NUCLEAR SCIENCE AND APPLICATIONS VOLUME 15, 16, SERIES A, 84-86

IMPACT OF NPK FERTILIZERS ON MUSTARD (*Brassica juncea* coss)

III. Oil and nutrient content of seeds.

S.F. Elahi, A. H. M. Ahmed,* R. Mandal and M. M. Hussain

Department of Soil Science, University of Dhaka
* Department of Chemistry, University of Dhaka.

Abstract

A field experiment following a partially confounded design was conducted to study the effect of NPK fertilizers on the oil and N, P, K, Ca and Mg contents of mustard seeds. Fertilizers showed an increase in oil content in most of the treatments, though not significantly. Increasing amount of either nitrogen or phosphorus decreased per cent oil content in seeds. However, both the nutrients together with potassium increased the same remarkbly. Concentration of N, P, K, Ca and Mg in seeds was not greatly influenced by fertilizer treatments. Effective oil yield was maximum in the plot receiving each of NPK at 131.4 kg/ha. However, from the economic point of view, the treatment of 134 4, 33 6 kg/ha of N and P, respectively, was considered to be the best.

Introduction

In comparison to consumption of vagetable oil, the only cooking oil, the production in Bangladesh is very low. This necessitate import vegetable oil from other countries. To achieve self-sufficiency, Bangladesh Agricultural Research Institute (BARI) is attempting to increase the production of oil yielding seeds by applying either fertilizers or irrigation and in some instances the both. Research carried out by BARI is on some important oil yielding crops namely mustard, sesame, soybean, groundnut, sunflower etc. Increase in yield would undoubtedly generate a new sphere to meet the acute deficit of cooking oil, but, decidedly it will be better if the quality could be improved.

With respect to popularity, mustard oil ranks the top because of its well flavour. Mustard seeds contain 32-35% oil accounting 27-48% of faty acids and the corresponding values for sesame oil are 45-50 and 56-60% respectively. This deserves attention how to improve the quantity and quality of oil in mustard seeds. With this views in mind, a field experiment was designed with NPK fertilizers to see their effects on contents of oil and nutrients (N, P, K, Ca. Mg) in mustard (*Brassica juncea* coss) seeds.

Materials and Method

Details of the experimental procedure was described in series I (Elahi *et al.*, 1984-85). Mustard seeds were collected at maturity.

Yield of seeds was measured. Oven dried seeds (1 hour at 100°C) were used for chemical analysis. N content was determined by semi micro Kjeldahl's degestion procedure (Jackson, 1958). Wet oxidation of the seeds was done by nitric and perchloric acid (Volk and Jones, 1938) mixture. From the digest P, K, Ca and Mg contents were determined following standard analytical techniques (viz. P by Vanadomolybdophosphoric yellow colour method spectrophotometrically using Coleman Junior II spectrophotometer ; K, Ca and Mg by Flame photometrically using EEL Flame photometer). Oil content was estimated by NMR analysis in the NMR Laboratory, Institute of Nuclear Agriculture, BAU, Mymenshing.

Results and Discussion

Changes in oil content and N, P. K. Ca and Mg concentration in mustard seeds due to NPK fertilizer application has been studied. The results thus obtained have been shown in Tables (1-3).

Oil content of the mustard seeds was modified by NPK fertilizers from 29 3 to 33 4 (Table 1). The highest oil content was recorded in seeds collected from the plot receiving 67.2, 33.6, & 134.4 kg/ha of N, P, & K respectively. It can be seen that the variation among the treatments was not statistically significant. However, on per cent change consideration of the oil concentration in seeds revealed a wide variation from 1 to 18.5%. Most of the treatments increased the content of oil in seeds over control Galgoczi (1967) observed that NPK fertilization increased content of oil in sunflower. Application of NPK produced an increse in oil content of winter rape was also recorded by Dembinski *et al.* (1969). Addition of phosphorus could not alter the situation very much.Phosphorus in the absence of nitrogen decreased the content of oil in seeds. However, with nitrogen and phosphorus, potassium increased oil content remarkbly. Similar results were obtained by Trepechev (1953) and Singh *et al.* (1960).

On calculation of total amount of oil (Table 1 extracted from mustard seeds (per cent oil yield of seed), completely different significance of the results may be visualised. The effective yield of oil increased with increasing doses of nitrogen and phosphorus. The effect of phosphorus is small when the level of nitrogen was small i. e at N_0 and N_1 levels. Effective yield of oil increased with increasing amount of phosphorus of N_2 and N_3 levels. The effects of nitrogen and phosph orus fertilizers were moderated by potassium. Increasing amount of potassium decreased the effective yield in most of the treatments.

Chemical analyses of seeds have been shown in Tables 2-3. A decrease in nitrogen content of seeds having different nitrogen, phosphorus and potassium combination over control was recorded (Table 2). Individually increased rates of NPK decreased the concentration of nitrogen in seeds. It has been seen that increase in soil fertility due to fertilization enhanced the plant growth and yield. This supposes that increased nutrient status of the soil might have caused an increase in non-nitrogenous substances like fats and oils. This. to a certain extent is confirmed if a comparison is made between oil and nitrogen contents of seeds (Tables 1 and 2). Similar views were expressed by Mitchell *et al.* (1976). The authors reported that per-

Table 1. Effect of NPK fertilizers on the oil content, effective oil yield and per cent change in oil content of mustard seeds.

