Effect of nitrogen, gibberellic acid and population on yield and seed quality of navy beans

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Large amounts of dried navy beans are imported into New Zealand each year for use in tinned baked beans. Research at Lincoln College has shown that it may be feasible to grow these in N.Z. and that yields of nearly 3 t/ha can be produced consistently if irrigation is available (1). However, seed quality is often low due to low plant height and the short growing season means frost may be a problem. This experiment was conducted to examine: the effects of early nitrogen in cool temperatures, late nitrogen, and gibberellic acid on navy beans.

Methods

Two populations (40 and 75 plants/m^2) of navy beans *(Phaseolus vulgaris* L.) cv. Sanilac were sown on 9 Nov. 1988, into a Templeton silt loam soil. Calcium ammonium nitrate (27% N) at 50 kg N/ha was applied at sowing and on 5 Jan. 1989. Gibberellic acid at 25 g ai/ha was applied with a knapsack sprayer on 16 Jan. while most plants were still flowering and on 31 Jan. when flowering had virtually ceased. The crop was irrigated according to a water budget.

Results and discussion

The 1988-89 growing season was one of the driest and warmest on record. By 31 Jan. 1989, dry matter production was about 790 g/m^2. Crop yield may have been affected by water stress, however overall seed yields were very high at 432 g/m2.

Early nitrogen caused no decrease in dry matter production and increased seed yield. At the first dry matter harvest, early N actually increased dry matter accumulation per plant from 0.55 g to 0.65 g (Table 1). This result is unlikely in most Canterbury seasons. However, the mean daily minimum temperature was approximately 1.7?C warmer than average while the daily minimum only fell below 11 C?7 times. According to (2) these temperatures are low enough to result in cellular damage. However, field grown plants may be less susceptible to damage than glasshouse grown plants. Furthermore, the lack of water may have reduced cellular expansion thereby reducing possible damage.

Table 1. The effect of early nitrogen and gibberellic acid on Sanilac navy beans.

	Dry Seed Yield g/m^2	DM g/m^2 (8/12/88)	DM g/plant (8/12/88)
Early N (kg/ha)			
0	411	46	0.55
50	452**	50	0.65**
Early GA (g/ha)			
0	430	50	0.61
25	433	46	0.60

* $p < 0.05$ ** $p < 0.01$

Gibberellic acid also had little effect on the crop. While early GA caused a small overall yield reduction, the highly significant reduction with late GA was caused by a somewhat higher population in these plots. There was no effect on DM production per plant. It is likely that GA application was not early enough (3). Also, water stress may have reduced any possible effect of the gibberellic acid. Continuing work will assess timing of GA application and autumn/winter nitrogen application.

1. Love, B.G., Askin, D.C., McKenzie, B.A. (1988). N.Z.J.E.A. 16, 231-237.

2. Andrews, M.H., Love, B.G., Sprent, J.I. (1989). Ann. Appl. Biol. 114.

3. Mislery, P., Boote, K.J., Martin, F.G. (1988). Field C. Res. 18, 113-121.