HORTICULTURE RESEARCH INTERNATIONAL

STOCKBRIDGE HOUSE

A REPORT TO THE HORTICULTURAL DEVELOPMENT COUNCIL, 18 LAVANT STREET, PETERSFIELD, HANTS, GU32 3EW

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BEETROOT: EVALUATION OF HYBRID VARIETIES

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Summary

The trial was designed to evaluate 6 hybrid beet varieties compared with a standard commercial variety, for uniformity of emergence, growth, habit, root size and internal characteristics. Preliminary results suggest that some varieties possess beneficial characteristics which may offset higher seed costs.

Introduction

Seed companies have introduced hybrid varieties claiming that they have advantages over open pollinated varieties. The hybrid seed is expensive and growers are concerned whether the extra cost is justified. New varieties require improved characteristics including uniformity of size and shape, good internal colour and good storage quality, which would enable growers to produce the crop more efficiently and which would command a premium from processors.

Objective

To evaluate hybrid beet varieties, assessing growth, storage and processing characteristics in comparison with the standard commercial variety, Crimson Globe.

Materials and Methods

Site:

HRI Stockbridge House, Cawood, Selby, North Yorkshire YO8 0TZ

Soil Type:

Sandy loam of the Quorndon Series.

Treatments/Varieties:

Detroit Elsoms Crimson Globe (Control)
Pablo
Action F1
Red Ace F1
Monogram
Sprinter
XPH 3646

Culture

One seed cluster was sown per 37 mm block. Seedlings were counted at emergence and singled to one per block to eliminate competition within the block. At planting seedlings were selected so that all plants of the same variety were at the same growth stage. To eliminate competition during the early stages of growth a spacing of 30 cm x 30 cm was used in the field.

Crop Diary

Propagation Method: 37 mm blocks

Sowing Date: 6 June 1991

Base Dressing:	100:40:200 kg/ha NPK + Solubor at 10 kg/ha
Planting Date:	2 July 1991
Herbicide:	Metamitron (as Goltix at 5 kg/ 1120 l water/ha)
Topdressing:	15 July 1991 - 150 kg/ha N
Pest & Disease Control:	Cypermethrin (as Ambush at 250 ml/1120 l/ha). No fungicides applied.

Design

Randomised block design with 3 replicates. Plots were 1.83 m x 6.6 m with 5 rows of 22 plants. 50 plants per plot were recorded from centre 3 rows

Records

Germination: Plants were assessed for rate of germination and total germination/100 cells.

Propagation: Plants were assessed for:

- Number of true leaves
- Length of longest leaf
- Length of hypocotyl
- Percentage dry matter
- Uniformity.

Field Assessments:

- Growth habit
- Variation in leaf length
- Variation in root diameter

Harvest:	Roots were assessed for: Uniformity of diameter Uniformity of depth Uniformity of weight Uniformity of shape Colour score Presence of white rings
After Storage:	Presence of external disease symptoms

Results

Table 1: Percentage germination (as a percentage of the total number of seedlings emerged)

	11 June	14 June	18 June	21 June	Number of shoots per 100 cells (27.6.92)
Pablo	80	86	92	98	159
Sprinter	52	68	74	97	188
XPH 3646	57	73	87	94	200
Red Ace	71	69	78	99	219
Monogram	48	92	95	100	101
Action	73	81	94	99	157
Crimson Globe	80	86	89	96	157
SED (63 df)	3.7	2.6	2.1	0.9	7.9
LSD (0.05)	7	5	4	2	16

The varieties Pablo, Action, Crimson Globe and Red Ace had a high percentage germination on 11 June (5 days after sowing). The varieties Monogram, Sprinter and XPH 3646 had a lower percentage germination on 11 June than the control Crimson Globe. Monogram, however had the highest percentage germination on 14 June. Sprinter and XPH 3646 showed a gradual rate of emergence. Red Ace produced a significantly higher number of seedlings than all other varieties except XPH 3646.

