CONTRACT REPORT FV131

BRUSSELS SPROUTS: TO INVESTIGATE THE POTENTIAL OF THE USE OF A HIGH PHOSPHATE STARTER SOLUTION TO IMPROVE YIELDS AND PREVENT LODGING OF CROPS RAISED IN CELLULAR TRAYS

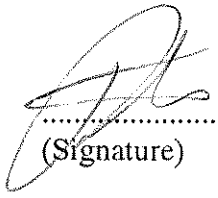
UNDERTAKEN FOR THE HDC
REPORT OF SECOND YEARS WORK

PRINCIPAL WORKER

R W P HIRON

AUTHENTICATION

I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.



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Date 2-12-93.....

Report authorised by ..... M B Wood
(Signature) Project Leader

Date 2/12/93.....

Report:	December 1993
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Project Title:	Brussels sprouts: To investigate the potential of the use of a high phosphate starter solution to improve yields and prevent lodging of crops propagated in cellular trays
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CONTENTS

RELEVANCE TO GROWERS AND PRACTICAL APPLICATION

APPLICATION

Despite the fact that in this trial the starter solution had a slight beneficial effect upon early growth, the two years of testing starter solutions on Brussels sprouts suggests that it is not a technique to be used on this crop at present. However, future research may modify this advice.

SUMMARY

One variety of Brussels sprouts was grown from cellular tray-raised transplants and given either 50 ml of a two percent starter solution of 10:52:17 soluble fertiliser or 50 ml water as a control. These two treatments were also given additional liquid feeds equivalent to 40 kg/ha nitrogen to the base of the Brussels sprouts stems, either as one application one week after planting, or as five feeds during weeks one to five after planting, this was done to ensure that nitrogen was not limiting when the plant was exploiting only a small soil volume. The starter solution increased plant weight by 30 percent during the first month of growth but this was not maintained thereafter. Starter solution did give a constant but statistically non-significant yield increase of sprouts in 30-40 mm grade. The extra nitrogen given as an early liquid supplement did not have any beneficial effect. None of the treatments had any effect on lodging.

EXPERIMENTAL SECTION

INTRODUCTION

Cellular tray-raised transplants were initially introduced for, and taken up by, cauliflower growers in the eastern counties, especially South Lincolnshire. Once the system had been accepted and growers converted to their use then all brassicas grown by those growers were raised by the tray system. This led to a significant proportion of Brussels sprouts grown in the county being raised in cellular trays despite the early observations that such plants were more prone to lodging and sometimes gave a reduced overall yield when compared with drilled or bare-root-transplant-established crops. The HDC funded trial done under this contract in 1992, where three varieties were grown in cellular trays and compared with bare-root plants, confirmed these apparent problems with cellular tray-raised Brussels sprouts.

Work at HRI-Kirton over the two previous seasons had investigated the effect of high phosphate starter solutions on transplanted cauliflowers and had seen significant advantages with them, one explanation for which could be the development of a larger early root system which leads to a more efficient nutrient and/or water extraction. Therefore it was thought that if this was the case, then starter solution-treated Brussels sprouts may develop a root system capable of more efficient nutrient extraction which may compensate for any yield loss inherent in the raising method and if the increased root growth included greater growth of structural roots and not just feeding roots, then the resultant root system may provide better anchorage and stability and thus reduce lodging.

However, the 1992 trial did not show any major potential benefit from using the starter solution on the cell-raised plants. But it was felt that the work should be repeated in 1993 in a modified form as starter solution trials are notoriously variable in the degree of effect achieved. Also, hypotheses concerning starter solutions had evolved since the first trial and needed further testing.

The reason for giving a starter solution is to boost early growth, the high phosphate activating and developing the root system to allow it to utilise broadcast fertiliser more efficiently. In fact the starter solution contains some nitrogen, but only the equivalent of 3.5 kg/ha. It was considered a possibility that the starter solution boost to a transplants root development and could lead to a nitrogen stress when the starter solution nitrogen had been used up but the root system was still exploiting only a very small soil volume.

