

# Farming Systems to Improve Crop Tolerance to Frost – Stubble Rate

Facey Group, Living Farm and DAFWA

Contact: Rebecca Smith - rebeccas@livingfarm.com.au

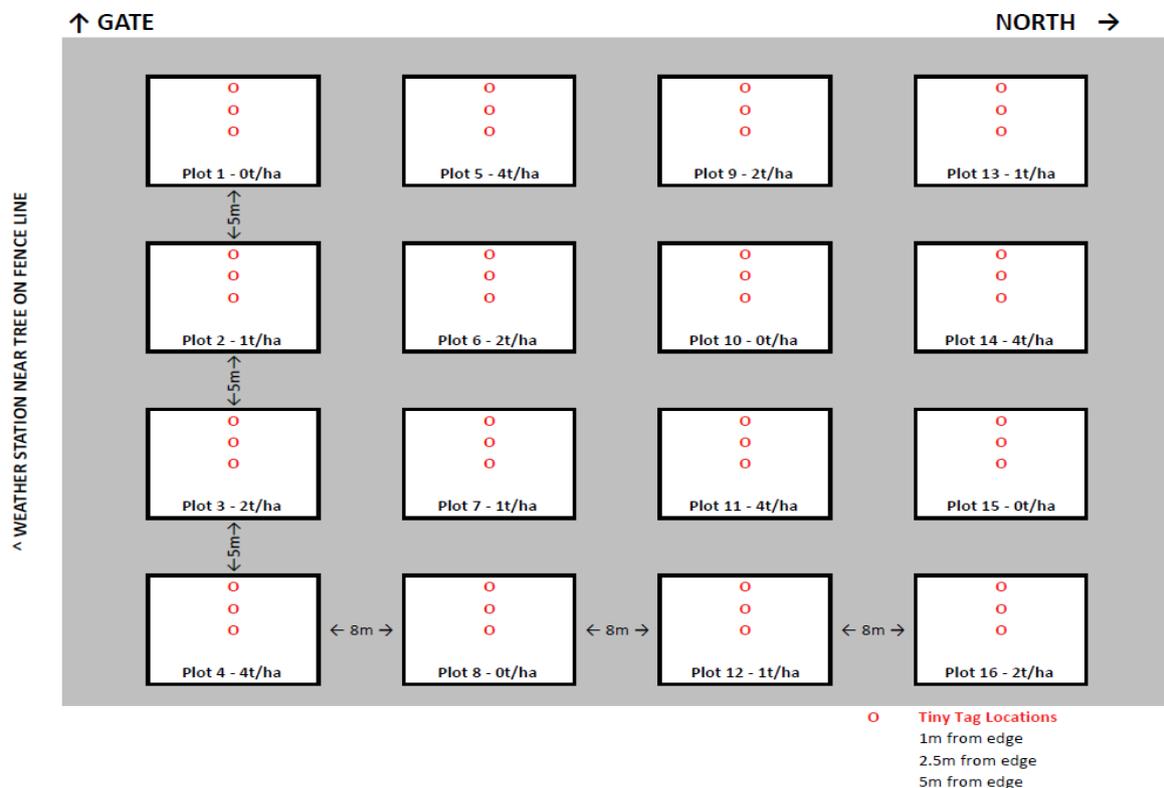
Ben Biddulph - ben.biddulph@agric.wa.gov.au

Chloe Turner - agrecc@faceygroup.org.au

## AIM

Determine thresholds of stubble loads (0, 1, 2 & 4t/ha) which increase severity and duration of frosts, and associated frost risks.

