

A COMPARISON OF SIX CULTIVARS OF FORAGE RAPE OVER A RANGE OF SOWING DATES IN CANTERBURY

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ABSTRACT

Dry matter yields of six cultivars of forage rape were compared in ten trials during two seasons in Canterbury. Trials were sown at Lincoln on five dates from early October to mid February 1984/85. In 1985/86 three sowing dates from late October to late March were compared at Lincoln, and four cultivars were compared in trials sown at Waikari and Rangiora. Yields were measured about three months after sowing in most trials, but were measured earlier at Waikari and Rangiora. Regrowth was measured from three trials in 1985/86. Rangi was used as the standard cultivar in all trials.

Baraska and Arran were consistently the higher yielding cultivars, producing on average 10-14% more than the standard cultivar Rangi. Winfred and Kentan were intermediate in yield with Wairangi slightly lower yielding on average than Rangi. Yields however varied considerably among trials and seasons. Regrowth from cutting was measured in one trial at Lincoln in 1985/86 and regrowth from grazing was measured in the two North Canterbury trials with Baraska producing the highest total yield.

Additional Key Words: Dry matter yield, regrowth.

INTRODUCTION

Brassicas have been important forage crops in animal production systems in New Zealand since 1870. In 1983/84 forage brassicas occupied an area of 138,000 ha from a total area of 200,000 ha sown to fodder crops (Anon, 1985). Forage rape occupies 23,000ha (11%) of this area of which 64% is grown on sheep farms that gain over 75% of their gross income from sheep. Canterbury is the most important province for production of forage rape with 16,000 ha (68%) and this is followed by Otago with 2100 ha (9%).

Forage rape is used for both summer and winter feed and is sown from October through to February and utilised from December (lamb finishing) to May (ewe maintenance). It is grown as a low input crop with minimal applications of fertilizer and pest or disease control made after establishment. In dryland farming, soil moisture deficit is the major factor limiting the yield of spring sown crops, while low temperatures restrict the growth of autumn sown crops.

The performance of cultivars may differ substantially. Stephen (1973) measured the winter production of forage rape cultivars in Canterbury in 1968 and 1969 by sowing the cultivars in early summer and harvesting in July. He found no yield differences between the cultivars Rangi and Moana. Mortlock (1975) compared Rangi with Wairoa brassica in 1974/75 by sowing on three dates from October to December and harvesting from December to June. Rangi outyielded Wairoa, but the differences were not significant. Rangi and Wairoa brassica have also been compared in Northland in five trials over three years (1974, 1979 and 1980) with October or November sowing dates and harvests in February and March (Piggot *et al.*, 1980). Rangi significantly outyielded Wairoa brassica in one trial from an early March harvest. Regrowth from Wairoa brassica outyielded Rangi in one trial with an April harvest after an initial harvest in February but in the other 4 trials there were no significant differences.

Data from Co-operative National Brassica trials (Anon, 1983/84, 1984/85) show that wide yield variations occur among different sowing and harvest dates. The sowing dates range from November in Southland to February in Canterbury and harvest dates from March to August in Canterbury and April to June in Southland. The dry matter yields from the above trials range from 3.9 to 11.5 t/ha in Southland and from 3.4 to 8.4 t/ha in Canterbury. Over the six years from 1980 to 1985 Baraska has in over 30 trials yielded 27% more than Rangi and Arran 18% more than Rangi but the range in yield advantage has been very variable - for example yields of Baraska have ranged from 1% to 46% above those of Rangi.

There is no published data on the comparative performance of current commercial cultivars of forage rape tested at a range of sowing and harvest dates. The trials reported in this paper were therefore designed to determine whether differences in the yield of cultivars resulted from different sowing and harvest dates. Six cultivars were chosen for the trials to represent the range currently commercially available. Baraska, Arran, Kentan, and Winfred were chosen to represent current commercial cultivars of overseas origin, while Wairangi of New Zealand origin and was bred by CRD, D.S.I.R. Rangi was chosen as the standard for all trials because, based on areas entered for seed certification, it is the dominant commercial cultivar grown (Anon, 1983).

