Managing Russian wheat aphid risk – early season considerations

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*The GRDC investment, 'Russian wheat aphid risk assessment and regional thresholds' is investigating regional risk and management tactics for RWA. After sampling Russian wheat aphid (RWA) over a dry spring, summer and autumn the South Australian Research and Development Institute (SARDI) and **cesar** have a better picture of RWA abundance in Tasmania, Victoria, South Australia and New South Wales as cereal growers approach sowing. A new round of RWA trial site experiments is also set to commence in the coming weeks, which will give researchers a second set of data to support development of regional economic thresholds. For now, we have preliminary trends to share from 2018 trial sites.*

Key early season considerations

- Observations in November showed RWA was present all over its known distribution area on many different grasses. Barley grass, brome grasses and volunteer wheat and barley were harbouring the highest numbers.
- Sampling over the summer and early autumn (January to March) showed that in the dry conditions the amount of actively growing grasses was strongly reduced.
- At this stage (during May) it has become very difficult to find any RWA.
- Risk of early RWA infestation therefore seems very low for the coming season.
- If for some reason volunteer cereals or barley grass are surviving in your area it is worth checking these for RWA. It is good practice to spray out weeds in the paddock before sowing.

Has green bridge surveillance for RWA resulted in an extension of range?

Spring-autumn monitoring resulted in detections of RWA in all regions where it was known to occur. Despite additional monitoring for RWA in northern New South Wales and southern Queensland during January 2019, no new RWA detections were made. Therefore, based on our current monitoring results, it does not appear that the RWA has established populations north of its most northern detection in Coonabarabran. However, it should be noted that previous climatic modelling results clearly indicate that the aphid can establish in these agroecological regions and we urge growers and advisors to make use of monitoring guidance in this information sheet and report any observations to your state Department of Agriculture. In the western region, where the aphid is not known to occur, the Department of Primary Industries and Regional Development has confirmed that there is no formal monitoring for RWA occurring in Western Australia. Detection of this aphid will rely on reports received by PestFax and communications with agronomists.

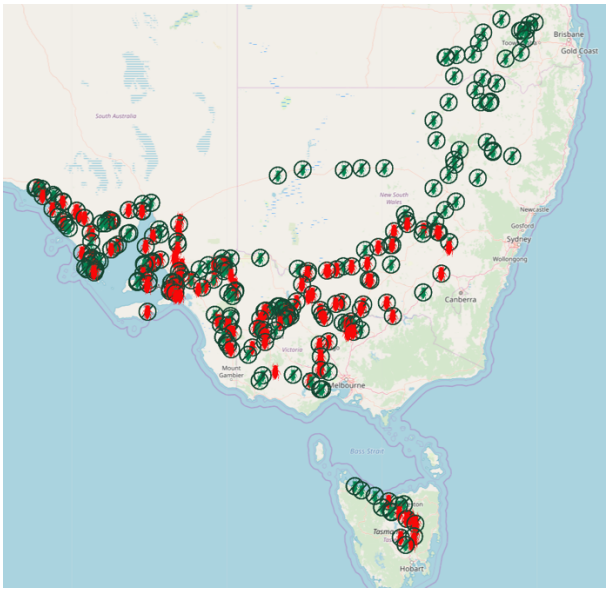


Figure 1. Project monitoring sites throughout South Australia, News South Wales, Victoria, Tasmania, and Queensland. Sampling results are from October 2018 onwards. Red = present, green with cross out = not detected.

What observations have been made about RWA abundance over the 2018/19 summer?
During spring sampling RWA was generally in high abundance at sites where the aphid was detected. Footage from a vacuum sample taken during this period highlights the number of RWA hiding in cereals and alternate hosts. View footage on **cesar**'s YouTube channel.

Monitoring during the drier, hotter months of January and February revealed a notable decrease in detectability of RWA – as preferred grass hosts became rare, aphid populations became too low to detect at most sites (figure 2). Only in higher rainfall cooler zones, such as Tasmania, did we observe an increase in detections.

