THE FERTILISER REQUIREMENTS OF LINSEED FOR OILSEED PRODUCTION

M. Woodhead,
Fletcher Agriculture,
Dunedin.

B.E. Neilson, *
Kempthorne Prosser & Co. Limited,
Hornby.

ABSTRACT

Fertiliser trials on linseed **(Linum usitatissimum L.)** grown out of good quality pasture and a moderate to high fertility situation were conducted during the 1975/76 growing season.

Nitrogen, phosphate and potash applications gave no seed yield increase. Nitrogen decreased the oil content of the seed, decreased the 1,000 seed weight of treatments with phosphate and interacted with potash. The nitrogen x potash interaction showed that the addition of nitrogen or potash alone increased the 1,000 seed weights but in the presence of both fertilisers the 1,000 seed weights did not increase.

In such a situation the use of fertiliser on linseed would normally be unnecessary and the use of nitrogen fertiliser undesirable for oilseed production.

INTRODUCTION

Little attention has been given to the fertiliser requirements of the linseed crop which is grown mainly in mid Canterbury. Keenan (1971) recommended the addition of 125kg superphosphate/ha except on heavy soils where such application was said to increase the possibility of lodging and to depress seed yields.

Jacob and Uexhull (1960) reported that a linseed crop yielding one tonne of seed/ha depleted the soil of 47kg/nitrogen, 35kg phosphate and 90kg potash; consequently they recommended the application of a 12-12-12 NPK compound fertiliser for oilseed production.

Farmer use of fertilisers with linseed has been minimal to date but some crops observed during the 1973/74 and 1974/75 seasons appeared to benefit from fertiliser applications. The trial reported here was carried out to examine the effect of nitrogen, phosphate and potash application on oilseed yields and quality.

EXPERIMENTAL

The trial was carried out in the 1975/76 growing season on two sites, both of which were out of good quality pasture; site A on a Lismore silt loam and site B on a Wakanui silt loam.

Each site had the same layout, twenty-five plots of approximately 35m^2. The fertilisers were drilled into each plot prior to seeding except for the nitrogen treatments which were broadcast onto the plot before seeding. (See Table 1 for site plan and treatments).

* present address: May & Baker New Zealand Ltd.,
Wingate,
Lower Hutt.

TABLE 1: Treatments and plot layout

(i) Ko, K½, K2 at each level of P½, P1, P2 and P4. (16 plots).

(ii) Controls (4 plots).

(iii) Nitrogen with each of Ko, K2 at each level of P1 and P4 (4 plots).

(iv) Nitrogen alone.

	K1	K2		K½	Ko
P1			NP1Ko		
P½			C4		
P4			NP1K2		
	C1	NP4Ko	C2	C3	NPoKo
P2			NP4K2		

Fertiliser rates used in kg/ha

K½ –	62.5 potassium chloride	P½ –	62.5 superphosphate
K1 –	125 potassium chloride	P1 –	125 superphosphate
K2 –	250 potassium chloride	P2 –	250 superphosphate
N –	215 amonium sulphate	P4 –	500 superphosphate

The seeding rate was 55kg/ha. **Linum usitatissimum** Redwood was used and the seed was treated with "orthocide". Overhead irrigation was carried out at site A well before flowering and again when flowering commenced. Site B required no irrigation as soil moisture content was sufficient to maintain satisfactory growth throughout the trial.

Weed control was carried out when the crops were 15-20cm in height; site A was treated with a mixture of Atrazine and MCPA (1.51 Atrazine A4 plus 500g MCPA in 200 1 water per hectare). Site B was treated with MCPA (850g MCPA in 200 1 water per hectare).

Harvesting was by machine; two strips of each plot, 1.60m by 4.7m, were direct headed using a conventional seed harvester (Massey Harris 630). Seed was collected, weighed and sampled, seed dry weight yield was calculated by measuring seed purity and water content; 1,000 seed weight and oil content was also determined. Water content was determined by drying at 105°C. to constant weight and oil analysis by Soxhlet Extraction.

Herbage samples were taken from a number of linseed crops in mid Canterbury at the near flowering or early flowering stage of growth for potassium analysis.

RESULTS AND DISCUSSION

The Soil analysis prior to laying down the trial indicated a moderate to high fertility situation at both sites. The soil analysis data was for:

Site A: pH 6.4, Ca 15, K12, P8 (Truog)
and for
Site B : pH 6.3, CA18, K5, P44 (Olsen 16hr)

Regular fertiliser application and good quality pasture probably contributed to the high fertility of the soils at both sites.

The results of the trial are shown in Tables 2 and 3: An increase in rate of phosphate application, whether nitrogen had been applied or not, had no effect on the seed yield or oil content. The 1,000 seed weights were also unaffected by level of phosphate in the absence of nitrogen but were decreased when nitrogen was applied.

