
246	36.48	100.27	80.00	104.81

Animal production

Lambs weaned per hectare (Table 7) was higher on the fertilized more highly stocked treatments. The ewes from fertilized plots had higher mean body weight at joining, 40.7, 42.4 and 44.5kg; and at lambing 31.2, 36.4, 36.6kg and higher mean lamb marking percentages, 81, 102 and 103% for the 0, 123 and 246 kg/ha

treatment respectively. This higher performance was partly explained by a higher estimated mean twinning rate in the fertilized treatments of 5.4, 15.6 and 17.6 for the 0, 123 and 246 kg/ha treatments respectively.

Table 7; Lambs weaned per hectare.

Fertilizer Treatment	1980	1981	1982	1983	1984	Mean
Nil	2.0	2.1	2.1	2.1	1.8	2.0
123	2.4	2.8	5.5	4.9	5.5	4.2
246	1.9	3.5	6.1	4.8	3.75	4.0

Economics

A cash flow budget was developed to show the additional costs incurred and the cash flows received from the 123 kg/ha block compared to the nil treatment block (Table 8).

This budget demonstrates the maximum cash outlay, the year of peak debt and the time taken to break even.

Three cumulative balances are given. The first had no interest, the second charged interest at 12% per annum and the third 18%. At 12% interest, peak debt was \$80.49 in 1981, the third year of the trial. However, \$47.50 of this cost was due to livestock purchase. The budget also shows that it took six years to break even, including payment for the extra livestock. At 18% interest, a further year is required to break even.

Table 8: Cash flow budget - 123 kg/ha treatment.

Years	1	2	3	4	5	6
			\$			
Extra lambs/ha.	0.00	0.40	0.60	3.40	3.80	3.70
Value of lamb.	14.00	14.00	18.00	10.00	20.00	18.00
Income/ha.						
Extra lambs \$/ha.	0.00	5.60	10.80	34.00	56.00	↑
66.60						
Extra wool \$/ha.			1.88	36.84	28.84	→
43.15						
CFA ewe sales.				4.40 ³	4.40	↑
4.40						
Total income/ha.	0.00	5.60	12.68	75.24	89.24	↑
114.15						
Outgo/ha.						
Pasture.	2.50					
Fertilizer.	13.25	14.30	16.17	18.20	19.60	↑
20.50						
Extra running costs.				11.75	11.75	↑
11.75						
Extra handfeed.					11.82	
Ewe purchases.			40.00 ¹	17.50 ²	17.50	↑
17.50						
Extra ram purchase.			7.50			↑
7.50						
Total outgo/ha	15.75	14.30	63.67	47.45	60.67	↑
57.25						
Balance.	-15.75	-8.70	-50.99	27.79	28.57	↓
56.90						
Cumulative Balance.	-15.75	-24.45	-75.44	-47.65	-19.08	↓
37.82						
Cumulative Balance @ 12% interest.	-15.75	-26.35	-80.49	-62.36	-41.27	↓
10.67						
Cumulative Balance @ 18% interest.	-15.75	-27.29	-83.19	-70.37	-54.47	-

1. Mixed age ewes assumed purchased at \$16.00/head (net).

2. 28% of flock purchased as maiden ewes @ \$25.00.

3. 22% of flock sold off as cast for age per annum at \$8.00/head (net).

Discussion

This demonstration shows that the return on investment in pasture improvement with sub. clover and fertilizer can be high.

The improvement programme has allowed a significant increase in carrying capacity as well as an increase in animal production on the demonstration site.

In such an improvement programme profitability is most sensitive to:-

- * Large cash outflow early in the programme especially livestock purchase.
- * Extra carrying capacity which affects - gross wool value/ha and lamb value/ha.

It is also sensitive to lamb weaning %, wool cut/head, extra wool price and interest rate.

In a real farm situation -

- * Stocking rates and lamb weaning % achieved in the demonstration (all blocks) are unlikely to be achieved.
- * A grazier is unlikely to improve his whole property at one time necessitating the borrowing of all money involved in the programme.
- * an interest rate of 18% may not apply.

