MANAGING RUTHERGLEN BUG (*Nysius vinitor*) MOVEMENT OUT OF CANOLA STUBBLE INTO SUMMER CROPS

FINAL REPORT – TRIAL: RGB17-2 2017

Melina Miles, Adam Quade, Trevor Volp

(Queensland Department of Agriculture and Fisheries, Toowoomba)

Branko Duric, Brendan Burton, Lawrie Price

(Northern Grower Alliance, Toowoomba & Tamworth)

Summary

No significant treatment differences were detected. Trial conditions were difficult with patchy RGB pressure across the trial, and movement of a limited duration. Suggestions are made about the design of further trials.

Background

Extremely large populations of rutherglen bug (*Nysius vinitor*) can breed up in canola (*Brassica napus*) and in spring and once the canola stubbles dry down, move out of the canola fields. Where they move into neighbouring cotton crops (or any other establishing summer crop), the heavy and continuous feeding that occurs can result in seedling death. Seed dressings do not prevent this damage, but may impact on the survival of the rutherglen bug and lessen the extent to which they move across the summer crop field. This mass movement of rutherglen bug from canola stubbles occurs wherever canola is grown in the northern region, but is of greatest significance in the regions with both winter and summer cropping programs in close proximity. Over the past 4 seasons (2012-2016), the problem has been particularly acute on the Liverpool Plains and around Moree in NSW.

Because infestations from canola stubble can move continuously for several weeks, seedling crops require continual protection from the constant reinvasion of adults and nymphs. Presently this is achieved by repeatedly treating the seedling crop with insecticide or pre-emptively spraying the canola stubble shortly after harvest. The implication of these treatments is a significant cost, whilst still losing summer crop plants and, by necessity, the use of broad spectrum insecticides early in the life of the crop which is disruptive and non-compliant with the cotton IRMS.

One of the challenges to the control of the persistent migration of rutherglen bug is the absence of insecticides with high efficacy and long residual that can be applied to bare earth between canola and susceptible fields as a barrier. A longstanding recommendation for the management of rutherglen bug migration has been to plough a trench between the source and susceptible crop. Whilst such an approach may work where soil is light and dusty, creating a 'slippery' slope on the trench, it is not a strategy that is effective on the black and red clays in the affected regions.

Another of the challenges is the limited opportunity to control the rutherglen bug build up in the canola, if the canola crop is not managed by the owner of the susceptible summer crop. To address this problem, this research focuses on options that can be applied on the interface between canola and summer crop.

This research aims to investigate the potential of bare earth insecticides and trap crops to reduce the movement of RGB from canola stubble into adjacent summer crops. The hypotheses are:

i) That Rutherglen bug movement can be slowed, or halted, by the presence of crop (trap).
ii) That a trap crop treated with neonicotinoid seed treatment will deliver a highly efficacious dose of insecticide to the Rutherglen bug, with long residual efficacy.

iii) That bifenthrin bare earth treatment is not sufficiently robust to minimise Rutherglen bug movement and prevent crop loss over 24 metres.

As this sort of work has not be undertaken previously, there are a number of assumptions being made in the design of the trial. Some of the uncertainties are potentially major influences on the success of the treatments in mitigating damage to neighbouring crop. For this reason, the scale of the trial (number of treatments) is conservative, and is designed to provide insight into the speed and distance of movement as well as the impact of insecticide and trap crop on this movement.

The trial is not trying to replicate exactly how such treatments might be deployed in practice by growers, but principally to test the potential of bare earth and trap crop treatments. The width of the plots is not necessarily going to be what are proposed as options in the future, but what we think will best test how large they may need to be to be effective.

Assumptions/uncertainties

i) **Unknown**: The speed and distance that rutherglen bugs will move across bare ground and through crop is unknown. Consequently, the scale of the trial is based on the convenience of 12-24 sowing/spraying equipment in establishing the trial only. If the movement is extremely fast, then it is likely that even W2 will have little impact in slowing the progress of the rutherglen bugs.

ii) **Assumption**: That the Rutherglen bugs will move from the canola towards the summer crop with little deviation from a straight line i.e. through a single treatment plot and into corresponding traps/sentinel crop.

   a. We know that furrows and trenches in a field will divert Rutherglen bugs, so the trial area will need to be as uniform as possible.
   b. Plots are made as large as is possible (30m long) to try and accommodate changes in direction and diagonal movement between the canola edge and the treated plot.