Mortlock (1975) showed that, once maximum dry matter production had been reached, Rangi and Wairoa brassica rapidly declined in yield especially from later sowings. These maximum yields occurred at about 120 days from sowing with late October and mid December sowing dates. Harvest dates were chosen so as to maximize potential yields for the cultivars in the trials. Grazing of regrowth is a common practice in Canterbury with the

TABLE 1: Trial sites, sowing and harvest dates and days to harvest.

Trial number and location	Sowing date	Harvest date	Days to harvest	Regrowth harvest date	Days to regrowth harvest
1 Lincoln	8/10/84	10/1/85	94		
2 "	8/11/84	15/2/85	99		
3 "	6/12/84	21/3/85	105		
4 "	11/1/85	15/4/85	94		
5 "	14/2/85	9/5/85	115		
6 "	29/10/85	27/1/86	91	11/4/86	74
7 "	10/12/85	11/4/86	122		
8 "	26/2/86	28/5/86	92		
9 Waikari	18/10/85	6/12/85	59	4/2/86	35
10 Rangiora	8/10/85	20/12/85	73	12/2/86	54

number of grazings being primarily dependant on summer rainfall. Three grazings from October sown crops of Rangiora are not uncommon in North Canterbury. To indicate total seasonal production potential yields of regrowth from three trials are reported in this paper.

MATERIALS AND METHODS

The 6 forage rape cultivars were tested in 10 trials in Canterbury. In 5 trials at Lincoln in 1984/85 the 5 cultivars tested were Baraska, Arran, Winfred, Wairangi, and Rangiora. In 1985/86, the same five cultivars plus Kentan were tested in three trials at Lincoln and Baraska, Winfred, Kentan and Rangiora were tested in trials at Waikari and Rangiora. The trials were all drilled to produce a plant population of approximately 60 plants per metre squared. In the trials at Lincoln all initial harvests were made about three months after sowing and in the trials at Waikari and Rangiora harvests were made immediately before grazing 59-73 days after sowing.

Regrowth was measured after grazing in the Waikari and Rangiora trials and after mechanical harvest in the 1985/86 October sowing date trial at Lincoln. Details of locations, sowing and harvest dates and days to harvest are presented in Table 1.

All trials were randomized complete block designs with each plot consisting of 9 rows spaced 0.15m apart. Plant counts were made 6-8 weeks after establishment. The trials were not irrigated or sprayed for control of cabbage aphids (*Brevicoryne brassicae* (L.)) during crop growth.

With the exception of the initial harvest at Waikari total fresh weight was measured with an experimental flail type forage harvester with a digital load cell. A 500g subsample from each plot was oven dried for 16hrs at 80°C to determine dry matter content. The initial harvest at Waikari was made by hand cutting to ground level an area of 2.625 m² area (2.5 m by 1.05 m) of each plot.

Other trial details are given in Table 2.

RESULTS

There were significant differences in plant population among cultivars at some sites, but no significant differences in dry matter content. The differences in plant population

TABLE 2: Trial site details.

	Lincoln	Waikari	Rangiora
Trial No.	1-8	9	10
Soil type	Templeton silt loam	Glasnevin silt loam	Lismore stony silt loam
Plotsize	5.0m x 1.35m	20.0m x 1.35m	20.0m x 1.35m
Replications	4	6	6
Fertilizer super-phosphate	250kg/ha	125kg/ha	125kg/ha
Lime	preplant	at sowing	at sowing
Herbicide			
Trifluralin	1.2kg/ha a.i.		
Insecticide			
Disulfoton	1.5kg/ha a.i.	1.5kg/ha a.i.	1.5kg/ha a.i.
Area Initially harvested	4.5 m ² (5.0m x 0.9m)	2.625 m ² (2.5m x 1.05m)	18.0 m ² (20.0m x 0.9m)
Area of Regrowth harvested	4.5 m ²	4.5 m ²	18.0 m ²

were caused more by uneven drilling than by seedling diseases or insect damage. Rainfall (mm) recorded at the D.S.I.R. weather station at Lincoln for 1984/85 and 1985/86, together with the long term averages 1974-1983 are presented in Table 3. Yields corrected by covariance analysis to account for differences in plant population are presented in Tables 4 and 5 for the 1984/85 and 1985/86 trials. Yield of regrowth from the 1985/86 October sown trial at Lincoln (trial 6) and the trials at Waikari and Rangiora are presented in Table 6. Total mean yields (initial yield and regrowth) are presented in Table 7.

