AN EVALUATION OF TURNIPS (NZ YORK GLOBE) AND 1000 HEADED KALE (BRASSICA OLERACEA) AS AUTUMN FINISHING CROPS FOR HEAVY WEIGHT LAMBS

K. T. Jagusch, P. A. Farquhar, Carol Kevey
Ruakura Agricultural Research Centre
Private Bag, Hamilton, New Zealand

ABSTRACT

In autumn 1976 a replicated field experiment with 318 late maturing crossbred lambs (Suffolk x Romney, Suffolk x Coopworth, Dorset x Coopworth) of initial carcass weight 13 kg, was conducted to compare performance when finished on either turnips, kale, or pasture under two management systems (fully on and pasture runoff). During 8 weeks turnip and kale fed lambs did not grow as fast as those given pasture, final carcass weights being 17.7, 17.3 and 18.3 kg respectively. Management system did not affect overall growth rate although lambs fed turnips supplemented with runoff pasture did better in the latter part of the experiment. The protein in turnips was 10%.

The digestibility of fresh turnips, kale, and pasture was 74, 71 and 72% respectively and that of the residue 79, 57 and 57% respectively.

Lambs apparently utilized 52% turnips, 35% kale, and 33% pasture.

The weight of marketable cuts, gross chemical components of the carcass and organoleptic properties were not differentially affected by feeding crop. Turnips appear an excellent replacement for pasture as finishing feed.

INTRODUCTION

Producing lambs of 20 kg carcass weight in contrast to conventional weights of 12-14 kg, is a means of diversifying the NZ prime lamb industry. Biological efficiency too is increased if such lambs can be finished quickly so that they do not compete with the ewe for flushing feed and affect carrying capacity.

The market possibilities in North America, Europe, and Middle East, as well as in the UK, has encouraged scientific (Kirton, 1974) and political (Bolger, 1977) interest in the biological and economic implications of heavy weight lamb production. Evidence reviewed by Rattray *et al.*, (1976) suggested that such lambs will take longer to finish than conventional lambs and a premium will be necessary to encourage production.

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 sheep areas, the strategic injection of highly digestible legumes or crops that produce a bulk of feed ahead of the finishers would seem essential if lambs are to achieve 20 kg carcass weights before winter. Special reasons for a summer-autumn finishing feed include internal parasite control through break feeding, avoidance of facial eczema and ryegrass staggers, separate management of the ewe flock, pasture renovation, and seedbed preparation for sowing lucerne, grass or other crops.

Most authors have looked at the productive value of crops for winter feeding of sheep (Claridge and Calder, 1944; Montgomery, 1948; Lewis, 1954; Drew, 1968; Scott, 1971; Stephen, 1973; Drew *et al.*, 1974). Mention of the use of 1000 headed kale for lambs has been made by Lobb (1943, 1947) and Robinson (1955) whilst Ayson (1956) extolled the virtues of white-fleshed turnips for summer finishing lambs in Hawkes Bay. However no critical evaluation of these crops as finishing feed has been made. This is done in the present paper with special reference to heavy weight lamb production.

MATERIAL AND METHODS

Design

The design was a twice replicated 3 (turnips, kale, pasture) x 2 (two management systems) factorial with 3 lamb breeds nested in each plot (n = 24/group containing 8 lambs of each breed). The two management systems (1 & 2) for the crops were a fully-on system once lambs had undergone a 12 day acclimatization period, and a pasture run-off system (R) allowing 24 hr intervals on either crop or pasture. Pasture-fed control groups were rotationally grazed at either 1 week (FR) or 3 week (SR) intervals. The experiment commenced on 22 March and ran for 54 days when lambs were slaughtered for carcass analysis.

Crops

Turnips and Kale were drilled in 18 cm rows during the last week of October, 1975, at rates of 0.7 kg/ha and 2.8 kg/ha respectively. The paddocks were previously in grass under high stock densities and were fertilised with split dressings of 30% potassic-superphosphate containing copper, at a rate of 750 kg/ha annually. The soil, a fertile Kaipaki loamy peat, was cultivated by rotary hoe in late September. A post emergent spray (pichloram plus chlornitrofen) was used to control weeds.

Animals

Suffolk x Romney, Suffolk x Coopworth, and Dorset x Coopworth lamb breeds (total n = 318) were used. Ten animals of each breed were killed as an initial slaughter group (ISG). Lambs were drenched twice with alternating brands of anthelmintic (+ Se).

Management

Crops were fed off in breaks of 1000 m^2. The decision to shift animals was based on visual observation, namely, turnips – when tops and bulbs selected by lambs were eaten to soil surface level and kale – when the majority of leaf had been eaten.

Crop R groups of lambs were alloted a 0.4 ha paddock for the whole experiment because autumn growth maintained pasture yields at 2600 kg DM/ha (Table 1).

Control groups rotationally grazed on pasture were challenged each shift with 3800 kg DM/ha in 0.4 ha paddocks (Table 1).