## TRIAL DETAILS



<b>Property:</b>	<b>Scott Young</b>
<b>Plot size &amp; replication:</b>	10m x 10m – 4 replications
<b>Crop Variety:</b>	Wheat – Magenta
<b>Sowing Date:</b>	19/05/2016
<b>Seeding Rate:</b>	70kg/ha
<b>Fertiliser (kg/ha):</b>	Pre-Seeding – MOP 40kg/ha IBS – MAP TE 50kg/ha, MOP 20kg/ha, Flexi-N Banded 50L/ha Post – Urea 65kg
<b>Paddock rotation:</b>	2014 Feed Barley, 2015 Lupins, 2016 Wheat
<b>Herbicides:</b>	Pre-seeding – Glyphosate 1L/ha, Ester 0.3L/ha, Paraquat 0.7L/ha, Boxer Gold 2.5L/ha, Diuron 0.3kg/ha Post – Paragon 0.35L/ha, Logran 10g/ha, Brom MA 0.5L/ha
<b>Fungicides:</b>	Seeding – Flutriafol 30L/ha
<b>Stubble Characteristics:</b>	0 t/ha, 1 t/ha, 2 t/ha and 4 t/ha

## **BACKGROUND**

With a decrease in the number of livestock on properties, and subsequent increase in cropping areas, frost is now a significant risk to broadacre grain production. An estimate of economic cost of frost in barley and wheat is \$63M annually (Fellowes 2006).

Previous agronomic work conducted with the Facey Group has shown that management practices such as changing stubble loads can change the ability of the soil to store heat during the day and maximise the heat released from the soil at night. Trials conducted in 2012 and 2013 demonstrated that the removal of stubble decreased both frost severity and duration (Jenkinson & Biddulph, 2014). As stubble retention is an important part of soil health management, current research is looking to determine whether there is a response curve between the amount of stubble that was retained and the severity of frost. This would determine whether growers could retain stubble while minimising frost risk.

## **METHODOLOGY**

A paddock with a known history of frost damage was identified early in the season. The trial was sown using farmers' broadacre seeding equipment, using farmers' standard cultivar, rotation and agronomic management. The site was sown on the 19<sup>th</sup> May to Magenta wheat at 70kg/ha with four replications of each stubble treatment. Each plot was soil sampled from 0-10cm and sent off for a basic soil analysis. Establishment counts were taken at the 2-leaf stage on the 21<sup>st</sup> June to calculate germination of plants/m<sup>2</sup>.

Oat stubble was applied at different rates (0 t/ha, 1 t/ha, 2 t/ha and 4 t/ha) on the 11<sup>th</sup> August at Z31 within the plots (10m x 10m).

Also at Z31 Tiny Tags were installed in the centre of each plot at a height of 300mm and then increased to 600mm as the canopy grew, to measure canopy temperatures every 15 minutes until harvest using unshielded Tiny Tag Temperature loggers (TGP-4017). Growth stage assessments were conducted from Z45-Z70 to estimate heading date, start and end of flowering, as well as grain fill.

Biomass samples were collected at anthesis to determine whether treatments had altered crop growth. At Z73, 30 heads were collected from within each plot and assessed for floret induced sterility. Harvest index samples were collected at maturity to identify total grain produced compared to biomass produced for each treatment. Harvest cuts were collected using a small plot research header and grain samples were collected for analysis.

## **RESULTS & DISCUSSION**

The interim temperature analysis, which included the frosts recorded between 15<sup>th</sup> August through to 4<sup>th</sup> October, showed the trial received 32 frost events (Figure 1). Of these, 14 events showed statistical differences between the stubble rates with the 4t/ha treatment consistently showing colder canopy temperatures. The 0t/ha maintained the highest maximum temperature during these frost events; the 1t/ha and 2t/ha treatments varied across the events. The number of hours each treatment experienced below different canopy temperature thresholds is shown in Figure 2, showing significant difference between the treatments. The 4t/ha stubble treatment spent significantly more time below the various thresholds than the 0t/ha stubble rate.

