Managing Russian wheat aphid risk – Autumn 2020 advice

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The GRDC investment, 'Russian wheat aphid risk assessment and regional thresholds', is investigating regional risk and management tactics for Russian wheat aphid (RWA). After sampling RWA throughout spring, the South Australian Research and Development Institute (SARDI), the research division of Primary Industries and Regions SA, and cesar have a picture of RWA seasonality in Australia and what role the previous season and the green bridge does play in following season risk.

Key early season considerations

- Over-summering populations of Russian Wheat Aphids depend on suitable climatic conditions and available grass hosts to create a green bridge between winter crops.
- In RWA's established range, populations are expected to be low following the dry 2019/2020 summer season, however, small refuges are estimated around north-western Victoria (including regions around Birchip and Nhill) as well as around the Murray and Goulburn valleys within northern Victoria and southern New South Wales, which should be monitored as the season progresses.
- Other exceptions may be in areas near large irrigated crops (such as orchards and summer irrigated pastures) where RWA can survive on grasses in the ground cover.
- In areas where recent rainfall is allowing volunteer cereals, barley-grass and Bromus species (including prairie grass) to germinate, these hosts might allow for RWA to build up over April-May.
- Monitoring RWA populations in emerging crops will be particularly important in these areas.

Current distribution

Since this project commenced in early 2018, the RWA range has expanded from mid-NSW to Tamworth and Coonamble. The project team has not received any other reports indicating a further expansion, however it is likely that some populations will be detected further north in the future. Industry reports of RWA occurrence are extremely important for tracking of RWA distribution in south-eastern Australia and continued ability to notify growers and advisers of any expansion of range. In regions where RWA is known to occur growers and advisers are urged to make use of the GRDC Tips and Tactics guide for RWA and continue to report any

observations to your regional PestFacts team (PestFacts – southeastern or PestFacts – South Australia) if you are in a state where RWA is known to occur.

Advice for regions and states where RWA is not known to occur

RWA has not been detected in Northern NSW, Queensland and Western Australia. In the Northern region in areas where RWA has not been found (Queensland and some parts of Northern NSW), report detections to the relevant state Department of Agriculture. Be aware that permits for insecticides can only be issued once a pest has been reported in a state. If you do find RWA in your crop outside of the current known range you can apply the same thresholds as used elsewhere. Yield loss by RWA is only observed with high infestation rates (> 10% of tillers with aphids) particularly following early season establishment events.

RWA seasonal patterns

For most grain growing regions in Australia (Tasmania has been observed to be a frequent exception), RWA populations are expected to grow within cultivated crops over the winter, then will disperse during a spring migration into refuges to 'over-summer', and then re-disperse back into emerging crops during an autumn migration (Figure 1). Crop damage requires aphids to migrate into emerging crops at the right time (during crop establishment) and in the right numbers. This means that a series of events need to occur:

1. Conditions during the previous spring support successful migration of aphids from mature cereal crops onto appropriate hosts for the summer period;
2. Conditions over the summer support aphid survival in sufficient numbers to migrate; and
3. Conditions during the autumn support successful migration of aphids into emerging crops.

As such, conditions across the previous growing season and the intervening summer will be influential in determining risk of aphid establishment at crop emergence.

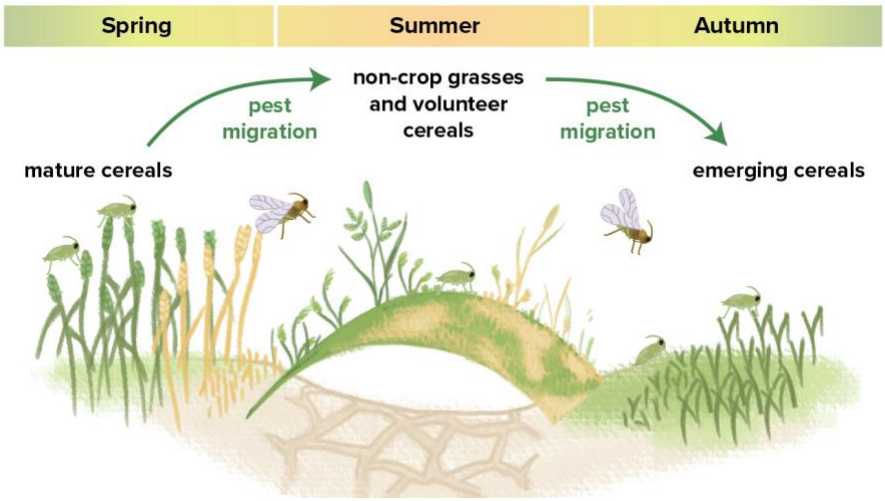

Figure 1. Schematic of the importance of available non-crop grass hosts and volunteer cereals over summer for pest populations to persist, build-up, and colonise establishing crops in autumn.