Measurements

In vivo digestibility of fresh crop and residues were measured with lambs indoors (n = 3/determination); pasture digestibilities were determined *in vitro* (Drew, 1966). Protein (N x 6.25) was determined by Kjeldahl.

Crop yields, residues after grazing, utilization per grazing, and voluntary intake were measured using a m^2 quadrat (3 quadrats/break) and that of pasture by cutting caged and grazed areas with a shearing hand piece after each shift. Yields of R pastures were measured fortnightly.

Fasted (18 hr) live weights were obtained at the start, middle, and end of the experiment.

The weights of marketable cuts, loin ribeye area, and fat cover were measured on all carcasses and the gross chemical composition and taste panel determinations on selected carcasses.

RESULTS

Feed Evaluation

The percentage DM digestibility of fresh turnips, kale, and pasture was 74 ± 0.3, 71 ± 0.6, and 72 ± 0.8 and their residue after grazing was 79 ± 0.4, 57 ± 0.4, and 57 ± 0.9 respectively. Lambs on digestibility trials could not eat sufficient kale residue to maintain weight. Both crops had 10% crude protein. There was 18% DM in the pasture R but pasture under a FR contained 15% DM whilst that for the SR was 23%. This compared with 12 and 18% DM for turnips and kale respectively.

Yield, Utilization, and Intake

The high standard errors of measurement (Table 1) reflects variation between plots, breaks, and paddocks. At each grazing lambs utilized less kale than turnips. Lambs on R utilized less crop and pasture than those fully-on turnips or kale and also those rotationally grazed on pasture. On average turnip, kale, and pasture groups ate 1.6, 1.3, and 1.6 kg DM/hd/day respectively. Utilization was also lower with the FR groups compared with the SR.

Live Weight and Carcass Weight

Pasture fed lambs grew significantly faster than those given crop although the differences in final carcass weight and live weight (Table 2) were small.

TABLE 1: Yield Utilization and Intake Data

	Yield (t DM/ha)	Utilization (%)	Intake (kg/DM/day)
Turnips	10.3 ±1.0	57 ±10	1.5 ±0.3
Turnips (R)	10.1 ±0.8	46 ±20	1.1 ±0.5
Pasture (R)	2.6 ±0.4	14 ±11	0.5 ± 0.3
Kale	10.1 ±1.4	39 ± 3	1.2 ±0.1
Kale (R)	9.5 ±1.9	30 ±10	0.9 ±0.3
Pasture (R)	2.6 ±0.7	13 ± 6	0.5 ±0.3
Pasture (FR)	3.7 ±0.8	28 ±12	1.6 ±1.0
Pasture (SR)	3.9 ±1.1	38 ± 9	1.6 ±0.2

TABLE 2: Animal Weight Data

	Initial Carcass Weight (kg)	Final Carcass Weight (kg)	Final Live Weight (kg)
Turnips	13.1	17.7	34.3
Kale	13.1	17.3	34.2
Pasture	13.2	18.3	35.5
SE (diff.)	0.1^{NS}	0.2**	0.3*

A significant management x breed interaction occurred in final carcass weight and live weight (Table 3) where Suffolk x Coopworth lambs responded to being fully on turnips and pasture (FR) better than Suffolk x Romney and Dorset x Coopworth lambs.

TABLE 3: Management and Breed Effects on Final Weights

Management System	Carcass Weight (kg)		Live Weight (kg)	
	1	2	1	2
Breed				
Suffolk x Romney	16.5	16.8	32.8	33.3
Suffolk x Coopworth	19.0	18.3	37.2	36.0
Dorset x Coopworth	18.1	18.0	34.2	34.5
SE (diff.)	0.3*		0.5*	

Management had a differential effect on lambs given turnips. During the first 34 days which includes the acclimatization period lambs fully-on turnips grew faster than those given a R. However between 34-54 days R lambs fed turnips did better than those fully-on.

Body Composition and Taste

The weights of marketable cuts, fat cover, and eye muscle area are given in Table 4. The significant results for rack and leg weight largely reflect the

TABLE 4: Marketable Cut Weight, Fat Cover, and Eye Muscle Area

	Shoulder (kg)	Rack (kg)	Loin (kg)	Leg (kg)	Fat Cover (mm)	Eye Muscle (mm)
Turnips	3.08	1.39	1.10	2.80	5.2	1195
Kale	3.02	1.37	1.19	2.65	5.0	1203
Pasture	3.09	1.54	1.17	2.81	5.8	1213
SE (diff.)	0.04^{NS}	0.04**	0.03^{NS}	0.05**	0.4^{NS}	40^{NS}

differences in carcass weight rather than a differential effect of treatment. Again breed differences were apparent; Suffolk x Coopworth and Dorset x Coopworth generally having higher weights of marketable cuts, greater fat cover, and larger rib-eye muscles than Dorset x Romney lambs.

Only carcasses from lambs fully-on crop or those from groups under the FR at pasture were subjected to chemical analysis and taste panel evaluation. Breed of animal significantly affected the gross chemical composition but feed treatment differences were not significant. A typical carcass (18 kg) contained 52% water, 29% fat, 15% protein, and 4% ash.

