CONTRACT REPORT C220 (FV86)
EVALUATION OF MINI-SET FOR DRY BULB ONION PRODUCTION

UNDERTAKEN FOR THE HDC

COMMERCIAL IN CONFIDENCE

Report to:	Horticultural Development Council 18 Lavant Street Petersfield Hants GU32 31W
ADAS (Now HRI-Kirton) Contract Manager	Mr M B Wood Kirton EHS Government Buildings Willington Road Kirton Boston Lincs PE20 1EJ
Period of investigation:	May 1990 - Oct 1992
Date of report issue:	Dec 1992
Principal workers:	R W P Hiron, PhD Horticulturist (author of the report)

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.

.....
Signature

R W P HIRON

Date ..... 2/12/92 .....

Report authorised by

.....
Signature

M B WOOD
(Contract Manager on behalf of Dr M R Shipway,
Head of Horticultural Development Division,
Horticulture Research International)

Date ..... 2/12/92 .....

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EVALUATION OF MINI SETS FOR DRY BULB ONION PRODUCTION

Summary

In 1990 at approximately 14 day intervals, sowing of multiseeded transplants from late March to mid July were grown on in the glasshouse to see how late sowings would respond to the bulbing stimulus and produce uniform mini sets of less than 8 mm diameter. The results showed that all sowings up until 21 June resulted in similar mini-set production whilst a sowing on 12 July did not. The following year the cut off date was narrowed to the first week of July.

In 1991 mini-sets from three of the 1990 sowings: 29 May and 6 & 21 June, were compared for dry bulb onion production with drilled, transplanted and 12-18 mm (normal) set-established crops. The mini-sets compared very unfavourably with an early poor yield of small bulbs, especially when compared with transplanted and normal-set crops.

In 1992 a small trial was set up to look at the effect of overwintering set storage temperature and pre- planting plant growth hormone dips on mini sets to try to improve their potential. The dips had no effect but 27°C storage of mini sets resulted in large yields of large bulbs of high quality.

Object

To determine the effect of sowing date on mini-set production, to compare mini-sets with conventional dry bulb onion crop production systems and investigate ways of making the system viable.

Introduction

The climate in Lincolnshire is marginal for successful bulb onion production and is often responsible for drilled crops giving poor yields.

For this reason drilling of seed has given way to establishment from multiseeded modular transplants and more latterly the use of sets. The transplants certainly gave reliable and consistent good yields at an early harvest date, but, they were relatively expensive and more importantly, very slow to establish compared with drilling . The popularity of sets really took off when the variety Sturon which is traditionally grown from sets was introduced into Lincolnshire for its skin quality. Sets are still expensive, being bought by weight, but can be established at near drilling speeds using converted bulb or potato type planters. Therefore the use of sets has largely replaced the use of multiseeded transplants. But establishment from sets still has its problems as there must be good set to soil contact for optimal growth, also set planters can only achieve random spacing.

In 1988, it was observed that multiseeded onion transplants, which are normally sown in January and planted in early April, would, if left in their cells until July/August produce very small but uniform sets which soon became known as mini-sets, because they are mostly less than 8 mm diameter. It was thought that these mini sets were uniform and small enough to be drilled by a bean drill (eg Jumbo Stanhay units fitted with wide-hole belts) which would ensure good set to soil contact and good spacing. It was also realized that because the sets were being raised under controlled conditions - in modular trays under glass - they could be regulated by with-holding water when they reached the desired size.

Exploitation of the idea then lapsed for several years. The following report covers the small amount of work that has been done on this topic over the last three years and which has received some support from the HDC.

Materials and Methods

1. Site

HRI Kirton is located in the village of Kirton situated five miles south of the town of Boston in Lincolnshire. The facilities used included, the vegetable propagation unit and a modern block of Venlo glass to sow and grow the multiseeded transplants, cleaning and grading lines as well as controlled temperature storage cabinets.

The 1991 field trial was grown in the field designated Lane 2 on the Northern (lighter silt) side of the farm and the 1992 trial on Newland 2 which was on newly acquired light silt land some 600 m distance from the main farm block at their nearest points.