iii) **Assumption**: that the insecticide treatments (bare earth, seed treatment) will have an impact on the rutherglen bug mortality before they leave the trial area. This is related to the speed at which the rutherglen bug travel across the trial. A seed treatment, for example, may take 24-48 hr to kill a nymph. We are relying on the trap crop that dispenses the insecticide to slow the rate of travel by the rutherglen bugs long enough for them to die, or at least become unwell, before they reach the summer crop. It is possible that the final assessment of summer crop damage may show a reduction in the level of plant loss, but not a complete absence of plant loss as a result of the rutherglen bugs having been exposed to insecticide.

iv) **Assumption**: The pitfall traps will not influence the number and distribution of rutherglen bugs moving across the trial from sampling point 1-5. The longer period of sample collection, 3-7 days should even up variations in counts that might occur if simply doing point sampling (e.g. vacuum sampling).

Material and Methods

A randomised complete block design experiment was conducted in a dryland block located at 'Lambrook', Mullaley, NSW (-31.130806, 149.980193). The trial was set up on 15 December 2017. Plots were 12 metres wide by 50 metres long. Each treatment had five replicates. Treatments included;

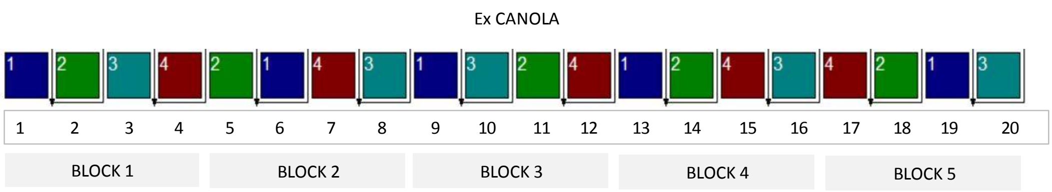
1. Normal sown crop with insecticide treated seed
2. Double sown crop with insecticide treated seed
3. Talstar 250 sprayed onto bare earth at 80 mL/ha
4. Diversion ditch dug at edge of canola

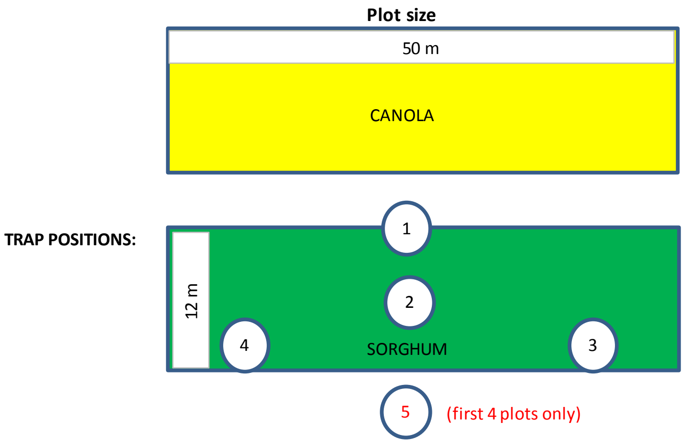
Rutherglen bug density was assessed by pitfall trap. Traps were laid out in the following pattern (see diagram below):

1. 1 m from canola edge of trial area (= what is entering the trial plot)
2. At the mid-point (6 m into plot)
3. At the far edge of trial area (12 m and in each corner)
4. At the far edge of trial area (12 m and in each corner)
5. 10 m into the summer crop (only done for the first replicate/block)