A consumer taste panel graded meat from the leg joint on a hedonic scale (range 1-10) for organoleptic qualities. Compared with grass finished lambs the crops had no effect on overall taste, tenderness, flavour, or juiciness of the meat; mean values being 6.7, 6.0, 6.8 and 6.4 respectively indicating overall acceptance.

DISCUSSION

In the present experiment pasture-fed and crop R lambs were offered about 5 kg DM/hd/day and the crop alone fed groups 3 kg/ha/day. Had the latter been offered in equal quantity to pasture, those on turnips would have eaten the tops and very little bulb, a situation which could increase finishing rate (Ayson, 1956) but gives poor utilization. In the case of kale probably only a small proportion (eg. 20%) would have been eaten compared with over 30% in this experiment. Although some live-weight gain was sacrificed in the present experiment so that a reasonable utilization was achieved, the difference between turnips and pasture groups becomes negligible knowing residual bulb, still of high digestibility after finishing the lambs, can readily be used by the ewe flock. Furthermore a farming system which needs the injection of crop (or other feed eg. lucerne), to finish lambs would not have the available pasture that was fed to the control groups in this experiment. Indeed most farmers would use all their available pasture for the ewe flock at this time of the year. It is also doubtful whether residual kale (digestibility = 57%) would be suitable for clean up by ewes in mid-pregnancy when it is important to maintain body weight (Rattray and Jagusch, 1977).

The short finishing period appeared to allow turnip fed lambs to buffer a low protein intake, a situation that is not a problem with kale fed lambs eating leaf which contains about 18% protein (Drew *et al.*, 1974). Although Lewis (1954) found fully-on turnips better for winter feeding hoggets compared with run-off and hay supplementation it is suggested that finishing lambs on turnips could require a pasture run-off after 5-6 weeks in view of the altered growth rate during the experiment and the fact that autumn pasture contains about 25% protein (Joyce and Newth, 1967).

Lastly a calculation of the annual costs for 1 ha of pasture in this experiment was 0.4 c/kg DM, that for turnips and kale was 1.4 c/kg DM.

ACKNOWLEDGEMENTS

D. Karl, Nutrition Centre; N. R. Cox and K. E. Jury, Biometrics Division, and K. S. MacLean and Fergus Grayson farm staff all of Ruakura Agricultural Research Centre.

REFERENCES

Ayson, E. C. 1956: Turnips for lamb fattening in Northern Hawke's Bay. *New Zealand Journal of Agriculture.* **93**: 231-239.

Bolger, J. B. 1977: Good product backed up by good service. *Food Technology in New Zealand.* p39.

Claridge, J. H., Calder, R. A. 1944: Chou moellier and 1000 Headed Kale. *New Zealand Journal of Agriculture.* **8**: 347-349.

Drew, K. R. 1966: The *in vitro* prediction of herbage digestibility. *Proceedings of New Zealand Society of Animal Production.* **26**: 52-70.

Drew, K. R. 1968: Winter feeding hoggets. *Ibid.* **28**: 94-106.

Drew, K. R., Stephen, R. C., Barry, T. N. 1974: The composition and productive features of some forage crops for sheep. *Proceedings of Agronomy Society of New Zealand.* **4**: 53-56.

Joyce, J. P., Newth, R. 1967: Use of the comparitive slaughter technique to estimate the nutritive value of pasture for hoggets. *Proceedings of New Zealand Society of Animal Production.* **27**: 166-180.

Kirton, A. H. 1974: Heavy weight lamb production. Time for a closer look. *New Zealand Journal of Agriculture.* **129** (3): 20-27.

Lewis, K. H. C. 1954: Trials on winter feeding of hoggets. *New Zealand Journal of Agriculture.* **89** (1): p. 560.

Lobb, W. R. 1943: 1000 Headed Kale as a fodder crop. *New Zealand Journal of Agriculture.* **67**: 111-113.

Lobb, W. R. 1947: 1000 Headed Kale and Chou moellier. *New Zealand Journal of Agriculture.* **74**: 273-277.

Montgomery, K. M. 1946: Feeding Chou moellier and Roots to sheep. *New Zealand Journal of Agriculture.* **72**: p. 515.

Rattray, P. V., Jagusch, K. T. 1977: Herbage allowances for sheep. *Proceedings of the Ruakura Farmers' Conference.* p. 49-51.

Rattray, P. V., Joyce, J. P., Drew, K. R., Moss, R. A., Beetham, M. R. 1976: Production of heavy weight lambs. *Ibid.* p27-33.

Robinson, G. S. 1955: Chou moellier is reliable summer and autumn forage crop. *New Zealand Journal of Agriculture.* **91**: 591-593.

Scott, R. S. 1971: The comparitive productivity and utilisation of some winter forage crops. *Proceedings of Agronomy Society of New Zealand.* **1**: 193-201.

Stephen, R. C. 1973: Winter forage crops in Canterbury. *Proceedings of Agronomy Society of New Zealand.* **3**: 13-17.