2. Trial design and treatments

i. The 1990 Trial: Effect of sowing date on mini set production.
This was a simple non-replicated observation to obtain both data and material for subsequent experimentation.

12 trays of the variety Hyton were sown at 6/7 seeds per cell on the following 11 dates:

14 and 27 March
10 and 27 April
9 and 29 May
6 and 21 June
12 and 27 July
3 August

ii. The 1991 trial: This was a simple comparison of six production systems at each of two establishment dates, arranged as a three-replicate split-plot design with establishment date as the main-plot treatment and production system as the sub-plot

treatment. Therefore, each replicate contained 2 main-plots which each contained 6 sub-plots, giving a total of 36 plots.

a. Systems:

1. Mini-sets raised from 29 May 1990 sowing of cv Hyton
2. Mini-sets raised from 6 June 1990 sowing of cv Hyton
3. Mini-sets raised from 21 June 1990 sowing of cv Hyton
4. Drilled crop of seed of variety cv Hyton but 1991 seedlot
5. Multiseeded transplant established (sown 29.1.91) using same seed as for drilled crop
6. Conventional 12-18 mm sets of cv Hyton raised at Kirton using same seed as for mini-sets

b. Establishment dates

1. Mid March
2. Early April

iii. 1992 Trial: Effect of overwinter storage temperature and preplanting dips on the yield of onion mini-sets.

This was a three replicate randomised block design using mini sets raised in 1991, and having two overwintering set storage regimes, four preplanting dips.
Therefore, 2 x 4 x 3 = 24 plots.

a. Overwintered mini-set storage temperatures

1. 5°C
2. 27°C

b. Preplanting in dips

1. Untreated
2. Water
3. Gibberelic acid

4. Kinetin

3. Records taken

i 1990 Trial: Crop diary, weight of mini sets post cleaning and grading.

ii 1991 Trial: Crop diary, onion yields by weight and number in size grades after drying and grading

iii 1992 Trial - as for 1991 trial

4. Trial diaries

i. 1990 Trial

General note:

All sowings were made in GPG 308 trays using Bulrush compost. Target sowing rate was 6 seeds per cell. Germination at 21°C for 10 days. All sowing received an etridiazole (Aaterra) drench two weeks after sowing. Growing regime post germination was in Venlo glasshouse at ambient.

All sowings were fed as per normal practice taking into account the time of year when sown. Feeding continued until the onset of sufficient top growth which was decided upon by the propagator.

Sowing dates: as per treatments

Watering stopped: 27 July for sowings 1-5 (ie 14 Mar-9 May)
20 August for sowings 6 & 7 (ie 29 May and 6 June)
6 September for sowing 8 (ie 21 June)
24 September for sowings 9-11 (ie 12 July-3 August)

Mini sets cleaned: Using bulb cleaner
20 August for sowings 1 - 5 and kept at ambient
6 September for sowings 6 & 7 and kept at ambient
24 September for sowing 8
NB The last three sowings were not cleaned as they did not bulb sufficiently.

Fungicides: 27 November all cleaned, sampled and netted mini-sets were dipped in benomyl as Benelate (1 kg/1,000 l), dried thoroughly, then weighed.

Overwinter /storage: In chitting trays in controlled temperature cabinet at 5°C

ii. 1991 Trial field diary

Field/Soil Type: Lane 2 / course silty marine alluvium

Previous cropping: 1988 Grass
1989 Brassica
1990 Grass

Soil analysis: pH 7.1, Phosphate index 4, Potassium index 2, Magnesium index 3.

Cultivations: 17 January, ploughed east - west
Early March, bedded out north - south
25 March + 10 April, beds prepared with two passes of Lely Roterra

Fertiliser: 13 March, 320 kg/ha Kaynitro (25:0:16)

Sowing/planting: 25 March and 10 April

Insecticides: 17 July, cypermethrim applied as Abush C

Fungicides : None

Herbicides: 10 April, sets and drilled of first planting sprayed with Propachlor plus Chlorthal Dimethyl as Ramrod plus Dacthal. Transplants of first planting received half rate Chlorburam plus Chloridazon as Alicep.