Assessments at Planting

Table 2: Plant assessments before transplanting

	No of Leaves	Length of Longest Leaf (mm)	Hypocotyl Length (mm)	Dry Matter (%)	Uniformity Assessment*
Pablo	4.0	160	14	5.6	8
Sprinter	3.6	119	15	7.5	9
XPH 3646	3.8	138	15	6.3	5
Red Ace	3.5	166	12	5.6	9
Monogram	3.0	160	13	5.8	5
Action	3.7	161	16	5.7	7
Crimson Globe	2.8	100	11	7.6	3
SED (12 df)	0.20	0.36	0.81	0.32	
LSD (0.05)	0.4	0.8	1.8	0.7	

* 1 = Erratic; 9 = Uniform

Number of Leaves

At planting Pablo had more true leaves than other varieties, but this was only significantly higher than Crimson Globe and Monogram. Crimson Globe had the lowest number of leaves at planting

Length of Longest Leaf

All hybrid varieties had longer leaves than the control Crimson Globe. The varieties Pablo, Red Ace, Monogram and Action gave the tallest plants.

Hypocotyl Length

All varieties except, Red Ace, produced longer hypocotyls than the control Crimson Globe. Sprinter, XPH 3646 and Action tended to produce the longest hypocotyls.

Percentage Dry Matter

The control Crimson Globe and hybrid variety Sprinter had a significantly higher percentage dry matter than all other varieties.

Uniformity Assessment

At planting, all hybrid varieties were more uniform than the control Crimson Globe. Crimson Globe was the least uniform variety. The most uniform were Pablo, Sprinter and Red Ace.

There were no significant differences for either variance of longest leaf or variance of root diameter, however the hybrids appear to be more uniform.

Harvest Assessments

Table 4: Harvest assessments

	Variance of Root Diameter (mm)+	Variance of Root Weight (g)+	Variance of Root Shape+
Pablo	4.4	9.0	1.7
Sprinter	4.0	8.4	0.5
XPH 3646	4.3	8.9	1.5
Red Ace	4.1	9.0	0.7
Monogram	4.8	9.0	1.9
Action	4.6	9.2	1.9
Crimson Globe	4.6	9.1	0.7
SED (12 df)	0.22	0.20	0.30
LSD (0.05)	0.5	0.5	0.7

+ Log Transform

Variance is a measure of the spread of values for each variety, so a large figure indicates a variable characteristic and a small figure indicates a more uniform characteristic.

Assessments in the Field (9 August)

Table 3: Field assessments - 9 August

	Habit*	Variance of Longest Leaf (mm) Log Transform	Variance of Root Diameter (mm) Log Transform
Pablo	6.6	2.1	3.8
Sprinter	6.5	2.5	3.6
XPH 3646	4.9	2.4	3.6
Red Ace	7.2	2.9	3.3
Monogram	6.5	3.1	3.9
Action	5.8	2.7	4.0
Crimson Globe	5.7	2.9	4.0
SED (12 df)	0.61	0.42	0.47
LSD (0.05)	1.3	NS	NS

* Habit: 1 = Spreading; 9 = Upright

Variance is a measure of the spread of values for each variety, so a large figure indicates a variable characteristic and a small figure indicates a more uniform characteristic.

Habit

The hybrid variety Red Ace had an upright growth habit while the variety XPH 3646 had a spreading habit (with a large number of smaller leaves within the main leaf canopy). All other varieties including Crimson Globe gave intermediate results.

Variance of Root Diameter

Monogram was the least uniform variety. Sprinter and Red Ace were the most uniform varieties. The control Crimson Globe gave an intermediate result.

Variance of Root Weight

Sprinter was more uniform than Crimson Globe and all other hybrids.

Variance of Bulb Shape

Action and Monogram gave a more variable root shape than Crimson Globe. Red Ace, Sprinter and Crimson Globe were all less variable than other varieties.

Table 5: Internal assessments at harvest

	Mean Colour Score (1-9)*	Mean White Rings Score (1-9)+
Pablo	8.1	7.0
Sprinter	8.0	7.3
XPH 3646	8.1	7.2
Red Ace	7.8	6.4
Monogram	7.8	4.6
Action	7.4	5.9
Crimson Globe	7.4	6.3
SED (12 df)	0.53	0.20
LSD (0.05)	NS	0.4

* Colour: 9 = Dark Red

\+ White Rings: 9 = Absent

Mean Colour Score

There were no significant differences in colour score.

