Does aphid feeding cause yield loss in unstressed determinate canola?

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Key messages

Aphids can cause yield loss to unstressed canola, however, they need to be present on a flowering spike from flowering.

Aphid control when 20-50% of flower spikes were infested prevented yield losses.

Background

It is estimated that $16 million dollars is spent annually (Murray *et al.* 2013) for the control of aphids in canola crops in Western Australia. However, field trials conducted by DAFWA during the 1990's found that canola cultivars compensated for aphid feeding damage by producing more racemes and yield loss only occurred in moisture stressed canola crops (Berlandier and Cartwright 1998; Berlandier and Valentine 2001; 2003). Agronomists suggested that the indeterminate cultivars used in these trials were able to compensate for feeding damage better than determinant cultivars which are mainly grown today.

In 2011, trials were conducted to determine if aphid feeding damage can induce yield loss in canola under good growing conditions. These trials were conducted on determinate and indeterminate cultivars. When aphids were introduced pre-flowering, both cultivars had up to 75% yield loss compared to the control. In 2012, trials were repeated with the aim to find a threshold for spraying for aphids that arrive in canola crops at flowering. However, due to the variability in yield of the canola plants there were no significant yield differences between sprayed and unsprayed treatments. Therefore in 2014, we decided to repeat this experiment.

Aims

To determine if aphids cause yield loss to un-stressed canola at flowering

Method

Because aphid movement in the field is variable, a small scale experiment conducted in Albany using aphid proof cages in a glasshouse was used. This allowed the simultaneous introduction of cabbage aphids (*Brevicoryne brassicae*) to plants. Canola cultivar ATR Gem was grown in pots as per Brennan and Bolland (2007), to minimise variability in growth between plants.

Five aphids were placed on the flower buds on the top of the main stem of each canola plant at 10% flowering. Previous trials suggest that the threshold for aphid control is 20% or more of flowering spikes infested with aphids (Berlandier and Valentine 2003). Aphids were controlled using alphacypermethrin (100gai/L) applied at horticultural rates when the aphid populations had increased to cover 20, 50 or 90% of the flowering spikes.

Treatments

1. Canola with no aphids
2. Canola with aphids not controlled
3. Canola with aphids sprayed when 20% of flowering spikes were infested with aphid colonies of 2.5 cm or more
4. Canola with aphids sprayed when 50% of flowering spikes were infested with aphid colonies of 2.5 cm or more
5. Canola with aphids sprayed when 90% of flowering spikes were infested with aphid colonies of 2.5 cm or more

Results

The trials were conducted under glasshouse conditions in the absence of any predation and temperatures were also elevated by 5 to10ºC compared to the exterior of the glasshouse. This means the aphid populations were able to increase at a faster rate than is likely to be observed in the field.

No difference in branching

There was no significant treatment difference in the number of branches produced by the canola plants between treatments. This suggests the canola plants in aphid treatments were not producing more branches to compensate for feeding damage.

Yield loss?

Canola with aphid colonies had fewer pods on the main stem when compared to the nil aphid treatment (Figure 1). The aphid colonies were observed to coat the main stem and caused flower abortion. However, if the aphid colonies extended to pods that were already formed, these pods were not observed to abort.

If aphids were controlled there was no significant difference in the number of pods on the first order branches (Figure 1). In the uncontrolled treatments, aphids colonised at least 80% of all first order stems leading to increased flower abortion and less pod formation (Figure 1).

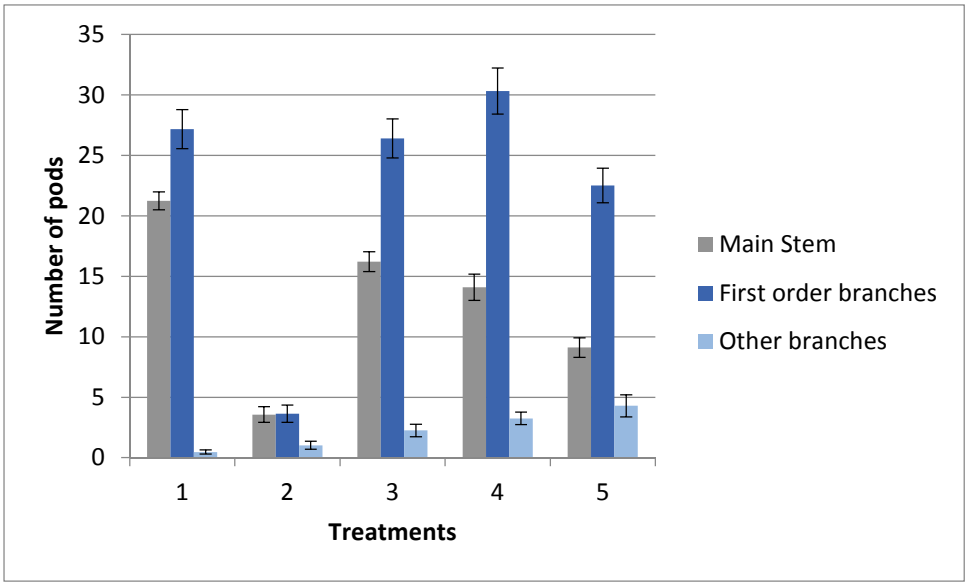

Figure 1: Number of pods on branches of canola plants ± standard error

All canola plants exposed to aphids produced significantly less seed on the main stem. According to Seymour (2011) the main stem is a major contributor to yield in low rainfall environs, however, it is only a minor contributor to the overall seed production of a canola plant in high rainfall areas. The first order branches produce the majority of the yield for canola in high rainfall environments. In this case, canola plants in the uncontrolled treatment and the late sprayed treatments produced significantly less seed (96% and 20% less) on the first order branches than the no aphid treatment.

Conclusion

Canola plants of the ATR Gem cultivar do not compensate for aphid feeding by producing more branches.

If aphid colonies are present from flowering, they do cause fewer pods to be produced on the racemes (flowering spikes) they have colonised. Consequently, these racemes have a lower yield.

Aphid control when 20-50% of flower spikes were infested prevented yield losses. Canola yield when control was applied at the 90% of flower spikes infested timing was much greater than no control but still resulted in about 20% yield loss under these conditions.

However, these findings are from a glasshouse trial where aphids were able to reproduce in the absence of predators and occurred in higher densities than may be found in the field. Consequently, these findings may not be the same in field grown canola. Further field trials are planned.

Key words

Aphid, Brevicoryne brassicae, cabbage aphid, canola, yield

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