Over the last 18 months the project team have carried out extensive sampling of crops and grasses all over the known RWA range. Throughout these surveys, RWA populations were found to be strongly influenced by region and season, with the largest populations present in the springtime within the warm dry regions of northern Victoria, southern New South Wales and South Australia (Figure 2). During the 2018-2019 summer, populations experienced a severe decline, and populations of RWA were very difficult to detect, largely because the main host plants (Barley grass, some Bromus and Phalaris species) were very rare in the dry summer conditions. There was no detected recovery in many regions in South Australia, Victoria and New South Wales as late as June 2019. Populations had appeared to have recovered to some extent by September 2019, and by November 2019 had recovered nearly their entire range (though not necessarily their populations sizes), with the exception of the Eyre Peninsula in South Australia where no populations were detected in the spring of 2019 (Figure 2A and 2D). This failure to recover the entire range of the previous spring may have been due to populations facing an early start to the 2019-2020 summer, with many sites appearing considerably drier in November 2019 than during November 2018, and many crops being already harvested by that point.

Overall, persistence of RWA over the green bridge was found to be associated with moderate temperatures (<20°C), low-moderate available soil moisture (5% in top 0-10cm), with migration occurring when daily maximum temperatures exceed 24°C. The presence of irrigated crops increased the likelihood of RWA detections at all surveillance points throughout the year.

