NUCLEAR SCIENCE AND APPLICATIONS VOLUME 15, 16, SERIES A, 1984-85

EFFECT OF NPK FERTILIZERS ON YIELD OF OIL AND NPK CONTENTS OF SESAME SEEDS (*Sesamum indicum*)

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Abstract

A pot experiment was designed in a 3^3 factorial combination with partial confounding to measure the effect of N (0, 90, 180 kg/ha), P and K (each at 0, 22, 44 kg/ha) on yield of oil and NPK contents of sesame seeds (*Sesamum indicum*). Individual application of N, P and K fertilizers produced significant impact on oil content of sesame seeds. Amongst them P showed its effectiveness most. N and P combinations were welleffective in increasing oil content. NPK at the highest levels was most promising in yielding oil. NPK at the medium rates also exhibited a nearly similar effect on oil content. N, P and K content of seeds were significantly varied by N application alone. In all respects, N (90 kg/ha) plus PK (each 22 kg/ha) played better in increasing the amounts of N, P and K in seeds.

Introduction

In Bangladesh vegetable oil is the only cooking oil for the masses. Mustard, sesame and groundnut are the most important traditional sources of oil. In the scale of popularity, sesame ranks next to mustard, principally grown here for traditional cooking purposes.

Furthermore, sesame has been found to contain 45-50% oil comprising 56-60% of fatty acids and the corresponding values for mustard oil are 32-35 and 27-48% respectively. Relatively high content of linolic acid, 42%, marks sesame oil well suited for cooking. Moreover, for higher percentage of protein (19-25%) sesame is considered superior to mustard seed. Sesame seed is also accredited with higher calcium, iron and vitamin content (Navia *et al.*, 1957). Above all, the oil and its hydrogenated products are very stable in comparison with other oils due to their higher resistant to oxidation attributable in part to a phenolic material, sesamol produced by hydrolysis of sesamolin and some other substances (Budowski, 1950 ; Budowski *et al.*, 1950).

With the increased demand of population Bangladesh undoubtedly requires to produce more oil seeds to meet her own requirement of edible vegetable oil. The acreage under oil seeds can not be increased at the expense of cereals or other important crops. Therefore, it is necessary to evolve means for increasing yield in an unit area by impressing

upon other factors like soil fertilityand soil management. This experiment was taken up to study the effect of different fertilizers on the quantity of oil and quality of sesame seeds.

Matrials and Methods

A clay loam soil of Tejgoan series, Dhaka, with pH 5.5, organic matter 1.89%, and total and available N,P,K 0.09 and 0.004; 0.10 and 0.002 ; and 0.50 and 0.004% respectively. NPK contents of soil and seeds were measured by standard analytical techniques. Oil was extracted by a mixture of chloroform and methanol (2 : 1, v/v). The intensity of specific colour of oil developed in the presence of chromic acid was estimated colorimetrically at 580 mm wavelength.

The soil (0-23 cm) was mixed thoroughly with urea, triple superphosphate and muriate of potash at the rate of 0 90 and 180 kg/ha as N ; 0.22 and 44 kg/ha as P_2O_5 and K_2O as per treatment. The treated soil (9 kg/ pot) was then put in 54 earthenware pots (30 cm × 25 cm size) and seeded with *Sesamum indicum*. The experiment was set up in a 3^3 factorial design with partial confounding with two replications. Pots were arranged as subblocks, each of nine pots and in this way two large blocks of 27 pots were made. After a few days of germination, the plants were thinned to three healthy plants of uniform size per pot. Tap water was used for irrigating the pots. Weeds were removed as they appeared

Yield of seeds and oil, and content of oil and NPK of seeds were determined.

Results and Discussion

The individual and combined application of NPK fertilizers on the oil content and quality of sesame seeds have been examined. The results thus obtained are presented in Tables 1 and 2.

i) OIL CONTENT

Analysis of variance show that oil content of sesame seeds was greatly influenced by the individual application of N, P and K and the result was found highly significant at 0.1% level (Table 1). Oil content was favourably increased by P than N and K application. Amongst the first order interactions, N and P treatments were most effective in increasing the oil content of sesame seeds. 180 kg N together with 44 kg each of P and K/ha was most stimulative in producing oil. The results of the present work are in agreement with the findings of Galgoczi (1967) who reported that NPK fertilization increased oil content of sunflower. Dembinski and Horodyski (1969) also reported that application of NPK caused an increase in oil content in winter rape. Moreover, Trepechev (1953) and Singh *et al.* (1960) described that N increased oil content of sesame seeds but this must be applied in conjunction with PK.

ii) EFFECTIVE YIELD

So far effective yield is concerned, total extractable oil per unit is usually favoured by a type of nutrient combination. Higher yield with lower oil content was decidedly not better than moderately higher yield with higher oil content. For this type of crop, yield and oil content are to be taken into consideration together. Thus calculations were made for effective yield (yield × % oil) (Table 1). The effective yield generally reflected the same trend as oil content.

