TIME AND LEVEL OF PHOSPHATE AND POTASH FERTILIZER IN RELATION TO YIELD AND DAMAGE SUSCEPTIBILITY OF POTATOES - 1977 NAS 806 ML

Variety - Désirée

Method

The following treatments were applied in a fully factorial trial with two replicates.

(1) Level of Phosphate (kg/ha)

a) = Nil
b) = 150
c) = 300

(2) Level of Potash (kg/ha)

a) = Nil
b) = 200
c) = 400
d) = 600

(3) Time of Fertilizer Application

a) Ploughed down in previous autumn
b) Applied to the surface approximately 6 weeks before planting
c) Applied to the surface immediately before seedbed preparation
d) Split - all phosphate applied to seedbed as in (c)
- 100 kg potash applied to seedbed the balance having been ploughed down in the previous autumn

The autumn fertilizer treatments were applied to the stubble of the preceeding wheat crop on 22 September 1976. The trial area was ploughed on 26 November and spring fertilizer application treatments were applied on 9 February and 4 April. Kieserite was applied to the whole area at 220 kg/ha on 31 March. Seedbed cultivations were carried out on 4/5 April and the crop planted on 6 April using a Robot planter to plant approximately 36,000 setts/ha on 91 cm rows.

Phosphate was applied as triple superphosphate (47% P_2O_5) and potash as muriate of potash (60% K_2O). Nitrogen was to have been applied as an overall application of 188 kg/ha during seedbed preparation but was overlooked and was therefore applied by hand after emergence.

Results - emergence

Plant counts were made on 18, 20, 23, 27 May and 9 June and showed a reduction in rate of emergence at the highest level of potash but this failed to be statistically significant after the third count. At the final count on 9 June there was no significant difference between treatments but the overall number averaged only 27,700/hectare. This low level of emergence was attributed to a very heavy infection of stem canker (Rhizoctonia solani) which was responsible for severe leaf rolling symptoms observed in the crop. As a check that virus was not involved on the CC certified seed stocks used, samples were submitted for virus testing at the end of the season. Even after growing on at Morley the level of virus infection was so low that the stock was still regarded as suitable for planting.

Growth

Soil analyses from the site showed phosphate to be index 2 and potash index 1 which is typical of the status of soils at Morley. Adequate reserves of lime and magnesium were recorded.

When examined on 10 June the trial showed differences of colour and vigour. The plants receiving no phosphate or potash were of a dark green colour and rather stunted. The colour was improved by either phosphate or potash applications with the spring and split treatments having the greatest effect.

The differences in vigour of the crop were mainly associated with phosphate and time of application as shown in table I.

Table I - Vigour score on 10 June

Time of application	Level of phosphate (kg/ha) 0	150	300	Mean
		(±0.21)		(±0.12)
Autumn	6.5	6.7	7.0	6.7
Pre-planting	6.7	7.5	7.4	7.2
Planting	6.1	7.1	7.1	6.8
Split	7.1	7.5	7.6	7.4
		(±0.11)		
Mean	6.6	7.2	7.3	

S.E. per plot (47 d.f.) = ±0.60 or 8.5% of G.M.

It appears that the pre-planting and split applications provided a better supply of nutrients while the autumn treatment was not sufficiently available and the seedbed applications of potash were relatively toxic.

Leaf samples were taken on 27 July and analysed for phosphate, potash, magnesium and calcium content. Phosphate content was not affected by treatment but potash levels varied considerably as shown in table 2. Both magnesium and calcium levels were reduced by increasing levels of potash. Reductions were slightly greater where the potash was applied in the autumn or split. The results in table 2 show that potash content of the leaves at the end of July was increased by increasing levels of potash fertilizer. As in 1976 the highest levels were recorded following autumn or split applications although the reason for this is not obvious.

Table 2 - Leaf Analysis - % K

Time of application	Level of potash (kg/ha) 0	200	400	600	Mean
Autumn	1.93	2.62	3.38	3.71	2.91
Pre-planting	2.22	1.91	2.33	2.37	2.21
Seedbed	2.07	1.99	2.31	2.71	2.27
Split	1.90	2.55	3.24	3.13	2.71
Mean	2.03	2.27	2.82	2.98	

Yield

The trial was harvested on 26/7 September and riddled on 3/4 October.

