3.4.5 Canopy management evaluation in canola - Dunkeld, Vic

Location:
Dunkeld Research Site.

Funding:
GRDC; Project No. SFS00017
Optimising cereal profitability in the high rainfall zone through the integration of disease management and canopy management principles.

Researchers:
Mr Nick Poole (FAR), Mr Rohan Wardle (SFS), Mr Ben O'Connor (SFS).

Author:
Ben O'Connor (SFS)

Take home messages:

- *Varieties:* Marlin and 46Y78 were used to evaluate how nitrogen timing and seeding rate would affect the biomass production and yield of each canola type. The hybrid canola produced a greater biomass throughout the season compared to Marlin, however this did not translate into a yield advantage. The canopy varied between varieties where 46Y78 had a much taller and larger canopy and Marlin had a shorter and denser canopy. This was reflected where Marlin had a greater leaf area index at pod-set compared to 46Y78.
- *Seeding Rate:* The higher plant population was found to have a yield advantage of 0.24 t/ha compared to that of the lower plant population, irrespective of nitrogen timing or variety choice. The seeding rate significantly impacted the canopy structure, where at the low plant population the canopy had fewer plants but a much greater number of branches (more leaves and pods) than that of the higher plant population. This canopy structure may require less stored soil water at grain fill as it has the ability to rely on the larger biomass.
- *Nitrogen Timing:* The split timing nitrogen application was found to have a yield benefit of 0.20 t/ha compared to that of the no nitrogen strategy, irrespective of seeding rate or variety choice. No significant difference in nitrogen timing was found on biomass production or grain quality. Nitrogen timing can become important when considering different varieties, where it can be tactically applied at sowing on Marlin (poor early vigour) compared to hybrid canola.

Treatments:
Variety
1. Marlin (Triazine Tolerant)
2. 46Y78 (Hybrid)

Nitrogen Timing
1. No Nitrogen
2. 50 kg N/ha @ Seedbed
3. 50 kg N/ha @ Green Bud
4. 25 kg N/ha @ Seedbed f.b. 25 kg N/ha @ Green Bud

Planting Population
1. 46 plants/m2
2. 83 plants/m2
3. 111 plants/m2

Background/Aim:
Protocol 5 has the overall objective of defining whether the benefits of canopy management in cereals could be applied to autumn sown canola in the HRZ of southern Australia. The trial examines how two different TT or Clearfield cultivars (hybrid and non-hybrid), three different planning populations & 4 different nitrogen timing influence the structure of the canola crop canopy. Impact of treatments will be assessed in terms of crop structure, yield and quality.

Within the trial there are a number of specific objectives, which are as follows:

- To determine the interaction of nitrogen timing with plant population using conventional (Triazine Tolerant) and hybrid (Clearfield) canola. Interaction determined in terms of yield, crop structure, predisposition to lodging and quality in the HRZ.
- To determine the influence of stem elongation nitrogen versus up front nitrogen on dry matter production and its relationship to yield.
- To examine how plant population and nitrogen timing influences green area index, green leaf retention during grain fill.
- The trial will also examine the predisposition of the canopy structure to disease pressure, principally blackleg & Sclerotinia.

The individual objectives within the trial are as follows:

- To determine how nitrogen timings developed for canopy management (based on stem elongation timings) apply to canola.
- To establish whether the interaction hybrid and conventional varieties interact differently with plant population and N timing.
- To determine whether reflectance from the Greenseeker has a relationship with dry matter.

Results and discussion:
Canopy management in canola is often an over looked management decision when compared to that of cereals. Canopy management in canola follows similar principles to that of cereals where tactical nitrogen, plant density and variety choice all play a critical role. Strategic canopy management will allow for a greater yield potential to be achieved whilst minimizing inputs.

Nitrogen timing was not found to significantly affect dry matter production between green-bud and pod-set. The 46Y78 hybrid canola produced more dry matter than the conventional Marlin canola variety throughout the season. The hybrid 46Y78 was a much taller crop throughout the season and its early vigour also assisted in producing a greater biomass.

Figure 1 clearly shows that 46Y78 produced a significantly larger biomass throughout the season however it is important to consider the canopy structure. Figure 2 illustrates the leaf area index - the ratio of leaf area (sq/m) to 1sq meter of ground. Where canola was sown at the low population the hybrid 46Y78 had more leaf area compared to Marlin. At the high population Marlin had significantly more leaf area then the 46Y78. At the high population Marlin had a greater density of crop canopy; this may assist the Triazine Tolerant variety to optimise its yield potential.

The seeding rate also affects the total biomass of the crop canopy. At green-bud the higher plant population has the larger biomass - a direct relationship between plant numbers and canopy density. At pod-set the lower plant population has the significantly larger biomass compared to the mid and high plant population. As the canopy develops the individual plants in the low density population are able to produce many more branches compared to that of the higher plant populations. These larger (but fewer) plants have more leaves and pods than the smaller plants in the higher plant populations.

