HDC Contract FV40c

Improving Onion Crop Establishment
A Continuation
of FV40a Polythene Crop Covers

1993 Report

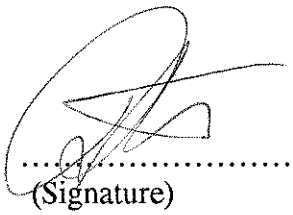
Report:	December 1993
Project Number:	FV40c
Project Title:	Improving Onion Crop Establishment A Continuation of FV40a Polythene Crop Covers
Project Leader:	M B Wood HRI-Kirton, 24 Willington Road, Kirton, Boston, Lincs PE20 1EJ Tel: 0205 723477 Fax: 0205 724957
Research Leader:	R W P Hiron HRI-Kirton
Location of Project:	HRI-Kirton
Project Co-ordinator:	D O'Connor
Date commenced:	May 1992
Date completed:	November 1993
Key words:	Onion sets, establishment, crop covers, starter solutions, transplants, drilling

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.



..... R W P Hiron
(Signature)

Date 30:11:93

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

Dr M R Shipway
Director of Horticulture Development Division
HRI Efford
Lymington
Hampshire
SO4 OLZ

Date 30/11/93

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APPLICATION

1. If suitable equipment is available serious consideration should be given to using a starter solution on the drilled onion crop.

2. Although in this report the Polytherm covering generally gave slightly better results than polythene, in view of the price difference between the two materials, if covering of onions is considered then polythene sheeting should be the advised material.

SUMMARY

Minisets were produced in the summer of 1992 and stored at 30°C overwinter. In the spring of 1993 the minisets were used in a trial to look at the effects of starter solutions and crop covers on enhancing the performance of onion crops established by drilling and, planting sets or transplants.

Starter solutions had a large effect upon the early growth of the drilled crop which was reflected in a yield increase at harvest. The starter solution also increased the early growth of the set crop but this had no beneficial effect upon yield. The starter solution used on the transplanted crop had no effect at all. However, yields of the set and transplanted crops in this trial were so high that the potential to demonstrate advantages to be gained with starter solutions on them may not have been available.

Two crop covers were used in the trial, polythene and Polytherm sheeting, the latter was included as a material with greater heat retention qualities. Both materials had a beneficial effect on early growth of sets and drilled crops, Polytherm generally performed better than polythene but not in all cases.

INTRODUCTION

The yield enhancing potential of high phosphate starter solutions for drilled crops has been demonstrated in commercial and HDC funded work (eg FV41: Drilled horticultural crops: starter fertilisers). Polythene covers are known to advance onion emergence and early growth as a result of soil warming, moisture retention and wind protection. More recently the potential of heat treated small sets which may have the potential to be drilled using conventional drills such as a Stanhay has been reported from HDC funded work (FV86: Bulb onions: evaluation of a technique to produce mini sets and test them for onion yield and quality). However, the effects of putting these techniques together has yet to be researched and that is the objective of the trial reported here, using three crop establishment methods; seeds, small sets and transplants.

MATERIALS AND METHODS

1. Treatments

i Seed drilled by Stanhay Singleair drill
ii Seed drilled by Stanhay drill plus starter solution
iii Seed drilled by Stanhay drill plus starter solution then covered with an unperforated polythene sheet
iv Seed drilled by Stanhay drill plus starter solution then covered with Polytherm sheet

v Small sets less than 12 mm diameter hand planted (5 cm spacing)
vi Small sets hand planted plus starter solution
vii Small sets hand planted plus starter solution then covered with unperforated polythene
viii Small sets hand planted plus starter solution then covered with Polytherm

ix Multi-seed transplants (25 cm spacing)
x Multi-seed transplants plus starter solution
xi Multi-seed transplants plus starter solution then covered with unperforated polythene
xii Multi-seed transplants plus starter solution then covered with Polytherm

The 12 treatments were fully randomised and blocked per replicate and there were three replicates. In addition to the above, their was also a small observation on drilling the small sets with the Stanhay 876 belt drill using belts for maize seed but which had been adapted at Stanhay Webb Ltd.

NB The starter solution for sets and drilled plots was 18.6 ml/m of row of a 35% solution of 10:52:17 N:P:K placed to the side and just below the seed/set, but for transplants it was 50 ml of a 2% solution of 10:52:17 put in the planting hole. These two systems are different both in the amount of NPK used and where the nutrient is placed but have been specifically developed for the two different systems, drilling and transplanting. No adjustments to base nitrogen was made to allow for the discrepancy between the two different starter solutions as the difference was small and nitrogen was not considered to be limiting on the site used.

