CONFIDENTIAL*

2.3. SUGAR BEET - SEED PRIMING, 1979

NAS 511 ML
4th year

SUMMARY

Peroxide seed priming treatments applied to a selected range of sugar beet varieties generally resulted in some improvement in seedling emergence in terms of both rate of emergence and in numbers of plants established. Later in the season differences in vigour were outgrown and crop development appeared to be unaffected by treatment. Yield data at the end of a long and healthy growing period showed little difference between priming treatments.

OBJECT

To compare the effects of peroxide seed priming treatments applied to 4 representative varieties of sugar beet on seedling emergence, final stand and yield.

TREATMENTS

All combinations of:

1. Variety
   a) Nomo
   b) Bush Mono G
   c) Amono
   d) Sharpe's Klein Monobeet

2. Seed Treatment
   a) Untreated seed, standard Filcoat pellet
   b) H_2O_2 seed steep, standard Filcoat pellet
   c) Untreated seed, CaO_2 pellet
   d) Untreated seed, MgO_2 pellet

3. Method of Crop Establishment
   a) 'Regular' - hand hoed from 9.5 cm spaced drilling
   b) 'Irregular' - drilled to a stand at 19 cm spaced drilling

METHOD

Seed of 4 commonly grown varieties was made available by the British Sugar Corporation for trial use as in 1977 and 1978. The lots were sub-divided for treatment; part of each was steeped in 0.2%

*NOT FOR PUBLICATION WITHOUT THE DIRECTOR'S CONSENT. This report deals primarily with only one year's work so any conclusions given are only provisional.

hydrogen peroxide for 10 hours before being dried back to its original moisture content and then pelleted in standard Filcoat material. The remainder of the seed was left untreated, but was pelleted either in standard Filcoat or in Filcoat incorporating calcium peroxide or magnesium peroxide at 50% of the weight of the original seed.

The trial was drilled on 19 April into a rapidly drying seedbed. All seed treatments were drilled at both 9.5 and 19.0 cm spacing in the row, the former being hand hoed to leave a constant and regular stand of 70 000 plants per hectare to eliminate the possible effects of population differences. This allowed assessment of any growth effects to be made more easily, whereas the drilled to a stand treatments would necessarily have expressed the combined effects of plant population and growth differences.

Plant emergence was closely monitored using cocktail sticks as seedling markers to reveal the pattern of potential establishment. The trial was harvested by hand on 4 December.

RESULTS

1. Seedling Emergence

Typical seedling counts recorded on 19.0 cm spaced drilling during the brairding period are given in table 1.

Table 1 Seedling establishment from 19.0 cm spacing, plants/ha (thousands)

Variety	Untreated	H_2O_2 steep	CaO_2 pellet	MgO_2 pellet
9 May		(±4.83)		
Nomo	16.7	20.7	8.3	11.5
Bush Mono G	32.5	38.3	48.2	48.3
Amono	20.3	30.2	51.3	42.7
Sharpe's Klein Monobeet	33.7	55.5	47.2	52.5
		(±2.41)		
Mean	25.8	36.2	38.7	38.7
13 May		(±3.37)		
Nomo	48.2	49.8	43.2	39.5
Bush Mono G	61.0	72.0	72.3	74.0
Amono	40.7	52.0	71.0	66.7
Sharpe's Klein Monobeet	69.7	76.5	72.3	75.0
		(±1.68)		
Mean	54.9	62.6	64.7	63.8

S.E. per plot (30 d.f.) 9 May ±8.36 or 24.0% of G.M.
13 May ±5.83 or 9.5% of G.M.

The particular batch of Nomo seed used in the trial gave a poor emergence and was not affected by treatment to a statistically significant extent. This was in marked contrast with previous experience with this variety. Since the performance of this seed lot was obviously below standard and not typical of the bulk of Nomo grown on the farm the results for this variety should be treated with caution.

Of the remaining varieties, Amono showed the biggest response to seed treatment although when untreated it gave poor emergence like Nomo. On 13 May there were significant increases in numbers of seedlings emerged from the H_2O_2 steeped seed compared with the untreated control and also from the two peroxide pellet treatments compared with the H_2O_2 steeped seed.

With Bush Mono G all peroxide treatments were significantly better than the control at this date but there were no apparent differences between the peroxides.