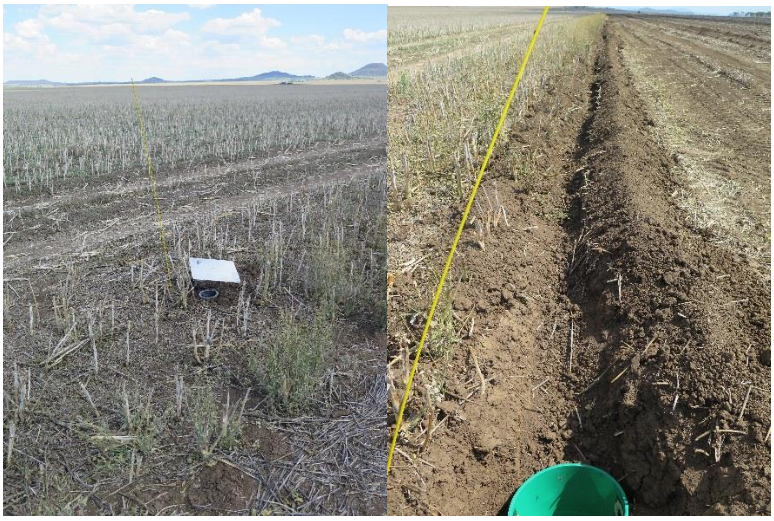
Rutherglen bug trial

1 Normal sown crop	**Seed with insecticide treatment**
2 2 x seeding rate	**Seed with insecticide treatment**
3 Talstar 250 80 mL/ha	**Applied across edge of Canola & New crop**
4 Diversion ditch	**Ditch dug at edge of canola**





Distribution of traps inside the plot



Pitfall trap (left) and diversion ditch treatment (right) in situ at the “Lambrook” trial site, December 2017.

Pitfall traps were double cupped, so that the sample could be removed and lidded without having to transfer material from the trap to a container. Traps were filled with liquid preservative (propylene glycol and 98% ethanol mixed at 50:50 ratio) to both trap and preserve specimens.

Traps were sampled at 7 DAT (22 December) and 14 DAT (29 December). The samples were then taken back to the laboratory where they were counted. All rutherglen bugs found were recorded into the size categories small, medium, large, adult male or adult female.

Plant damage assessments were planned for 1-2 weekly intervals, and at the conclusion of the trial. These assessments were not made as the migration of RGB nymphs was not sufficiently large, or prolonged to enable these measures to be made.

Analyses

Total counts of nymphs from pitfall traps were log transformed to meet assumptions of normality. *Only data from 7 DAT collection was used in the analysis as RGB numbers were too low to analyse in the 14 DAT collection.*

We performed REML variance components analysis in R to using the log transformed nymph counts as the response variable and we used treatment and trap position as fixed effects, with block as a random effect.

Results

There was no significant difference between treatments for total nymph counts in pitfall traps (Table 2). However, there was a significant difference between the trap positions, with traps located on the edge of the plots having significantly lower numbers than the middle ones, and of the middle traps position 1 having significantly higher numbers than position 2 (Figure 4). There was a strong effect of block (Figure 4), which was accounted for in the analysis.

Table 2: No significant treatment difference was found in the number of nymphs entering pitfall traps. Trap position was a significant factor.