Autumn sampling has begun, and preliminary work suggest that RWA populations are still very low. Not only were the populations of grass-host plants been decimated by the hot and dry summer conditions, but RWA populations have also suffered from the heat. RWA populations were not yet showing signs of recovery during preliminary early autumn checks of highly irrigated areas, and areas that had received summer rainfall. For example, the Birchip area was visited in April 2019, as high rainfall occurred in December and grasses were found to be more abundant. However, in spite of an extra sampling effort and available host plants very few aphids were detected. Similarly, around Shepparton where irrigated pastures provided green preferred hosts over the summer, the RWA population in March 2019 was still found to be very small.

At this stage, finding any RWA is extremely difficult, as shown by the 2019 map below. Only where preferred hosts, including volunteer cereals, canary grass, and enneapogin grass, survive due to available water (seeps, dams, irrigation and higher rainfall areas) have we occasionally been able to detect small populations. Autumn surveys are now commencing in Victoria and

NSW, in light of recent rainfalls. The autumn survey of Tasmania is currently underway, and preliminary results suggest there has been almost no change in RWA population distributions or abundance since summer, with populations so far being found almost exclusively on volunteer cereal regrowth. As with the beginning of the 2018 winter cropping season RWA pressure seems again very low and risk of colonisation of crops early in the season seems minimal.

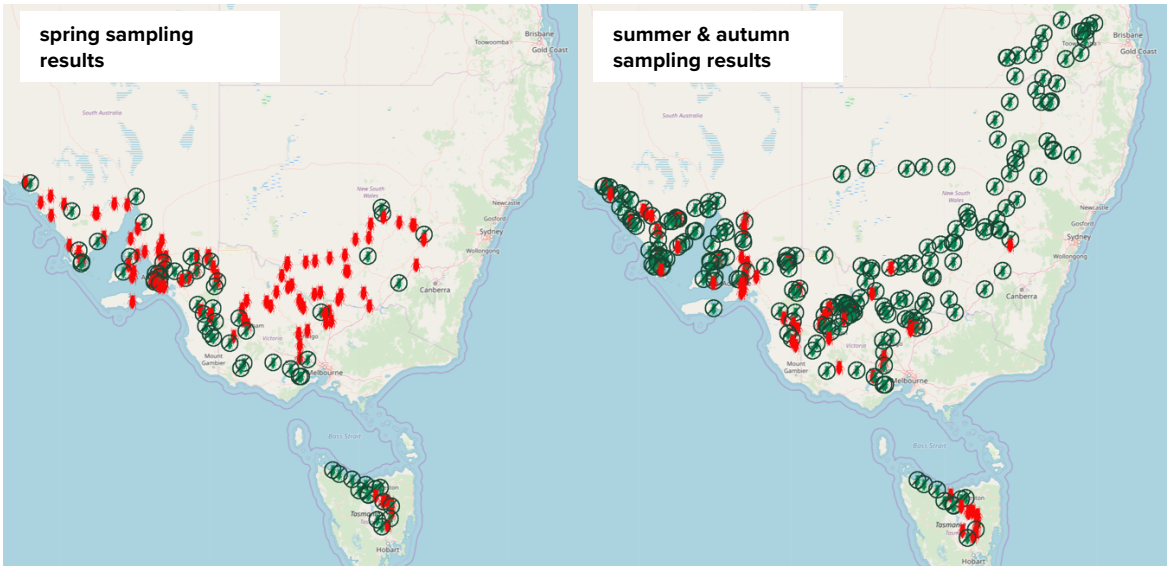


Figure 2. During spring green bridge sampling RWA were detected in most locations sampled (left). During summer and autumn monitoring RWA detections decreased (right). Red = present, green with cross out = not detected. Data collected by **cesar** and SARDI, map developer: James Maino, **cesar**

What do we know about the environmental conditions that have supported RWA survival over the 2018/19 summer?

