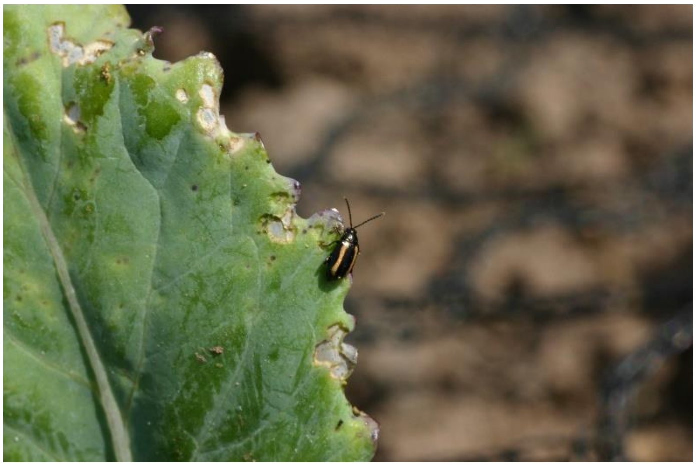
Members' Experiments 2021

Testing a novel method of pest control



Brassicas could be considered one of the most pest prone group of crops, but they are also the most widely grown. A common pest is the flea beetle (*Psylliodes* and *Phyllotreta* spp.) which is widespread and has been on the increase in the last few years. The adults are easily recognisable as small shiny black beetles that jump like fleas when disturbed. They are most of a problem in seedlings where the adult beetles (and to a lesser extent, the larvae) eat at the stems and can kill plants as they emerge by damaging the growing point. The adults can also render brassica salad crops such as rocket, mizuna and mustards inedible by 'peppering' the leaves with lots of small holes.

There are a number of different species of flea beetle that attack brassica plants, at different times of year. The cabbage stem flea beetle (*Psylliodes chrysocephala*) which attacks oilseed rape as it emerges, is perhaps considered the pest with most widespread impact in agriculture. Currently there are few effective treatments available. Neonicotinoids were used extensively until they were banned in 2013, but it has also developed resistance to most other pesticides. In organic gardens, mesh netting is sometimes recommended, but its effectiveness is limited, as it tends to just trap the pest under the netting.

A number of alternative biological treatments are currently being investigated by PhD student, Claire Hoarau at Adams University including use of nematodes, soap sprays and soil-dwelling bacteria (*Bacillus thurengiensis*). NIAB have also been investigating a biostimulant, that is applied as a seed coating developed by Wasware. The biostimulant is made from 'frass' the droppings and insect casings of the maggot of the black soldier fly. These are fed on food waste, giving the product good sustainability credentials. The biostimulant has a high chitin content, which is thought to stimulate the plant's natural defence mechanisms against insect attack, and perhaps other pests such as slugs too. This alternative approach will very little impact on wildlife and non-target organisms, compared to using a pesticide.

Garden Organic were approached by NIAB to trial this new approach with its members. We tested it as a seed coating and by applying it directly to the soil. This was a preliminary trial, with the hope of extending it to do further work in the future. The trial was sent out to 25 people, with 14 people returning results. Demonstration plots were also set up at Garden Organic headquarters at Ryton, although only the soil amendment could be tested at this site, as the seed treatment had not yet received approval for organic certification.

'Green in Snow' mustard was chosen as a test crop. It is an oriental green that is rapidly growing, and often suffers from problems with flea beetle, like many oriental greens.

Methods

At each site, three plots, each 1 m^2 were prepared for direct sowing in mid-May. Four rows with 10 seeds in each row were sown into each plot. Each plot had a different treatment:
Plot 1 – Control treatment
Plot 2 – Biostimulant applied as a soil amendment
Plot 3 – Biostimulant applied as a seed coating

Monitoring Emergence
The emergence of the plants was monitored by counting the total number of plants emerged in the central 2 rows of each plot, and continuing to count until no further plants emerged.

Monitoring pest damage
Pest damage was assessed on a weekly basis, where possible, observing the central two rows in each plot to minimise edge effects. The following scales were used for assessment:

Slugs and flea beetle
1 = no damage,
2 = low (0 – 24% leaf area lost)
3 = moderate (25 – 49% leaf area lost)
4 = high (50 – 75% leaf area lost)
5 = severe (>75% leaf area lost)

Aphids
1 = no damage,
2 = low (0 – 24% leaf area covered)
3 = moderate (25 – 49% leaf area covered)
4 = high (50 – 75% leaf area covered)
5 = severe (>75% leaf area covered)

Harvests
Six participants also provided data on leaves harvested from the plants, separating out undamaged and damaged fractions of leaves and weighing them.

