CROPS AS SUPPLEMENTS TO PASTURES FOR FINISHING LAMBS

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ABSTRACT

The concepts that field crops for finishing lambs replace rather than supplement pastures on a portion of a farm and that 'run off' pastures supplement crops rather than the converse are presented. Specific advantages of field crops and their utilization by sheep are discussed. Data is given to show field crops do not promote rapid live weight gains of lambs considering their high digestibility when compared with legumes and grains. An economic analysis showed lambs are better quitted at lower carcass weights from pasture because the cost of cropping was greater than the extra revenue achieved from taking lambs through to higher carcass weights. However the analysis favoured lucerne as an alternative to field crops for taking lambs through to heavier carcass weights in autumn.

FUNCTION OF FIELD CROPS

Under land intensive management where sheep numbers are matched by ewe requirement to annual pasture production 70-80% of the pasture eaten is produced in spring and summer (Table 1). Consideration can therefore be given to replacing some pastures on a farm with field crops that produce a large bulk of highly digestible feed to fill the shortfall in autumn and winter (Table 2). In Table 1 it can be seen pasture production in two contrasting environments is very much lower than even the poorer yielding field crops during this period (Table 2). Studies concerning relative yields of crop have pointed favourably to the growing of kales, particularly medium-stem and giant kale (Scott, 1971; Stephen, 1973; Mortlock, 1975) and subsequently these crops have been selected for animal-farmlet studies with all crop systems (Stephen and McDonald, 1977; Stephen *et al.*, 1977; McDonald *et al.*, 1977 a, b).

Run-off pastures are often used in conjunction with field crops in order to balance the ration, to stand stock during wet weather, or to overcome the mental bogey of animals breaking out onto a fresh area of crop. With the exception of pasture renovation programmes the use of run-offs is faulty pasture management because the combination of short rotation lengths and severe defoliations at any time of the year depresses pasture production (Figure 1) (data from Sheep Nutrition, Ruakura Agric. Res. Centre). Pasture 'run-offs' should be break grazed by electric fencing and sheep stood on the crop during its utilization in the interests of continued high annual yields from pasture. In this sense pasture is a supplement to field crops rather than the converse.

Figure 1. The effect of short, medium and long grazing rotations on net pasture production.

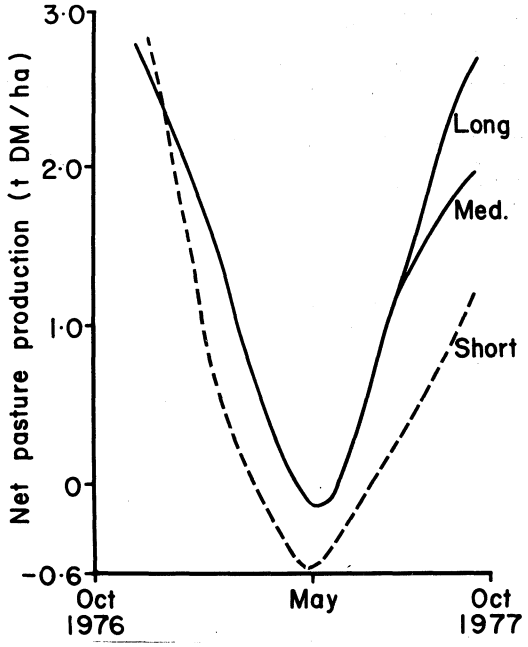


TABLE 1: Pasture yields (t DM ha^{-1}) on sheep farmlets in Invermay (I) and Ruakura (R).

	Total		Spring		Summer		Autumn		Winter	
Year	I*	R+	I	R	I	R	I	R	I	R
1	9.0	11.8	4.1	4.4	2.8	3.9	1.2	1.7	0.9	1.8
2	14.5	14.5	5.0	6.2	5.3	4.4	2.8	2.9	1.4	1.0
3	12.5	19.2	5.7	8.2	3.5	6.8	2.6	2.7	0.7	1.5
4	13.6	18.0	6.4	8.8	5.5	6.1	1.6	1.8	0.1	1.3

* Monteath *et al.*, 1977;
\+ Jagusch *et al.*, 1978.