Fixed term	**df**	**F-statistic**	**p-value**
Treatment	3	0.53	0.672

Trap position	3	32.55	**<0.001**
Treatment x trap position	9	1.14	0.352

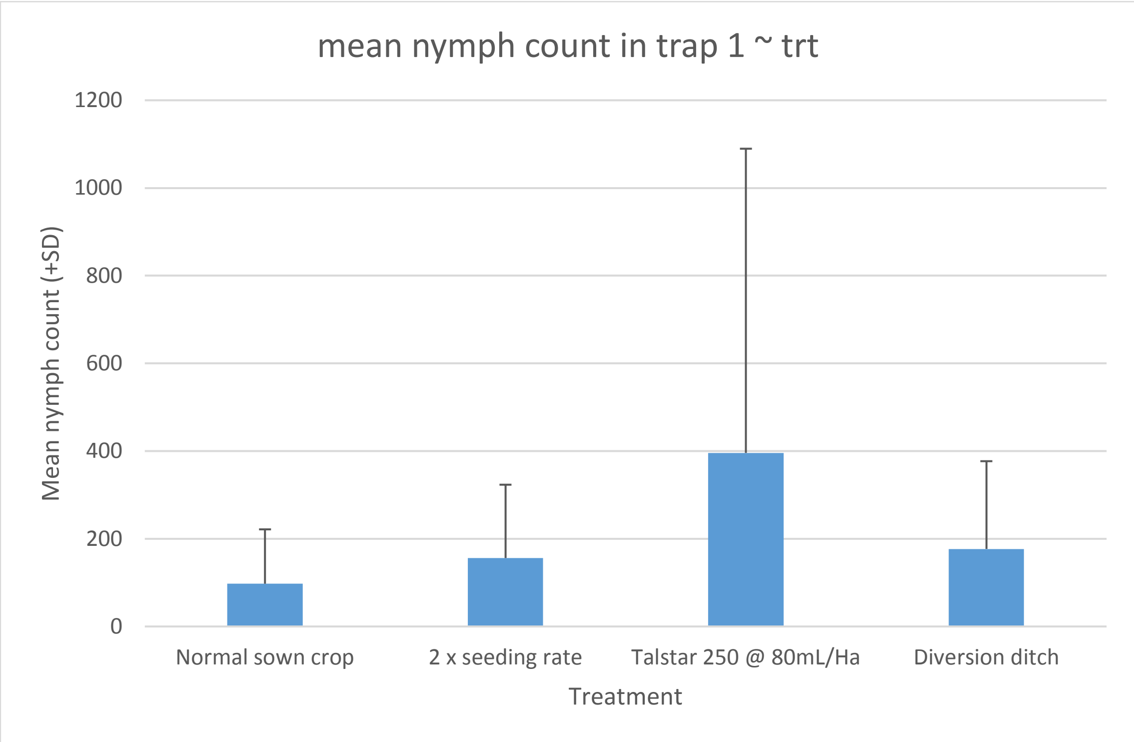


Figure 3: Mean number of nymphs collected in trap position 1 as a function of treatment.

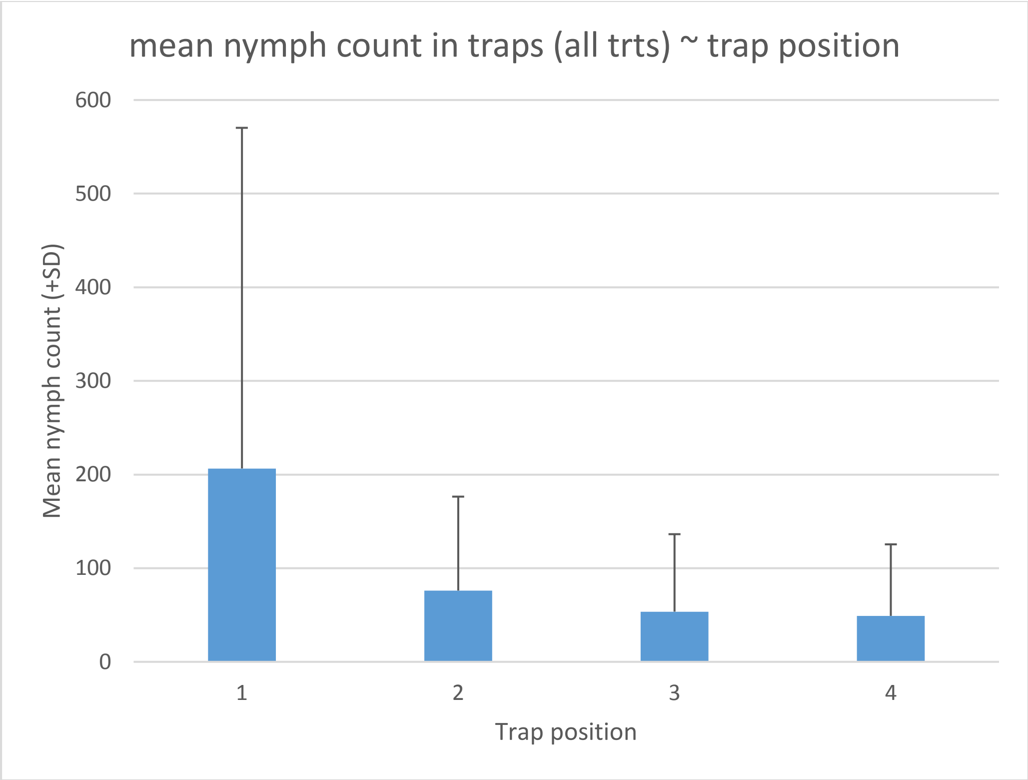


Figure 4: Mean number of nymphs collected in traps (all treatments) as a function of trap position.