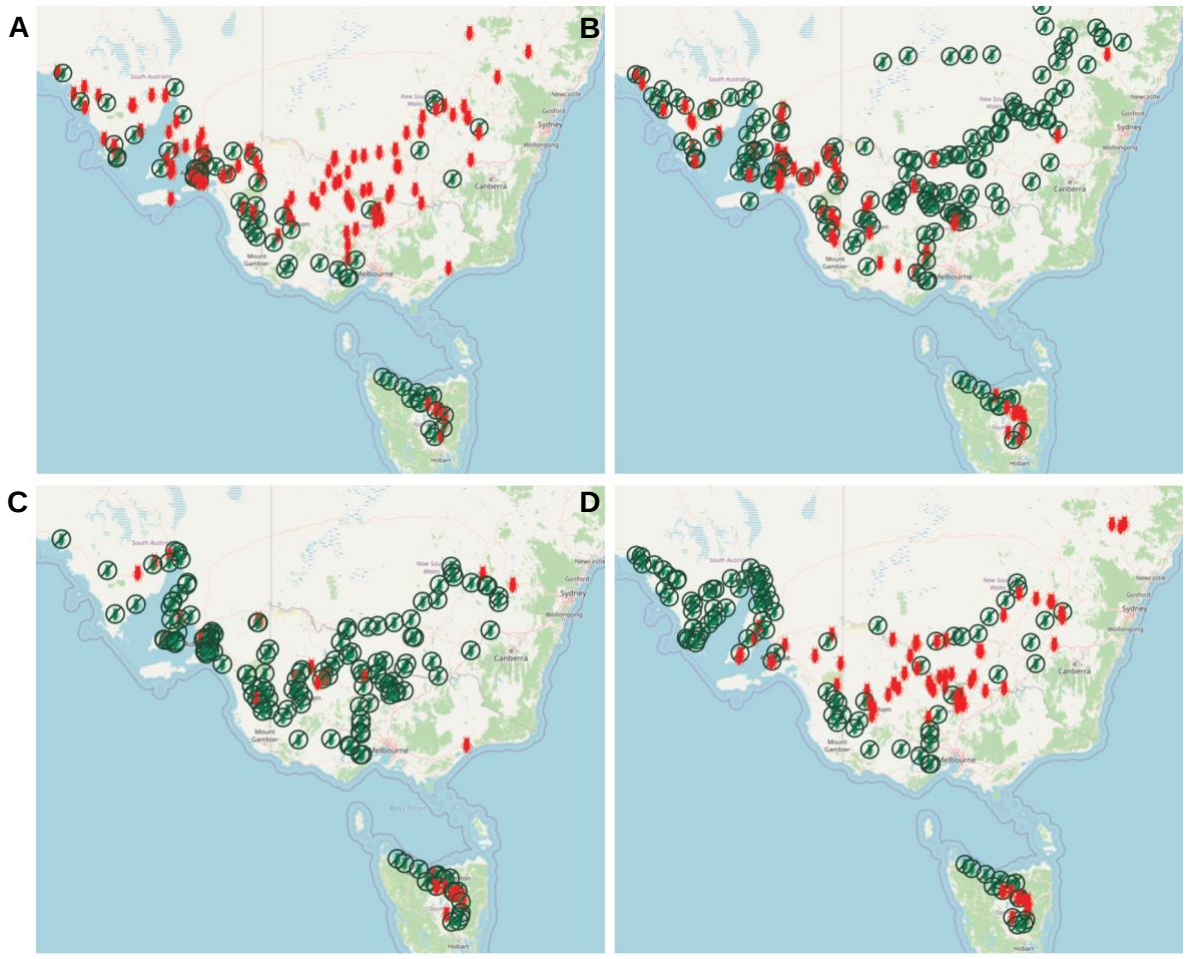

Figure 2. Seasonal green bridge sampling results for spring 2018 (A; October - November 2018), summer 2019 (B: January-March 2019), autumn 2019 (C: April - June 2019), early spring 2019 (D: September - October 2019) and late spring (E: October - November 2019). Red = present, green with cross out = not detected. Data collected by **cesar** and SARDI, map developer: James Maino, **cesar**

Predicted RWA risk for 2020

Because the final surveys of this project concluded in November 2019, the project team cannot comment on the over summer persistence of RWA during the 2019-2020 summer. However, it is possible to consider the three key time periods leading up to the 2019 and 2020 winter cropping seasons and draw inferences from that data about RWA risk leading into this winter cropping season:

1. Conditions during the previous spring: Surveys conducted during the 2019 spring showed populations were not as abundant as they were during the 2018 spring (Figure 2A and 2D).
2. Conditions over the summer: The early start to the 2019-2020 summer (with many sites already appearing quite dry by November) would extend the period over which RWA

populations would need to persist. However, compared to the 2018-2019 summer, during the 2019-2020 summer most regions within the south eastern Australian grain regions experienced lower maximum temperatures, and some regions received a greater degree of higher than average rainfalls (BOM 2020)

3. Conditions during the autumn: The 2020 autumn break appeared to arrive earlier in many regions (whereas the 2019 autumn was extremely dry, with RWA detections remaining very scarce from April to June 2019).

While the reduced spring populations and early start to the summer could reduce RWA risk in the autumn, the milder summer conditions and early autumn break could increase risk of RWA, as shorter summers tend to correlate with better over-summer persistence of pests. To explore these complex relationships, the competing environmental factors were considered simultaneously through the creation of a risk model. This model integrates climatic data (temperature and soil moisture) and RWA presence/absence observations across the field surveys to predict green bridge suitability for supporting populations of RWA into the future.

Figure 3 compares the results of the risk model across two time periods (2018/19 and 2019/20) and shows where suitability was predicted to remain highest across October to April, and thus the locations where RWA would be most likely to persist and more readily colonise. The forecast confirms that prior to the 2019 growing season there was a poor green bridge for RWA, while the prediction for this season shows some locations in northern Victoria remained comparatively suitable over the green bridge and should be monitored for early season RWA activity.

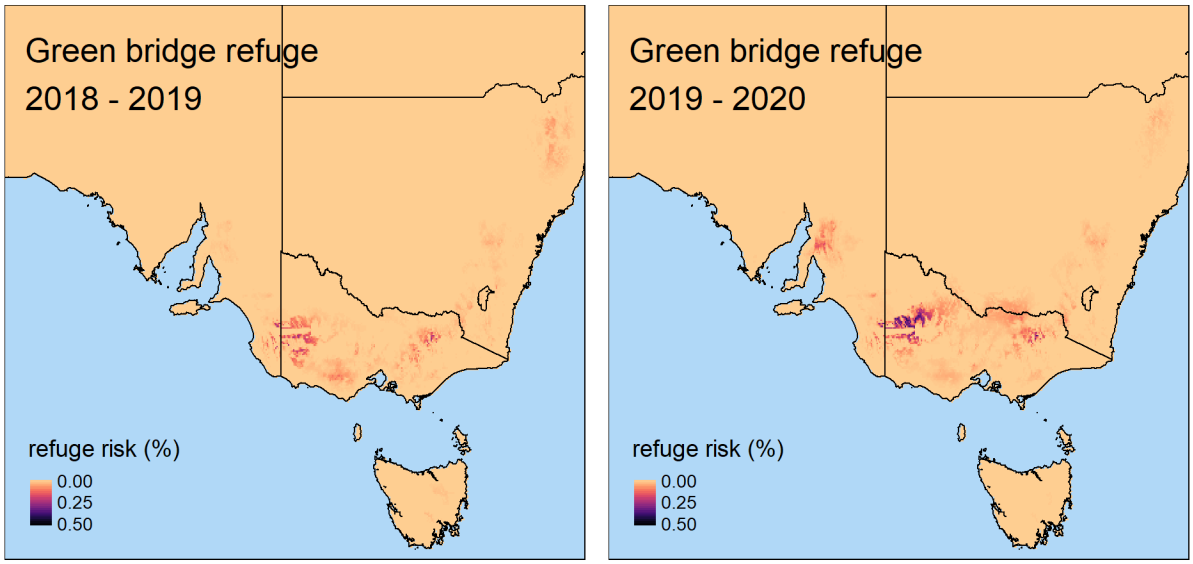

Figure 3. Results of the RWA risk model for the 2018-2019 and 2019-2020 green bridges. Refuge risk can be interpreted as the probability that RWA would be detected in every month across monthly random surveys over the green bridge (October to April). Despite regional variation, the values of refuge risk were predicted overall to be low across the southeastern grain growing region during both years. These predictions assume no visible irrigation, and as such, presence of irrigation is expected increase risk above these predicted levels.