2. Crop Diary

Crop:	Onions	
Field/soil type:	Asplands 1/Gley soils/coarse silty alluvial	
Soil analysis:	pH 8.0 Index: P - 4, K - 2, Mg - 4	
Previous cropping:	1991 - Early summer brassicas/spring sown wheat 1992 - Grass	
Cultivations:	13.11.92 -	4 tonnes/ha ground limestone applied
	24 & 25.11.92 -	Ploughed
	7.3.93 -	Trial area bedded out
	8.3.93 -	One pass Lely Roterra pre-planting

Fertiliser:	Base:	28.2.93 -	90 kg/ha nitrogen as Kaynitro applied
	Top:		None
Mini-set production:		8.4.92 -	102 Hassy 308 plastic trays sown cv Hysam 4/5 seeds/cell
		10.7.92 -	Drying off commenced
		3.9.92 -	Sample cleaned
		9.11.92 -	Placed into 30°C store until planting
Multi-seeded transplant propagation:		28.1.93 -	Hysam sown in 308 plastic trays 5/6 plants/block and grown with heat
Planting/drilling:		8.3.93 -	Drilled mini-set demo area with Stanhay 876 Drill - 5 rows/1.83 m wide/bed
		10.3.93 -	Drilled seed treatments with Stanhay Singleair Unit. Guard and discard beds also drilled. Planted set trmts by hand after starter solution application. All four rows to a bed.
		29.3.93 -	Transplant treatments planted four rows per bed.
Herbicides:		12.3.93 -	Diquat & paraquat applied as Farmon PDQ at 2 l/ha plus propachlor as 9 l/ha Ramrod Flowable and pendimethalin as 1 l/ha Sovereign.
		31.3.93 -	Chlorbufam and chloridazon applied to transplants only as Alicep at 4.5 kg/ha.
		7.5.93 -	Coltsfoot and thistles treated with glyphosate as Roundup 50% mixture painted on.
		19.5.93 -	Chlorbufam and chloridazon applied to all but transplants as Alicep at 4.5 kg/ha.
		5.6.93 -	Ioxynil as ½ rate Totril applied at 1.4 l/ha
Insecticides:			None
Fungicides:		3.5.93 -	Chlorothalonil as Bravo 500 at 2 l/ha applied
		20.5.93 -	Chlorothalonil as Bravo 500 at 2 l/ha applied
Irrigation:			None
Notes:		12.3.92 -	Relevant drilled and set plots covered with plastic or Polytherm
		1.4.93 -	Relevant transplant treatments covered
		6.5.93 -	poly covers off

3. Records Taken

i Crop diary
ii Final stand count
iii Fresh wt. of samples on two occasions
iv Harvest and yield data
v Photocopy records on one occasion

RESULTS AND DISCUSSION

1. Final stand counts

Basically all systems established well and were close to achieving the target population of 45 plants per square metre (82 per metre of bed). The transplants had a slightly higher population but this was consistent across all transplant treatments. Starter solution and covers had no effect on population in the recorded area but it was observed that covers could damage plants if left on too long. The data is presented in Table 1.

Table 1 Final stand counts taken 7 June

Treatment	No. plants/m bed	No. plants/m² (target 45/m²)
Seed drilled	86.3	47.2
Seed drilled + starter	88.7	48.5
Seed drilled + starter + polythene	82.3	45.0
Seed drilled + starter + Polytherm	89.0	48.6
Sets	71.0	38.8
Sets + starter	76.0	41.5
Sets + starter + polythene	76.7	41.9
Sets + starter + Polytherm	79.0	43.2
Transplants	94.7	51.7
Transplants + starter	94.0	51.4
Transplants + starter + polythene	98.7	53.9
Transplants + starter + Polytherm	93.7	51.2
Means of systems		
System	85.6	46.8
System + starter	86.2	47.1
System + starter + polythene	82.6	45.1
System + starter + Polytherm	87.2	47.7
Seed	86.6	47.3
Sets	75.7	41.3
Transplants	95.3	52.1

2. Fresh weight of 25 plant samples on two dates

These results are given in Table 2. The starter solution had its largest effect on the drilled crop (100% increase) and a lesser effect with sets (50% increase) but little effect on the transplant crop (8% increase).