TABLE 2: Yield (t DM ha^{-1}) and digestibility (%) of field crops.

	Ruakura* (autumn) Yield	Digestibility		Invermay+ (winter) Yield	Digestibility
Turnips	10.2	74	Turnips	5.2	90
1000 Headed Kale	9.8	72	Medium-stemmed Kale	12.0	82
Wairoa Brassica	7.6	81	Swedes	12.0	92
Sugar Sorghum	4.1	71	Mangels	6.4	92

* Present paper;

\+ Drew *et al.*, 1974.

ADVANTAGES OF FIELD CROPS

In the face of deteriorating summer pastures through low production, browning off, or accumulation of dead material, a situation enhanced by seasonal drought in many areas, field crops not only alleviate a feed shortage but they enable different classes of stock to be managed separately. Furthermore crops are a means of controlling internal parasites, avoiding facial eczema and ryegrass staggers associated with fungal development on pasture litter, and preparing the ground for other crops and new pastures by the concentration of nutrients from dung and urine. It is very doubtful whether heavy weight lamb carcasses (20 kg versus conventional 13 kg) could be achieved before winter, if crops or some alternative are not used (Rattray *et al.*, 1976), as high pasture allowances are required to promote rapid lamb growth (Jagusch, 1978).

CROP UTILIZATION

Studies conducted in New Zealand on feeding field crops to sheep were listed by Jagusch *et al.*, (1977) and have been discussed by Barry (1978). Most authors have looked at the productive value of crops for young sheep during winter with detailed experiments on nutritive value being done by Barry *et al.*, (1971) and Drew *et al.*, (1974) at Invermay. Hoggets fed turnips and swedes grew best in these experiments even though per grazing utilizations were of the order of 90% as were the digestibilities.

These data contrast with that at Ruakura where in two years trial work feeding crops to lambs in late summer and autumn, turnip digestibilities were only 74 and 83% respectively and 1000 headed kale, Wairoa brassica, and sugar sorghum were 71, 81 and 71% digestible respectively. In these experiments high total utilization, similar to that in Invermay studies, was only achieved if lambs were followed by the ewe flock (utilization by lambs was usually less than 50%). The notable exception was 1000 headed kale where stems were too fibrous (digestibility = 57%) for the ewes and had to be disced in.

Recent research concerning allocation of pasture to grazing sheep suggests all productive parameters respond dramatically to increased 'offer' of pasture up to levels very much higher than the animals voluntary intake (Rattray and Jagusch, 1977, 1978; Jagusch, 1978). In other words better production ensues when utilization per grazing is reduced. Interpretation of data where 'offer' has not been controlled between the feeds being compared is difficult if special attributes of the grazed plant or crop are being investigated. For this reason several field crops for finishing lambs were compared this year using a range of allowances ('offer'). The results are given in Table 3.

TABLE 3: Live weight gains of lambs fed field crops (g day^{-1})

	Crop allowance (kg DM hd^{-1} day^{-1}) 1.5	3.0	4.5
Turnips	114	118	147
Wairoa brassica	89	101	123
Sugar Sorghum	31	100	114
Pasture	-	89	-
SE (diff)	±11**	±10^{NS}	±10**

At any one level of 'offer' turnip-fed lambs grew significantly faster than those fed the other crops. At the lowest allowance sugar sorghum had little feed value when lambs were forced to eat stems (digestibility = 61%) rather than leaf. In a previous trial lambs offered approximately 4 kg DM hd^{-1} day^{-1} of turnips and 1000 headed kale grew at 150 g hd^{-1} day^{-1} (Jagusch *et al.*, 1977). Under these conditions therefore we can expect field crops to generate approximately 3 kg carcass weight per lamb during a 6-8 week finishing period in late summer and autumn. The data in Table 3 also shows how fallacious interpretations can be made in experiments comparing feeds if 'offer' is not stable.