Sharpe's Klein Monobeet exhibited some improvement due to peroxide treatments, particularly at the earlier stages of emergence. On 9 May the differences in seedling numbers established between untreated control and peroxide treatments were statistically significant but again there did not appear to be any real difference between the peroxides.

The seedling emergence data can be summarised in a number of ways. The calculation of the number of days taken to reach a set level of emergence, in this case 50% of seeds sown, can give a reasonable picture of true differences in rate of emergence. Another calculation based on a weighted mean % emergence can also be used, this is called Field Germinative Energy and has the advantage of taking the whole of the data into account. The more rapid the emergence, the nearer the figure will be to 100 (max.). (Reference: NAS 511 ML 78).

Both assessments are given in table 2.

Table 2 Summary of Emergence Data

Variety	Untreated	H_2O_2 steep	CaO_2 pellet	MgO_2 pellet
Days to 50% Emergence		(±1.20)		
Nomo	29.9	29.1	29.5	31.6
Bush Mono G	23.3	21.9	21.4	20.8
Amono	32.0	29.3	20.9	21.2
Sharpe's Klein Monobeet	22.3	20.1	20.7	20.3
		(±0.60)		
Mean	26.9	25.1	23.1	23.5
Field Germinative Energy		(±2.63)		
Nomo	28.4	29.9	26.2	24.2
Bush Mono G	37.9	43.6	44.0	50.4
Amono	25.9	33.3	48.0	44.0
Sharpe's Klein Monobeet	42.0	50.8	47.2	51.8
		(±1.31)		
Mean	33.5	39.4	41.3	42.6

S.E. per plot (30 d.f.) Days to 50% Emerg. ±2.08 or 8.5% of G.M.
Field Germinative Energy ±4.55 or 11.6% of G.M.

Both assessments of the data confirm the poor performance of Nomo and lack of response to treatment by this batch of seed.

There was an outstanding response by Amono to the peroxide seed pellet treatments in both Days to 50% Emergence and in Field Germinative Energy, but the H_2O_2 seed steep was less effective.

While the apparent improvements in Days to 50% Emergence for the peroxide treatments on Bush Mono G and Sharpe's Klein Monobeet were not statistically significant, Field Germinative Energy calculations indicate significant improvements for the MgO_2 pellet over untreated control for both these varieties and also a significant improvement for the H_2O_2 seed steep for Sharpe's Klein Monobeet.

In no case was any seed treatment significantly worse than the control.

2. Plant Development

Samples of 20 entire seedlings were taken on 7 June (49 days after drilling) and assessed for total dry weight. The results, meaned over 9.5 and 19.0 cm spaced drilling, are presented in table 3.

Table 3 Dry seedling weight (mg) at 49 days

Variety	Untreated	H_2O_2 steep	CaO_2 pellet	MgO_2 pellet
		($\pm$36.7)		
Nomo	283	300	285	233
Bush Mono G	437	414	449	435
Amono	436	503	464	451
Sharpe's Klein Monobeet	357	559	474	428
		($\pm$18.4)		
Mean	378	444	418	387

S.E. per plot (31 d.f.) = $\pm$73.4 or 18.1% of G.M.

Nomo was significantly behind the other varieties in seedling development. The effects of seed priming treatments were less obvious but overall there was some evidence of an increase in seedling size especially from the hydrogen peroxide seed steep, however this was not quite statistically significant. Observations on growth later in the season indicated no apparent differences in vigour between priming treatments.

3. Final Plant Populations

Table 4 Numbers of roots at harvest (thous/ha)

Variety	Untreated	H_2O_2 steep	CaO_2 pellet	MgO_2 pellet
Regular		($\pm$2.06)		
Nomo	69.0	69.5	72.0	70.2
Bush Mono G	68.7	67.7	69.8	68.2
Amono	68.5	67.7	70.7	69.7
Sharpe's Klein Monobeet	71.2	70.2	69.8	69.3
		($\pm$1.03)		
Mean	69.3	68.7	70.6	69.3
Irregular		($\pm$2.06)		
Nomo	58.2	51.3	55.7	53.0
Bush Mono G	64.2	71.3	71.3	73.7
Amono	45.2	55.7	69.0	66.5
Sharpe's Klein Monobeet	72.8	79.0	75.0	76.2
		($\pm$1.03)		
Mean	60.1	64.3	67.7	67.3

S.E. per plot (62 d.f.) = $\pm$3.56 or 5.3% of G.M.