TABLE 2: The main effect of phosphate and potash application in the absence of applied nitrogen, on the seed yield, oil content and 1,000 seed weight of linseed.

Super-phosphate (kg/ha)	Seed Yield (kg/ha)	Oil Content (%)	1,000 seed weight (g)
62.5	1,875 a	39.5 a	6.4 a
125	1,928 a	39.5 a	6.4 a
250	1,861 a	39.7 a	6.5 a
500	1,755 a	40.9 a	6.4 a
Potassium Chloride (kg/ha)			
Nil	1,948 a	39.9 a	6.3 a
62.5	1,941 a	40.0 a	6.6 a
125	1,589 b	40.0 a	6.4 a
250	1,935 a	39.6 a	6.4 a
C.V.%	12.6	5.9	3.1

Addition of and increase in rate of application of potash had no significant effect in the absence or presence of applied nitrogen on seed yield, oil content and 1,000 seed weight. The apparently significantly lower seed yield at the 125kg/ha potash level is not considered to be a real effect but is a result of an abnormally low value at one site.

TABLE 3: The main effect of nitrogen, phosphate and potash on seed yield, oil content and 1,000 seed weight of linseed.

Ammonium Sulphate (kg/ha)	Seed yield (kg/ha)	Oil Content (%)	1,000 seed wt (g)
Nil	1,848 a	40.3 aA	6.3 a
215	2,094 a	37.4 bA	6.4 a
Superphosphate (kg/ha)			
125	2,101 a	38.4 a	6.5 aA
500	1,848 a	39.5 a	6.3 bB
Potassium Chloride (kg/ha)			
Nil	1,935 a	38.4 a	6.4 a
250	2,015 a	39.4 a	6.4 a
Control	1,848	38.5	6.3
C.V.%	11.9	4.8	1.6

NITROGEN x POTASH INTERACTION
1,000 seed wt.

Am. Sulphate kg/ha	Potassium chloride (kg/ha) Nil	250
Nil	6.25 b	6.42 a
215	6.52 a	6.38 ab

The lack of yield response to phosphate and potash application confirms work by McLeod (pers. comm.) who has observed little response from phosphate and a variable response to potash with linseed and linen flax yields in South Canterbury over a number of years.

The effect of nitrogen application on seed yield and 1,000 seed weight was not significant but nitrogen addition depressed seed oil content. There was also a significant interaction between nitrogen and potash application on the 1,000 seed weight, addition of either nitrogen and potash alone increased the 1,000 seed weight, but when both fertilisers were added together the apparent increase was not significant.

Linseed when grown out of pasture containing clover or other legumes would not normally be expected to give a yield response with nitrogen application due to adequate nitrogen reserved being available, this would appear to have been the case at both sites. In such a situation the observed oil content depression suggests that nitrogen application is not desirable.

The differences between the sites are shown in Table 4: the seed yield, oil content and 1,000 seed weight of the control plots at site B were signific-

antly higher than those at site A.

TABLE 4: The difference in linseed yield, 1000 seed weight and oil content between sites.

Control Means	Site A	Site B
Yield (t/ha)	1.3 b	2.4 a
1,000 seed wt (g)	5.8 b	6.9 a
Oil content (%DM)	36 b	41 a

The difference between the sites is attributed to soil moisture differences. Moisture stress occurred on the Lismore silt loam and two irrigations were required to stimulate growth, however, no irrigation was required on the Wakanui silt loam as no sign of moisture stress occurred. It was unlikely that a significant difference in rainfall occurred between the two sites, which suggests a difference in the water holding capacity of the two soils. The different availability of soil moisture is suggested as the reason for the difference in seed yield, oil content and 1,000 seed weight between the two sites.

The mean potassium content of the sampled linseed crops sown with potash based fertilisers was 2.20% compared with 1.65% for other linseed crops. This difference is significant although the confidence limits for the crops without potash application is $\pm$ 0.36 ($t<0.05$).

The herbage analysis indicated that although additional potash had no effect on seed yield and oil content, it was taken up by the plant and was probably incorporated into other plant material.

ACKNOWLEDGEMENTS

A.R. Wallace, D.S.I.R., Lincoln; R. Hughes, Kempthorne Prosser & Co. Ltd, Ashburton; and Fletcher Agriculture staff are acknowledged for their valuable and much appreciated assistance.

REFERENCES

Jacob, A., and Uexhull H.V., 1960 – Flax or Linseed 2d ed Verlagsgesellschaft fur Ackerban mbH Hannover, 1960 :239-242.

Keenan, B.T., 1971. Crops Section, Technical Research Division, New Zealand Department of Agriculture. C23.

McLeod, C.C., Personal Communications.