Wheat yield and quality

The aim of this trial was to investigate the effects of seeding rates (plant density) on grain yield and quality for four wheat varieties at three locations (Berriwillock, Birchip and Rupanyup)

Summary of trial
Previous BCG results indicated that higher plant densities achieved by increasing seeding rates provided many benefits including stable or increased yields (never a yield penalty), reduced screenings, increased access to moisture, nutrient and light and better competition against weed populations.

The results of this trial support the findings of previous BCG research.

For many growers seed of their preferred variety may be in relatively low supply following the 2002 drought but it will be important to maintain or increase current seeding rates in 2003.

Why it was conducted:
Previous research conducted by BCG (1997/98/99) concluded that:
- Increasing seeding rates will usually increase crop yields
- Increasing seeding rates may reduce screenings, and
- Increasing seeding rates has never led to a negative yield or grain quality response

Furthermore, higher plant populations resulting from increased seeding rates enables wheat to compete more effectively against weeds for moisture, nutrients and light.

In 2002, BCG repeated this research to determine if recently released wheat varieties responded similarly to those tested in 1997-99.

How it was conducted:
Trials were established at Berriwillock, Birchip and Rupanyup during the 2002 season to investigate the effect of seeding rates on wheat yield and quality.

At each site 4 varieties were sown (Berriwillock – Annuello, H45, Mitre and Yitpi; Birchip - Mitre, H45, Silverstar and Yitpi; and Rupanyup – Mitre, H45, Lorikeet and Yitpi). For each variety four plant densities were targeted: 100, 150, 200 and 250 plants/m^2.

All treatments were pre-drilled with Urea (Berriwillock and Birchip at 40kg/ha and Rupanyup 70kg/ha) and sown with 80kg Mallee Mix 1. Sowing occurred on the 24th May, 3rd June and 17th June at Birchip, Berriwillock and Rupanyup respectively.

Throughout the season critical crop development stages were monitored (plant, tiller and head densities) and yield, screenings and protein were recorded at harvest.

Trials were conducted using a replicated randomised block design.

Results of the trial:
No results were obtained from Berriwillock and Rupanyup as the crops failed due to drought. At the Birchip site the average grain yield of all treatments was 0.7t/ha.

Crop development
As expected seeding rate had a significant effect on the plant density achieved (P<0.001). On average the target plant densities of 100, 150, 200 and 250 plants/m^2 achieved 105, 156, 186 and 225 plants/m^2 respectively (LSD 5%=13). Wheat variety had no effect on plant density. This was expected as target plant densities were based on 1000-grain weights and germination results of each variety.

Shoots per squared metre increased significantly with plant density (P<0.001). Higher the seeding rate the greater the number of shoots/ m^2. At 100, 150, 200 and 250 plants/ m^2 the number of shoots/ m^2 were 310, 459, 550 and 664 respectively (LSD 5%=37). Interestingly, regardless of the plant density or the variety each plant produced three shoots (a main stem and two tillers).

Tiller mortality was very high for all treatments due to drought conditions (average tiller mortality of 59%) and increased significantly with seeding rate for Yitpi and H45. Heads/ m^2 increased significantly with seeding rate for all varieties.

Table 1: The influence of seeding rate on grain yield, protein and screenings in four wheat varieties.

Variety	Plant density (plts/m^2)	Yield (t/ha)	Protein (%)	Screen (%)
Yitpi	100	0.62	13.9	6.6
Yitpi	150	0.69	14	6.0
Yitpi	200	0.71	14.4	5.0
Yitpi	250	0.55	14.7	4.8
Significance	**-**	**NS**	**P<0.01, LSD=0.5**	**P<0.01, LSD=0.9**
Silverstar	100	0.80	11.9	8.5
Silverstar	150	0.76	12.1	7.0
Silverstar	200	0.79	12.1	6.2
Silverstar	250	0.81	12.4	6.0
Significance	**-**	**NS**	**NS**	**P<0.05, LSD=1.5**
H45	100	0.68	12.4	6.0
H45	150	0.54	13.2	5.2
H45	200	0.60	12.6	4.1
H45	250	0.52	12.8	3.7
Significance	**-**	**NS**	**NS**	**P<0.01, LSD=1.1**
Mitre	100	0.77	12.3	4.2
Mitre	150	0.85	12	4.6
Mitre	200	0.84	12.8	3.7
Mitre	250	0.80	12.7	4.5
Significance	**-**	**NS**	**P<0.05, LSD=0.5**	**NS**

Yield
Seeding rate did not have a significant effect on crop yield, either positive or negative, in any of the four varieties tested. The fact that higher seeding rates did not lead to a yield penalty is an important result.

Grain protein
Grain protein was significantly effected by seeding rate in the varieties Yitpi and Mitre but not in Silverstar or H45. In both Yitpi and Mitre higher seeding rates resulted in higher grain protein.

Screenings
Seeding rate had a significant impact on grain size and screenings in Yitpi, Silverstar and H45. In these three varieties the higher the seeding rate the lower the screenings. At the lower seeding rates Yitpi, Silverstar and Mitre were above the receival standard of 5%, however, at the two highest seeding rates (200 and 250 plants/m^2) the level of screenings in both Yitpi and H45 decreased to the acceptable standard of 4.8% and 3.7% respectively. Silverstar's screenings remained unacceptably high at 6%.

Interpretation:
The crop development results were not unexpected. Higher seeding rates resulted in higher plant densities that in turn resulted in higher shoot numbers per squared metre. Interestingly, regardless of the plant density or the variety each plant produced three shoots (a main stem and two tillers). It has been previously suggested that sparser crops will result in individual plants producing higher shoot numbers – this did not occur in this trial. Tiller mortality rates were very high (59% on average) owing to the dry season and this resulted in lower head numbers than expected.

Seeding rate in this trial did not influence yield. This is an important result as it adds further weight to the results of previous BCG research that suggests higher seeding rates will not lead to yield penalties even under moisture stressed conditions. When moisture is not limiting higher seeding rates will often significantly increase wheat yields.

The impact of higher seeding rates on screenings in wheat is also very important. Again the result obtained in this trial, ie higher seeding rates significantly reduced screenings in Yitpi, Silverstar and H45, is supported by previous research conducted by BCG.

The influence that seeding rate has on grain protein has been quite inconsistent.

Commercial practise:
For many growers seed of their preferred variety may be in relatively low supply following the 2002 drought but it will be important to maintain or increase current seeding rates in 2003.

Higher seeding rates in wheat can provide multiple benefits. These benefits include:
- Increasing seeding rates will usually increase crop yields when moisture is not limiting,
- Increasing seeding rates will not result in a yield penalty even under moisture stressed conditions
- Increasing seeding rates can reduce screenings, and
- Increasing seeding rates will increase the crop's ability to access moisture, nutrients and lights resulting in increased pressure on weed population (this is particularly important when tackling herbicide resistant weed populations).