Management of early sown wheat

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RESEARCH

Location
Minnipa Agricultural Centre, Paddock S2/8
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2017 Total: 282 mm
2017 GSR: 155 mm
Yield
Potential: 1.7 t/ha (W)
Actual: Highest yielding treatment, 2.5 t/ha
Paddock History
2016: Grass free pasture
2015: Wheat
2014: Wheat
Soil Type
Sandy loam
Plot Size
5 m x 1.4 m x 4 reps
Yield Limiting Factors
Drought, mice

Key messages

- **Maximum yields were achieved when flowering occurred in late August.**
- **Fast developing winter variety Longsword sown in early April achieved similar yields to the best performing spring variety Cutlass sown in early May.**

Why do the trial?

The aim of this trial is to determine which of the new generation of winter cultivars have the best yield and adaptation in different environments and what is their optimal sowing window.

Flowering time is critical for wheat yield and must occur within an optimal period. At Minnipa this period has been defined from the 22 August – 8 September (*Flohr et al*. 2017). Growers need to match variety developmental rate with sowing time in order to ensure flowering occurs during this period. For example, fast - medium developing spring wheat varieties (e.g. Scepter) need to be sown within the period from 29 April – 9 May to flower on time at Minnipa (*Flohr et al.* 2017).

Sowing earlier may require varieties that are slower developing, such as varieties with increased photoperiod sensitivity (e.g. Cutlass). For sowing prior to 20 April, winter varieties may be required. Winter wheats will not progress to flower until their vernalisation requirement is met (cold accumulation).

Previous research has shown currently available winter wheats (e.g. Wedgetail) are not well adapted to SA. The pre-release winter cultivars in this trial have diverse phenology and adaptation, the faster ones are likely to be best suited to low rainfall locations such as Minnipa. The first fast winter wheat cultivar, Longsword (RAC2341) was released in 2017 and is commercially available in 2018. Winter wheats have received little evaluation sown early in low rainfall environments.

How was it done?

The trial was a two-way factorial time of sowing experiment incorporating eight varieties that differ in developmental controls across four times of sowing (TOS) on 23 March, 3 April, 18 April and 5 May.

1. Scepter (fast spring)
2. Cutlass (slow photoperiod responsive spring)
3. Longsword (previously coded RAC2341) (fast winter)
4. V09150-0 (fast-medium winter)
5. Kittyhawk (medium winter)
6. LPB14-0392 (intermediate fast winter-slow spring)
7. ADV11.9419 (slow winter)
8. ADV08.0008 (medium winter)

All varieties were planted with adjusted seeding rates aiming for a target plant density of 150 plants/m^2. Ten mm of irrigation at sowing was applied to ensure even establishment. 50 kg/ha of MAP fertiliser was applied in furrow, and the site was managed for pest and disease throughout the season. Plots were sown in six row 5 m plots at 22.8 cm row spacing, the two outside rows were removed at harvest and the middle four rows harvested to account for edge effects.

Measurements included plant emergence, establishment, timing of stem elongation, flowering time (measured as 50% of heads in the plot flowering), biomass at maturity, harvest index, grain yield and components.

What happened?

The site received above average summer rainfall, however the period from April – July was extremely dry, with most of the in season rainfall occurring in August and September. Despite the dry start, the establishment was greater than 80 plants/m^2 in all sowing dates. Previous research has demonstrated there is no significant yield effect from different plant densities in the range of 50 – 150 plants/m^2 in winter wheats established early. There were no significant frost events during the flowering period, however maximum temperature exceeded 30°C on several occasions from 20 September (Figure 1).

There was a significant variety x sowing date interaction for grain yield at the site ($P<0.001$). Spring varieties Scepter and Cutlass flowered too early from sowing dates in March and April. Winter varieties had relatively lower yields at the March sowing date despite flowering at a similar time to the April sowings; this is likely due to the dry start reducing biomass and grain number. This provides insights into the ability of new winter wheats to tolerate vegetative drought and suggests March sowing may be too early (Figure 1).

Peak yields were achieved when flowering occurred during late August, around the 24 and 25 August. This is consistent with previous work identifying the optimal flowering period for Minnipa to be between 22 August – 8 September (Figure 1).