Table 1. Effect of NPK fertilizers on the content and effective yield of oil in sesame seeds.

TSP-P (kg/ha)		0		22		44	
Urea-N (kg/ha)	MP-K (kg/ha)	% Oil	Effective yield (g/plant)	% Oil	Effective yield (g/plant)	% Oil	Effective yield (g/plant)
0	0	17·0	0.026	21.0	0.100	26.0	0.180
	22	19.4	0.099	31 6	0.140	26 5	0.120
	44	24.9	0.050	27.5	0.130	27.9	0.153
90	0	23.0	0.170	27.6	0.250	26.1	0.150
	22	27.6	0.083	33.3	0.602	27.3	0.520
	44	28.2	0.132	31.4	0.320	31.7	0.680
180	0	25.4	0.213	31 4	0.204	34 0	0.500
	22	29.1	0.240	32.2	0.724	25.9	0.380
	44	29.0	0.120	28.7	0.190	34.8	0.452
L S D (0.1% level) 8.77							

Table 2. Effect of NPK fertilizers on the NPK contents (mg/100 g seed) of sesame seeds.

TSP-P (kg/ha)		0			22			44		
Urea-N (kg/ha)	MP-K (kg/ha)	N	P	K	N	P	K	N	P	K
0	0	0.40	4.0	9.0	0.76	5.0	9.5	0.56	9.9	10.5
	22	0.41	2.5	20.6	0.51	7.0	19.0	0.37	8.1	12.8
	44	0.53	5.1	15.6	0.50	4.3	13.7	0.42	6.2	20.6
90	0	0.88	5.8	14.9	0.75	7.3	5.9	0.67	7.3	5.3
	22	0.50	3.6	14.7	0.78	10.1	18.1	0.70	6.3	9.4
	44	0.68	4.8	17.8	0.58	5.2	14.5	0.71	9.7	11.0
180	0	1.03	6.1	15.3	0.67	5.9	9.7	0.86	7.7	10.3
	22	0.77	6.9	12.4	0.80	7.5	15.7	0.65	9.3	18.2
	44	0.63	4.4	17.6	0.97	8.3	7.4	1.14	10.9	11.7
L S D (0.1% level		0.20	2.91	7.78						

Effective yield was maximum where 180 kg N alongwith 22 kg each of P and K/ha was applied. A decrease in N from 180 to 90 kg/ha with the increase of P and K from 22 to 44 kg/ha also showed a very close result.

iii) NPK CONTENT OF SEEDS

N, P and K contents of seeds were considered as the index to analyze the quality of sesame seeds (Table 2).

The individual effects of N and P on N content of seeds were significant at 0.1% level (Table 2). N application produced better result than that of P supply to the soil. The effect became more pronounced with the increased dose. N supply also caused the plants more active in absorbing higher amounts of P and K from the soil. On the other hand the added P helped in accumulation of P and N in seeds. P is neither antagonistic nor synergestic with the K uptake and thereby its concentration in seeds. K alone failed to produce any significant increase in P and K content of seeds but K content of seeds at lower dose is greater than that at higher dose. The same phenomenon was also observed in seed yield. Higher concentration of K in soil possibly created a condition unfavourable for the uptake of P and K. Low uptake of these elements might have hampered the physiological processes of the plants thereby lower demand for K.

Combinations of N, P and K produced fluctuating results. A considerable increase in N, P and K contents of seeds was found at 90 kg N together with 22 kg each of P and K/ha treatment. However, 180 kg N alongwith 44 kg each of P and K/ha produced highest concentration of N and P in seeds. Maximal K content of seeds was recorded with the same amount of N and P but 22 kg K/ha instead. Pumtamkar and Bathmal (1967) also expressed a similar view that NPK in higher doses increased their contents in groundnut seeds.

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