1984/85 Trials

The best cultivars were Baraska and Arran which outyielded Rangiora, the standard cultivar, in the first three sowing dates. (Table 4) However, the yields of the two cultivars were not significantly different when sown in January and February. Differences among cultivars were greatest from the November sowing, where the yield of

TABLE 3: Mean monthly rainfall and long term average rainfall during the growing seasons.

Month	long term Average Rainfall (mm)	Rainfall in 84/85 (mm)	differences from long term (%)	Rainfall in 85/86 (mm)	differences from long term (%)
October	61.0	35.1	58	31.7	51
November	52.9	73.8	140	112.5	212
December	67.3	53.2	79	58.9	87
January	63.3	8.1	13	48.6	76
February	41.9	64.0	153	98.1	180
March	57.6	43.9	76	141.6	246
April	62.1	9.1	15	21.1	33
May	52.6	42.0	80	37.6	71

TABLE 4: Mean dry matter yield (t/ha) of five forage rape cultivars sown on five sowing dates in 1984/85.

Cultivar	Trial:	1	2	3	4	5	Mean of 5 trials
	Sowing date:	8/10/84	8/11/84	6/12/84	4/11/85	14/2/85	
Baraska		5.5	9.6	7.4	7.2	4.0	6.7
Arran		5.1	8.3	7.6	8.3	3.7	6.6
Winfred		4.7	6.6	5.9	6.9	3.9	5.6
Wairangi		5.2	7.4	5.6	6.5	3.6	5.7
Rangi		4.8	8.6	5.8	7.4	4.0	6.1
Trial means		5.1	8.1	6.5	7.3	3.8	
Significance		*	*	*	*	NS	*
CV%		7.4	14.1	14.1	9.8	19.3	10.0
LSD.05		0.6	2.6	1.4	1.1	1.1	0.8
LSD.01			3.0				

Baraska was 3.0t/ha more than Winfred, the lowest yielding cultivar. Arran was 30% and 11% better yielding than Rangi in the December and January sowings, but yields were not significantly different from the October, November or February sowing dates. Yields of Rangi ranged from 4.0 t/ha from the February sowing (115 days to harvest) to 8.6 t/ha from the November sowing date (99 days to harvest).

Mean yields for each trial were not consistently affected by the range of sowing dates used or by the number of days to harvest. Soil moisture deficits were high during February 1985 as the rainfall in January was only 13% of the long term average and this could have contributed to yields obtained from trial 3. The effect of lower autumn temperatures contributed to the decreased trial mean yield in trial 5.

1985/86 Trials

In this season Baraska, Arran, Winfred and Kentan all yielded more on average than Rangi or Wairangi although the yield from Winfred was inconsistent. Baraska significantly outyielded Rangi by 18% and 26% in the October and February sowings at Lincoln, and by 27% in the October sown trial at Rangiora. In the December sowing at Lincoln and in the trial at Waikari the differences were not significant. In contrast to the 1984/85 trials Winfred yielded 32% more than Rangi the October and February sown trials at Lincoln and 12% higher in the October sown trial at Waikari. Kentan and Arran yielded

TABLE 5: Dry matter yields (t/ha) of six cultivars of forage rape from five trials grown in 1985/86.

Cultivar	Sowing date and Trial number				
	6 29/10/85	7 10/12/85	8 26/2/86	9 18/10/85	10 8/10/85
Baraska	5.6	3.4	3.9	4.0	2.5
Arran	5.4	3.3	3.6		
Winfred	6.2	2.6	4.1	4.1	1.9
Wairangi	4.8	2.7	2.6		
Rangi	4.7	3.1	3.1	3.7	2.0
Kentan	5.0	3.4	3.8	4.3	2.3
Trial means	5.3	3.1	3.5	4.0	2.2
Significance	*	**	*	*	**
CV%	17.3	11.5	10.0	9.6	12.1
LSD.05	0.5	0.5	0.6	0.2	0.3
LSD.01		0.7			

about 14% more than Rangi although the differences were not significant at any sowing date. As in the first year Wairangi was the lowest yielding cultivar.

The regrowth harvested from trials 9 and 10 at Waikari and Rangiora were strongly influenced by stocking rate and the level of utilization by the grazing animals. The total dry matter yields from trials 9 and 10 (Table 7) were influenced by the palatability of the crop to stock and Rangi produced less regrowth than other cultivar because it was grazed harder.

