Effect of four brassica cultivars on the subsequent establishment of tall fescue pasture

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Abstract

Two experiments were conducted to evaluate the impact of different brassica crop types on subsequent pasture establishment. Brassica crops (York Globe turnip, Pasja hybrid turnip, Maris Kestrel kale and Hobson rape) were planted in spring and allowed to grow through summer before intensive grazing in early March with sheep. The experimental areas were then cultivated and sown with tall fescue and white clover to evaluate the effect of brassica regrowth on pasture establishment.

In 1991/92, the pasture establishment experiment was ended when there was little brassica regrowth following mulching and intensive cultivation. In 1992/93, with less intensive cultivation before sowing new pasture, differences in regrowth of brassica cultivars were recorded. Approximately 30% of Hobson rape plants survived cultivation compared to 10% of the other cultivars. Hobson rape had the highest level of ground cover, reaching 65% by the first grazing.

Tall fescue and white clover seedling counts were not significantly affected by brassica cultivar two months after sowing. However, tall fescue plants in the Hobson treatment were significantly taller (94 mm) than in the other treatments (averaging 77 mm). Differences in pasture height were associated with shading by brassica regrowth, with tall fescue plants being etiolated under brassica plants. Although grazing 3 months after sowing minimised further brassica regrowth, brassica cultivar effects on pasture establishment were apparent in the following spring. In October, tall fescue cover was lower in the Hobson treatment (27% cover by point analysis) than in the other treatments (40%).

These experiments show that the regrowth of some brassica crops can significantly reduce the subsequent establishment of new tall fescue pasture.

Additional key words: *turnip, kale, rape, hybrid turnip,* Festuca arundinacea, *regrowth, ground cover*

Introduction

On the East Coast of the North Island brassica crops are often spring sown, used for summer forage, and then followed by new pasture sown in late summer or autumn. In a survey undertaken to assess the on-farm establishment of drought tolerant pastures (Smith *et al.*, 1994), it was observed that occasionally residual growth from brassica crops was interfering with establishment of tall fescue/cocksfoot pastures. Regrowth was most noticeable from the cultivar Pasja, a turnip-rape hybrid.

Problems with regrowth of brassica crops in new pasture have not been reported previously on the East Coast of the North Island, although competition from brassica nurse crops in establishing pasture has been reported (White, 1977; Cullen, 1964). Factors that could be associated with competition between establishing pasture and brassicas include: soil fertility level (Cullen, 1964), leaf shape and leaf angle of brassica (White, 1977), location of growing points on the brassica crop, seasonal growth conditions (White, 1977), grazing intensity of crop before pasture sowing, cultivation intensity before pasture establishment, timing of pasture sowing, pasture species and seed mixture (Cullen, 1964), and length of time before removal of brassica regrowth (White, 1977). Brassica regrowth potential in pasture was expected to be related to the number of growing points remaining after brassica grazing and cultivation.

There are many brassica cultivars available to farmers, with a range of growth characteristics. The objective of the experiments reported in this paper was to assess the impact of different brassica crop types on the subsequent establishment of tall fescue pasture. Tall fescue was used for the test pasture because it is slower

to establish than traditional ryegrass pastures, and therefore more susceptible to competition from brassica regrowth. The results are expected to be of interest to both farmers and the seed industry.

