3.1.3 GENOTYPE AND MANAGEMENT COMBINATIONS FOR HIGHLY PRODUCTIVE CROPPING SYSTEMS IN THE HRZ OF SOUTHERN AUSTRALIA (HAMILTON VIC)

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Location: DPI, Hamilton

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Rainfall (2005): 541 mm
GSR: (Apr – Nov) 387 mm
(long term average 691 mm)

Summary:
Both cultivar and N fertiliser treatments significantly affected grain yield but there were no cultivar by N fertiliser interactions. The rate and timing of N fertiliser applied did not affect yield but high N fertiliser gave higher yields than the Nil N. Low harvest index (<30%) and water-use efficiency values (mean 6.7 kg grain/ha/mm) indicate that crops are performing below potential for this environment.

Despite the season being abnormally short (decile 1 for rainfall), the winter canola type Caracas performed relatively well. Given a more favourable season this cultivar could provide high yields as well as providing the potential for grazing in this environment.

Background:
The past 10 years have seen a significant increase in the area of cropping in the high rainfall zone of southern Australia. A wide range of crop types and maturities are available to growers in the HRZ but there is a lack of understanding as to which crop type is best suited to the environment and the most appropriate management to maximise the crop yields. Poor synchrony between critical crop developmental stages and resources (moisture, light, temperature) through the growing season appear to result in a poor conversation of biomass into grain. Better matching crop requirements to seasonal conditions will result in a more efficient conversion of resource to grain.

This project is using knowledge of the high rainfall environment (climate, soils etc) and that gained from past crop research that describes the crop growth requirements to identify plant characteristics suited to the HRZ. This invormation will enable the fast tracking of breeding programs as well as provide information to growers and agronomist on factors influencing crop production in this environment.

Objectives:
To provide advice to breeders, researchers, agronomists and growers on the plant characteristics suited to the HRZ.

Methodology:
The experiment was conducted on raised beds (1.7m furrow to furrow). The furrows were not sown. There were 8 rows with 15cm row spacings. Dry matter and grain yields were calculated on a per hectare basis including the area of the furrow.

Experimental Design
Four cultivars:
Sapphire (conventional), Grace (TT), Hyola (hybrid) and Caracas (winter type) X

5N treatments:
1) Nil (0N),
2) P – Predrilled (50 kg/N),
3) PB – Predrilled (50N) + bud visible (75N)
4) PF – Predrilled (50N) and first flower (75N)
5) PBF – Predrilled (50N) + bud visible (37.5N) + first flower (37.5N)

Soil nitrate level to 60 cm taken prior to sowing was 11 mg/kg.

Sowing Date: 29th May 2005
Harvest Date: 15th December 2005

Measurements:
Plant counts, biomass and green area at bud visible, biomass at first flower and harvest. At harvest – 1000-grain weight, grains per pod, pods per plant, plant height, harvest index, oil content.

Chemical applications:

May 30	S-Metolorchlor
June 30	Bifenthrin
August 1	Clopyralid
July 5	Clethodim + Clopyralid

Results and Discussion

Annual and growing season rainfalls for 2005 at Hamilton were very low compared to the long term average (Decile 1 for the year and the growing season).

There were significant differences in yields between cultivars and the different N fertiliser treatments but there were no cultivar by N treatment interactions. There was no significant difference in yield between Caracas, Hyola and Sapphire but Grace was significantly lower than the other three cultivars. Both Caracas and Grace had significantly lower harvest indices than Hyola but were not significantly different to Sapphire. Significant biomass differences between cultivars at the bud visible stage had disappeared by the time the crops reached the first flower stage.

Caracas was significantly taller than the other cultivars (Table 3-6). As Caracas is a winter canola, it has a vernalisation requirement and therefore flowered significantly later than the other cultivars (up to 23 days). All cultivars were windrowed on the same day at a stage where Caracas had only 20% of the grain turning brown (compared to 40-60% for the other cultivars). It is likely that the later break and short growing season did not favour Caracas yet it still produced good yields with high grain numbers per pod. It is possible that given a longer growing season, Caracas will perform well in this environment. If sown early, it may also be possible for the Caracas to be grazed.

Table 3-6: Mean values and significances for four canola cultivars at Hamilton.

Values are mean of 5 N fertilizer application treatments.

	Caracas	Grace	Hyola	Sapphire	lsd	Fprob
Yield (t/ha)	2.74	2.12	2.57	2.66	0.220	<0.001
Harvest Index (HI) %	24.7	25.6	28.6	27.0	2.39	0.009
Grains/pod	23.2	22.3	19.1	21.3	2.0	<0.001
Pods/Plant	208	182	257	246	44.6	0.005
Bud DM (kg/ha)	765	458	754	697	114	<0.001
First Flower DM (kg/ha)	428	419	457	433		Nsd
Plant Height (cm)	171	145	147	144	5.8	<0.001

The application of N fertilizer increased grain yield significantly over the Nil fertilizer treatment. However there were no significant differences in yields between the different rates and timings. Plant height was also reduced with the Nil N treatment compared to the other treatments (Table 3-7).

Table 3-7: Mean values and significances for five N fertilizer treatments at Hamilton.

Values are mean of four cultivars.

	Nil	P	PB	PBF	PF	Lsd	Fprob
Yield (t/ha)	2.27	2.53	2.55	2.68	2.59	0.246	0.024
Plant Height	143	155	156	154	151	6.5	0.002

Low harvest indices and water-use efficiency show a poor conversion of resources to grain. Robertson *et al* 2004 demonstrated HI to be relatively stable between 30 and 40% where yields exceeded 2 t/ha. Despite yields greater than 2 t/ha in this experiment, harvest indices were low (Table 3-6). Caracas (PBF) was the highest yielding treatment (3 t/ha) with a HI of only 22%. Conversion of growing season rainfall (GRS) to grain was also low with a mean value for all N treatments of 6.7 kg/ha/mm GSR, compared to 10 kg/ha/mm achieved by growers in other regions. These results indicate crops are performing well below potential for this environment.

References:

Robertson, M.J., Holland, J.F and Bambach R (2004). *Australian Journal Experimental Agriculture* 44, 43-52.