Cutlass and Longsword flowering in late August produced the highest yields. Across all sowing dates the fast developing Longsword was the highest yielding winter variety compared to pre-release cultivars and commercially available slower developing winter Kittyhawk at this site (Figure 2). Based on flowering dates Longsword will likely flower after the optimum period with sowing dates after 20 April and appears better suited to early–mid April plantings at Minnipa.

LPB14-0392 demonstrated a unique unstable flowering behaviour that requires further investigation. From March sowing it flowers too early (similar to spring varieties), however from April sowing it demonstrated it could flower within the optimum period and achieve yields comparable to Longsword. From early May sowing it was too late flowering along with other winter wheats.

All other winter varieties flowered too late from all sowing dates, although the slightly quicker winter variety V09150-01 flowered just after the end of the optimal period (9 September) from March sowing. This flowering behaviour may have a better fit in slightly later districts. Even though the line ADV11.9419 flowered much later in September it still achieved comparable yields to other winter types. The ability to maintain high relative yields outside of the optimum flowering window is a useful attribute in some regions and will be investigated further.

What does this mean?

Prior to 2017 the new winter cultivars have had little exposure to the low rainfall environments and particularly at really early sowing dates (mid-March). In this trial the fast developing winter variety Longsword sown in early April achieved similar yields to the best performing spring variety Cutlass sown in early May. This data also highlights the importance of matching variety to sowing time to ensure flowering occurs at the optimum time. Maximum yields were achieved when flowering occurred in late August consistent with published optimum flowering times for Minnipa.

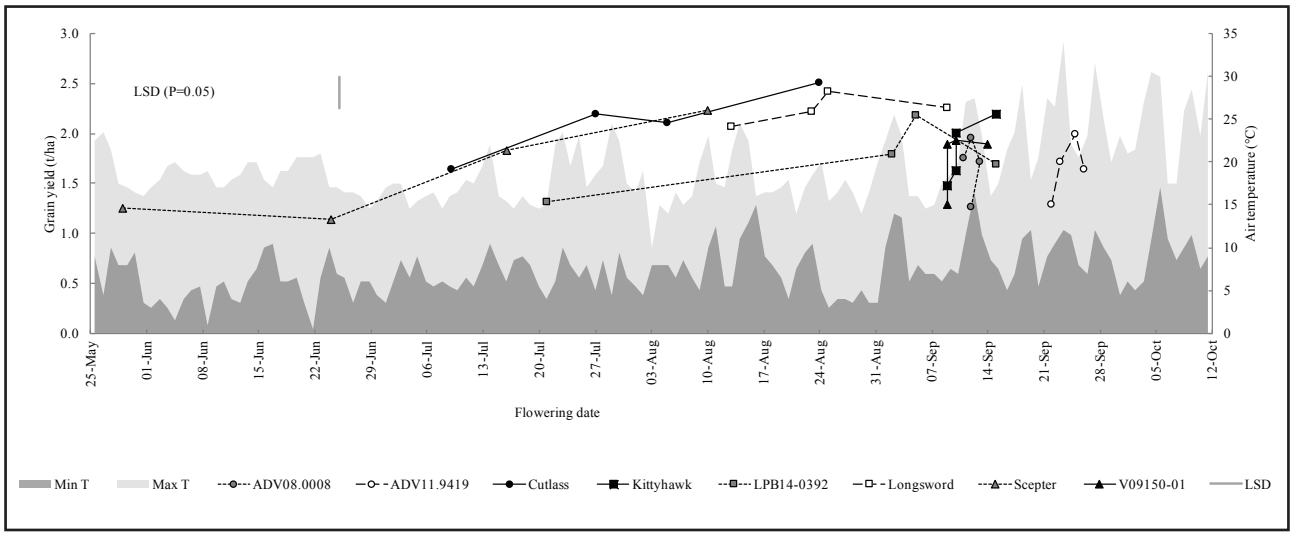

Figure 1. Relationship between flowering date and grain yield for all varieties at Minnipa in 2017, each symbol corresponds to a different sowing date from TOS1 (Left) – TOS4 (Right).