The relationship between sowing rate and variety (Figure 4) found that there was no significant difference in yield. At each plant population 46Y78 was found to have a slight yield advantage over Marlin, on average this was 0.13 t/ha. The difference in leaf area index (Figure 2) between sowing rate and variety at the high plant population did not translate into a yield advantage for Marlin.

The timing of nitrogen to manipulate the crop canopy and increase yield did not display a clear response. 46Y78 showed a slight response (0.13 t/ha) to any nitrogen application, irrespective of timing, compared to the no nitrogen treatment. Marlin showed a slight yield response (0.20 t/ha) with the split application compared to the single or no nitrogen treatments. Variety specific agronomy is important to consider when managing a cropping system, in this case, Marlin (a conventional variety) can be managed differently to 46Y78 (a hybrid) to optimise its yield potential.

Figure 1: Effect of Canola Variety on Dry Matter Production – mean of 2 sowing rates and 4 nitrogen timings.

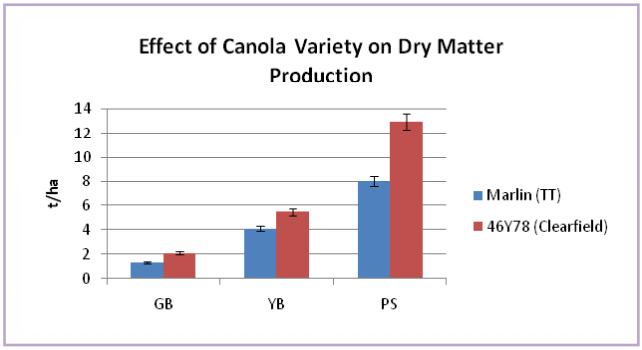


Figure 2: Effect of Seeding Rate and Variety on Leaf Area Index at Yellow-Bud – mean of 4 nitrogen timings.

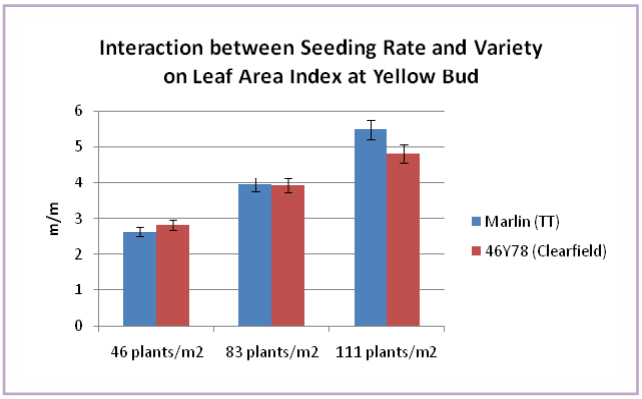


Figure 3: Effect of Seeding Rate on Dry Matter Production – mean of 2 varieties and 4 nitrogen timings.

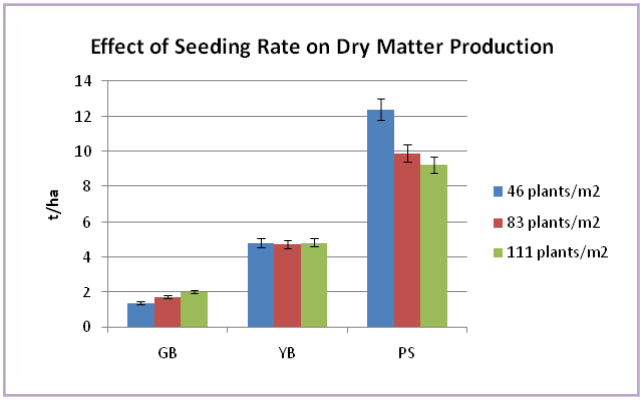
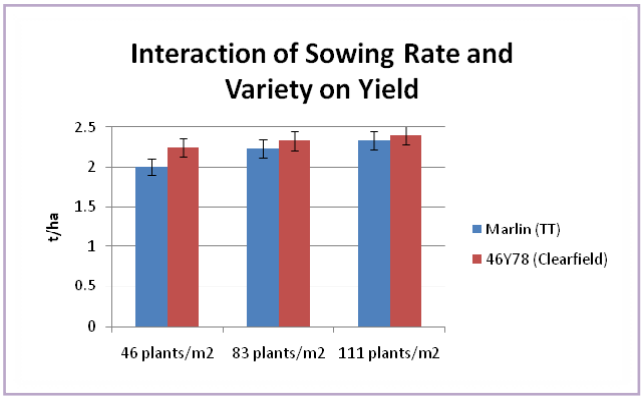


Figure 4: Interaction of Sowing Rate and Variety on Yield – mean of 4 nitrogen timings.