TABLE 6: Yield of regrowth (t/ha) from six cultivars of forage rape grown in three trials in 1985/86.

Cultivars	Sowing date and location		
	Trial 6	Trial 9	Trial 10
	26/10/85 Lincoln	18/10/85 Waikari	8/10/85 Rangiora
Baraska	0.8	2.7	0.5
Arran	0.8		
Winfred	0.6	2.4	0.3
Wairangi	0.9		
Rangi	0.7	2.6	0.4
Kentan	0.8	2.3	0.4
Trial means	0.8	2.5	0.4
Significance	NS	*	NS
CV%	11.2	14.2	9.6
LSD.05	0.1	0.2	0.1

TABLE 7: Dry matter yield (kg/ha, initial yield & regrowth) of six cultivars of forage rape from three trials grown in 1985/86.

Cultivars	Sowing date and location		
	Trial 6	Trial 9	Trial 10
	26/10/85 Lincoln	18/10/85 Waikari	8/10/85 Rangiora
Baraska	6.4	6.7	3.0
Arran	6.2		
Winfred	6.8	6.5	2.2
Wairangi	5.7		
Rangi	5.4	6.3	2.4
Kentan	5.8	6.6	2.7
Trial means	6.1	6.5	2.6
Significance	*	*	NS
CV%	11.6	9.2	8.6
LSD.05	0.3	0.2	0.1

Wairangi produced significantly more regrowth at Lincoln than Rangi. Baraska produced the highest total yield from both harvests in two trials, 14% above Rangi, and Winfred produced the highest total yield in the trial sown at Lincoln, 26% above Rangi. As in the 1984/85 trials there was no consistent effect of sowing date on the mean yields, although the lowest mean trial yield was again obtained from the low trial mean yields of the Waikari and Rangiora sites were caused by moisture stress.

DISCUSSION

Substantial variations in yield occurred both within and between years, but some general trends were apparent. In both years, averaged over eight sowing dates Baraska and Arran were the higher yielding cultivars in the Lincoln trials. They were outyielded by Winfred in the October sown trial in 1985/86. Winfred was the most variable cultivar with yields ranging from 6.2 t/ha in the October sown trial in 1985/86 to 2.6 t/ha in the December sown trial in 1985/86. The leaves of Winfred seem to be more sensitive

to moisture stress which could account for its more variable yield.

The standard cultivar, Rangi was generally lower yielding than the other commercial cultivars, and yields ranged from 2.0 t/ha to 8.6 t/ha (Tables 4 and 5). Yields reported here were more variable than those reported by Mortlock (1975) and Piggot *et al.* (1980) but some trials were grown on very light, unirrigated, stony silt loam soils. The highest yield of 9.6 t/ha obtained from Baraska was recorded from the November 1984 trial at Lincoln, but this yield was not obtained in the 1985/86 trials.

The effects of sowing date on the mean yields of the cultivar was variable with no clear trend being apparent. A possible explanation for the range of yields could be the moisture stress which occurred during January and February (Table 1) and the reduction in yield which occurred as winter approached.

The yields of regrowth were high in the Waikari trial because they were measured after grazing while the yields at Lincoln were measured following cutting. Regrowth yields ranged from 0.3 t/ha for Winfred at the Rangiora site to 2.7 t/ha for Baraska at Waikari. These results indicate that regrowth measured following cutting must be interpreted with caution when compared to cutting from pre-grazed plots. Baraska produced the highest regrowth and total yields (Table 7) in the Waikari and Rangiora trials but the initial yield of Winfred was higher at Lincoln and more regrowth occurred from Wairangi. At Waikari yields after grazing fell within the range obtained by Piggot *et al.* (1980) but in the trial in Northland regrowth accumulated over 46-71 days whereas in the trials reported here regrowth accumulated for only 35 days.

There were no major changes in the rankings of the yields of the cultivars over the sowing dates tested. Therefore a cultivar such as Baraska that yields well from an October sowing is also likely to rank highly when sown in February. This conclusion means that breeders can evaluate advanced breeding lines of forage rape from small plots (around 7 m²) planted at only a few sowing dates and that the yield rankings obtained are likely to be similar to yields obtained from other sowing dates.

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