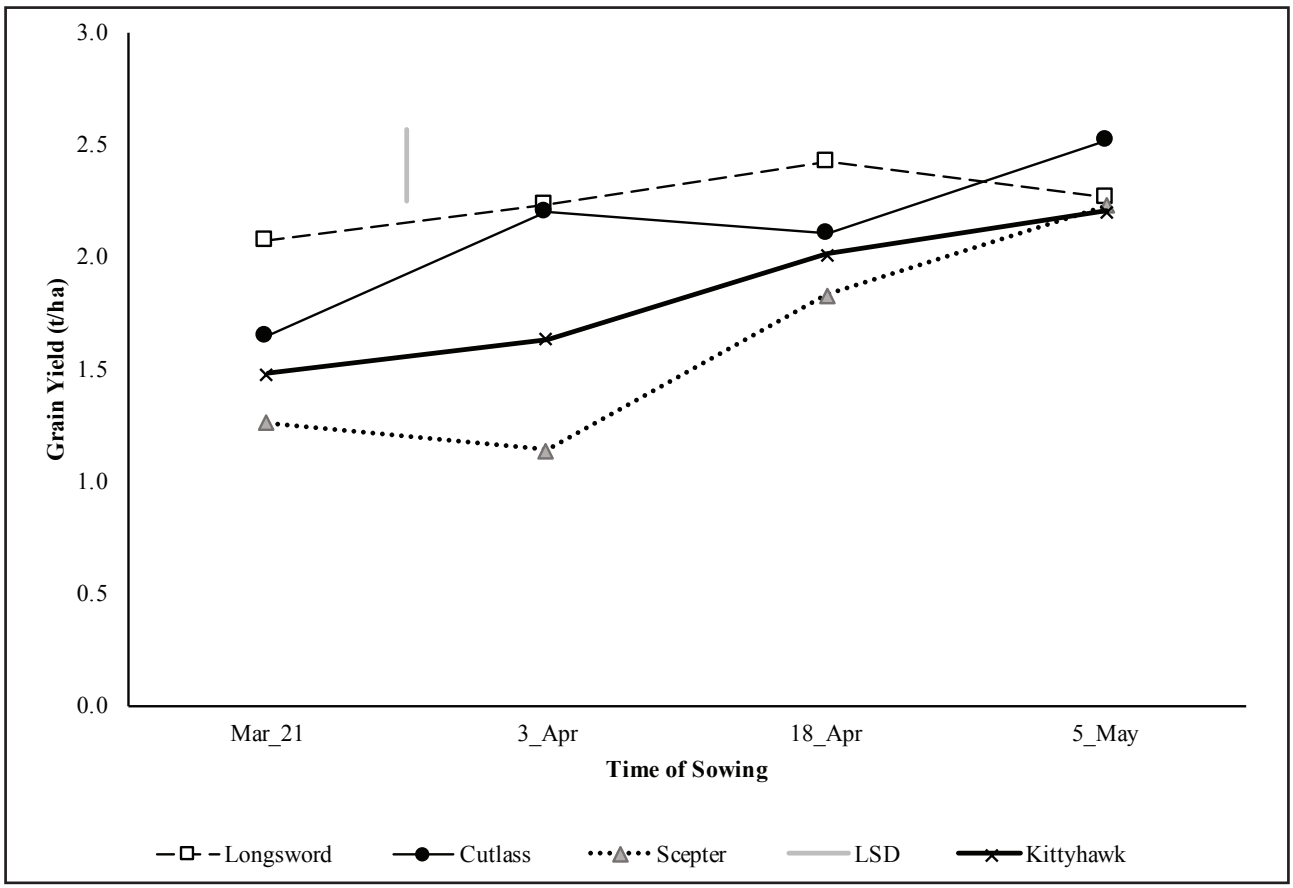

Figure 2. The effect of time of sowing on grain yield in selected commercially available wheat varieties at Minnipa in 2017 (LSD P=0.05).

While this trial is only from one year of data, it builds on evidence that faster developing winter varieties such as Longsword or varieties with different development controls like LPB14-0392 are needed for sowing dates prior to 20 April in the lower rainfall zones. The longer vegetative period of winter varieties also opens opportunities for grazing.

The project is in its first year and will be continued in 2018 and 2019. Yield and flowering time data is available from eight sites including Minnipa, Hart, Loxton, and Booleroo Centre in SA and Mildura, Horsham, Birchip and Yarrawonga in Victoria.

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