ALTERNATIVES TO FIELD CROPS

The alternatives to field crops for finishing lambs are legumes (lucerne, white clover, red clover) and grains (wheat, barley, maize).

On free draining soils and in the absence of temporary flooding lucerne is the legume of choice because it readily out yields ryegrass pastures (Vartha and O'Connor, 1968) and grows well in summer and autumn with minimum moisture requirement (Hoglund *et al.*, 1973).

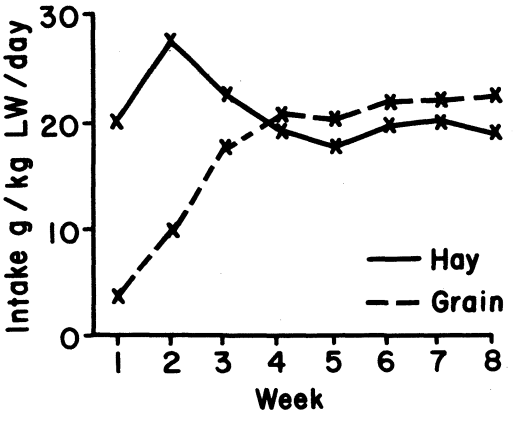
Very little work has been done with grain feeding of lambs in New Zealand for obvious reasons. Preliminary results with lambs fed either whole wheat, barley, or maize in addition to lucerne hay for

eight weeks following abrupt weaning at 6 weeks of age show substantial gains in live weight can be made, equivalent to increases of 5 kg carcass weight per lamb during an 8 week finishing period (Table 4). Figure 2 shows the quantity of grain and hay used in this study to achieve such gains. Lambs were gradually acclimatized to grain so 'lactic acidosis' problems were limited. Thus the proportion of hay eaten was initially high. However the possibility that even better performances could be achieved by restricting hay to only 10% of the ration and having lambs acclimatizing more quickly to grain, as is the method used at the Rowett Research Institute (K. L. Blaxter, pers. comm.)., has still to be examined.

TABLE 4: Live weights (kg) of early weaned lambs finishing on whole grain

Week	Wheat	Barley	Maize
1	18	18	19
2	21	21	21
3	22	22	23
4	23	23	24
5	24	24	26
6	27	27	29
7	29	29	30
8	30	30	31

Figure 2. Intake of hay and grain by finishing lambs



Field crops, legumes, and grains are all highly digestible, they undergo rapid comminution in the rumen, and generate a volatile fatty acid profile which should promote rapid growth rates. Present evidence would suggest field crops fall behind lucerne and grain which promote live weight gains greater than 200 g hd^{-1} day^{-1} (Jagusch *et al.*, 1971). The reasons for the failure of crops to give rapid growth rates requires further research (cf. Barry, 1978).

ECONOMIC ANALYSIS

Broadly speaking most agronomic and nutritional facets of replacing some pastures on a farm by crops are known. The justification for injecting crops into a sheep system and a comparison with other alternatives can now be made on economic grounds.

Table 5 summarises the costs of growing 1 kg DM of grass pasture, turnips, and lucerne used in this analysis. Permanent grass pasture is by far the cheapest ration to grow followed by lucerne, and turnips. Details of the feed costs are given in Appendix 1. They represent typical costs for an intensive lamb finishing unit in the Waikato. Basically the high cost of producing turnips reflected cultivation costs which in the case of lucerne was diluted because a stand lasts a number of years.

TABLE 5: Feed growing costs.

