CONFIDENTIAL*

SUGAR BEET - SEED PRIMING, 1980 NAS 511 ML
5th year

SUMMARY

The use of peroxide seed treatments adversely affected the rate of seedling emergence and early growth of a number of sugar beet varieties. In general this effect was worse where the treatment involved calcium peroxide in the seed pellet coat. After a good growing season yields of sugar were high and no differences were found between the 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

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

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METHOD

Seed of 4 commonly grown varieties, as supplied by the BSC, was subdivided for treatment as in previous years. Both the peroxide seed steep treatment and the peroxide pellet treatment were applied by Messrs. Germain Ltd., who also applied the standard Filcoat pellet. In contrast to previous trials, when the calcium peroxide was mixed with the clay used in the standard Filcoat pellet, the calcium peroxide was applied direct to the seed and the standard Filcoat material was applied as an outer layer.

The trial was drilled on 5 April into ample fine moist mould produced by a Salo dutch harrow on overwintered ploughing. Pre-emergence weed control consisted of Pyramin FL at the recommended rate applied on 10 April as a band over the row. Each seed treatment was drilled at both 9.5 and 19.0 cm spacing in the row, the former being hand hoed to leave a uniform and regular stand of 70 000 plants per hectare to eliminate the possible effects of population differences. The drilled to a stand treatments would be expected to show the combined effects of plant population and growth differences.

Plant emergence was closely monitored using cocktail stick markers as previously.

The trial was harvested by hand on 4/5 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 emergence from 19.0 cm spacing, plants/ha (000's)

Variety	Untreated	H_2O_2 steep	CaO_2 pellet
22 April		($\pm$3.11)	
Mono	43.9	40.9	25.7
Bush Mono G	49.0	45.2	41.4
Amono	45.4	44.5	30.5
Sharpe's Klein Monobeet	40.4	36.6	27.7
Mean	44.7	($\pm$1.56) 41.8	31.3
28 April		($\pm$3.20)	
Mono	72.5	77.9	57.9
Bush Mono G	71.5	64.2	69.0
Amono	74.5	70.4	64.4
Sharpe's Klein Monobeet	66.9	67.4	63.5
Mean	71.3	($\pm$1.60) 70.0	63.7

S.E. per plot (33 d.f.) 22 April = $\pm$6.22 or 15.8% of G.M.
28 April = $\pm$6.40 or 9.4% of G.M.

This season conditions for germination and early seedling growth were good with adequate moisture in a fine seedbed and reasonable soil temperatures after a cold start. Initially both seed priming treatments depressed emergence compared with the control. This effect was most marked with the calcium peroxide pellet treatment. Later there was some recovery by the seed steep treatment, with Nomo, Amono and Sharpe's Klein Monobeet showing a generally similar reaction. The emergence from the peroxide pellet treatment remained slower than the control throughout.

Summaries of the rates of emergence are presented in Table 2 using calculated indices based on all the individual seedling counts made during the emergence period. The first summary uses the time taken to reach a set level of emergence, as days to 50% emergence of the seed set in this case, while the second summary is a weighted mean % emergence which we call Field Germinative Energy, as in previous trials of this series (reference NAS 511 ML 78).

Table 2 Summary of Emergence

Variety	Untreated	H_2O_2 steep	CaO_2 pellet
Days to 50% Emergence		($\pm$0.84)	
Nomo	19.4	19.2	23.7
Bush Mono G	18.9	19.8	20.1
Amono	19.0	19.6	21.7
Sharpe's Klein Monobeet	20.1	21.4	22.2
Mean	19.4	($\pm$0.42) 20.0	21.9
Field Germinative Energy		($\pm$1.99)	
Nomo	59.6	60.5	47.1
Bush Mono G	58.0	52.8	54.5
Amono	59.4	56.0	53.0
Sharpe's Klein Monobeet	54.9	53.2	48.7
Mean	58.0	($\pm$1.00) 55.6	50.8

S.E. per plot (33 d.f.) Days to 50% Emergence = $\pm$1.69 or 8.3% of G.M.
Field Germinative Energy = $\pm$3.98 or 7.3% of G.M.

On average the peroxide pellet treatment delayed emergence, producing the longest time to reach 50% emergence of all the seed treatments. This applied to all varieties. The peroxide steeped seed tended to be intermediate between the peroxide pellet and the control in performance, but the statistical analysis revealed no significant differences between the rates of emergence of peroxide steeped seed and the untreated control using this parameter.

The Field Germinative Energy summary showed a similar trend. Overall the peroxide pellet produced the lowest F.G.E.. However there was evidence of a varietal interaction: with Bush Mono G the rates of emergence determined by this method for both steep and peroxide pellet treatments were almost equally below control, while with Mono the peroxide steep did not appear to have any negative effect.

These effects on rate of emergence are generally contrary to observed effects in previous trials, which have occasionally demonstrated improvements in early growth following various peroxide seed treatments. Explanations for the depressing effect of the pellet treatment may concern the effects of the new process of applying the coating, or the structure of the coat itself interacting with soil conditions in some way. Furthermore, the seed dry matter in the CaO_2 pellets was 5.8% compared with 10.1% in the control. It is interesting to note that the H_2O_2 seed steep also did not appear to be generally favourable to rate of emergence. Again, there was a change in the process of applying the H_2O_2 which may account for the performance. In view of the good performance of untreated seed, it is unlikely that seedbed moisture was a limiting factor, however until a satisfactory explanation is found no factors can be entirely eliminated.

2. Plant Development

Samples of 20 entire seedlings were taken on 28 May (53 days after drilling) and assessed for total dry weight. The results for 19.0 cm spaced drilling are given in Table 3.

