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Cultural control strategies: the impact of stubble management on invertebrate pests in dryland cropping systems 2015 trial

Key points

- Pest density was very low throughout the course of the trial and there was no obvious impact of stubble management practices on ground-dwelling pest numbers.
- High numbers of beneficials (mostly ants and spiders) were active in the plots early in the season.
- There were slightly lower numbers of beneficials in the burnt plots, but this difference had disappeared by crop emergence.

Background

Reduced-tillage practices that retain stubble on the surface of the soil are becoming increasingly common and provide many benefits for dryland farming systems across New South Wales. However, the management of high stubble loads can prove challenging for growers. We know that stubble management can influence pathogens of wheat, and disease transmission from one crop to the next. Less is known about the impact of stubble management on the life-cycles of arthropod pests. There is some indication that stubble retention has increased risk of slug and snail outbreaks, by improving the microclimate for these species in the crop field. However, we know that beneficial species, such as carabid beetles, should benefit from these changed conditions at the soil surface. It is critical that we identify stubble management practices that solve production problems, but at the same time reduces pest risk.

Photo 1: Trial site prior to planting (the burnt plots are very obvious)



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CWFS trial 2015 and insect sampling

We used the existing stubble management trial site developed by the Central West Farming Systems (CWFS) as the foundation for **assessing the short-term impacts of stubble management options on ground-dwelling invertebrates**. The trial field near Wirrinya was sown to wheat in 2014 and then canola in 2015 (planted in late April 2015). A replicated complete block trial (4 replicates per treatment) was set up inside the field with plot sizes of 30m wide by 40m long. These plot sizes were much larger than the previous year, and enabled a more robust assessment of ground-dwelling pest densities within each plot. There were four stubble treatments imposed in early May: standing, burnt, mulched (or knocked over, harrowed) and cultivated. To sample the ground-dwelling invertebrates we used pitfall traps (120ml, 11cm high, 4.5cm diameter opening) plastic vials three-quarters filled with a 50:50 mix of propylene glycol and water. The traps were buried flush with the soil surface and left open for seven days. One trapping round was conducted pre-sowing (trapping ended 8/04/2015), and a second at crop emergence (ended

20/05/2015). At both time points we also assessed numbers of canola seedlings, stubble load (percent of dead plant material on soil surface), and the weeds present in each plot. One data logger was placed on a metal pin 3cm above the soil surface to record temperature and humidity hourly over the trapping period.

Findings

The stubble management techniques used here changed the amount of dead plant material covering the soil surface, with the standing stubble treatment having the highest proportional cover (90-91%), then mulched (82-86%), cultivated (25-28%) and burned (0-2%). This changed the microclimate experienced by invertebrates at ground-level.

The pitfall traps captured very few ground-dwelling pests, but good numbers of beneficials (mostly ants) and generally numbers of main groups decreased across time as winter progressed (Table 1). Pest numbers were very low throughout the trial. There was no significant difference in the number of pests caught in each treatment in the pre-sow sample (p-value=0.241) and the post-sow sample (p-value=0.738, Fig. 2). In April the number of pests in the mulched plots was lower than all other treatments (although there was no statistically significant difference between the treatments). There were good numbers of beneficial invertebrates, mostly ants and spiders, in the plots in this early season period. For the beneficial invertebrates we found a slightly significant effect of stubble management in pre-sow samples (p-value=0.0939, Fig. 3), with burnt plots having less beneficials than standing stubble plots. However, this difference disappeared by the post-sow sample (p-value= 0.380).

Conclusions and next steps

Ideally we would like to identify a stubble management practice that simultaneously reduces pest densities and increases the number of beneficials. In this short-term study we found that there were no obvious differences in stubble management practices that impact pests, but pest numbers were very low overall. There was also very little impact of stubble management approach on grain yield (burnt 1.2 t/ha > standing 0.9 = mulched, knocked over 0.9 > cultivated mean 0.6). The beneficials present were robust to all stubble management practices, but burnt plots had a short-term reduction in numbers of beneficials. Invertebrate pest densities were low throughout the course of this study, and repeating this experiment during a year with higher early-season numbers would be useful.

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Table 1. Total number of invertebrate pests and beneficials in different groups collected during two rounds of pitfall trapping.

	presow	postsow
Beneficials (total)	4369	3679
Spiders	320	216
Ants	4036	3456
Carabidae (predatory beetles)	1	0
Staphylinidae (predatory beetles)	8	3
Parasitic wasps	3	4
Centipedes	1	0
Pests (total)	23	13
Scarabaeidae	0	1
Elateridae - wireworms larvae	0	1
Tenebrionidae (false wireworms)	0	1
Curculionidae	0	1
Lucerne Flea	0	3
Aphids	1	0
Orthoptera	22	6