Crop	Production (t DM ha^{-1})	Annual Cost ($ ha^{-1} $annum^{-1}$)	Feed Cost (c kg^{-1} DM)
Pasture	12.0	35.00	0.3
Turnips	12.0*	198.00	1.7
Lucerne	14.0	84.00	0.6

* Turnips 8.0t DM ha^{-1}; new pasture 4.0t DM ha^{-1}

An exercise in economic analysis using sheep gross margins and partial budgeting techniques was undertaken with flocks fed on either grass pastures, pasture + turnips, or pasture + lucerne. Complete details of this economic analysis are given in Sorrenson and Jagusch (1978). The systems assumed a 2 year flock (5 year old replacements bought in) of ewes (20 ewes ha^{-1}) producing 100% finished lambs. Lambs from the pasture alone flock were by Southdown rams and were quitted early when they reached 12 kg carcass weight. On the other hand for the turnip and lucerne supplemented flocks half of the lambs were sold at 12 kg carcass weight and the other half finished in late summer-autumn to 15 kg carcass weight. In the latter 2 systems 15% of the farm had to be in turnips or lucerne to finish the lambs to heavier weights. Details of the gross margin analysis ($ ewe^{-1}) are given in Appendix 2 and they slightly favour the pasture + turnip system.

In Table 6 the results are compared on a $ ha^{-1} basis. For this purpose we were able to compare the above 3 systems with that of a purchased grain finishing system calculated by Jagusch and Bell (1978) using data from Table 4 (grain finishing lambs). The grain finishing system allowed 24 ewes ha^{-1} to be carried instead of 20 ha^{-1} because of the pasture released through standing grain-fed lambs elsewhere.

TABLE 6: Gross margin and net income changes from 4 sheep systems ($ ha^{-1})

	Pasture	Pasture + Turnips	Pasture + Lucerne	Pasture + Grain
Stock gross margin	322	342	333	394
Feed costs	35	56	42	97
Total gross margin	287	286	291	297
Change in Net Income	0	- 1	4	10

At expected levels of productivity and prices the pasture plus lucerne system and the grain finishing system showed marginally higher gains in net income to the farmer compared with pasture alone, whilst

that for the crop system was lower. However it should be noted that the grain finishing system required additional capital investment, increased stocking rates, and higher per ewe productivity to be viable (Jagusch and Bell, 1978).

The economic results reported here particularly apply to data obtained in Waikato but are likely to reflect the economics of injecting lucerne or forage crops for finishing lambs to heavier weights in many other intensive lamb fattening areas in New Zealand. The economics of growing heavier weight lambs would be markedly improved if schedule prices favoured them, instead of the present pricing structure which generally offers less per kg the heavier the carcass.

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APPENDIX 1: Feed growing costs ($ ha^{-1} annum^{-1}) (M.A.F., 1978; Lincoln College, 1978)

1. PERMANENT PASTURE

Fertiliser 500 kg 30% K super at $52.40/tonne		= 26.20
Costs per tonne –		
fertiliser (net of subsidy)	= 41.65	
transport, 40 km (net of subsidy)	= 3.60	
spreading	= 7.15	
	52.40	
Weed Control		= 2.20
Half of farm sprayed per annum		
Material MCPA (4 litres product/ha at 75 c/litre net of subsidy)	= 3.00	
Application 0.5 hr/ha at $2.80	= 1.40	
	4.40	
Pest Control		= 6.72
10% of farm per annum		
Material 1 kg a.i./ha of fensulphothion	= 30.00	
Seed 12 kg grasses + 2 kg white clover	= 23.22	
Undersowing cost (contract)	= 14.00	
	67.22	
Total		= $ 35.12

2. TURNIPS

Use of contractors for all tractor work except spraying of weeds.