Yield potential can be increase through a combination of canopy management strategies. Individually, each parameter will have a minimal impact on yield potential, however when used in combination they can increase yield potential. There was no significant difference in yield observed between Marlin and 46Y78, although 46Y78 recorded a slight yield advantage of 0.13 t/ha. Marlin had an oil content of 41.9% compared to 39.2% of 46Y78. Although the hybrid canola produced a larger biomass throughout the season this did not translate into a yield advantage.

The higher plant population was found to have a significantly greater yield compared to the lower plant population. A yield advantage of 0.24 t/ha was achieved by the higher plant population, irrespective of nitrogen timing and variety choice. No significant difference was observed in grain quality between seeding rates.

The split nitrogen timing was the highest yielding nitrogen strategy (2.36 t/ha) significantly higher than the no nitrogen strategy (2.16 t/ha) irrespective of seeding rate or variety choice. As mentioned earlier, nitrogen timing did not have a significant effect on biomass production; it also did not affect grain quality. Nitrogen timing can become important when considering different varieties, where it can be tactically applied at sowing on Marlin (poor early vigour) compared to hybrid canola.

Figure 5: Interaction of Variety and Nitrogen Timing on Yield – mean of 3 sowing rates.

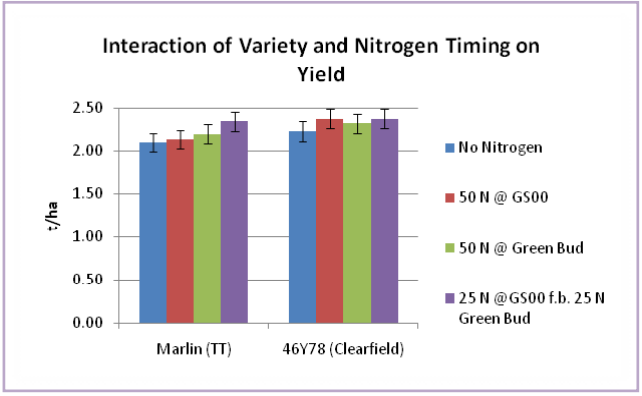


Table 1: Canola yield and quality analysis; including oil and test weight to 8% moisture.

	[1]Yield (t/ha)	[2]Sig. Diff.	[3]Oil (%)	[3]Test Weight (kg/hl)
Variety				
Marlin	2.19	a	41.9	68.7
46Y78	2.32	a	39.2	70.0
Prob (F)	**0.324***		**0.036**	**0.087***
LSD (0.05)	**0.36**		**2.39**	**1.58**
Seeding Rate				
46 plants/m2	2.13	b	40.4	69.4
83 plants/m2	2.28	ab	40.7	69.3
111 plants/m2	2.37	a	40.5	69.3
Prob (F)	**0.015**		**0.925***	**0.903***
LSD (0.05)	**0.15**		**1.67**	**0.82**
Nitrogen Timing				
No Nitrogen	2.16	b	41.0	69.1
50 N @ GS00	2.26	ab	40.6	69.2
50 N @ Green Bud	2.26	ab	40.2	69.5
25 N @GS00 f.b. 25 N Green Bud	2.36	a	40.6	69.5
Prob (F)	**0.014**		**0.210***	**0.351***
LSD (0.05)	**0.12**		**0.79**	**0.47**

[1] Consideration needs to be taken for yields, as plots represent 72.5% of arable area and thus should be calculated using this percentage for comparison to local and commercial results.
[2]Means followed by the same letter do not significantly differ (P=0.10, LSD).
[3]Quality parameterisation is based on 2009-2010 NACMA Canola Standards and should be used as a guide only. Testing was undertaken at Riordan Grains, Inverleigh Office.
*These parameters are not statistically significant at the p=0.05 level.

Summary:
Yield potential can be increase through a combination of canopy management strategies. Individually, each parameter will have a minimal impact on yield potential, however when used in combination they can increase yield potential. The split timing nitrogen application was found to have a yield benefit of 0.20 t/ha compared to that of the no nitrogen strategy; however no significant difference in nitrogen timing was found on biomass production or grain quality. No significant difference in yield was observed between

The lower plant population was found to have a larger biomass at pod-set compared to the high plant population. The seeding rate significantly impacted the canopy structure, where at the low plant population the canopy had fewer plants but a much greater number of branches (more leaves and pods) than that of the higher plant population. The lower plant population was found to have a larger biomass at pod-set compared to the high plant population. However, this did not translate into a yield advantage, where the higher plant population yielded 0.24 t/ha higher than then low plant population.

The principles of canopy management in cereals can be applied to canola where sowing rate, cultivar and nitrogen timing can be tactically managed to increase the grain yield and quality of the crop.