18 April as above on second sowing.
1 June full rate Alicep on all plots except transplants which received Half rate.

Irrigation: None.

iii. 1992 Trial

Mini sets

production: 21 June 1990 GPG 308 trays sown grown at above
5 August 1990 watering ceased
29 August 1990 sets cleaned
21 September 1990 sets at 5°C
8 November 1990 sets dipped in Benlate dried thoroughly
11 November 1990 sets returned to 5°C
2 December half of 1990 sets removed to 27°C
25 March 1990 sets treated with dips (see treatments) then dried thoroughly

Field/soil type: New Land 1 / course silty marine alluvium

Soil analysis: pH 7.2 phosphate index 4, potassium index 2, magnesium index 3

Previous cropping: 1990 Grass
1991 Grass

Cultivations: 18 October 1991, subsoiled

5 December 1991, lime applied as per analysis : 4 tonnes/acre on low pH, areas and 2 tonnes/acre on rest

11 February 1992 ploughed E-W

Worked with Lely Roterra immediately before planting

Fertiliser: Base: 7 April 1992 ICI No 7 (16:8:24) applied at 90 kg/ha N, all in base

Planting: 8 April 1992, trial planted by hand

Herbicides: 22 April 1992 Pendimethalin as 1l/ha Stomp and Propachlor as 9l/ha Ramrod applied

15 May 1992 Chlorobufan and Chloridazon applied as 1/2 rate Alicep at 2kg/ha

Insecticides: Delthamethrin as Decis applied

Fungicides: None applied

Irrigation: None applied

Harvest: 4 August 1992 all 5°C stored mini-sets treatments lifted

27 August 1992 all 27°C stored mini-sets treatments lifted

Results and Discussion

I. 1990 Trial: Effect of sowing date on mini-sets production

It was important to establish the latest possible sowing dates for mini-sets, as, if it is to be a viable production method the mini-sets would have to be raised when vegetable transplant glasshouses were generally empty (ie June - October) the results

in Table 1 show very uniform production as recorded by weight from sowing from the 14 March to 21 June but sowing on or after 12 July failed to produce mini sets.

As a supplementary observation the following year the period from 21 June to 12 July was investigated with sowing every 2 - 3 days. Again production was very uniform but with a sharp cut off point after the 5 July.

Therefore, the indications from work carried out so far are that sowings up to the end of June seem to be acceptable for mini-set production.

Table 1. Effect of sowing date on mini-set production 1990

Sowing date 1990	wt (kg) waste from 12 trays	wt (kg) mini-sets from 12 trays
14 March	0.03	7.84
27 March	0.09	7.62
10 April	0.13	7.73
27 April	0.16	7.55
9 May	0.09	7.54
29 May	0.04	7.61
6 June	0.02	7.62
21 June	0.05	7.60
12 July	-	-
27 July	-	-
3 August	-	-

Table 1a. Supplementary information on effect of sowing date on mini-set production 1991

Sowing date 1991	wt (kg) mini sets from 10 trays
21 June	6.22
24 June	6.38
26 June	6.08
28 June	6.15
1 July	6.04
3 July	6.25
5 July	6.45
8 July	4.07
12 July	-

II 1991 Trial: A comparison of mini set with conventional onion production systems

The data pertaining to this trial is given in Table 2 where it can be seen that the mini-sets produced from sowings on three of the dates from the 1990 trial performed very similarly, there were no significant differences between them for any parameter, but, they performed very poorly when compared with the traditional establishment systems, with a very poor marketable yield of small bulbs. This was due in part to an early die-down of an extremely small framed plant. Interestingly, the small frame did lead to a reduction in thick necks.

These results were obviously disappointing, but it was considered worth mounting a small experiment to see if this poor yield could be overcome. It was decided to look at two aspects, pre planting dips of growth hormones and, somewhat more hopefully, set storage temperatures overwinter.