Yields were recorded in 30-40 mm, 40-60 mm, 60-80 mm and over 80 mm size fractions and at the same time the specific gravity of the 40-60 mm fraction was measured.

Table 3 - Ware Yield (t/ha) 40-80 mm

Time of application	Level of potash (kg/ha) 0	200	400	600	Level of phosphate (kg/ha) 0	150	300	Mean
		(±0.63)				(±0.54)		(±0.31)
Autumn	9.7	11.5	12.5	11.5	11.0	11.6	11.3	11.3
Pre-planting	9.9	11.3	12.5	13.1	11.7	12.3	11.2	11.7
Seedbed	10.0	11.8	12.6	12.6	11.0	12.2	12.0	11.7
Split	8.9	12.9	13.1	12.6	11.9	11.5	12.2	11.8
Level of potash (kg/ha)						(±0.54)		(±0.31)
0					9.2	9.5	10.1	9.6
200					11.5	12.9	11.2	11.9
400					12.8	12.6	12.7	12.7
600					12.2	12.6	12.6	12.4
						(±0.27)		
Mean	9.6	11.9	12.7	12.4	11.4	11.9	11.6	

S.E. per plot (47 d.f.) = ±1.54 or 13.2% of G.M.

Yields were severely limited by disease, drought and possibly the late application of nitrogen so that results should be treated with considerable reserve.

The only significant response shown in table 3 is to rate of potash fertilizer. However as observed in the 1976 trial there was an increase in smaller tubers (40-60 mm) at the higher rate of phosphate. The yield of larger tubers (60-80 mm) was increased by the higher levels of potash.

Although the time of application did not have a significant effect on yield the autumn application was again slightly lower yielding than the other applications with the split application providing marginally the highest yield.

Blackspot Bruising

Table 4 - % Internal Blackspot

Time of application	Level of potash (kg/ha) 0	200	400	600	Mean
		(±3.19)			(±1.59)
Autumn	49.5	42.4	39.6	26.3	39.5
Pre-planting	59.5	42.8	33.1	25.5	40.2
Seedbed	50.4	45.0	24.6	19.2	34.8
Split	56.5	40.0	28.5	25.8	37.7
		(±1.59)			
Mean	54.0	42.6	31.4	24.2	

S.E. per plot (47 d.f.) = ±7.80 or 20.5% of G.M.

As shown in table 4 the level of internal blackspot bruising was halved by the application of the highest rate of potash. There was no significant difference between the times of application although the greatest reduction in blackspot was again recorded following seedbed application.

Tuber Composition

The level of phosphate fertilizer had no effect on the specific gravity of the tubers but increasing the potash from 0 to 600 kg/ha reduced the specific gravity from 1.0965 to 1.0882 which represents a reduction in dry matter of about 1.5%. This was confirmed by tuber analysis which showed a reduction of 1.1% in dry matter. As indicated by the previous year's results, the autumn and split applications had rather less effect than the spring applications.

Conclusions

Due to a combination of unfortunate circumstances this was an exceptionally poor crop and the results should be treated with caution. However the main trends observed were similar to those of the previous trial and it is proposed to extend this series by one year (to 4 years) in order that the final conclusions will represent more normal situations.

1. Increasing the level of phosphate fertilizer increased the yield of 40-60 mm ware but did not give a significant increase in total ware yield.

2. Where potash was applied to the seedbed it reduced the rate of emergence but did not affect final plant numbers.

3. Leaf and tuber analyses confirmed that uptake of autumn applied potash was satisfactory. The levels recorded were consistently higher than where the potash was applied to the seedbed. Susceptibility to blackspot and the dry matter content of the tubers appears to be linked but these were not directly linked to the level of potash in the plant since the lowest incidence of blackspot and lowest dry matter were recorded following seedbed application.

4. A significant reduction in blackspot bruising together with the highest yield was recorded following the split application and this would appear to be the most satisfactory compromise.

5. Although there was an unexpected lack of yield response from the last increment in potash fertilizer the overall response was 2.8 t/ha for a potash cost of £63/ha. Since more than half of the applied potash remained as a contribution to soil reserves the reduction in blackspot could again be considered to be a bonus provided that high dry matter tubers were not required.