Based on our current understanding of RWA biology in Australia early infestation can occur via landing of winged aphid from the air, or local, wingless aphid walking onto seedlings. After early infestation, there is a slow build-up of the population in winter, and a faster build-up in spring. As the cereal matures it eventually becomes less palatable and the aphid will migrate to alternate hosts to see out the summer period (figure 3).

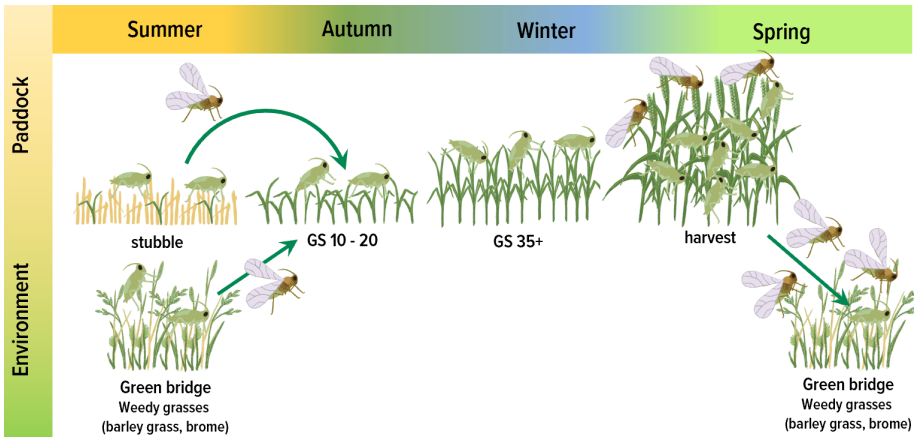


Figure 3. Early infestation can occur through local movement of apterous (wingless) aphid, or long-range movement of alates (winged aphid). Migration will occur again as the crop matures. The green bridge plays an important role in carrying RWA populations over to the next cropping period.* Image credit: Maarten van Helden, SARDI; Elia Pirtle, **cesar**

*This figure does not mention the role played by wild grass hosts over winter. This is a topic that requires further research.

In regard to local movement of wingless aphid, understanding how the green bridge contributes to seasonal risk is important. The green bridge essentially provides a temporal refuge due to the existence of alternate hosts, that thrive during summer and are palatable to RWA. These summer hosts may in turn be kept palatable and nourishing by irrigation and other factors, such as local weather events.

As mentioned, as the weather became drier throughout the 2018/19 summer, it became apparent that RWA populations had largely contracted to areas where green material was still maintained through water availability. Alternate hosts were recorded during monitoring and the list of the main hosts observed by the project so far RWA are included in table 1.

Table 1. Some alternate hosts for RWA

Latin name	Common name	Level of RWA populations
Avena barbata	Wild oat	Low
Bromus catharcticus	Prairie grass	High
Bromus diandrus	Great Brome	High
Bromus hordaceus	Soft Brome	High
Cynodon dactylon	Couch Grass	Low
Hordeum lepinorum	Barley Grass	Very High
Hordeum vulgare	Barley	High
Lolium rigidum	Annual Rye grass	Low
Phalaris aquatica	Canary grass	Medium
Setaria verticillata	Rough bristle-grass	Medium
Triticum aestivum	Wheat	High

When will RWA migrate into cereal crops and what is the risk?
Migration of RWA into cereals will occur from wingless aphid moving short distances into crops, or from the development of winged aphid – these can be blown by the wind and move quite a bit further (sometimes 10's or even 100's of kilometres).

With summer hosts remaining desiccated, migration of winged aphid requires local conditions to be just right. In order for winged RWA to migrate temperatures need be high (20-25 degrees) and wind speed must be low. According to the BoM seasonal outlook, warmer than average days and nights are likely for May to July in Eastern Australia – a climate outlook that could support RWA flight. However, regional climate conditions in the lead up to sowing and during May, will influence the abundance of local RWA populations.