Treatments	N_0			N_1			N_2			N_4		
	Oil content (%)	Effective Yield (g)	% Change	Oil content (%)	Effective Yield (g)	% Change	Oil content %	Effective Yield (g)	% Change	Oil content (%)	Effective Yield (g)	% Change
P_0K_0	29.3	48.9		33.3	95.3	13.5	30.0	111.8	2.3	32.1	180.3	9.6
P_0K_1	28.4	43.8	−3.1	31.1	92.0	6.1	30.7	72.5	4.7	30.0	51.6	2.3
P_0K_2	30.0	29.9	2.4	31.6	84.4	7.7	31.5	106.6	7.5	31.9	69.8	5.1
P_0K_3	30.2	78 8	3.1	30.1	46.5	5.4	30.8	78.0	5.2	32.1	82.3	9.5
P_1K_0	31.7	61.1	8.2	30.4	100.9	3.6	31.5	124.6	7.6	31.2	257·3	6.3
P_1K_1	32.0	64 1	9.1	32.2	108.1	9.8	31.5	153.5	7.4	30 0	125.7	2.4
P_1K_2	29.5	45.0	0.6	29.8	72.8	1.8	32.7	120.7	11.5	30.5	152 2	4.1
P_1K_3	30.9	57.5	5.5	32.3	81.5	10.2	33.4	114.5	15.9	31.1	241.1	6.1
P_2K_0	31.1	41.0	5.9	29 7	99.1	1.2	30.6	174.0	4.3	28.9	207.4	−1.5
P_2K_1	29.1	51.7	−0.7	32.2	95.0	9.8	31.8	158.9	8.3	31.5	190.0	7.3
P_2K_2	30.1	66.2	2.8	30.6	66.5	4.4	32.2	126.4	9.7	29.3	180.2	0.0
P_2K_2	31.6	53.6	6.3	33.4	72.4	13.7	29.9	123.8	2.1	30.9	185.5	5.3
P_3K_0	28.6	48.9	−2.6	32.1	81.9	9.4	30.5	181.2	4.1	31.5	224.1	7.5
P_3K_1	31.9	71.0	8.9	30.7	125.7	4.6	33.3	161.3	13.6	27.8	79,9	−5.1
P_3K_2	30.8	38.5	2.2	33.1	150.7	12.8	30.2	135.0	3.1	30.6	185.8	4.5
P_3K_3	30.1	77.7	2.6	30.7	85.2	4.6	32.7	113.4	11.7	34.7	279.9	18.5

CD at 5% level, 5.69 for oil content

0, 1, 2, 3, represents 0, 33.6, 67.2, 134.4 kg/ha respectively.

Table 2. Effect of NPK fertilizers on the per cent nitrogen and phosphorus content of mustard seeds.

Treatments	N_0		N_1		N_2		N_3	
	N	P	N	P	N	P	N	P
$P_0 K_0$	3.22	3.83	2.30	3.24	2.84	3.83	2.84	3.69
$P_0 K_1$	2.95	3.99	2.02	3.95	2.85	3.57	2.94	3.83
$P_0 K_2$	2.58	3.23	3.20	3.20	2.64	3.93	2.57	3.73
$P_0 K_3$	2.57	3.30	2.93	3.78	2.78	3.82	2.58	3.49
$P_1 K_0$	3.05	3.36	2.71	3.91	2.63	3.84	2.72	3.96
$P_1 K_1$	2.65	3.79	2.61	3.96	2.73	3.74	2.59	3.94
$P_1 K_2$	2.82	3.86	2.45	3.20	2.81	3.95	2.79	3.95
$P_1 K_3$	2.90	3.75	2.77	3.83	2.52	3.66	2.85	3.96
$P_2 K_0$	2.23	3.78	2.53	3.96	3.05	3.62	2.99	3.88
$P_2 K_1$	2.73	3.67	3.44	3.69	2.41	2.84	2.69	3.84
$P_2 K_2$	2.96	3.93	2.79	3.62	2.37	3.61	2.34	3.94
$P_2 K_3$	2.82	2.92	2.96	3.68	2.52	3.83	2.59	3.32
$P_3 K_0$	2.80	3.82	2.44	3.87	2.46	3.81	2.68	3.31
$P_3 K_1$	2.57	4.05	2.26	3.53	2.82	3.80	2.63	3.21
$P_3 K_2$	3.16	3.58	2.86	3.38	2.63	3.34	2.61	3.99
$P_3 K_3$	2.86	3.78	2.64	3.83	2.79	3.64	2.86	3.29

CD at 5% level, 1.02 and 1.29 for N and P respectively.
Denotations same as Table 1.

centage of oil in seeds as well are independent, though it is dependent on fertilizer treatments.

Fertilizer application did not have any significant effect on the phosphorus content of mustard seeds (Table 2). The maximum (3.99%) and minimum (2.92%) phosphorus content were recorded at $N_3P_3K_2$ and $N_0P_2K_3$ treatment respectively. No such definite pattern in phosphorus content change was observed due to fertilization of the field. A little decrease in phosphorus content was evident with increasing doses of nitrogen and phosphorus. This possibly supposes the dimini-