Cultivation (turnips from pasture)		= 61.50
Plough	= 25.00	
Discing	= 11.00	
Harrow	= 9.50	
Roller/drill	= 16.00	
	61.50	
Turnip seed 0.7 kg at $3.20/kg		= 2.24
Weed control		= 12.01
Material 2.8 l/ha picloran/chlornitrofen at $3.79	= 10.61	
Application 0.5 hr/ha at $2.80	= 1.40	
	12.01	
Cultivation (back to grass)		= 50.00
Plough	= 25.00	
Discing	= 11.00	
Roller/drill	= 14.00	
	50.00	
Pasture seed		
26 kg grass/white clover mixture/ha		= 46.44
Fertiliser		
500 kg 30% K super at $52.40/tonne		= 26.20
Total		= $198.39

3. LUCERNE. Use of contractors for all tractor work except spraying of weeds.

ESTABLISHMENT

Fertiliser		= 36.67
1 tonne lime per ha at $6.50 (ex works)	= 6.50	
Transport, 40km (net of subsidy)	= 3.60	
Spreading at $4.79/tonne	= 4.79	
400 kg/ha reverted super at $54.45/t	= 21.78	
	36.67	
Cultivation		= 109.00
1 rotary hoe (5-8 cm)	= 30.00	
Deep plough	= 25.00	
3 harrowings	= 30.00	
Roll	= 8.00	
Drill & roll	= 16.00	
	109.00	
Weed control		= 57.80
Post emergence – kerb 50 w at 1 kg a.i./ha 50% chemical. Require 2 kg/ha chemical at $28.20/kg.		
Spraying – 0.5 hr/ha at $2.80/hr.		
Seed		= 47.50
10 kg/ha of pelleted, innoculated seed at $4.75 / kg (bacterial wilt resistant).		
		$250.97

MAINTENANCE

Fertiliser	
500 kg 30% K super at $52.40	= 26.20
same details as for pasture	
Plus 15 kg calcine magnesite/ha at $145/t	= 2.18
Weed control	= 10.59
Every 2 years – paraquat at 1½l/ha plus simazine at 1.25 kg/ha = $19.78.	
Spraying – 0.5 hr/ha at $2.80/hr = $1.40.	
Pest Control (lucerne aphid)	= 8.80
2 sprayings (spring & autumn = pirimor at .125 gm a.i./ha at $3.00/ha = $6.00	
Spraying at $1.40/spray = $2.80	
	$ 47.77

Therefore the total annual cost of lucerne = $35.85 + 47.77 = $83.62

It is assumed the stand lasts 7 years.

Therefore annual establishment cost = $35.85

APPENDIX 2
Sheep gross margins ($ ewe^{-1})

	Pasture	Pasture + Lucerne	Pasture + Turnips
GROSS REVENUE (MAF, 1977)			
Lamb sales*	13.40	13.97	14.42
Cull ewes .491 at $9.80	4.81		
Wool sales .98 sheep at $1.70 net/kg	6.66		
Total gross revenue	24.87	25.44	25.89
DIRECT COSTS (MAF, 1978; Lincoln College, 1978)			
Replacement purchase .54 ewe at $12.50	6.75		
Shearing (shearers only) .98 sheep at $32/100	.31		
Tup crutch .46 sheep at $11/100	.05		
Main crutching .99 sheep at $15/100	.15		
Drenching – ewes 2 drenches (pre tup and pre lamb) .99 ewe at 9.7 c/dose	.19		
– lambs 50% 1 drench for crop & lucerne at 3.9 c/dose	.00	.02	.02
Vaccination (triple) .98 ewe at 6.4 c/ewe	.06		
Ear tags, footrot and docking at 11 c/ewe	.11		
Dipping .46 ewes at 14 c/ewe (replacement ewes already dipped)	.06		
Ram (2 per 100, 4 year life) .005 at $55/ram	.28		
Wool shed expenses at 2 c/kg wool	.08		
Cartage (all cartage over 24 km except purchased ewes 80 km)			
.491 cull ewe at 28 c	.14		
.54 replacement ewe at 55 c	.30		
lambs to works at 25 c/lamb	.25		
wool at .9 c/kg	.04		
Total direct Costs	8.77	8.79	8.79
Gross Margins	16.10	16.65	17.10

* MAF mean lamb price adjusted for differences in grades and selling time from AFFCO (1978).