Section 10

Pests

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Russian wheat aphid: FITE approach economically sound

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Location
Minnipa Agricultural Centre, paddock S4
Rainfall
Av. Annual: 324 mm
Av. GSR: 241 mm
2019 Total: 254 mm
2019 GSR: 234 mm
Yield
Actual: Trial average yield: 2.24 t/ha (Scepter 2.16; Spartacus 2.55, Aurora 1.84 t/ha)
Paddock history
2018: Vetch
2017: Barley
2016: Wheat
Soil type
Sandy loam
Plot size
12 m x 1.8m (6 row) x 4 reps x 25.5 cm row spacing
Trial design
Randomised complete block design

Key messages

- **In the 2019 Minnipa field trials, natural infestation of RWA was extremely low. As such, prophylactic seed treatments were not warranted against this aphid for the 2019 season.**
- **After artificial inoculation, RWA numbers increased to levels above the United States (US) intervention threshold. In this trial up to 15% of tillers with aphids and >30% of tillers with symptoms were measured, but no significant effect on yield was observed.**
- **RWA should be managed using currently recommended intervention thresholds. The US threshold of 20% of plants with RWA before tillering, and 10% of tillers with aphids after GS35-40 seems sufficiently conservative to avoid any yield loss. Find further details in the GRDC RWA Tips and Tactics Guide, which can be downloaded online.**

Why do the trial?

Russian Wheat Aphid (RWA) was first reported in 2016 in South Australia (SA), and has since been detected widely throughout Victoria, and in New South Wales (NSW) as far north as Coonamble and as far east as Tamworth. It has not been detected in Queensland or Western Australia.

As part of the GRDC investment "Russian Wheat Aphid Risk Assessment and Regional Thresholds", field trials were run at Minnipa for the second year through the Minnipa Agricultural Centre team. The purpose of these trials was to look into the level of natural infestation of cereal crops, and the effect of high RWA populations (obtained through artificial inoculation) on aphid and symptom dynamics and yield loss. This trial was one of a suite of trials undertaken in SA, Victoria, Tasmania, and NSW over 2018 and 2019, and contributes to a larger dataset.

The aim of the trial reported here was to determine the risk of RWA infestation in cereal crops in the Minnipa area in 2019 and observe the effect of high aphid numbers achieved through artificial inoculation on crop development and yield.

How was it done?

Two replicated trials were sown in paddock S4 at Minnipa Agricultural Centre on 15 May 2019, using seeding equipment with direct drill, press wheels and 25.5 cm row spacing, targeting a plant density of 150 plants/m^2.

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Crop types sown were Scepter wheat, Spartacus barley, Aurora durum wheat and fertiliser, herbicides and fungicide were managed as per best practice. The trials were harvested on 8 November 2019.

The trials were set-up in two separate areas (one area inoculated, one area natural infestation) as a randomised complete block design. Seed-treated buffer zones were installed around and between trials.

Trial 1 Natural infestation trial

- 2 cereals (wheat, barley), 2 treatments, 4 replicates=16 plots
- untreated control (UTC)
- Imidacloprid seed-treated (1.2 kg/t Imidacloprid)

Trial 2 - Artificial inoculation trial

- inoculated with 50 RWA/m^2 at growth stage (GS) 20 on 26 June 2019
- 3 cereals, 3 treatments, 4 replicates=36 plots
- untreated control (UTC)
- Imidacloprid seed-treated (1.2 kg/t Imidacloprid)
- Chlorpyrifos (600 ml/ha; applied 19 August)

Aphids (all species), natural enemies and symptoms were scored every two weeks by observing 25 random tillers in each plot until harvest.

Plots were harvested on 8 November and total yield and quality parameters were recorded. Statistical analysis was done using R, more advanced analysis is still underway.

What happened?

Russian wheat aphid populations (Figure 1) were almost absent in the natural infestation areas during the whole trial (circles), except for a small increase (not visible in the graph) at the end of September when aphids start migrating. No Oat aphids (*Rhopalosiphum padi*) or Corn aphids (*R. maidis*) were observed in this site. In the inoculated area, RWA populations established on the UTC and Chlorpyrifos treatment immediately after inoculation. In the imidacloprid treated plots that were also inoculated, aphids could not establish (4 weeks after sowing), but a small peak can be observed at the last observation date (October) when aphids start migrating (mainly from the other inoculated plots) because plants are ripening off.

Initial populations in the UTC treatment were around 5 aphids per 100 tillers, increasing to around 100 aphids per 100 tillers at the end of September. In the chlorpyrifos treatment, aphid dynamics were nearly identical, but spraying on 19 August strongly reduced the population to < 10 RWA/100 tillers (Figure 1).