Materials and Methods

Two experiments were conducted at Poukawa Research Station, Hastings, on Matapiro silt loam sites. The effects of four brassica cultivars on subsequent pasture establishment were evaluated: York Globe turnip (*Brassica rapa* ssp. *rapa*), Pasja forage brassica (*B. rapa* var. *rapa* x var. *chinensis*), Hobson rape (*B. napus* ssp. *oleifera*) and Maris Kestrel kale (*B. oleracea* var. *acephala*). Cultivars were selected to represent different crop types and were expected to have contrasting regrowth potentials in the subsequent new pastures (High: Maris Kestrel and Pasja, Low: Hobson and York Globe). Similar methods were used in both experiments (Table 1), except for cultivation before sowing tall fescue. The brassica crops were planted in spring and allowed to grow through summer before grazing in March by sheep. All plots were grazed together in one block, with the objective of grazing crops to a low residue as is the normal practice of farmers. The experimental areas were then cultivated and sown with new pasture (20 kg/ha Grasslands Roa tall fescue, 2 kg/ha Grasslands Pitau white clover). Cultivation was very intensive in the 1991/92 experiment, with mulching of the crop residue followed by ploughing and discing. The pasture was then sown using a conventional drill. In the 1992/93 experiment, cultivation was less intensive (Table 1). The cultivation and sowing procedure used in the 1992/93 experiment was adopted to conform to typical farm practice for establishing tall fescue pasture on the East Coast of the North Island (Smith *et al.*, 1993).

Table 1. Experimental design and planting details.

	1992/93 Experiment
Experimental design	Randomised block Cultivars (4) Replicate blocks (4) Plot size 10 m x 7 m
Brassica	
Previously	Brassica
Cultivation	Ploughed, disc, harrow, roll
Sowing	Seed drilled 6 November 1992
Fertilizer	160 kg/ha 8:14:13:2 drilled with seed
Herbicide	None
Insecticide	1 kg/ha Phorate at sowing
Grazing	16-21 March 1993
Pasture	
Cultivation	Disc 3 times, harrow, roll
Sowing	Seed broadcast 31 March 1993, harrowed, rolled.
Fertilizer	150 kg/ha 8:14:13:2 at sowing
Grazing	14 July, 2 September, 18 October, thereafter as per normal farm management.

Before cultivation, brassica plant populations and crop height were measured in 4 quadrats (60 cm by 90 cm) per plot. Measurements on tall fescue pastures included: pasture seedling counts, brassica regrowth ground cover, and pasture cover 4, 7 and 16 months after sowing. Seedling counts on new pasture were made in 10 quadrats (7 cm by 40 cm) per plot. Brassica regrowth in pasture was measured as percentage of ground area covered by brassica crop, calculated from regrowing crop plant populations (counted in 10 quadrats 60 cm by 90 cm per plot) and average leaf canopy area per plant (2 diameter measurements per plant). Cover of tall fescue, clovers, other grasses, other species and bare ground were measured using point analysis, with the first hit being recorded for 200 needle points per plot (Radcliffe and Mountier, 1964).

Results

Based on brassica crop height measurements and yield height relationships (Korte *et al.*, 1994), brassica crop yields before grazing in March were estimated as 4-6 t DM/ha in both years.

In 1991/92, the combination of intensive cultivation and dry weather resulted in little brassica regrowth following the sowing of new pasture. Mulching lacerated brassica crop residues and dry soil conditions assisted with desiccation of brassica stubble. Ploughing buried most crop residues. No treatment differences were apparent in pasture establishment and further measurements were discontinued.

In 1992/93, cultivation was less intensive, with no mulching or ploughing, and significant differences in brassica crop regrowth occurred (Table 2). Brassica plant populations before grazing and cultivation were

similar for the 4 cultivars evaluated (Table 2), averaging 43 plants/m^2. Viable brassica plant populations were markedly reduced by the combination of grazing and cultivation. Approximately 30% of Hobson plants survived in new pasture. Approximately 10% of Maris Kestrel, Pasja and York Globe plants survived, with the difference in population between these 3 cultivars being non-significant ($P<0.05$).

Table 2. Brassica plant populations (plants/m^2) and percentage ground cover of brassica plants in new pasture (%) in the 1992/93 experiment. Significance level of *F* test shown after SED, * P=0.05, *** P=0.001.