Table 2.

Production system	Date 80% diedown	Mkble yield t/ha > 40 mm size	Wt of outsized smalls 25-40 mm t/ha	No. bolters + thick/necks as a % no. lifted	Plant pop at harvest (pl/m^2)
Mini-sets (29 May 1990 sowing)	29 Aug	18.5	5.5	0.5	48.1
Mini-sets (6 June 1990 sowing)	29 Aug	19.0	6.1	0	53.3
Mini-sets (21 June 1990 sowing)	1 Sept	18.5	5.5	0	49.8
Drilled crop	16 Sept	29.2	1.0	12.0	43.1
Transplanted crop	6 Sept	44.4	0.2	1.4	34.9
Traditional 12-18 mm sets	11 Sept	57.3	0.3	7.0	44.8
SED = ± (20 df)	1.09 (days)	2.22	0.65	2.91	3.92

III 1992 Trial: Effect of over wintering storage temperatures and pre planting dips on the yield of onion mini sets.

The results of the overwinter set storage temperatures are given in Table 4 and the pre planting dips in Table 5. To deal with the dips first, no treatment gave any advantage, in fact with Gibberelic acid there was a yield suppression, and an, interaction between dip and storage temperature as the Gibberelic acid dip severely retarded yield of cool stored mini-sets (Table 3).

However, the effect of storage temperature is quite dramatic as onions from heat stored mini-sets died down nearly three weeks later and very nearly trebled the yields of similarly established crop from low temperature stored mini-sets, also 5°C stored mini-sets had a slightly lower plant population indicating a slightly lower survival rate. There were no thick necks in this trial.

The above findings are exploitable as the idea of using mini-sets could be turned into a viable production method and also the observation of effect of storage temperature on harvest date may be usable to spread the harvest date of large areas of a single variety of set. However, it is felt that some fundamental work is needed to understand the changes in crop physiology that this effect of storage temperatures is bringing about. Therefore, HDC, HRI and the University of Nottingham have bid for an AFRC CASE studentship to investigate this observation.

Table 3. Interaction of Gibberelic acid dip and set storage temps.

Dip treatment	Set storage Temp 5°C	27°C
Untreated	28.9	56.4
Water	25.3	53.5
Gibberelic acid	13.0	53.9
Kinetin	20.7	59.8
SED (14df) = 3.78		

Table 4. Effect of overwintering set storage temperature on bulb onions proceeded from mini-sets.

Storage temp.	Date 80% diedown	Mkble yield t/ha > 40 mm size	No. bolters + thick/necks as a % No. lifted	Plant pop at harvest (pl/m^2)
5°C	3 August	21.9	0	29.7
27°C	22 August	55.9	0	33.0
SED	0.4 (day)	1.89	0	1.30

Table 5. Effect of pre planting dips on bulbs produce from mini-sets.

Pre planting dip	Date 80% diedown	Mkble yield t/ha > 40 mm size	No. bolters + thick/necks as a % No. lifted	Plant pop at harvest (pl/m^2)
Untreated	12 August	42.6	0	32.8
Water	11 August	39.4	0	32.2
Gibberelic acid	15 August	33.4	0	29.7
Kinetin	13 August	40.2	0	30.8
SED (14 DF)	0.6 (day)	2.67	0	1.84

Conclusions

1. Mini-sets can be produced from a late June sowing when glasshouse space is usually available on vegetable plant raising nurseries.

2. If mini-sets are heat treated at 27°C overwinter they can produce large yields of large bulbs with a low incidence of thick necks.

Recommendations for further work

1. It is strongly recommended that the physiology of the changes in sets when stored at different temperatures be studied.

2. Further work to lead to commercial evaluation of mini sets should be considered.

Acknowledgements

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Storage of data

The raw data will be stored at HRI Kirton, Government Buildings, Willington Road, Kirton, Boston, Lincs PE20 1EJ for a period of 10 years. The HDC will be consulted prior to disposal of it.

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