Plants grown under Polytherm were generally slightly bigger than those under polythene but both had a very large effect on the drilled crop (up to 85% increase) and sets (up to 120% increase) and a large but less impressive effect on transplants (up to 45% increase).

As would be expected, the transplant had the largest biomass but was closely followed by sets.

Table 2 Fresh wt of 25 plant samples on two occasions

Treatment	Fresh wt (g) 7 June	9 July
Seed drilled	45.3	1295
Seed drilled + starter	90.4	1570
Seed drilled + starter + polythene	138.2	2178
Seed drilled + starter + Polytherm	167.8	3327
Sets	179.9	3150
Sets + starter	271.9	3558
Sets + starter + polythene	536.5	4742
Sets + starter + Polytherm	608.0	5392
Transplants	401.1	4300
Transplants + starter	434.7	4107
Transplants + starter + polythene	664.0	4955
Transplants + starter + Polytherm	626.5	5085
Means of systems		
System	212.4	2886
System + starter	265.7	3078
System + starter + polythene	446.2	3958
System + starter + Polytherm	467.4	4399
Seed	110.9	2093
Sets	419.0	4307
Transplants	501.9	4460

3. Harvest date and yield data

This data is given in Tables 3 & 4. Transplants harvested about one week before the sets which were about a week ahead of the drilled crop. The results show a non-significant trend for the starter solution to advance harvest date in drilled and set crops but not with transplants. Starter plus polythene does significantly enhance harvest date with drilled and sets but again there was no effect on transplants. Further, with drilled- and set-raised crops there was a non-significant trend that Polytherm advances harvest date more than polythene whereas transplants appear to show the opposite.

Total marketable yield is given in Table 3 and the breakdown of this into size grade is shown in Table 4. The starter solution has a large effect on the drilled crop but not on the sets or on the transplants. However, care must be taken not to assume from these results that starter solutions have no potential on sets or transplants as crop yields were so high in this trial that potential for yield increases may just not have been available.

The covers, had an effect, although not statistically significant, on the drilled crop, but had a large effect on sets. Covering had no effects on transplants. The recorded marketable yield of transplants was compounded by a large percentage of waste. This waste was mainly softness/rotting of the necks and some bolting and seems to have been a component of the system rather than caused by any treatment as it is relatively unaffected by starter solution or polythene.

Plant population at harvest was relatively uniform and unaffected by treatment. However, if those given are compared with the emergence data in Table 1 then the drilled crop and sets relate quite closely but by August the transplanted crop seems to have lost a proportion of the plants that were recorded in June.

As the plant populations at harvest were so uniform the differences in total yield should be reflected by differences in size grade proportions and this is borne out by the data in Table 4.

Table 3 Harvest date and yield data

Treatment	Date of 50% diedown	Marketable yield t/ha >40 mm diam bulbs	Waste t/ha	Plant population pl/m²
Seed drilled	9 September	58.1	1.8	42.9
Seed drilled + starter	5 September	69.0	1.2	44.8
Seed drilled + starter + polythene	3 September	73.2	1.2	40.2
Seed drilled + starter + Polytherm	29 August	77.5	1.1	44.6
Sets	2 September	71.4	1.6	37.2
Sets + starter	28 August	72.4	3.6	39.4
Sets + starter + polythene	24 August	82.1	4.0	41.6
Sets + starter + Polytherm	20 August	78.6	3.6	41.9
Transplants	20 August	67.5	10.9	41.8
Transplants + starter	20 August	70.2	9.1	37.0
Transplants + starter + polythene	19 August	65.9	14.2	40.6
Transplants + starter + Polytherm	24 August	73.8	13.1	41.7
SED (21 df) = ±	3 days	4.79		2.66
Means of systems				
System	31 August	65.7	4.8	40.6
System + starter	28 August	70.5	4.6	40.4
System + starter + polythene	26 August	73.7	6.5	40.8
System + starter + Polytherm	25 August	76.6	4.5	42.7
SED (21 df) = ±	1.7 days	2.77		1.54
Seed	4 September	69.3	1.3	43.1
Sets	27 August	76.1	3.2	40.0
Transplants	21 August	69.3	11.8	40.3
SED (21 df) = ±	1.5 days	2.40		1.33

