Grower Summary

FV 394

Vegetable crops: Development of a screening programme for plant growth enhancement products.

Final 2012

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The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

PLEASE NOTE: The HDC, whilst reporting the results of this independent work, does not advocate or promote the use of the products reviewed in this study for crop protection. It is important to note that:

a) The trials reported in this study are not specifically designed regulatory trials to support a product claim and they have not been through any regulatory scrutiny to assess consistency, level of control and appropriate dose of the products.

b) It is important for growers to remember that before using any product for plant protection purposes always check whether the product is currently approved for the intended use and situation.

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number:	FV 394
Project Title:	Vegetable crops: Development of a screening programme for plant growth enhancement products**.**
Project Leader:	Pat Croft
Contractor:	Stockbridge Technology Centre Research Foundation
Industry Representative:	Martin Evans
Report:	Final
Publication Date:	12/06/2012
Previous report/(s):	None
Start Date:	1st April 2011
End Date:	31st March 2012
Project Cost (Total Project Cost):	£28,200 (£28,700)

Headlines

- The screening of 12 amino acid, micronutrient and phosphate/phosphite products on three crops established that some of the products improved yield and reduced levels of Botrytis in lettuce.

- There were improvements on crop yield for many products in comparison to the control, but there was no statistical reliability in many of the results.

Background

Vegetable growers are faced with increased demand for UK-grown produce in an arena of reduced pesticide availability, increased fertiliser costs, pressure to reduce greenhouse emissions, demands to improve productivity and quality whilst protecting the environment and improving biodiversity. High yields require the management and optimisation of all resources, including N, P, K and micronutrient availability. This project focused on screening plant enhancers (non- NPK macro and micronutrient products).

These products claim to be meeting growers' demands for better yields and crop quality at reduced inputs and costs. Plant enhancers are often categorised as 'snake oils' because of the similarity of their claims but variability in their results. However, it is known that micronutrients are increasingly being identified as crucial to crop productivity and quality (Marschner, 1995). This means that plant enhancers may have an important role to play in crop and yield improvement.

There is currently no formal screening of these products to provide even a qualitative review of plant enhancers for the benefit of growers. A programme of work to address this deficiency would allow growers to identify effective products, as well as inconsistent and ineffective ones.

The aim is to provide a service to the UK horticultural sector that uses recent science, known expertise and grower consultations to equip vegetable growers with better-informed options for crop improvement using plant enhancers.

This project will serve as a starting point to investigate the plant enhancers found to be most successful on a wider soil types and more vegetable crops.

Summary of the results and main conclusions

- Tables 1 to 3 below summarise the recorded effects of the different treatments for each of the three crops (lettuce, carrots and peas). The tables provide a simple comparison of the treatments (NPK and treatment) to the control (NPK only), indicating where the treatments gave a better performance than the control (>) or not (x). The table also indicates were these differences are significant after statistical analysis ($p<0.05$) (+).

- Significant treatment effects were recorded on lettuce, where increases in weight and reductions in Botrytis levels were recorded at harvest.

- In carrots and peas some treatments did improve measurements in comparison to the control plots, but there were no statistically valid improvements.

- It is not possible to determine if the lack of statistical evidence is due to the high variability that is inherent with the products, or if indeed the treatments had not provided additional benefits. It is also possible that the extreme dry conditions experienced for much of the crops (except for the lettuce which was irrigated) may have hindered some of the activity that some of the microbial products may have otherwise produced.

Tables 1-3. Mean measurements per sample per plot. Summarising means for each crop and comparing treatment means to the control mean (x = means are not different, > = treatment better than the control (but not statistically significant), + = treatment statistically better than the control ($p<0.05$)) .

Table 1. Lettuce

	Treatments	Means per plot (20 plants per plot) Weight (g)	No. with *Botrytis*	No. with *Sclerotinia*	No. with tip burn
1	Control (NPK only)	*	*	*	*
2	InCA	>	+	>	>
3	Wormcast Pro	>	+	X	>
4	Omex BioStarter	>	>	>	>
5	Omex Bio Plus	>	+	>	>
6	PLC Colonize AG	X	+	>	>
7	PHC Complete Plus	X	>	>	X
8	TTL Plus	X	+	>	X
9	Serenade	+	+	>	>
10	HYT b	>	+	>	>
11	HYTb + a + c	>	+	>	>
12	Phos Star	+	+	>	>

