GROWTH AND REGROWTH OF SOME BRASSICA FORAGES GROWN OVER SUMMER IN THE MANAWATU

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ABSTRACT

"Gruner" Kale, "Winfred" Rape, "Wairoa Brassica" and "Perko" were compared in the summer of 1984/85. Portions of each crop were hard or lax grazed in January or February 1985. In the lax grazed plots the leaf was removed from the plant, while in the hard grazed plots only fibrous stem remained. The maximum yields from the ungrazed crops over the five months to April 1985 were: Gruner 8900 kg DM/ha, Winfred 7000 kg DM/ha, Wairoa, 5340 kg DM/ha, and Perko 6130 kg DM/ha. The yield of Gruner reached a stable ceiling at 8900 kg DM/ha but the yield of the other three brassicas decreased with time.

The yields obtained in April 1985 from plants that had been laxly grazed in January or February and allowed to regrow were higher than those obtained from plants which were not grazed throughout the growing season.

INTRODUCTION

While forage brassicas have been grown in New Zealand since 1870 (Palmer, 1982) the area of brassica sown has declined from 298,000 ha in 1960 to a total of 140,000 ha in 1985 (New Zealand Department Statistics, 1963, 1987). Much of this reduction in area can be attributed to farmers making more efficient use of pastures, and thus avoiding the need for summer or winter forage crops.

In recent years new cultivars of brassicas and interspecific hybrids between types of brassicas have been developed, which can produce high yields soon after sowing or can regrow well after grazing. This has led to a resurgence of interest in the use of brassicas as forage crops.

In the Manawatu brassica crops may be sown as an insurance against summer drought or outbreaks of facial eczema in autumn. Summer grown brassica crops may also be grown by farmers for finishing heavy weight lambs in autumn. There is little published information on either the yields of the newer brassicas, or their regrowth after grazing. This paper details an experiment which examined the growth and regrowth of a range of brassica cultivars in the Manawatu.

METHODS

The use of terms such as 'Kale', 'Rape'. or 'Root crops' which describe brassicas in terms of the sites for storage of carbohydrates are no longer appropriate, as plants which result from crosses made between plants of these groups or plants which do not form large stores of carbohydrate do not fit comfortably within these categories. The use of the term 'Forage brassica' as a general term and reference to specific cultivars and their parentage is suggested as a better method of naming the intraspecific brassica hybrids which are agriculturally important.

The crops used in this experiment are listed below. Of these, three were the result of hybridisations between brassicas:

'Winfred' Rape	: (Marrowstem Kale x Turnips, Anon, 1985)
'Wairoa Brassica'	: (Rape x Swedes, Mortlock, 1975)
'Perko'	: (Chinese cabbage x Turnips, Ydgren *pers. comm*)
'Gruner' Kale	: a diploid fodder kale (Ydgren *pers comm*)

The four brassicas were sown on 15 November 1984 on a Tokomaru Silt Loam on the Pasture and Crop Unit at Massey University. The area had previously been in pasture for three years and, after the application of paraquat at 4 l/ha on 9 November 1984, was ploughed and cultivated two days before sowing.

The experiment was sown in a randomised complete block design with five replicates. Each plot was 6.4 m wide (4 drill widths) and 80 m long. Fertiliser (80 kg/ha of NPK 12:10:10) and insecticide (Thimet at 6 kg/ha) were applied at sowing.

The sowing rates of each brassica crop followed recommended practice. The weight of seed sown was determined by weighing the unsown seed removed from the drill.

The sowing rates were: Gruner, 2.0 kg/ha, Winfred, 7.2 kg/ha (coated seed): Wairoa, 4.0 kg/ha; Perko, 4.3 kg/ha.

The headlands were sown in strips of each cultivar so that stock could become accustomed to the feed before grazing the plots. On 18 December Dicamba at 700 ml/ha was applied to the plots to control weeds.

Dry Matter Accumulation

Samples were taken on four occasions to assess dry matter yield. In Gruner, Winfred and Wairoa two areas, each of $0.3m^2$ **were cut at ground level in each plot, while Perko bulbs in the sampled areas were pulled from the ground. As the size of the** individual plants in each sample was variable, the sample was separated into large, medium and small plants. The number of plants and total fresh weight of each group was determined and two representative plants in of each category selected for determination of dry weight.

Grazing and Regrowth

Four grazing teatments were applied. These were:

7 January — **hard grazing**
— **lax grazing**
24 February — **hard grazing**
— **lax grazing**

Before each grazing the dry matter yield of each plot was measured and three electric mesh fences were run across the experiment to delineate two strips across all plots. The area of each strip was approximately 0.1 ha.

The subplots were grazed by sheep which had previously grazed the headlands. The intensity of grazing was manipulated by altering the number of sheep, the age of the sheep, and the period they remained on the crop (e.g. mature ewes: 17 hours lax or 36 hours hard).

In the area which was grazed 'laxly,' the plants retained most of the stem and a small amount of leaf. In the 'hard' grazed areas

all the leaf and some stem was grazed from the Gruner, Winfred and Wairoa plants.