Table 4 Breakdown of marketable yield diameter size grade

Treatment	Marketable yield in size grade t/ha 25-40 mm	40-60 mm	60-80 mm	80+ m
Seed drilled	0.6	13.5	41.1	3.6
Seed drilled + starter	0.4	10.2	52.0	6.8
Seed drilled + starter + polythene	0.1	6.9	49.7	16.5
Seed drilled + starter + Polytherm	0.2	7.7	54.0	15.7
Sets	0.1	4.9	44.8	21.7
Sets + starter	0.2	5.4	44.9	22.1
Sets + starter + polythene	0.1	3.7	49.5	29.0
Sets + starter + Polytherm	0.1	5.5	49.0	24.0
Transplants	0.2	3.4	49.9	14.2
Transplants + starter	0.1	4.6	48.7	16.8
Transplants + starter + polythene	0.0	2.7	43.9	19.3
Transplants + starter + Polytherm	0.1	2.2	45.6	26.0
SED (21 df) = ±	0.1	1.62	4.70	5.29
Means of systems				
System	0.3	7.3	45.2	13.1
System + starter	0.2	6.7	48.6	15.2
System + starter + polythene	0.1	4.4	47.7	21.6
System + starter + Polytherm	0.1	5.1	49.5	22.0
SED (21 df) = ±	0.06	0.94	2.71	3.05
Seed	0.3	9.6	49.2	10.6
Sets	0.1	4.8	47.1	24.2
Transplants	0.1	3.2	47.0	19.1
SED (21 df) = ±	0.05	0.09	2.35	2.64

4. Photocopies of onions samples from each treatment 8 June

Single plant photocopy records of each treatment are given in Appendix 1, and these should be viewed in conjunction with Table 2 where the fresh weight of samples taken on 7 June are listed. These confirm, visually, the findings recorded earlier that during early growth the starter solution had an effect on both drilled- and set-established crops as did polythene and Polytherm covers whilst the effect on transplanted crops was not so great.

5. Observations on small sets drilled with Stanhay 876 belt drill

A sample of the small sets to be used in this trial was sent to Mr M Pettifer at Stanhay Webb Ltd at Exning, Cambridgeshire who arranged for a set of maize belts to be repunched to accommodate the sets and tested them on their trial test bed. This was done and a small number of plots were drilled at HRI Kirton with sets. However, they were not recorded because the belts quickly became deformed as there was so little material between the holes. However it is the opinion of Stanhay Webb that these small sets could be drilled with special units that have been used in the past for drilling peanuts. At the time of writing this report Stanhay Webb Ltd have reported success with a sample of small sets and the 'Peanut Unit'.

CONCLUSIONS

1. Starter solution had a growth promoting effect on the early growth of a drilled crop and a lesser effect on the set crop but no effect on the transplanted crop this was reflected in the subsequent yields of the drilled and transplanted crops but with no enhancement of yield of the set crop. However crop yields were so high in this year of trialling that opportunity for crop yield increases with sets or transplants may not have been available.

2. Polythene and Polytherm covering materials both had a beneficial effect on early growth of sets and drilled crops. Polytherm generally performed slightly better than polythene, but not in all cases, and in view of the price difference between the products polythene should be used as a covering material for onions if a crop cover is required.

RECOMMENDATIONS FOR FURTHER WORK

1. The trial should be repeated for a second year in which hopefully yields would be more normal and that the performance-enhancing potential of starter solutions and crop covers on sets and transplants could be determined. If the trial was repeated then it is suggested that Polytherm be dropped as a treatment and perhaps replaced by pre-emergence irrigation as developed at HRI-Wellesbourne in project FV40.

ACKNOWLEDGEMENTS

Thanks are due to Miss Jane Bowtell and Miss Sally A Minns for excellent technical assistance in planning, planting and recording this piece of work. Also to Mr Andrew Mead of HRI-Wellesbourne for assistance with the statistical analysis of the data and interpretation of it.

Appendix 1

Photocopies of onion seedlings

PLANTS FROM THE DRILLED CROP 8 JUNE

SEED

SEED + STARTER

SEED + STARTER
+ POLYTHENE

SEED + STARTER
+ POLYTHERM

PLANTS FROM THE SET CROPS 8 JUNE

SET

SET + STARTER

SET + STARTER
+ POLYTHENE

SET + STARTER
+ POLYTHERM

PLANTS FROM THE TRANSPLANTED CROPS 8 JUNE

TRANSPLANT

TRANSPLANT + STARTER

TRANSPLANT + STARTER + POLYTHENE

TRANSPLANT + STARTER + POLYTHERM