A second cash flow budget was developed to show extra costs incurred and extra cash flows from a 10 ha improved enterprise unit, (Table 9) compared to a native pasture situation reflecting a more 'real farm' scene (wool cut, stocking rate, wool price and lamb weaning %). costs and returns reflect more the situation today:

(i) Stocking rate

Carrying capacity of much of the native pasture country east of Mumbil would be more like 3 dse/ha and achievable carrying capacity on the same country improved with sub. clover and super. 6.8 dse/ha (as against 4.25 dse and 8.5 dse/ha respectively on the demonstration).

(ii) Cash flow

Large cash outflows early in the programme have a large effect on the profitability of the exercise.

Beside the initial costs in Year 1 for seed and fertilizer, livestock purchase is the single biggest recurring cost and the one item that the profitability is most sensitive to. For the cash flow analysis it is assumed that this money is borrowed.

However graziers are more likely to adopt an improvement programme on a paddock by paddock basis and stock for the extra carrying capacity would come from natural flock increase:

- Extending the age of ewes
- Keep wethers (normally sold)
- Keep cull maiden ewes

Substituting an opportunity cost of \$15.00 for stock purchase reduces the time to break even to five years (at 18% interest).

(iii) Interest rates

Under present financial conditions people are not venturing into such a programme and borrowing is not likely to be attractive.

Investments of this nature are more likely to happen during periods of surplus cash flow for tax relief purposes.

In the cash flow budget 18% interest is used. However the net interest rate is more likely to be 15%. Adding this adjustment to the above does not significantly affect the profitability of the exercise. Profitability is affected by interest rate, but more influenced when there is a large cash outflow at the beginning of the programme.

Nitrophilous weeds, erosion etc, have been suggested as long term problems for such a programme. Our experience for the Mumbil site and the surrounding area show no such problems at this stage. Saffron thistles have increased and are not considered to be a major threat to the long term profitability of such a programme.

Phalaris potential

Further improvement with phalaris based pastures is the suggested remedy to the above problems.

Even discounting stock purchases and interest rate figures cash flow analysis shows that significant increases in stocking rate are necessary to generate profitability similar to sub. clover pastures. A stocking rate in excess of 12 dse/ha is necessary to break even in a similar time to a sub. clover pasture. It is unlikely that this could be achieved.

Table 9 Cash flow budget showing extra costs and returns for aerially established sub. clover pasture 1986 on low fertility soil in a medium rainfall area (550-700mm) in Central West NSW.

Year:	1	2	3	4	5	6	7	8	9	10
Stocking Rate ¹	2.0	2.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0
Extra Lambs	1	6	15	15	19	19	19	19	19	19
Value of Lamb	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70
<u>Income</u>										
Extra Lambs \$/ha	16	96	236	236	298	298	298	298	298	298
Extra Wool \$/ha	47	126	286	286	366	366	366	366	366	366
CFA Bwe Sales ²	44	55	77	77	88	88	88	88	88	88
Bwe Salvage ³	-	-	-	-	-	-	-	-	-	562
Total Income	106	268	591	591	752	752	752	752	752	1314
<u>Output/ha</u>										
Pasture	217	-	-	-	-	-	-	-	-	-
Fertilizer	261	244	244	-	244	-	244	-	244	-
Extra Running Cost	-	45	135	135	180	180	180	180	180	180
Bwe Purchase ⁴	-	207	341	169	279	194	194	194	194	194
Allowance for Failure ⁵	-	60	-	-	-	-	-	-	-	-
Total Output	478	556	720	304	703	374	618	374	618	374
Balance	-372	-263	-129	286	49	379	135	379	135	940
Cumulative Balance at 12%	-416	-789	-1028	-831	-876	-557	-473	-106	29	969
Cumulative Balance at 18%	-439	-825	-1130	-996	-1117	-871	-668	-578	-523	417

1. 1 ewe = 1.7 d.s.e.s.

2. 20% of flock sold of as cost for age at \$11.00 head net.

3. Bwe salvage value: \$18.00

4. Maiden ewes purchased at \$22.00

5. Allowance for Failure: 2 years in 10

ASSUMPTIONS

	Stocking Rate	Wool Cut	Wool Price	Lamb Weaning %
Original	2.0	4.2	3.25	85
New	2-4	4.5	3.55	90

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References

Campbell, M. H. (1985) Pasture establishment using aerial techniques, NSW Department of Agriculture Agfact P2.2.2.

Muir, A.M. (1985) Livestock and pasture budgets for Central Western NSW 1985/86. NSW Department of Agriculture Regional Bulletin, Orange NSW.