Can Bees Increase Crop Yields?

Background

Bees are well known for their honey production but they also have a role in pollination of many plants. This ability, as a pollinator, can result in significant crop yields. Many overseas countries use bees primarily as crop pollinators, in South Australia they have been used on horticultural crops.

There has been limited emphasis placed on the specific role bees may play in increasing legume cop yields and how to manage the bees for maximum pollination impact.

What was done?

Several trials using faba beans and canola were set up at Bellevista, KI to evaluate the benefit of yield and pod development from the introduction of bees and the management of the pollination process.

1. Broadacre Treatments: Farah Faba beans were seeded at 120 kg/ha on the 15th May 2006 with 80 kg/ha of DAP (20% with the seed and 80% below the seed). 16 hives were placed at strategic locations over the 35 ha paddock (hives at this rate is considered to be grossly under-pollinated). An exclusion area was constructed with light shade cloth to have areas that bees (and other natural pollinators) would not have access to.

2. Saturation Trial Plots: This 3ha trial focused on varied crop-row spacing and a range of plant densities per linear meter. Historically croppers have increased seeding rates to try and increase overall yields. However, the closer bean plants are, the more difficult it is for bees to have access to flowers for pollination. Farah faba beans were seeded on the 10th June with 100 kg /ha DAP. The bees were introduced at 4 hives/ha.

The dry conditions had a significant impact on the loss of top flowers in all treatments.

Results

1. Broadacre Trial: The percentage of pods per stem was counted on 1st November in both the control (bee exclusion area) and the area open to bees and feature in *Table 1*.

Table 1: Percentage of pods per stem

Treatment	No. stems and total No. pods*	4 seed pods	3 seed pods	2 seed pods	1 seed pods	Total No. seed	Average No. seed per stem
Bee exclusion	198 bearing stems with 257 pods	29	17	51	31	598	3.02
Open Bee Access	120 bearing stems with 497 pods	54	123	130	107	1,144	9.53

* Note stems were selected from the same, randomly selected, sized area in both the "bee exclusion" and "open bee access" sites. However when the trial was set up the bee exclusion areas were established on the areas of better plant germination and growth. Hence the higher number of bearing stems.

Table 1. demonstrates that the inclusion of bees on the faba bean plot significantly increased the number of seeds set per stem due to the improved pollination. The bees have resulted in a potential 3-fold increase in yield.

2. Saturation Trial Plots: Due to the dry seasonal conditions, all crop canopy treatments remained open due to the stunted nature of the crop. (i.e. there was no significant differences in canopy densities across row-spacings and plant density treatments). Plants within the exclusion areas (shade cloth exclusion tents) had slightly higher observed soil moisture levels due to the shade effect and wind protection. Beans in the open areas dropped more flowers due to moisture stress. As with the broad acre treatment the top flowers had lower numbers of seeds set possibly due to the dry conditions.

Table 2: Percentage of pods per stem

Treatment	No. stems and total No. pods*	4 seed pods	3 seed pods	2 seed pods	1 seed pods	Total No. seed	Average No. seed per stem
Bee exclusion	130 bearing stems with 325 pods	30	94	80	46	750	5.76
Open Bee Access	80 bearing stems with 322 pods	59	141	144	597	804	10.05

*Note stems were selected from the same, randomly selected, sized area in both the "bee exclusion" and "open bee access" sites. However when the trial was set up the bee exclusion areas were established on the areas of better plant germination and growth. Hence the higher number of bearing stems.

Table 2. demonstrates that the inclusion of bees on the faba bean plot significantly increased the number of seeds set per stem due to the improved pollination with a potential doubling in yield.

Future work will focus on optimization of pollination management techniques to suit our seasonal conditions and crop varieties. Issues such as timing of bee introduction and the density of bees required through the flowering period will be investigated.

Visual differences were noted in the bee area seed set, attributed to bees not getting to all pods, especially as crop progressed i.e. need to increase stocking rate to maximise potential yield.

In 2007 trial work will focus on the optimum 'stocking rate' of bees to maximise pollination whilst still being cost effective.

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Funding/Sponsors:

- Bellevista Property

Take Home Message:

- Bees have an obvious role in honey production, but their role in pollination has yet to be truly measured in broad acre cropping.
- Inclusion of bees, as pollinators, increased crop yield between two and three fold, with no increase in inputs