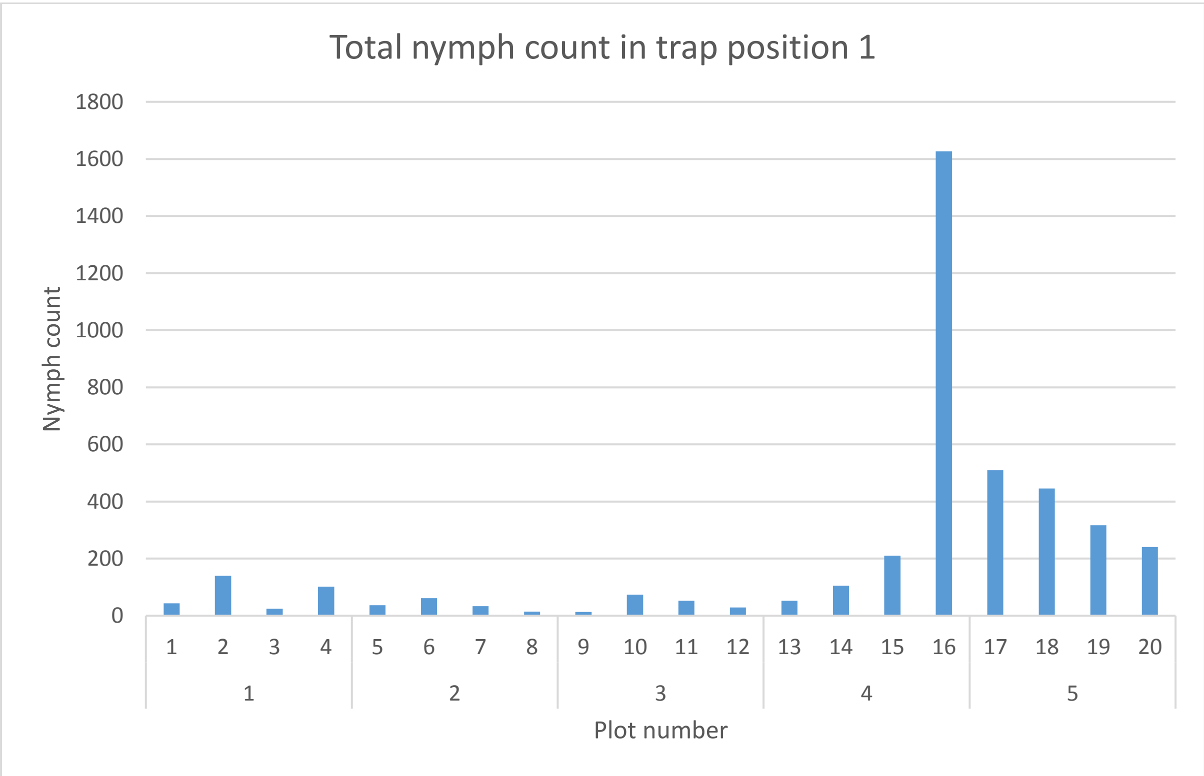


Figure 5: Bar plot showing nymph aggregation in the field across plots and blocks.

Discussion

There was RGB movement into the trial, with nymphs captured at all trap locations over 7 days of trapping. The trap closest to the canola (Trap position 1) had significantly higher catches than traps at greater distances from the canola. Had the migration been of a greater magnitude (density and duration), it is likely that RGB would have easily moved past all the trap positions.

The patchiness/variability of the RGB catches has been a major factor in the inability to detect significant differences between the treatments. The majority of the trial (4/5 blocks) had very low RGB numbers in comparison with densities in the 5th block.

The establishment of this trial was a massive undertaking to install pitfall traps and diversion ditches, in particular. By necessity the trial was established before any major movement of nymphs from the field was observed, so there was no opportunity to adjust the placement of the trial to maximise exposure to the migrating population.

RGB movement out of canola has been particularly problematic where the canola crop dries down, leaving no food source on which the RGB nymphs can feed. This scarcity of food is thought to be the trigger for the mass movement of nymphs. The 2017 spring-early summer was characterised by relative high rainfall which resulted in a carpet of volunteer canola in the trial paddock, and persistently green canola stalks and regrowth. At the Lambrook site, a second generation of RGB was observed developing on the volunteers, rather than moving out of the paddock. These conditions have contributed to the relatively low migrating nymph population through the trial. In the Liverpool Plains area, there were no reports of damaging RGB migrations, in contrast to previous year.

Conclusions

Conditions which promote the movement of nymphs out of the canola stubble are necessary to ensure the prolonged, high pressure needed to test the treatments of interest. In the event of a wet spring, it may be possible to manipulate the timing of the movement with the application of herbicide to kill volunteers, regrowth and stubble.

Trial layout must take into consideration the distribution of the RGB population in the canola paddock. If necessary, blocks may have to be discontinuous to ensure adequate RGB activity to test the treatments.