Results

General pest problems at participant sites

We asked some preliminary questions to assess the frequency of pest problems at the growers' sites:

Number of people encountering pest problems at their site

Frequency	Flea beetle	Slugs	Aphids
Never	0	0	0
Occasionally (less than 1 in 5 years)	2	1	0
Sometimes (around 1 in 3 years)	3	1	3
Regularly (most years)	3	4	5
Always (every year)	4	7	5

Flea beetle was a problem with all members. Although it wasn't as frequent a problem as slugs, it was still widespread, with 7 of the 12 members that responded, regularly or always encountering it.

Emergence

Seeds were sown directly, with a median sowing date of 15th May.
The seed coating appeared to slightly reduce the final number of plants emerged. It was difficult to ascertain whether this was a real effect, as there was considerable variation between sites, most of it likely to be caused by slugs, as numbers of plants decreased between taking successive measurements in some cases.

Final number of plants emerged (out of 20)

	Control	Soil Amendment	Seed Coating
Average	11.3	11.9	9.1
Standard deviation	7.2	6.2	6.4

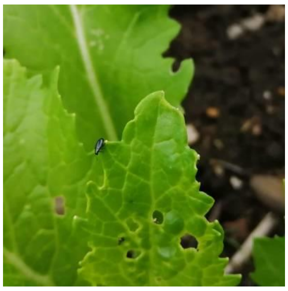
Flea beetle damage

May and June were colder than average, and flea beetle was only observed in small numbers during these months. An observation at Ryton was that flea beetle was very active in nearby radish plots, earlier in April, but then was less active in the following weeks in May, when the trial was established.

In order to obtain an average assessment from different sites sampled at a similar time, results were sorted into order of date, then an average was taken from 6 different sites all clustered between the dates of 8th and 13th June.

Flea beetle damage score (1-5)

	Control	Soil Amendment	Seed Coating
Average	2.2	2.7	1.7
Standard deviation	1.0	1.0	0.5



On average, the seed coating treatment resulted in a small reduction in flea beetle damage, although due to the small sample size, and the large amount of variability, this was not significant (p = 9%, ie. a 9% chance that these results could be attributed to natural variability). Conversely the soil amendment resulted in a small increase in pest damage. Again this result is not significant, and it is difficult to ascertain the reason behind it.

Slug damage

Slug damage was generally at low levels in May (with a few exceptions) but increased slightly in June. There was a large amount of variation, so although there were differences between the treatments, these are unlikely to be significant (p = 60%).

Slug damage score (1-5)

	Control	Soil Amendment	Seed Coating
Average	1.7	1.7	2.0
Standard deviation	0.8	0.8	1.1

Aphids

Aphids were only present at very low numbers, and were absent at most sites, so the data is not presented here.

Harvest

Six of the participants took harvest samples to measure the yields and percentage of crop damaged by pest. These harvests were taken in May, June and July. In most cases, the plants started to flower in July, and the trial was ended.

The soil amendment resulted in a large increase in yield, although the small sample size and high degree of variability meant that this increase was not significant (p=16%). The soil amendment does contain some nitrogen, and at the rate applied, it would have applied the equivalent of 30kg/ha which is only a small boost. Therefore, it may be that the soil amendment had other effects on properties on plant metabolism or soil microbiology that boosted plant growth, although further investigation would be needed to ascertain the reason. The treatments had no effect on the proportion of leaf material that was considered to be damaged which was *c* 35%.

Total harvests taken from plots (g)

	Control	Soil Amendment	Seed Coating
Average	191	507	183
Standard deviation	237	611	213

Conclusions

It was difficult to draw firm conclusions from this small trial. The seed treatment may have caused a small reduction in incidence of flea beetle, but it was difficult to tell whether this effect was real. Flea beetle was only present in low numbers, making it difficult to assess whether the treatments were having an impact. There was also a lot of variability between sites, which with the small

number of samples, often masked any treatment effects. A larger sample size would help to negate this.
The soil amendment appeared to result in a large increase in yield, but again, the large variability made it difficult to conclude whether this was a real effect. The soil amendment contained some nitrogen, this was only a small amount, so it could be some other mechanism that is increasing the yield of the plants.

If we were to repeat this trial, it would make sense to carry it out as an outdoor pot trial, which would be less confounded by slug damage.