Table 2. Peas

	Treatments	Means per sample (2 x 0.5m) Numbers of pods	Stem length	Pod weights	Nodule score
1	Control (NPK only)	*	*	*	*
2	InCA	>	>	>	>
3	Wormcast Pro	>	>	X	X
4	Omex BioStarter	>	X	>	>
5	Omex Bio Plus	>	>	>	>
6	PLC Colonize AG	>	X	>	X
7	PHC Complete Plus	X	>	X	X
8	TTL Plus	>	X	>	X
9	Serenade	>	X	>	X
10	HYT b	X	x	>	X
11	HYTb + a + c	>	>	>	>
12	Phos Star	>	>	>	X

Table 3. Carrots

	Treatments	Means per sample (60 carrots) Cavity spot score	Carrot root fly score	Diameter	Length
1	Control (NPK only)	*	*	*	*
2	InCA	>	X	X	X
3	Wormcast Pro	X	X	X	X
4	Omex BioStarter	X	>	X	X
5	Omex Bio Plus	>	X	>	>
6	PLC Colonize AG	>	>	X	X
7	PHC Complete Plus	>	X	X	X
8	TTL Plus	>	X	X	X
9	Serenade	>	X	X	X
10	HYT b	X	>	>	>
11	HYTb + a + c	X	>	X	X
12	Phos Star	X	X	X	X

Lettuce (Frisco)

Yield:

Lettuce treated with Serenade and Phos-Star had significantly heavier lettuce at harvest than the control plots.

The mean numbers of plants with tip burn were recorded at harvest. Treatments that produced lower levels of tip burn were, Inca, Wormcast, Biomex, Biomex plus, Colonise, Serenade, HYT b and HYT a+b and Phos Star, but these differences were not statistically significant.

The percentage of marketable lettuce at harvest was recorded. Phos-Star gave the highest percentage (96%) but this higher level was not significant when compared to the standard NPK treated plots.

Disease:

All treatments produced lower levels of *Botrytis cinerea* than the control plots and this difference was significant for InCA, Wormcast, Biomex Plus, Colonise, TTL, Serenade, HYT b, HYT a + b, Phos-star

All treatments (Except for Wormcast) produced lower levels of *Sclerotinia sclerotiorum* than the standard control at harvest. However none of the differences were statistically significant because of the high variability around the averages for each treatment. Unlike Botrytis,

Sclerotinia was much more clustered in its distribution, which would increase the variability within the data.

Peas (Ambassador)

Yield:

The weight and numbers of pods were recorded. The results showed that several treatments produced higher numbers of pods in comparison to the NPK treated control plots, (InCa, Wormcast, Bioex, Biomex Plus, Colonise, TTL, Serenade, HYT b, HYT a + b, and Phos-Star). However there was high variability around the average weight and numbers for some treatments and this may have resulted in the recorded differences not being statistically significant.

The stem length (per plant) and stem length with pod numbers (per sample plot) were recorded. Although some treatments increased stem length, again differences were not significant. There was no correlation between stem length and pod number

Nodule formation was given a score (out of 10). Biomex Plus, HYT a+b, provided a larger score for nodule formation. But again, there is a large variability in the data. Phos Star scored very low on the nodule score but this product would not be expected to improve this aspect of crop agronomy.

Disease:

Scores were given to powdery mildew in pods sampled; disease levels were too low to determine any treatment effect.

Carrots (Nairobi)

Yield:

The measurements of carrot diameter and length gave no significantof effect of treatment. There was no statistically significant effect of treatment on weight at harvest.

Disease/Pest:

Overall levels of cavity spot were very low during the trial, making treatment comparisons invalid. The dry weather conditions experienced at the start of the crop will have contributed to the low cavity spot levels.

There was also no apparent effect on carrot root fly damage, but again in the trial, levels of damage were relatively low, making treatment comparison difficult to determine.

Further trials should consider increasing numbers of replicates.

Future trials may test products under different environmental conditions. Testing products under less arid conditions, as experienced in the present trial, may provide clearer improvements in terms of product efficacy. Therefore consider irrigating crops if dry spring/summer.

Financial Benefits

The recent government report: The Future of Food and Farming: Challenges and choices for global sustainability, indicates a need for sustainable intensification of production technologies. This will result in pressures from consumers and retailers regarding crop inputs such as pesticides and fertilisers (Foresight, 2011). It is possible that micronutrients may provide sustainable methods of maintaining, or even increasing, yield and quality. It is important for the horticultural industry to begin to understand the growing body of evidence on micronutrient nutrition and that the increasing list of plant enhancement products is tested for their potential benefits on different crops.

Action Points

There are no action points at this stage as further work is required to increase the number of replicates.

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