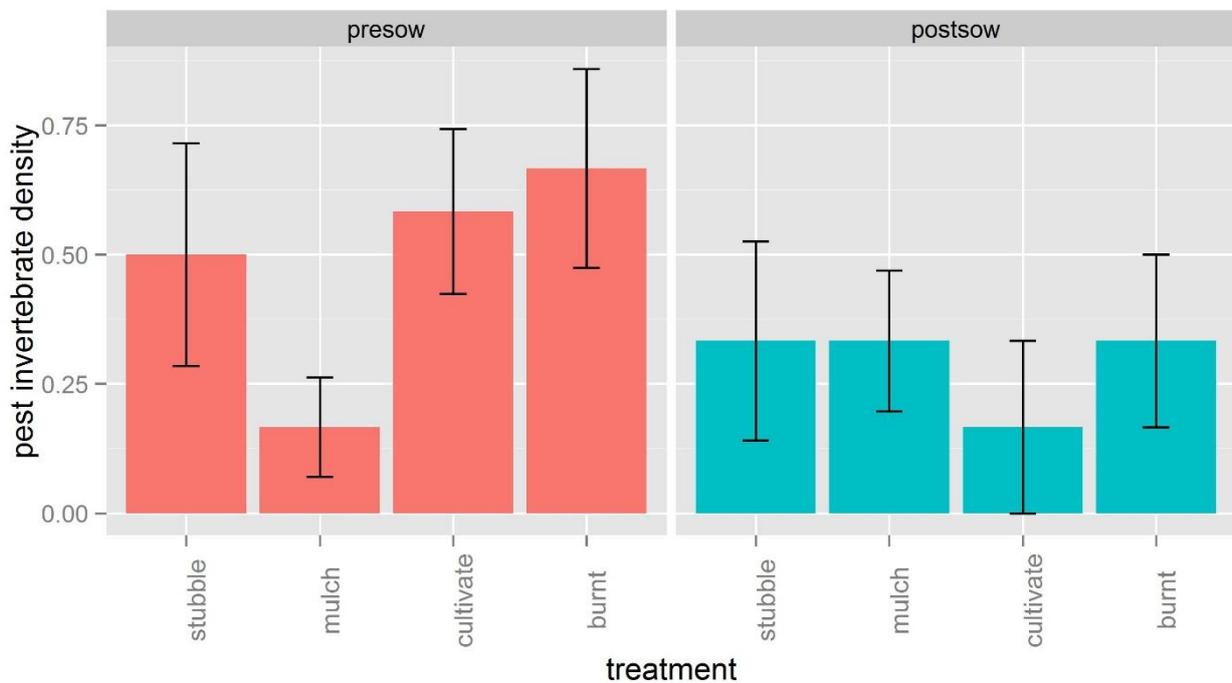


Fig. 2. Impact of stubble management treatment on the density of invertebrate pests collected via pitfall traps in each plot. Bar indicates mean per 5 pitfall traps per week per plot and standard error.

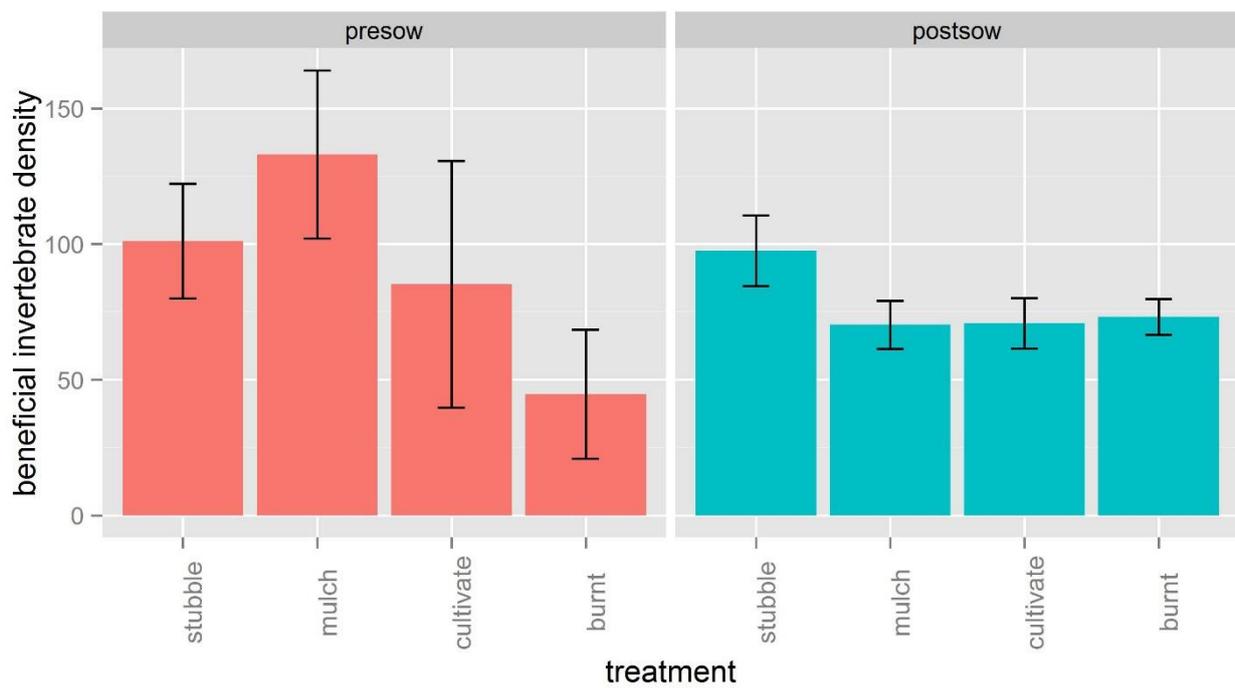


Fig. 3. Impact of stubble management treatment on the density of invertebrate beneficials (mostly ants) collected via pitfall traps in each plot. Bar indicates mean per 5 pitfall traps per week per plot and standard error.