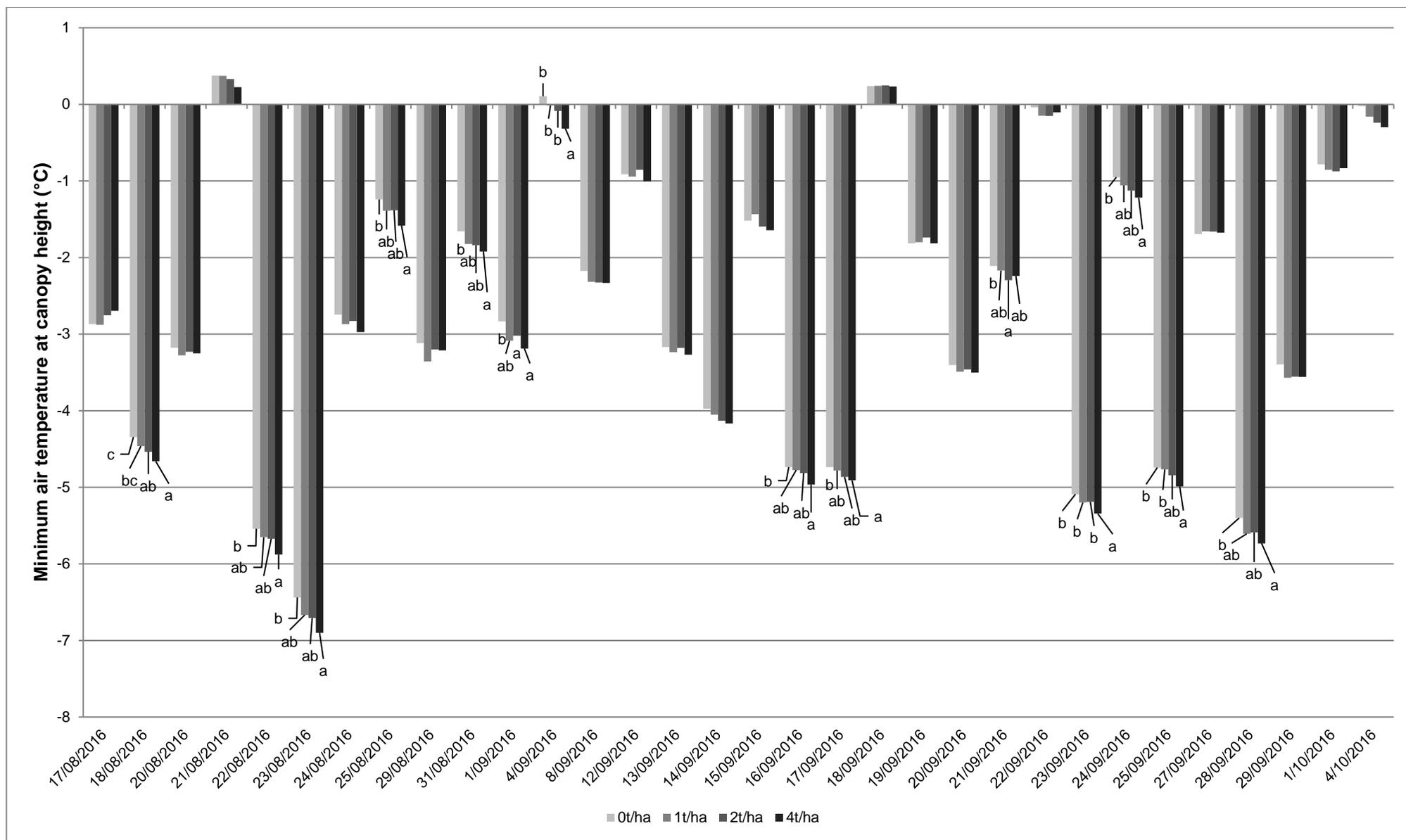
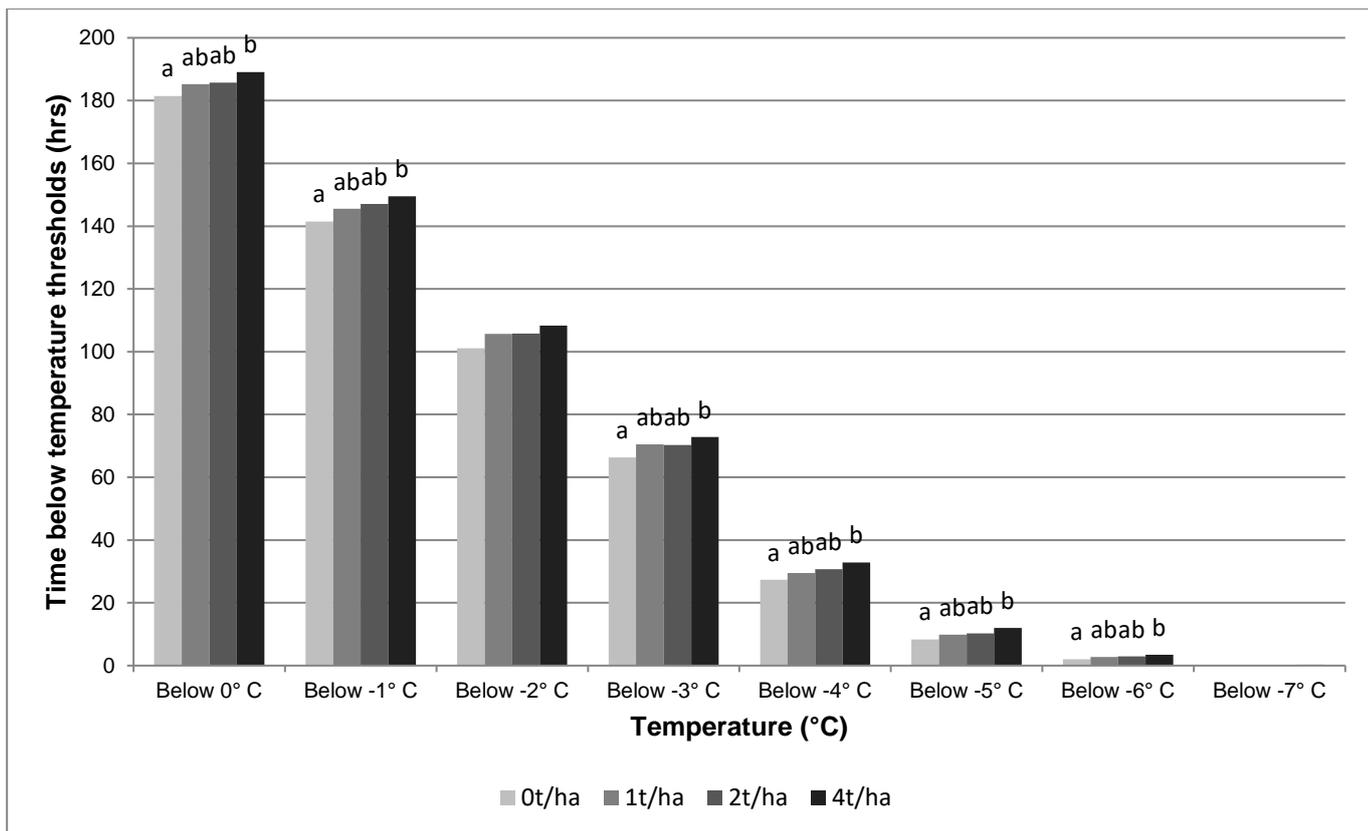


Figure 1: Interim minimum canopy temperatures - significance is indicated by different letters



**Figure 2:** The number of hours experienced below different canopy temperature thresholds - significance is indicated by different letters

## CONCLUSION

The interim temperature results suggest that retaining 4t/ha of stubble significantly increases the severity and duration of frosts when compared to 0t/ha. On all occasions, reducing stubble loads to 0t/ha reduced the severity and duration.

The harvest and frost induced sterility results from this trial are not yet released by the National Frost Initiative. Once the final analysis has been completed, the results of these will be forwarded onto Facey Group members.

## ACKNOWLEDGEMENTS

GRDC for funding the trial through the National Frost Initiative. Peter Hanson, Theweatherlogger for installation, maintenance and data acquisition of onsite weather station. Scott Young for providing the trial site and providing stubble for the treatments, carrying out the seeding and agronomic management.