3.2.8 WHEAT GENOTYPE AND MANAGEMENT COMBINATIONS FOR HIGHLY PRODUCTIVE CROPPING SYSTEMS IN THE HRZ OF SOUTHERN AUSTRALIA (YALLA-Y-POORA VIC)

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Location: SFS Trial Site at Yalla Y Poora

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Rainfall (2005): 543 mm
GSR: (Apr – Nov) 359 mm

Summary:
Both cultivar and N fertilizer had significant effects on grain yield. Cultivar Chara, yielded higher (3.83 t/ha) than Wylah (3.34 t/ha). Yields were related to the number of spikelets per head, stem biomass in October plus total and head biomass in November. N fertilizer also increased yields (3.75 t/ha for 175 kg/ha compared with 3.42 t/ha for Nil N applied) by increasing biomass and green area later into the season and by producing more spikelets per head with fewer infertile spikelets.

Low harvest index (<40%) and water-use efficiency values (mean 10 kg grain/ha/mm) indicate that crops are performing below potential for this environment.

Background:
The past 10 years have seen a significant increase in the area to cropping in the high rainfall zone of southern Australia. To date, growers have relied on cultivars developed from other cropping regions in Australia and overseas. Due to the increase in production from the HRZ and the foreseen potential of the area, breeders and industry now recognize a market for cultivars bred specifically for the HRZ. This project is using knowledge of the high rainfall environment (climate, soils etc) and that gained from past crop research that describes crop growth requirements to identify plant characteristics suited to the HRZ. This information 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 sown on raised beds (1.7 m furrow to furrow). The furrows were not sown. There were 8 rows with 15 cm row spacings. Dry matter and grain yields were calculated on a per hectare basis including the area of the furrow.

Experimental Design – Randomized block design with 4 replicates.
Plot size – 10m long by 1.7 m wide raised bed.

Treatments:
Two cultivars (Chara and Wylah) x two N fertilizer treatments; High – 175 kg N in 3 applications (50 predrilled at sowing, 50 at mid tillering and 50 at GS31) and Low N (no N fertilizer applied).

Soil nitrate level to 60 cm, taken prior to sowing was 6 mg/kg.

Sowing Date: 6 June 2005

Harvest Date: 3 January 2006

***Measurements*:**

Every 3-4 weeks - Biomass (total, stem, leaf and head) cuts, number of tillers (fertile and infertile), soil moisture, light interception, GAI (green area index), plant N and water-soluble carbohydrates (WSC).

At Harvest – Grain yield, harvest index (HI), protein, heads/m^2, grains per head, 1000-grain weight, number spikelets per head, number sterile spikelets (at the top and bottom of the head).

Chemical Applications (2005):

June 15	S-Metolorchlor + Bifenthrin
August 1	Diflufenican
August 16	Tralkoxydin
August 30	Propiconazole
October 14	Propiconazole

Results and Discussion

There were significant differences for both cultivar and N fertilizer treatment but no cultivar by N fertilizer interactions. Chara had significantly (*P*<0.001) higher yields than Wylah. Characteristics including, number of spikelets per head, October stem biomass and November total and head biomass were all significantly higher for Chara than Wylah (Table 1).

Table 3-19: Mean Values And Significances For Wheat Cultivars Chara and Wylah at Yalla-Y-Poora.
Values are means of the two N fertilizer application rates (175 kg/ha and nil N applied.

	Chara	Wylah	LSD	F pr
Yield (t/ha)	3.83	3.34	0.217	<0.001
No. Spikelets per head	15.02	14.17	0.638	0.015
October stem biomass (kg/ha)	4418	3906	495.1	0.044
November total biomass (kg/ha)	8734	7695	997.5	0.043
November head biomass (kg/ha)	3069	2573	322	0.007

The High N fertilizer treatments yielded higher than the Nil N, had significantly more spikelets per head, higher green area indices in September, October and November and a greater head biomass in November. Nil N treatments had more sterile spikelets at the top of the head and grain weights were higher than the high N treatment (Table 2). Lower grain weights in the High N treatment indicate a possible shortage of moisture during the grain fill period.

Table 3-20: Mean values and significances for wheat at two N fertilizer application rates (175 kg/ha and nil N applied) at Yalla Y Poora. Mean of two cultivars (Chara and Wylah).

	High N	Low N	Lsd	Fprob
Yield (t/ha)	3.75	3.42	0.217	0.007
1000 Grain wt	38.46	40.19	0.865	0.001
No. Spikelets per head	15.00	14.20	0.638	0.020
No. Sterile spikelets per head	0.11	0.32	0.134	0.006
September GAI (cm^2/cm^2)	2.38	1.86	0.381	0.012
October GAI (cm^2/cm^2)	3.24	2.42	0.388	0.001
November GAI (cm^2/cm^2)	1.43	1.18	0.247	0.049
November head biomass (kg/ha)	3055	2588	322	0.009

Higher green area indices, especially later in the season (November) may have enabled photosynthesis to continue longer into the grain fill period hence increasing yields. Higher stem biomass in October may have lead to greater levels of water-soluble carbohydrates, which could have been transported to the grain during grain fill. Samples are currently being analyzed to test this hypothesis.

Low harvest indices and water-use efficiency from all treatments in this experiment show a poor conversion of resources to grain.

The highest yielding treatment was Chara High N fertilizer (4 t/ha), which had a HI of only 39%. Conversion of rainfall to grain ranged between 8.9 kg/ha/mm growing season rainfall (GSR) (Wylah Low N) and 11.2 kg/ha/mm GSR (Chara High N) with a mean of 10 kg/ha/mm, considerably lower than the potential of 22 kg/ha/mm (Sadras and Angus 2004). Biomass per mm GSR ranged between 18.9 (Chara Low N) and 22.9 (Chara High N). This indicates that in this environment, these cultivars performed well below potential given the resources available.

References:

Sadras V., and Angus, J. (2004). In: GRDC GroundCover Publication, Issue 53, Dec 2004