Therefore the following trial repeated the investigation of the effect of the high phosphate starter solution on one variety of Brussels sprouts but also looked at supplying nitrogen to the plants immediately post-planting to ensure there was no nutrient-induced stress to prevent the expression of the starter solutions effects.

MATERIALS AND METHODS

1 Treatments and trial design

Variety:		Content
Starter solutions:	i	Cell raised transplants plus starter solution (50 ml 2% solution 10:52:17)
	ii	Cell raised transplants plus 50 ml water
	iii	Cell raised transplants plus starter plus five early liquid feeds in weeks 1-6 following transplanting
	iv	Cell raised transplants plus water plus five early liquid feeds
	v	Cell raised transplants plus starter plus one early liquid feed in week one following transplanting
	vi	Cell raised transplants plus water plus one early liquid feed

NB The liquid feeds applied either as one or five weekly feeds put on the equivalent of 40 kg/ha nitrogen in total.

The six treatments were randomised and blocked per replicate. There were four replicates and 30 recorded plants per plot at harvest.

2. Trial diary

Field/Soil type:	40 Acres 4 mixed silt/clay loams
Soil analysis:	pH 7.75 Index: P - 4, K - 3, Mg - 4

Previous cropping:	1991 Narcissus (lifted) 1992 Grass	
Cultivations:	9/11/92	Ploughed Worked with Lely before planting
Fertiliser:		
Base:	5/5/93	150 kg/ha N as Kaynitro
Top:	4/6/93	100 kg/ha N as Nitram
Propagation:	Variety Philemon sown 8 March in 308 cellular trays. Seeds were chitted at 21°C for 24 hrs before being placed in an unheated Venlo glasshouse. Plants were given liquid feeds of 100:200 mg/l $N:K_2O$ as necessary. Fosetyl-aluminium (as 5 g/m² Aliette) against downy mildew and damping-off, and tolclofos-methyl (as 2.25 g/m² Basilex) against damping-off were applied. Plants were treated with a pre-planting drench of chlorpyrifos (as Dursban 4)	
Planting:	24/5/93	Trial planted
Herbicides:	1/6/93	Propachlor as 9 l/ha Ramrod & Chlorthal-dimethyl as 6 kg/ha Dacthal W-75
	22/6/93	Desmetryn as 1.7 kg/ha Semeron 25 WP applied
Insecticides:	29/6/93	Demeton-S-methyl as 560 ml/ha Campbell's DSM & cypermethrin as 250 ml/ha Ambush C applied
	28/7/93	Demeton-S-methyl & cypermethrin as above
	17/8/93	Demeton-S-methyl & cypermethrin as above
	23/8/93	Methiocarb as Draza applied to pathways
	22/9/93	Methiocarb as Draza applied to pathways
	8/10/93	Pirimicarb as 420 g/ha Aphox & cypermethrin as 250 ml/ha Ambush C applied
Fungicides:	22/7/93	Iprodione as 2 l/ha Rovral Flo & chlorothalonil as 3 l/ha Bravo applied
	12/8/93	Iprodione & chlorothalonil as above
	1/9/93	Chlorothalonil as 3 l/ha Bravo applied

Notes:	13/10/93	Trial harvested and graded

3. Assessments

i Fresh weight of six-plant samples on three occasions.

ii Leaning and lodging.

iii Yield in size grades.

RESULTS AND DISCUSSION

1. Fresh weight of six-plant samples on three occasions

Samples were taken approximately two, four and six weeks after planting. Although there was no dramatic visual differences in the field two weeks after planting, all three treatments which had received a starter solution were heavier than those given water only. They averaged a 33 percent weight increase. This was maintained during early growth as four weeks after planting those given a starter solution were 28 percent heavier than those given water only, but six weeks after planting the difference had dropped to 11 percent. The extra nitrogen given as either one or five liquid feeds had no effect on plant growth and so would suggest that nitrogen was not limiting during this phase with this crop on this occasion.