Table 3 Seedling dry weight (mg) at 53 days

Variety	Untreated	H_2O_2 steep	CaO_2 pellet
		($\pm$39.9)	
Mono	522	600	457
Bush Mono G	660	597	435
Amono	575	512	477
Sharpe's Klein Monobeet	640	510	567
		($\pm$19.9)	
Mean	599	555	484

S.E. $\pm$ per plot (33 d.f.) = $\pm$79.9 or 14.6% of G.M.

The effects of rate of emergence on seedling development were still apparent at 53 days from drilling. In general there was a significantly reduced average seedling dry weight from the calcium peroxide pellet compared with the untreated control. The apparent reduction in seedling weight from the peroxide seed steep was not significantly different from the controls.

Later in the season growth differences were lost and all treatments produced healthy beet with good vigour.

3. Final Plant Populations

Table 4 Numbers of roots at harvest (000's/ha)

Variety	Untreated	H_2O_2 steep	CaO_2 pellet
Regular Stand		($\pm$2.50)	
Nono	70.3	73.0	69.0
Bush Mono G	71.0	72.3	68.3
Amono	71.0	71.3	74.2
Sharpe's Klein Monobeet	69.7	73.8	72.5
		($\pm$1.25)	
Mean	70.5	72.6	71.0
Irregular Stand		($\pm$2.50)	
Nono	84.2	81.5	67.8
Bush Mono G	72.8	69.3	70.7
Amono	77.2	73.8	78.2
Sharpe's Klein Monobeet	71.2	72.7	61.0
		($\pm$1.25)	
Mean	76.3	74.3	69.4

S.E. per plot (46 d.f.) = $\pm$4.33 or 6.0% of G.M.

Final root numbers on the Regular hand hoed plots were close to 70 000/ha, the target population for these treatments. On the Irregular plots, drilled at 19 cm, the final root numbers generally reflected the earlier emergence pattern with fewer roots following the peroxide treatments, especially after the peroxide pellet treatment. However, it is worthy of note that where Amono was coated in the peroxide pellet there was an exceptional recovery from the early slow emergence to give a similar population to the control. Bush Mono G was also little affected by the peroxide treatments. All root populations were considered adequate for good yields.

4. Yield

As in previous trials in this series the % sugar in the roots was only affected by variety, with Nono having a slightly lower sugar content than the other varieties. There was no interaction with seed treatment and the yield data is presented simply as yield of sugar:

Table 5 Yield of sugar t/ha

Variety	Untreated	H_2O_2 steep	CaO_2 pellet
		(±0.412)	
Regular Stand			
Nomo	10.43	10.42	10.55
Bush Mono G	10.49	10.82	10.20
Anono	10.01	10.92	10.44
Sharpe's Klein Monobeet	11.13	10.63	10.62
		(±0.206)	
Mean	10.52	10.70	10.45
		(±0.412)	
Irregular Stand			
Nomo	10.57	10.86	10.37
Bush Mono G	10.11	11.03	10.12
Anono	10.89	10.60	11.22
Sharpe's Klein Monobeet	10.49	10.56	10.36
		(±0.206)	
Mean	10.52	10.76	10.52

S.E. per plot (46 d.f.) = ±0.715 or 6.8% of G.M.

With root yields averaging around 62 t/ha (25 t/ac) and sugar content at over 17% there was a good yield of sugar from all treatments. Statistical analysis of the results indicates that there were no significant differences between any treatments.

In a good growing season the seed treatments do not appear to have had any effect on the yield of sugar, despite having adversely affected seedling emergence and early growth.

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APPENDIX NAS 511 ML 80

Treatment	% Seedling Emergence 18/4	20/4	22/4	24/4	28/4	1/5	6/5	9/5	15/5
Nomo	(±0.73)	(±2.24)	(±2.71)	(±2.57)	(±2.78)	(±2.69)	(±2.62)	(±2.57)	(±1.69)
Untreated	2.0	22.2	38.2	48.3	63.0	69.7	74.0	74.6	74.2
H_2O_2 steep	2.9	23.1	35.5	49.2	67.7	71.6	74.6	75.9	73.9
CaO_2 pellet	1.0	11.1	22.4	33.3	50.3	55.0	60.1	61.5	63.5
Bush Mono G									
Untreated	3.8	29.3	42.6	50.4	62.2	67.3	69.2	69.7	69.2
H_2O_2 steep	5.2	29.2	39.3	47.8	55.9	59.1	62.7	63.3	62.7
CaO_2 pellet	4.0	22.8	36.0	46.6	60.0	62.9	66.1	67.1	66.0
Amono									
Untreated	2.6	22.7	39.5	51.2	64.8	68.9	72.3	73.4	72.8
H_2O_2 steep	4.2	25.7	38.7	47.7	61.2	63.9	68.0	69.3	66.8
CaO_2 pellet	2.0	15.4	26.5	37.9	56.0	63.2	67.1	69.0	69.3
Sharpe's K. Monobeet									
Untreated	0.5	19.1	35.1	46.6	58.2	64.3	67.2	68.3	69.7
H_2O_2 steep	3.8	21.0	31.8	44.3	58.6	61.7	64.9	65.3	66.7
CaO_2 pellet	1.1	14.3	24.1	34.8	55.2	58.9	63.3	63.2	60.0
S.E. per plot (33 d.f.)	±1.47	±4.49	±5.41	±5.13	±5.56	±5.39	±5.23	±5.14	±3.38
or as % G.M.	53.1	21.0	15.8	11.4	9.4	8.4	7.8	7.5	5.0