8.11 Optimal Plant Density And The Effect Of Grazing On Grain Yield Of Early Sown Wheat - Epping Forest, Tas

Location:
"Fairfield", Epping Forest, Tasmania

Funding Organization: Grain and Graze

Researchers:
Geoff Dean and Brett Davey, SFS/TIAR
Simon Munford, DPIW

Author: Geoff Dean

Acknowledgments: Tom and Philip Osborne

Growing season rainfall (Mar-Nov):
369 mm including irrigation

Summary of Findings:

There was no significant difference in the grain yield from cut and uncut early sown Mackellar wheat and May sown wheat, all sown at 200 plants/m^2. Early sown uncut wheat at a density of 50 plants/m^2 yielded significantly lower than 125 and 200 plants/m^2.

With lower plant densities and cutting treatments imposed, there were less tillers and ears/m^2, however this resulted in reduced soil water usage and more moisture being available for grain fill. Plant height was significantly greater with the highest plant density in early sown wheat and the incidence of lodging was significantly greater for this treatment.

Background:

Studies on the effect of grazing on grain yield have compared plots sown at the same time. However grain yield from an early sowing may be lower than from a "traditional" May sowing as most Australian varieties have not been selected for a March or earlier sowing and are more prone to disease and lodging. It is therefore important to also compare yields of an early sown with a May sowing.

In the UK, planting dates for grain-only wheat crops have progressively shifted back to September ie comparable with March in Australia. This enables development of a strong vigorous plant entering winter and has the added advantage of removing moisture from the soil profile in Tasmania (a benefit in most years!). Lower plant densities are recognised as essential to reduce the canopy size and minimise leaf disease and lodging.

In Tasmania these potential problems can be reduced through canopy management by grazing, but given the high grain yields overseas it would be informative to evaluate early sowing of a grain-only wheat crop. There is potential for early sowing in Tasmania where the crop can be watered up in a dry summer/autumn. The major limiting factors will be excess vegetative growth and greater disease pressure due to the longer growing season.

The objective of this study was to compare grain yields of early sown wheat with grazed (cut) wheat sown at the same time and that sown at a more traditional time, May.

A further aim was to compare a commercial plant density for dual purpose and grain-only production with reduced rates comparable to that used for early sowing in the UK.

Method:
Variety: Mackellar
Treatments:

March sown:	normal density – 200 plants/m^2 (approx 90 kg/ha)
	reduced – 125 plants/m^2
	UK early sowing – 50 plants/m^2
	Grazed (cut)
May sown:	200 plants/m^2

The trial was sown under a centre pivot and there were four replicates in a randomised complete block design with buffer plots to separate the different sowing dates. The earlier sowing date was on 12th April and that of the "traditional" treatment, 25th May. The trial was sown with 9:13:17:4 fertiliser at 250kg/ha and followed a tickbean crop.

Nitrogen (50kgN/ha) was top-dressed on 6th September and a further 50kgN applied to plots on 19th October and watered in. To cover the range of growth stages, three fungicides were applied. Soil moisture cores were taken after flowering to measure available water during grain fill.

The "grazed" plots were cut on 28th August at GS30-31. Prior to grain harvest, samples were hand harvested to compare yield components. Grain from the rest of each plot was harvested by machine on 15th January 2008.

Results and Discussion:

Growth and dry matter:
With irrigation, establishment was reasonable but the higher densities for both sowing dates were around 20% lower than the target. The low density plots at 50 plants/m^2 looked very sparse early in the season but by September had tillered well and largely caught up. In contrast the highest density plots grew well during early tillering but later in the season the high population of tillers/ears were more prone to lodging. Diseases were adequately controlled but more evident in the early sown ungrazed plots.

Grain yield:
Both cutting and later sowing had no significant effects on grain yield compared with the early sown uncut treatments at 200 plants/m^2. There were significantly lower yields in the early sown 50 plants/m^2 treatment. There was no significant difference between the 125 and 200 plant/m^2 densities but this is the third season where there has been a trend towards increased yield in early sown wheat with density increasing from 125 to 200 plants/m^2.

▼ Table 8.42: Effect of cutting and sowing date and varying plant density of early sown wheat (Mackellar) on grain yield and yield components, Epping Forest, 2007-08.

Sowing date/cut treatment	Density	Yield (t/ha)	Plant ht (cm)	Lodging (%)	Soil moisture content (%)
April/uncut	200/m^2	8.14	87.5	33.8	12.6
April/uncut	125/m^2	7.99	84.8	4.8	
April/uncut	50/m^2	7.17	80.7	1.8	15.1
April/cut	200/m^2	8.14	71.8	0.3	15.0
May /uncut	200/m^2	8.37	81.8	1.3	12.8
F prob.		**0.008**	**<0.001**	**0.004**	**0.007**
LSD (0.05)		**0.602**	**2.34**	**16.54**	**1.39**
CV%		**4.9**	**1.9**	**128.6**	**5.0**

Data on yield components is still being processed but preliminary examination shows that the number of ears/m^2 was significantly higher for both the May sown and the uncut early sown at 200 plants/m^2 treatments. Cutting significantly reduced the number of ears/m^2 and the 125 and 50 plants/m^2 treatments did not fully compensate for the low initial plant densities. The number of ears/plant were however significantly higher for these densities.

The soil moisture data in Table 8.42 shows that although cutting and lower plant density both reduced the number of tillers/m^2 this resulted in significantly higher soil moisture content and more available water for grain fill.

Plant height measurements at maturity correlate broadly with ear numbers, with progressive and significant decreases in plant height with decreasing plant density (Table 8.42).

Cutting and the later sowing also resulted in lower plant heights. Not surprisingly plant height also correlated with the extent of lodging. In particular, the visually thinner stems at the highest density of the earlier sowing resulted in significantly more lodging.

Application of plant growth regulators (PGR) will reduce the incidence of lodging and a new product was evaluated at the Fairfield site on early sown uncut wheat. There were however no consistent yield differences. Similarly, with a PGR trial conducted at Hagley in 2007-08 on Brennan wheat, there were no significant yield increases after application with Moddus, Cycocel and a combination of the two compared with untreated plots. This is in contrast to trials conducted 5 years ago where there a yield gain from application of Moddus.