Final root populations on the Regular hand hoed stand were close to the target of 70 000 per hectare for all treatments.

Where the treatments were drilled to a stand the population differences at harvest closely reflected the emergence pattern in the spring. Low root numbers occurred on all the Nomo treatments and on the untreated and H_2O_2 steeped Anono treatments. With both Bush Mono G and Anono there were significant increases in root numbers from all priming treatments, but with Sharpe's Klein Monobeet, which gave good establishment untreated, the apparent improvements through priming were not as obvious.

4. Yield

The trial was hand harvested on 4 December. Sugar content of the roots was similar for all priming treatments, being affected only by variety. Yield data is presented as yield of sugar:

Yield of sugar (t/ha)

Variety	Untreated	H_2O_2 steep	CaO_2 pellet	MgO_2 pellet
Regular		(±0.275)		
Nomo	10.79	10.45	9.98	10.61
Bush Mono G	9.62	10.09	10.07	10.40
Anono	10.64	10.17	10.61	10.00
Sharpe's Klein Monobeet	9.85	10.08	9.88	9.76
		(±0.138)		
Mean	10.22	10.20	10.13	10.19
Irregular		(±0.275)		
Nomo	11.09	10.40	10.04	10.19
Bush Mono G	9.89	9.86	10.30	9.85
Anono	10.63	10.05	10.44	10.53
Sharpe's Klein Monobeet	10.54	10.23	10.81	10.45
		(±0.138)		
Mean	10.54	10.14	10.40	10.25

S.E. per plot (62 d.f.) = ±0.477 or 4.7% of G.M.

Good yields were obtained on all treatments and there were no significant differences due to seed priming. It is not surprising that seed treatments had so little effect on yield in a season which allowed low and irregular populations of Nomo and Anono to yield as well as any other treatment.

G.M.P. & W.E.B.

ADDENDUM NAS 511 ML 79

	% Seedling Emergence							
	8/5	9/5	10/5	11/5	13/5	14/5	17/5	21/5
Nomo	(±4.77)	(±4.43)	(±4.07)	(±3.51)	(±3.05)	(±3.01)	(±2.80)	(±2.98)
Untreated	6.7	14.6	21.9	27.8	42.3	45.5	49.8	51.6
H_2O_2 steep	9.7	18.3	25.1	31.5	44.1	47.8	46.6	48.5
CaO_2 pellet	2.3	7.6	18.4	26.2	39.4	42.3	48.8	51.6
MgO_2 pellet	3.8	10.1	17.9	24.4	35.2	38.5	44.5	45.6
Bush Mono G								
Untreated	14.0	28.5	37.2	42.1	53.8	55.0	61.3	62.6
H_2O_2 steep	20.8	34.1	42.5	48.9	63.9	65.3	66.8	67.5
CaO_2 pellet	24.9	40.8	47.2	52.4	61.3	62.2	64.3	65.3
MgO_2 pellet	27.5	45.1	52.8	57.7	68.9	70.4	76.0	76.9
Amono								
Untreated	11.0	18.0	24.4	29.1	36.1	38.6	41.6	41.7
H_2O_2 steep	17.6	27.2	32.7	37.2	46.8	48.5	51.5	52.7
CaO_2 pellet	29.1	46.6	51.5	58.0	64.4	65.9	68.7	70.2
MgO_2 pellet	24.1	39.0	47.0	54.1	61.1	62.6	63.8	64.3
Sharpe's K.M.								
Untreated	9.7	29.7	40.9	47.6	61.8	64.6	67.6	68.9
H_2O_2 steep	35.2	49.3	56.9	61.1	67.9	69.4	72.4	73.2
CaO_2 pellet	31.1	42.2	52.4	57.9	64.7	65.9	67.9	69.1
MgO_2 pellet	29.1	48.9	55.0	62.9	69.6	72.5	75.7	77.5
S.E. per plot (30 d.f.)	±8.25	±7.67	±7.01	±6.08	±5.28	±5.22	±4.85	±5.17
or as % G.M.	44.5	24.5	18.1	13.5	9.6	9.1	8.0	8.4