Since differences between commodities were not significant, results are not presented separately per commodity for aphids and symptoms.

The percentage of tillers with symptoms (Figure 2) shows a rapid build-up on the treatments with aphid populations, reaching around 30-40 % at the start of August. This then falls gradually during the rest of the observational period. Symptoms are less obvious in a maturing crop. Symptoms do not fluctuate as much as aphid dynamics, and persist when aphids are eliminated (chlorpyrifos treatment). Therefore, symptom expression was similar between the UTC and the chlorpyrifos treatment, despite the aphids being eliminated by spraying on 19 August (GS 35).

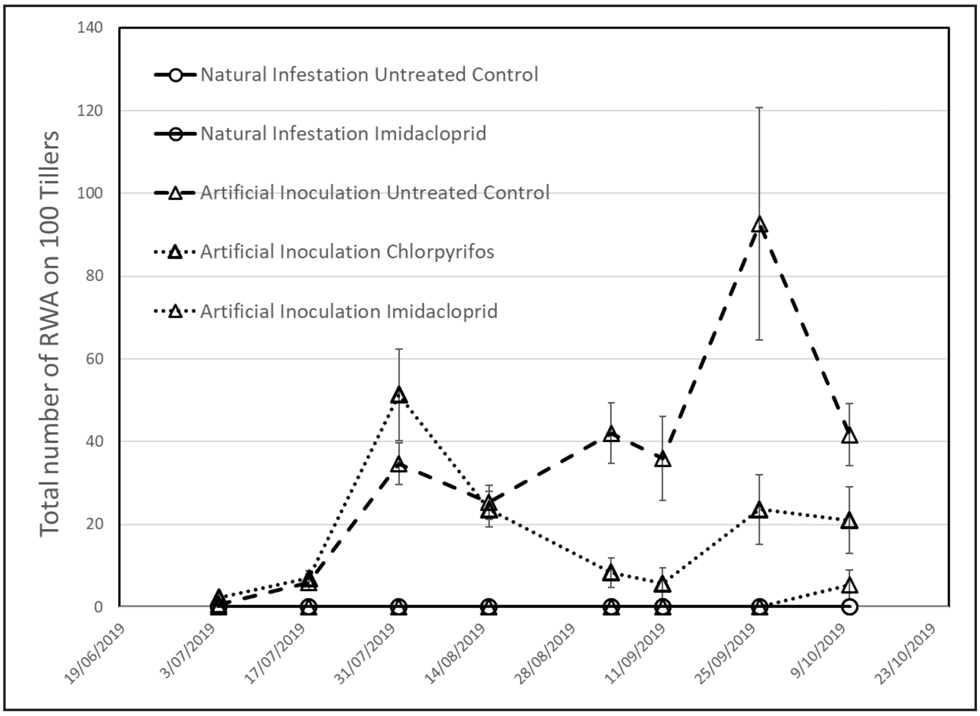

Figure 1. Russian wheat aphid dynamics in the trial (all commodities) at Minnipa in 2019. Bars show standard errors.