	Pre-cultivation 16 March	After pasture sowing 30 April	14 May	3 June	25 June
Plants/m^2					
Maris Kestrel	38	3	2	2	2
Pasja	48	6	5	4	3
York Globe	40	3	3	2	2
Hobson	45	13	12	10	9
SED	5.7 *	1.3 ***	1.3 ***	0.9 ***	1.3***
Brassica cover (%)					
Maris Kestrel		2	4	8	10
Pasja		8	23	28	22
York Globe		5	11	15	16
Hobson		18	43	57	65
SED		1.3 ***	3.5 ***	4.9 ***	7.5***

From pasture sowing until the first grazing in July, surviving brassica plants increased in size, shading an increasing proportion of new pasture (Table 2). Hobson rape had the highest level of ground cover, 65% by the first grazing. Pasja reached 22% ground cover by the first grazing. Differences in cover between brassica cultivars were largely attributable to differences in plant population.

Tall fescue and white clover seedling counts were not significantly ($P<0.05$) affected by brassica cultivars 2 months after sowing (Table 3). However, pasture canopy height was affected by brassica cultivar, with the height being greatest where Hobson had been planted. Differences in pasture canopy height reflected the percentage of the sward growing in the shade of brassica canopies, with tall fescue under brassica plants being etiolated. Mean pasture height for shaded and unshaded tall fescue was respectively 9±2 cm and 8±2 cm, with pasture height being significantly correlated with percentage brassica cover (r=0.72, $P<0.01$).

At the first grazing of the new pasture in July, care was taken to avoid overgrazing tall fescue. Ewes grazed brassica regrowth freely and minimal brassica regrowth occurred after this grazing.

The longer term effects of different brassica cultivars on pasture establishment are shown in Table 4. At the first two measurements, tall fescue cover was significantly ($P<0.05$) decreased, and the percentage of bare ground increased, in pastures sown after Hobson compared with other brassicas. Other sward components were not significantly affected by the brassica treatments. Seventeen months after pasture sowing, differences in tall fescue cover between treatments were not statistically significant ($P<0.05$), but Hobson plots had more white clover and bare ground than other treatments.

Table 3. Effect of different brassicas on pasture seedling counts (plants/m^2) and pasture canopy height on 17 May 1993. Significance level of *F* test shown after SED, ns = non-significant, ** P=0.01.

	Plants/m^2				
Cultivar	Tall fescue	White clover	Subterranean clover	Other grass	Canopy Height (cm)
Maris Kestrel	482	171	9	69	7.8
Pasja	434	137	7	39	7.9
York Globe	393	164	9	71	7.4
Hobson	477	167	32	50	9.4
SED	53 ns	0.4 **	13 ns	12 ns	0.4 **

Table 4. Effect of different brassicas on succeeding pasture cover (percent cover hits) in the 1992/93 experiment. Significance level of *F* test shown after SED, ns = non-significant, * P=0.05, ** P=0.01.

	Tall fescue	White clover	Other grass	Other species	Bare soil
15 July 93					
Maris Kestrel	52	9	6	15	17
Pasja	47	10	5	9	28
York Globe	46	10	6	14	23
Hobson	34	10	4	12	38
SED	3.5 **	1.8 ns	0.9 ns	2.2 ns	3.5 **
20 October 93					
Maris Kestrel	40	21	5	5	28
Pasja	42	21	5	4	27
York Globe	38	22	6	3	29
Hobson	27	24	3	3	40
SED	3.1 **	2.2 ns	1.3 ns	1.3 ns	2.2 **
25 July 1994					
Maris Kestrel	50	33	10	1	6
Pasja	52	28	11	0	9
York Globe	50	30	12	1	6
Hobson	44	37	7	1	10
SED	3.1 ns	2.2 *	0.9 **	0.4 ns	0.9 *

Discussion

These experiments showed that brassica crop regrowth can have a negative impact on pasture establishment, but that intensive grazing and cultivation can prevent such regrowth. The greater regrowth of Hobson than other brassicas in the second experiment reflected differences in grazing intensity and resistance to cultivation. After grazing, Hobson consisted of a woody stalk/stem approximately 15 cm in length that sheep had rejected. The stump had many buds from which regrowth could potentially occur. The bulbs of York Globe turnips were either half eaten or kicked out of the ground by sheep, leaving relatively few potential sites for regrowth. Pasja and Maris Kestrel were grazed almost to ground level. Discing and cultivation uprooted plants, with turnips and Pasja being most severely affected. The Hobson stubble was sufficiently tough to largely withstand cultivation. Maris Kestrel kale was intermediate between Hobson and turnips in its ability to withstand cultivation.