Table 1 Fresh weight of six-plant samples at three dates

Treatments	Fresh weight (g) of six-plant samples		
	8 June	23 June	7 July
Starter solution (50 ml 2% soln. 10:52:17)	67.9	743	3425
50 ml water	49.4	587	3040
Starter plus 5 early liquid feeds	64.3	707	3436
Water plus 5 early liquid feeds	57.2	583	3065
Starter plus 1 early liquid feed	76.2	793	3543
Water plus 1 early liquid feed	50.4	581	3248
SED (15 df) = ±	5.27	42.4	189.5
Mean of treatments with starter	69.5	748	3368
Mean of treatments without starter	52.3	584	3118
SED (15 df) = ±	3.04	24.5	109.4
Mean of no extra early feeds	58.7	665	3233
Mean of 5 extra early feeds	60.7	645	3101
Mean of 1 extra early feed	63.3	687	3395
SED (15 df) = ±	3.73	30.0	134.0

2. Leaning and lodging

A Brussels sprout plant was deemed to be leaning if the angle of the stem was adjudged to be 45° or more away from the vertical, number per plot were recorded. In the 1992 trial, to get an overall impression of lodging a sample of ten plants per plot were measured for length of stalk and head height above ground and expressed as a ratio. Head height above ground was divided by stem length so that a ratio of 1.00 represented a perfectly upright plant and 0.0 one laid flat on the ground. This latter measurement was not taken in 1993 as there was so little lodging and no effect of treatment. Results are given in Table 2.

Table 2 An assessment of number of plants leaning per plot in the trial

Treatment	No. plants/plot leaning	% Leaning (ang trans)
Starter solution (50 ml 2% soln. 10:52:17)	0	0
50 ml water	0.7	3.7
Starter solution plus 5 early feeds	1.0	6.4
Water plus 5 early feeds	0.3	2.6
Starter solution plus 1 early feed	0.3	2.6
Water plus 1 early feed	0.3	2.6
SED (15 df) = ±		3.99

3. Yield in size grades

This data is given in Table 3. There are no statistically significant effects of any treatment on yield. However, it is interesting to note that all three treatments that had received a starter solution had a higher yield than the water equivalent and that this increase in weight is related to an increase in the 30-40 mm size grade.

Table 3 Yield in size grade

Treatment	Yield t/ha in size grade mm						
	12.5-20	20-30	30-40	>40	Total mkble	Waste	Total biomass
Starter solution (50 ml 2% soln. 10:52:17)	1.05	8.79	5.73	0.01	15.58	4.27	19.85
50 ml water	1.15	8.74	5.09	0.00	14.98	3.20	18.18
Starter solution plus 5 early feeds	1.19	8.53	4.63	0.00	14.35	3.74	18.09
Water plus 5 early feeds	1.04	8.46	4.09	0.03	13.61	4.34	17.95
Starter solution plus 1 early feed	1.01	8.73	5.86	0.08	15.68	3.87	19.55
Water plus 1 early feed	1.09	8.14	5.14	0.02	14.39	4.63	19.02
SED (15 df) = ±	0.187	0.603	0.628	0.038	1.159	1.170	

CONCLUSIONS

1. The starter solution had a beneficial effect of the early growth of Brussels sprouts and a non significant but consistent slight effect of increasing the yield mainly in the 30-40 mm size grade.

2. Giving extra nitrogen to the roots of plants during early growth had no beneficial effect in this trial.

3. None of the treatments affected lodging.

RECOMMENDATIONS FOR FURTHER WORK

1. As more and more experience with starter solutions on transplants is gained, it appears at present, that long term crops such as Brussels sprouts and winter white cabbage, do not respond as dramatically to starter solutions as shorter growing crops such as cauliflowers, therefore it would be interesting to repeat this trial with a responsive crop to see if the early nitrogen feeds can boost the starter solution effect.

2. As mentioned above, some crops seem to respond better to starter solutions than others. For example starter solutions should be recommended for cauliflower but not at present for Brussels sprouts or white cabbage. Starter solutions should be tested on a wider range of crops to enable advice on those which derive most economic benefit from them.

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