Mean White Rings Score

The varieties Pablo, Sprinter and XPH 3646 had less pronounced white rings. Action and Monogram had severe white rings, while the control Crimson Globe and hybrid Red Ace gave intermediate results.

Table 6: Assessment on removal from cold store - 19 March 1992

	Percentage with External Disease Symptoms
Pablo	52
Sprinter	35
XPH 3646	28
Red Ace	29
Monogram	92
Action	21
Crimson Globe	55

Hybrids Red Ace and Action produced the least number of diseased roots. Sprinter and XPH 3646 also produced fewer diseased roots than the control Crimson Globe, while hybrid Pablo gave a similar result to Crimson Globe. The highest percentage of diseased roots were recorded for hybrid Monogram.

The disease was not identified but was of a secondary nature and would make affected roots unmarketable.

Varietal Characteristics

Pablo	Rapid emergence. Large uniform plants at transplanting. Less pronounced internal white rings and good colour.
Sprinter	Slow emergence. Compact, uniform plants at transplanting. Uniform root size, weight and shape at harvest. Colour good. Less pronounced internal white rings.
XPH 3646	Slow emergence. Uniform number of seedlings/tray. Large number of small leaves within main leaf canopy.
Red Ace	Rapid emergence. Compact, uniform growth at transplanting. High percentage germination. Upright growth habit in field. Uniform root size and shape. Intermediate colour and white rings score. Few diseased roots after storage.
Monogram	No outstanding features in propagation or in the field. Root size variable. Root shape variable - tendency towards a flattened bulb shape. Poor colour with pronounced white rings. High percentage with external disease symptoms after storage.
Action	Rapid emergence. Uniform number of seedlings/tray. No distinguishing characteristics in field. Root shape variable at harvest. Poor colour, pronounced white rings. Few diseased roots after storage.
Crimson Globe	Rapid emergence. Least uniform variety at transplanting (showing some dieback of stems). Even root shape. 50% showing external disease symptoms after storage.

Discussion

Emergence of Pablo and Crimson Globe was rapid. The varieties Monogram, Sprinter and XPH 3646 had a slower emergence. The varieties Sprinter and Red Ace could be identified by uniform and compact upright growth compared with the variety Pablo which was also uniform but plants were larger than other varieties at planting. Crimson Globe was identified by erratic growth and some dieback of stems. The varieties Action, Monogram and XPH 3646 produced least variation in the number of shoots produced per tray. Although growers do not transplant red beet these features could be important in terms of herbicide applications and uniformity of establishment which will eventually affect final grade out, therefore reducing waste, grading time and number of roots for disposal on lower value markets.

In the field the variety Red Ace could be easily identified from other varieties because of its upright growth habit and lack of wilting in warm conditions. The variety XPH 3646 had a large number of small leaves within the main leaf canopy. These characteristics may be important where beet is harvested by a top lifter or at processors where difficulty in removing foliage can lead to quality problems and increased processing time.

At harvest the variety Sprinter produced uniform bulbs with little variation of root diameter, weight and shape. Red Ace produced uniform bulbs with little variance of root diameter and bulb shape. Monogram was least uniform with large variation of bulb diameter and shape and also a flattened bulb shape. Internally this variety also had pronounced white rings as did the variety Action.

After storage Monogram had a high percentage of roots showing external symptoms of disease. The varieties Red Ace and Action had least diseased roots. Future work should investigate storage potential of hybrid varieties.

Conclusions

The varieties Red Ace and Sprinter performed well in terms of uniformity of growth, characteristics at harvest and quality after storage. The varieties Action, XPH 3646 and Monogram produced an equal number of shoots per tray but this did not improve uniformity of growth or characteristics at harvest.

Monogram did not store well, with a high percentage of roots with secondary disease after storage. Crimson Globe (control) had erratic emergence and looked poor during propagation. It did however have a uniform root shape at harvest. After storage 55% of roots showed disease symptoms.

The variety Pablo was uniform during propagation and had few internal white rings but it did not display exceptional qualities elsewhere.

Recommendations

Further evaluation of the hybrid beet varieties is required to assess whether the qualities displayed at wide spacing can be achieved using commercial plant populations.

Processing and storage qualities are an important selection factor. It would therefore be interesting to seek cooperation with a processing firm and to extend the work to a full storage trial.