After the sheep were removed the number of plants and the dry weight of the stubble remaining was measured (sampling area $0.45m^2$) and the areas were allowed to regrow. In mid March the plants in the two areas grazed in January were resampled. This plant material was made up of the stubble remaining from the grazing and regrowth and the plant population and dry matter yield was sampled.

A similar method was used in mid April to assess regrowth after the hard and lax grazings in February.

RESULTS

The early summer months of the 1984/85 season were warmer and wetter than those of an average year (Figure 1). Brassica seedlings began to emerge about 10 days after sowing. Not all seedlings emerged at this time and populations on 18 December were lower than on 16 January (Table 1). The number of plants/m^2 in the ungrazed area of each crop decreased over time. Lax grazing in January or February had little effect on the population of any of the crops but plant numbers fell when plants were hard grazed. The Perko plants were more easily dislodged during grazing than plants of the other crops especially in February when the sheep began to graze the bulbs. So many bulbs were dislodged from the hard grazed plots of perko that no population counts could be made at the end of the experiment (Table 1).

The plants grew well over the summer and 62 days after sowing yield of over 5000 KgDM/ha were obtained from all crops (Table 2). In February the plots of Winfred and Wairoa became severely infested with aphids. Although some aphids were found on the Gruner and Perko plants, the populations remained low. No aphicides were applied.

Perko showed symptoms of powdery mildew (*Erysiphe polygoni*) in February. Again no control measures were taken. As a result of the aphids and powdery mildew, leaf abscission accelerated. Grazing the plants was a practical method of overcoming these problems and the regrowth from those portions of the crop which were grazed was free of aphids or mildew.

Although the yields of Gruner were initially lower than those of the other three brassicas, eventually over 8900 KgDM/ha was ovtained from this cultivar and its yield remained stable until the end of the experiment in April (Table 2). The yields of Winfred, Wairoa and Perko declined in late January, soon after the maximum yield was obtained.

After lax grazing in January, 39% of the Gruner and 87% of the Perko on offer to the sheep remained as stubble (Table 3). In the areas which were hard grazed these figures fell to 16 and 30% respectively. The efficiency of grazing of these two crops changed

Table 1. Plant Populations of four brassicas before and after grazing (plants /m^2).

a) Areas not grazed throughout the season:

Harvest data Days from	18 Dec. (33 DAS)	16 Jan. (62 DAS)	14 Feb (91 DAS)	2 April (139 DAS)
Gruner	71	82	61	47
Winfred	41	65	50	45
Wairoa	54	55	40	51
Perko	56	52	50	40
LSD (5%)	12.9	20.5	16.4	14.6

b) Areas Grazed in January:

	Stubble: 29 January 75 days from sowing		Regrowth: 8 March 114 days from sowing	
	Lax	Hard	Lax	Hard
Gruner	74	45	75	24
Winfred	55	55	74	51
Wairoa	45	54	61	53
Perko	54	40	50	39
LSD (5%)	15.8	25.6	24.0	18.8

c) Areas Grazed in February:

	Stubble: 5 March 111 days from sowing		Regrowth: 13 April 150 days from sowing	
	Lax	Hard	Lax	Hard
Gruner	64	27	45	32
Winfred	43	30	43	30
Wairoa	48	24	28	25
Perko	38	22	24	not measured
LSD (5%)	18.2	19.4	13.9	8.7

Table 2. Yields (Kg D.M./ha) of Ungrazed Brassica

Harvest date Days from sowing	18 Dec. 33	16 Jan. 62	14 Feb. 91	2 April 139
Gruner	368 a	5110 def	8631 i	8910 i
Winfred	710 a	6988 h	6658 gh	4899 def
Wairoa	870 a	5344 efg	4235 de	3824 dc
Perko	1222 ab	6133 fgh	4570 de	2579 bc

Means within rows and across columns with letters in common are not significantly different at $P< 0.05$ (LSD).

Table 3. Yields of Brassicas Grazed on January 16 (62 days after sowing; Kg DM/ha)

	Stubble after Grazing		Regrowth 50 days After grazing		Total yield to 112 days	
	Lax	Hard	Lax	Hard	Lax	Hard
Gruner	2007	824	5000	815	10110	5926
Winfred	4291	1353	5659	3248	12647	8592
Wairoa	3307	1356	5051	2596	10395	7940
Perko	5342	1842	423	1007	6556	7140
LSD (5%)	1845	419	4358	992	4562	1352

when they were grazed in February. Fiftynine percent of the Gruner and 26% of the Perko on offer to the sheep in the lax grazed area remained after grazing, and in the hard grazed areas only 8% of the Gruner and 10% of the Perko on offer to the sheep remained.

With the exception of hard grazed Gruner the total yield (yield before grazing plus regrowth) obtained from the portions of the crops grazed in January and allowed to regrow (Table 3) generally exceeded those accumulated in the ungrazed portion of the crop over the whole growing season (Table 2). When grazing was delayed until February only Gruner and Winfred regrew sufficiently for the total yields (Table 4) to exceed that of the ungrazed portions of the crops (Table 2).