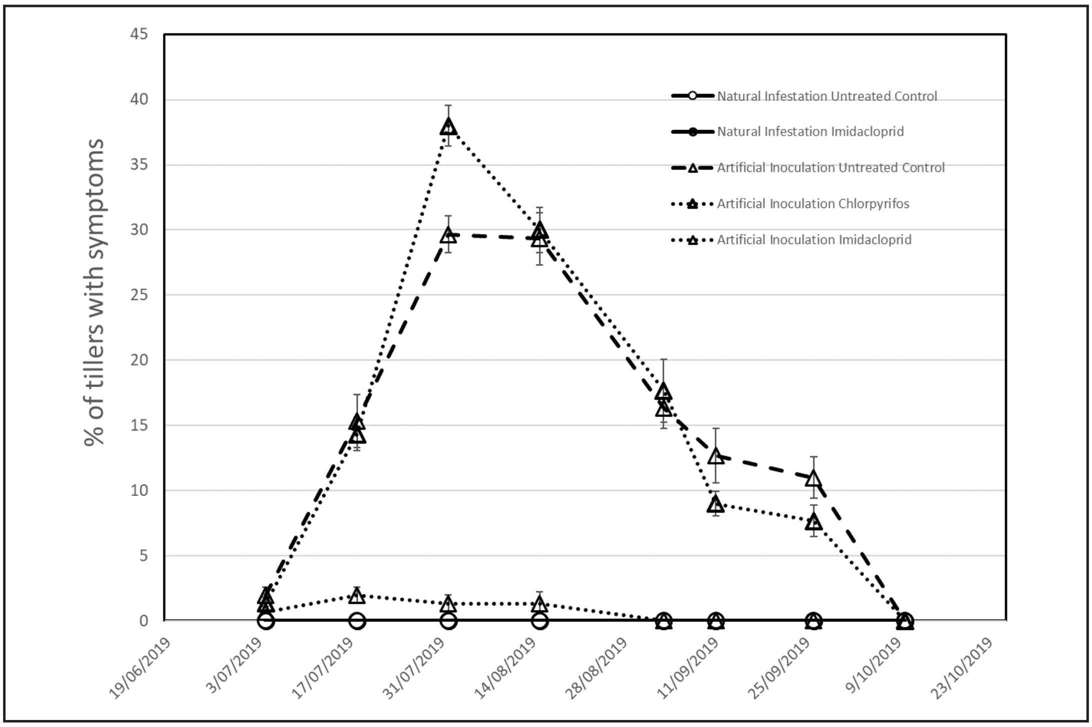

Figure 2. Percentage of tillers with symptoms (all commodities) at Minnipa in 2019. Bars show standard errors.

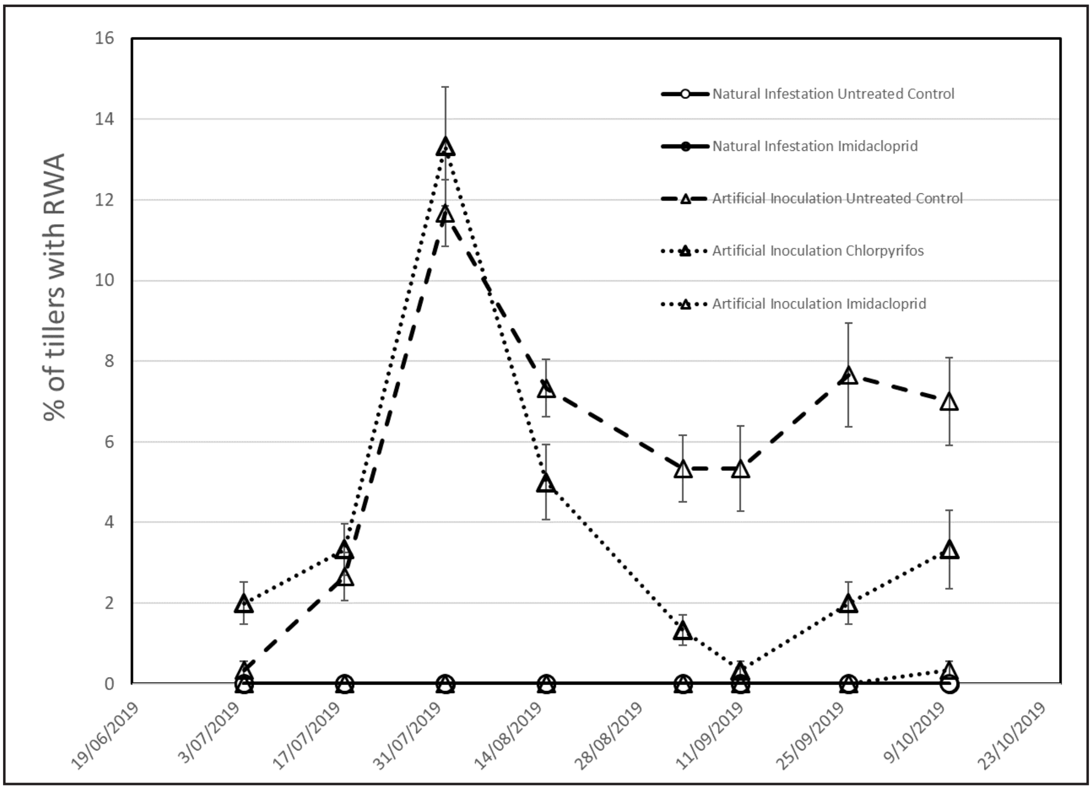

Figure 3. Percentage of tillers with Russian wheat aphids (all commodities) at Minnipa in 2019. Bars show standard errors.

The US intervention thresholds for RWA are based on the percentage of tillers with aphids. The intervention threshold is 10% of tillers with aphids after tillering (GS 35). This percentage of tillers with Russian wheat aphids is presented in Figure 3. Maximum frequency of occurrence (10-15% of tillers with RWA) is observed in late July and then drops in the chlorpyrifos treatment to ~1% after insecticide application. In the UTC a slow, more gradual, drop occurs later in season, showing that aphids leave the maturing crop at this stage. This means that the peak aphid population is slightly higher than the US intervention threshold for both the inoculated UTC and the Chlorpyrifos treatments.