Shading of tall fescue plants by brassica leaf canopies from sowing to the first grazing presumably resulted in death or reduced tillering of tall fescue plants, leaving more bare ground. Slugs were also possibly involved in tall fescue plant decline in the shade of brassica plants. Slug damage was observed on shaded tall fescue plants. Differences between treatments in tall fescue cover had largely disappeared by July 1994. The recovery of tall fescue in the Hobson treatment was probably due to tall fescue plants developing prostrate tillers that provided increased cover over bare soil. Under less favourable conditions, with high weed seed populations, it is possible that weeds could establish in the areas where brassica regrowth markedly reduced competition from the grass sward (Cullen, 1966).

Hobson rape was demonstrated to have a greater regrowth potential than other crop types evaluated, but in the survey (Smith *et al.*, 1993) Pasja was the cultivar observed to cause the most problems in establishing tall fescue pasture. The reasons for this probably related to lack of cultivation before pasture sowing. Pasja is often favoured for planting before sowing new pasture because it has rapid early growth and maturity (Korte *et al.*, 1994).

The amount of cultivation farmers use before planting new pasture varies markedly. A recent survey (Korte, unpublished data) of 110 chicory pastures in the Gisborne, Hawkes Bay and Wairarapa districts indicated

that of the 40 paddocks sown following a crop, 35% were ploughed before new pasture was sown. No farmers reported mulching paddocks before pasture seeding. These two experiments covered the range of cultivation intensity used on East Coast farms.

Tall fescue pasture is particularly sensitive to competition during establishment because the species is slower to establish than many other grasses, so that brassica regrowth has longer to develop before the first grazing. By contrast, perennial ryegrass pastures can be grazed earlier so that competition is minimised. Since these experiments were conducted, East Coast farmers have started using herbicides (MCPB) to control brassica regrowth in new pasture.

Conclusions

It was concluded that regrowth of brassica crops can retard the establishment of slow establishing pasture species like tall fescue, but that over time the negative effects can be compensated for by horizontal spread of plants that establish. The importance of negative effects will depend on the vigour of brassica regrowth. It is recommended that farmers inspect brassica residue before sowing new pasture, and if necessary use further grazing, cultivation, or herbicide application to minimise regrowth.

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References

Cullen, N.A. 1964. The effect of nurse crops on the establishment of pasture. 1. Rape (*Brassica napus* L.) forage crop. *New Zealand Journal of Agricultural Research* **7**, 42-51.

Cullen, N.A. 1966. Invermay trials show importance of competition between pasture species. *New Zealand Journal of Agriculture* ***112*** *(April),* 31-32.

Korte, C.J., Slay, M.W.A. and Smith, D.R. 1994. Evaluation of spring sown brassica crops in Hawkes Bay: 1991/92 and 1992/93 trials. Unpublished report for N.Z. Meat Research and Development council project number 91MT 35/3.5. 40 pp.

Radcliffe, J.E. and Mountier, N.S. 1964. Problems in measuring pasture composition in the field. Part 1. Discussion of general problems and some considerations of the point method. *New Zealand Journal of Botany* **2**, 90-97.

Smith, D.R., Slay, M.W.A., Gray, M.H. and Milne, G.D. 1993. On-farm establishment of drought-tolerant pastures on the east coast of the North Island. *Proceedings of the New Zealand Grassland Association* ***55***, 33-38.

White, J.G.H. 1973. Pasture establishment. *In:* Pastures and Pasture plants (ed. R.H.M. Langer), pp. 129-157. A.H. & A.W. Reed, Wellington.