DISCUSSION

Yields of 8000 kg/DM/ha in ungrazed brassica crops grown over summer are not uncommon (Douglas, 1980; Piggot *et al.*, 1980; Banfield and Rea, 1986; Percival *et al.*, 1986). The similarity of yields of ungrazed brassica and total yields obtained from brassicas which were grazed in January and allowed to regrow (Table 2) suggests that the forage brassicas evaluated in this experiment offer farmers good flexibility in designing forage systems for summer production.

The final yields obtained from the brassicas may have been reduced because of the leaf senescence which occurred when the crops became infested with aphids or infected with aphids or infected with powdery mildew in February. Mortlock (1975), and Percival *et al.* (1986) have reported that yields of rapes have peaked and then declined as the season progressed. Kales have some genetic resistance to aphids (Palmer, 1982) but not all cultivars of rape are resistant. However, there is little published information on the resistance of brassicas to aphids that would enable farmers to make informed decisions when selecting appropriate cultivars. Cultivars which yield well as winter brassicas are not necessarily suitable for growing during summer when aphids are present.

While all the brassicas grown provided satisfactory yields over the summer the resistance of the ungrazed Gruner to aphids and powdery mildew gave it a clear advantage over the other cultivars (Table 2). Grazing removed the infected leaf material and appeared to control the aphids, and reduced some of the differences between cultivars (Tables 3 & 4). Gruner, Winfred and Wairoa appeared to withstand grazing better than Perko (Tables 3 & 4). Farmers have reported that the utilization of Perko is low (Percival *et al.*, 1986) and observations of the crop grown and grazed in 1984/85 suggests that the pricklyness of the leaves may contribute to the poor acceptability of the crop to stock. Its bulbs were very palatable and were severly grazed by sheep in February (table 4).

Regrowth after grazing is dependant on plant and environmental factors. In our experiment almost all the leaf was removed during lax grazing and in the hard grazing treatment more of the carbohydrate stored within the plants was harvested. Although more stem was harvested when the plants were hard grazed the number of buds remaining on the plants were similar and concentrated along the remaining length of stem and at its base. (Newton, unpublished data).

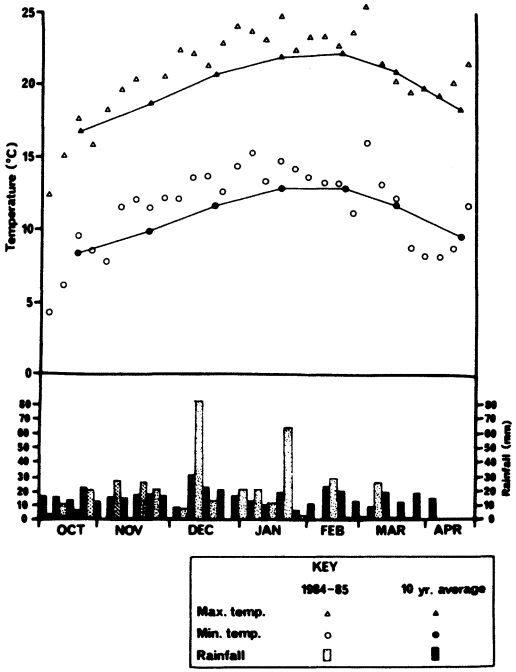

Figure 1. Climate data for Palmerston North.

Table 4. Yields Kg DM/ha of Brassicas Grazed on the February (91 days after sowing)

	Stubble after Grazing		Regrowth		Total yield to 149 days	
	Lax	Hard	Lax	Hard	Lax	Hard
Gruner	5163	731	1058	1421	9689	10052
Winfred	2778	775	1054	1293	7712	7951
Wairoa	2369	775	246	1257	4481	5492
Perko	1200	466	148	not calc.	4718	not calc.
LSD (5%)	1489	655	**1099**	**706**	**1753**	**1507**

* Total yield = Regrowth and yield before grazing.

The 1984/85 season was slightly warmer and wetter than average (Figure 1). Delaying grazing until February increased the amount of herbage on offer to the stock, but decreased the amount of regrowth made by April (Table 4). Further work is needed to determine the contribution of plant factors and environmental conditions to regrowth and the interrelationship between them.

When deciding which forage brassica to sow farmers still need to match potential feed supply with anticipated animal requirements. This work provides some information on how yields can be increased by extending the grazing period, there is still a need for comparative information on crops which provide forage soon after sowing.

The brassicas included in this trial were selected because their pattern on growth was 'similar', even so the growth of Perko was markedly different from that of Gruner (Table 2). This means that the grazings in January and February may not have occured when regrowth was most likely to occur in Perko, and a better estimate of the suitability of Perko as a forage crop may come from comparisons of it with turnips and stubble turnips rather than Rapes and Kales.

Information on palatability, digestibility and the growth rates of stock are also required along with information on yield and regrowth if farmers are to select the most suitable brassica forage crops for their farming operation.

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