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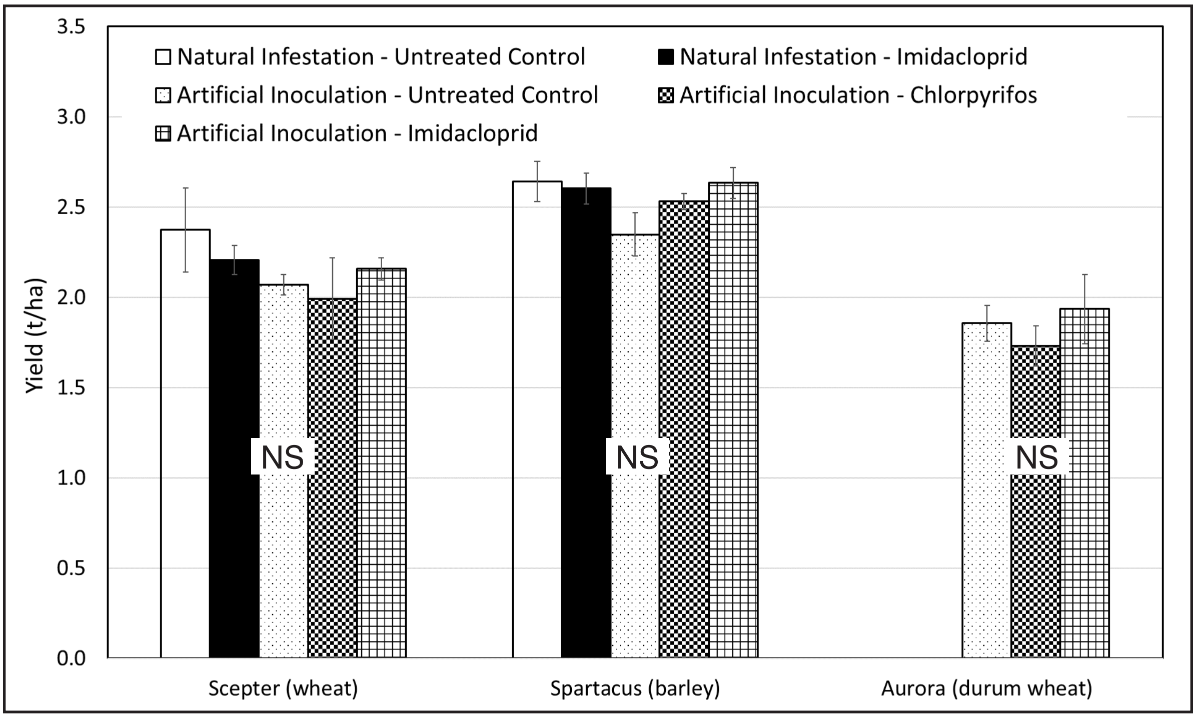

Figure 4. Harvest weight (t/ha) in each treatment and commodity at Minnipa in 2019. Bars represent standard errors. No statistically significant differences between treatments per commodity.

With these aphid populations being higher than the intervention threshold it was expected that yield differences would occur. However (Figure 4), there were no statistically significant differences per treatment for any of the commodities (wheat, barley, durum wheat).

This shows that the US threshold is sufficiently conservative to be adopted in cropping situations as shown here (in a 2-2.5 t/ha environment). Fourteen similar trials were run elsewhere in Australia and combined analysis of the data will allow the currently recommended intervention threshold for RWA to be refined.

The absence of RWA in the natural infestation trial showed that very little pressure occurred around sowing time (May) in the Minnipa area. The same was observed in most other trials, showing that RWA pressure in 2019 was very low. It is expected that RWA survival is strongly dependent on the amount of host grasses present over summer (the 'green bridge'), which allow populations to remain large and facilitate migration to establishing crops.

Commercial practice

Results from this trial (and others) show that RWA risk in Australia in 2019 was very low (http://cesaraustralia.com/sustainable-agriculture/rwa-portal/). From the limited information collected to date, Russian wheat aphid seems rarely present in cereal crops in damaging numbers. The use of prophylactic seed coatings using neonicotinoids (imidacloprid e.g. Gaucho® or thiamethoxam e.g. Cruiser®) as an insurance treatment for RWA seems unnecessary for Australian cropping conditions that we have observed to date. Therefore, growers are advised to adopt the FITE strategy (Find, Identify, Threshold, Enact). This is preferable since RWA is probably only an occasional problem, heavily influenced by seasonal climate (the green bridge). Symptoms are easy to observe; growers/advisors have a large time-period to check for symptoms and aphids before a decision is needed (after GS30-40) and such treatments, if needed, reduce RWA effectively.

This approach, treating only if needed, will be more economical, cause less off-target effects and reduce the risk of selecting for resistance to insecticides (that can occur in multiple pest species).

Acknowledgements

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