During May some parts of the southern region are likely to be drier than average. These include Western Victoria, Central Victoria, Northern Tasmania, the southern part of the South West Slopes in New South Wales, and the south eastern region of South Australia. Since green bridge sampling over summer and autumn has demonstrated how RWA population levels have been negatively impacted by limited green material, it is likely that dry weather during early establishment will further limit RWA population numbers as alternative grass hosts in the area that would usually support population build up at this time of year will be less abundant. However, growers in those areas that have experienced rainfall events during December - February, should assess their risk by determining if they have an abundance of alternative hosts (refer to table 1). Overall, the low abundance of RWA found during summer and preliminary autumn sampling is likely to work in the favour of growers this season in regard to RWA infestation of establishing crops.

How should I monitor for RWA in my establishing crop?
Growers are encouraged to continue monitoring for RWA, particularly in establishing crops as economically significant yield impacts are more likely from infestations that occur before late stem elongation – the likelihood of economic damage decreases very quickly after this growth stage. In addition, the 'berlese bag' method can be used to monitor for RWA in neighbouring alternate hosts (figure 4). To use this method, fill a large zip lock bag half full of grass tillers and a sheet of paper towel. Seal the bag and place it somewhere warm out of direct sunlight and check for RWA in the corners of the bag after two days. In both spring and summer, the research team found that symptoms (curled and striped leaves and trapped heads) were rarely observed in non-crop grasses, and when they were observed, they were more subtle in appearance than those observed in cereal crops (figure 5). Looking for symptoms is therefore not a good strategy for monitoring RWA presence in weeds, rather growers are advised to look for the aphid itself.

During cropping, signs of infestation are usually very visible. During seedling growth and tillering look for leaf streaking, which can appear white or purple. At late tillering and during stem elongation you may notice a flat habit and leaf rolling. Peeling back rolled leaves will often uncover the aphid.

Refer to this RWA identification video take a closer look at key RWA features, which can be viewed using a hand lens. Remember, you can also send a sample or photo to your local PestFacts team at SARDI (South Australia) or **cesar** (south-eastern Australia).

Figure 4. Berlese bag method of monitoring in surrounding vegetation (left, middle) and RWA colony inside a curled cereal flag leaf (right). Image credit: Dr Elia Pirtle, **cesar**

Figure 5. RWA found on some alternate host grasses over the 2018/19 summer period. Mild symptoms were observed in alternate hosts over spring and summer. Image credit: Elia Pirtle, **cesar**

What have the field trials shown us so far about RWA impact on cereals?

Economic thresholds will be a key step in managing this aphid. They provide guidance on when (and if) to action chemical control measures in order to avoid significant yield loss and save growers time and money. Seed treatments are often used to manage RWA, however this control must be used responsibly and only when regional risk of early RWA infestation is deemed to be high. In 2018, 15 trial sites were set up throughout South Australia, Victoria, southern NSW, and Tasmania in collaboration with regional organisations. Trial site operators, under the guidance of SARDI, recorded RWA infestation levels, symptoms and subsequent yield.

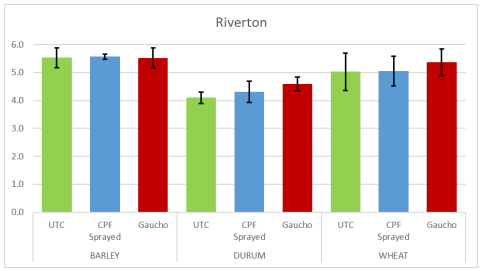
Currently, threshold recommendations are based on overseas (US) research, which is the best advice that we can supply. This research recommends control at >20% of all seedlings infested up to GS 30 and >10% of tillers infested from GS 30.

To determine scientifically robust thresholds pest infestation must occur. In 2018, a subset of sites were 'inoculated' with wingless RWA at GS 20. Inoculations occurred only in regions where the aphid had been detected and a series of measures were put in place to minimise the risk of the increased population to surrounding areas during and after the trials. We have produced a Frequently Asked Questions sheet to supply further information about inoculation of sites.