Take home message: Overall, RWA populations are expected to once again be low across most of the known range this autumn, with a slightly higher risk in areas that received summer rainfall or had persistent summer irrigation allowing for more aphid persistence across the summer.

The environment surrounding your paddock - how does this influence RWA risk?

The persistent presence of cool-season grasses during summer would increase the risk of aphids over-summering. If for some reason the plants on which these aphids live are killed (due to mowing, grazing, herbicide, or senescence) and weather conditions permit, these aphids could move into young cereal crops. Based on 2018-2019 field trial data this seems to be a rare event.

Despite the widespread presence of RWA during spring 2018 and 2019, in nearly all trial work conducted looking at the populations of RWA in different regions across New South Wales, Victoria, Tasmania and South Australia (on barley, wheat and durum wheat), the project team observed no, or extremely low, 'natural' infestation of RWA occurring in early growth stages of the 2019 growing season. Further, no yield losses were observed. The only exception to this was the Eugowra (Central NSW) trial site that did become infested from RWA migrating from a neighboring irrigated canary grass paddock that was sprayed out at the time the cereals went

in. This caused aphids to migrate from the dying pasture. If local movement or migration into crops does occur, monitoring of crops for RWA is a simple procedure that will inform the need to control aphids before economic yield loss becomes a risk.

Reminder: threshold recommendations are based on overseas (US) research. That research recommends control at >20% of all seedlings infested up to GS 30 and >10% of tillers infested from GS 30.

Beneficial controlling of RWA during autumn

Generalist predators were found year-round during field surveys over 2018-2019. This was primarily made up of spiders, which tended to be present in vacuum samples even at the driest sites, as well as lacewings (green and brown) and ladybirds, which were found at their highest numbers in the spring and to a lesser degree the autumn (generally corresponding with the presence of RWA). Activity of specialised parasitoid wasps was also highest in the spring, but with some activity in the autumn as well, in particular in areas where aphid populations had started to build up early (including the eastern parts of the NSW grain regions, around Eugowra and Condobolin). Predator populations tend to build up with a bit of a lag behind the aphids, so if you are observing aphids building up, keep an eye out for generalist predators moving in or an increase in mummified aphids as a sign of parasitism.

Conclusion

This research project has shown that even when RWA are consistently present in the environment they rarely naturally infest winter sown cereal crops, and when they do there is still not a strong risk of yield loss. Therefore, the use of insecticide seed treatment against RWA does not appear on the whole to be a cost-effective option and adds to the risk of insecticide resistance emerging in other species. Instead, a combination of autumn monitoring when crops are emerging and the use of economic thresholds to determine cost effectiveness of intervention is the recommended management strategy.

Exceptions to the expected cost inefficiency of prophylactic seed treatments to manage RWA may be areas where high populations of grasses frequently persist over summer through irrigation: irrigated grass paddocks, irrigated orchards, and maybe some summer cereals.

Remember to report

Refer to this RWA identification video to take a closer look at key RWA features, which can be viewed using a hand lens.

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Useful resources

To view the RWA Interactive Map
http://www.cesaraustralia.com/sustainable-agriculture/rwa-portal/

GrowNotes Tips & Tactics for Russian Wheat Aphid
https://grdc.com.au/__data/assets/pdf_file/0025/289321/GRDC-Tips-and-Tactics-Russian-Wheat-Aphid.pdf

Russian Wheat Aphid Tactics for Future Control
https://grdc.com.au/__data/assets/pdf_file/0027/244377/Russian-Wheat-Aphid-Tactics-for-Future-Control.PDF

Russian Wheat Aphid Dynamics in 2017 (research update)
https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/08/russian-wheat-aphid-dynamics-in-2017

Russian Wheat Aphid – Current investigations and recent findings (research update)
https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2019/02/russian-wheat-aphid-current-investigations-and-recent-findings

The GRDC investment, 'Russian wheat aphid risk assessment and regional thresholds', has been launched to investigate regional risk and management tactics for RWA.

References

BOM (2020) Average annual, seasonal and monthly rainfall. In: Bur. Meteorol. http://www.bom.gov.au/jsp/ncc/climate_averages/rainfall/index.jsp. Accessed 30 Apr 2020