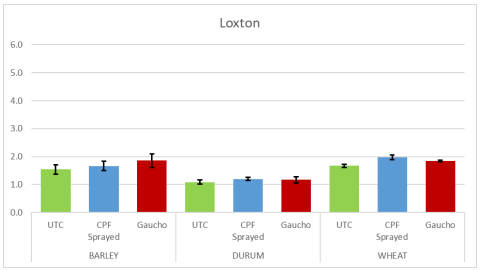
While it is early days, and we need further data gathered during 2019 to support development of thresholds, we can supply several observations.

- The non-inoculated trials did not show significant RWA numbers, and therefore no yield loss due to RWA. These sites provided insufficient data for threshold development.*
- No immigration of RWA during winter months was observed.
- In contrast, inoculation of trial sites largely resulted in aphid infestations above overseas thresholds. RWA build up in inoculated sites were in the range of 100 to >2000 RWA per 100 tillers. This resulted in a large range of symptom frequency on tillers, from 28%-75%.
- However, most inoculated trials showed little yield loss, except in those cases of rather extreme drought stress in low rainfall areas where very high aphid infestations did build up.
- This resulted in a dataset that is being used for threshold development and emphasises the benefit of using inoculations to achieve enough infestation to determine thresholds.
- Overall, yield loss was not as high as expected in spite of aphid numbers being largely above the overseas threshold. It seems that the overseas thresholds are, at this stage, acceptable for affected Australian grain growing regions.

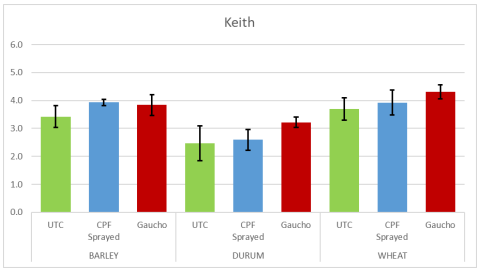
**It is important to remember that there was very little green bridge in the lead up to the 2018 season.*



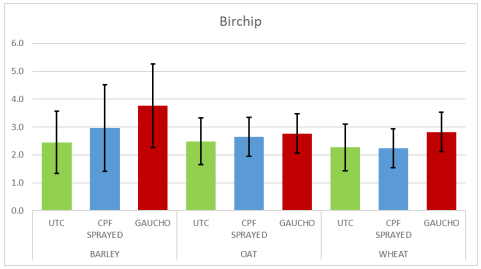
Symptom frequency = 28%
RWA abundance = 135 aphid per 100 tillers



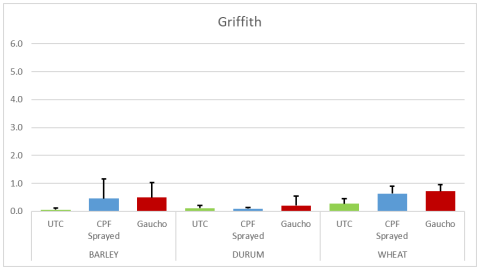
Symptom frequency = 24%
RWA abundance = 1209 aphid per 100 tillers



Symptom frequency = 40%
RWA abundance = 744 aphid per 100 tillers



Symptom frequency = 50%
RWA abundance = 536 aphid per 100 tillers



Symptom frequency = 75%
RWA abundance = 2279 aphid per 100 tillers

Figure 6. Yield measurements from 2018 inoculated trial sites (t/ha) show large variability. Overall, yield loss was not as high as expected, except at the Griffith site. Graph and data credit: SARDI.

What trials are planned during 2019?

SARDI will conduct another round of field trials in 2019 to ensure regional economic thresholds are based on robust science. In areas where RWA has established recently (northern NSW), trials will rely on natural infestation of RWA at these sites. As was the case in 2018, the next set of inoculated trials are only being conducted in areas where RWA has been confirmed as established since 2017. Since the project team expects that RWA pressure will again be low after a dry summer, inoculation will give the best chance of success in developing regionally relevant economic thresholds.

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

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