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IMPACT OF NPK FERTILIZERS ON THE GROWTH, YIELD AND OIL CONTENT OF SESAME (*SESAMUM INDICUM*)

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Abstract

A pot experiment was conducted in a 3^3 factorial design with partial confounding to evaluate the effect of NPK on *Sesamum indicum* (var. Ganga). NPK did not significantly affect the height of the plant in the early stage of growth Increased height was attained at maturity by N, P and NP fertilization. In contrast, K, NK and NP produced some growth retarding effect. N and NP combinations appeared to be effective in pod setting but P, K and PK combinations proved to be of no use in this respect. Yield of seeds was in general at par with pod setting. The highest yield was recorded at 224 kg/ha with each of N, P and K. Yield of seeds in general followed the same pattern as pod setting. N, NP, NK and NPK treatments appeared to increase oil content in seeds by more than 5 times.

Introduction

In the scale of popularity, sesame ranks next to mustard, principally grown in Bangladesh for traditional cooking purposes. This is basically a short-day crop cultivated in Kharief season. The seed yield and oil content, quality and quantity primarily depends upon the variety but the same could be improved notably by proper fertilization and cultural practices (Singh *et al.*, 1960).

Seeds sowing technique and cultural practices are very much inadequate in Bangladesh. The crop is mostly grown without any fertilizers. No attempt have been made to boost up the yield either by proper selection of varieties or by the use of fertilizer or irrigation. In the face of acute shortage of edible oil, the increase in the potentiality of yield and oil content of sesame seeds becomes imminent. Thus, a pot culture experiment was carried out with NPK fertilizers to assess the nutrient requirement of the plant and the impact thereof on growth, yield and oil content.

Materials and Methods

A clay loam soil of Kajla series, Dhaka with pH 6.7., maximum water holding capacity 55%., organic matter 0·59%. and total available N, P, K 0.05 and 0.001; 0 1 and 0·004 ; and 1·5 and 0 005% respectively as measured by

standard analytical techniques was used in this experiment.

The soil was mixed thoroughly with urea, triple superphosphate and muriate of potash each at the rate of O, 112 and 224 kg/ha as N, P_2O_5 and K_2O as per treatment.

The treated soil was then put in 54 earthenware pots (30 cm X 25 cm size) at the rate of 22.4 kg/ha and seeded with *Sesamum indicum* (var. Ganga). The experiment was set up in a 3^3 factorial design with partial confounding. Pots were arranged as sub-blocks, each of nine pots and in this way to large blocks of 27 pots were made. After a few days of germination, the plants were thinned and only five healthy plants of uniform size were kept in each pot. Tap water was used for irrigating the pots.

Two plants were harvested after 45 days of growth. Height of the plants at 45 days of growth and at maturity, dry weight of shoots, number of pods, seed yield and oil content in seed were recorded.

OIL EXTRACTION

The oil content in seeds was determined by Soxhlet's extraction method. Over dried seeds were crushed in a mortar, washed with extractant (petroleum-ether, 80-100°C fraction), and transferred quantitatively to the previously weighed extraction thimble. The thimble was closed with a cotton wool plug and placed inside the pre-weighed Soxhlet's apparatus. Sufficient petroleum-ether was poured into the Soxhlet's flask to facilitate easy siphoning. Flask was heated over a glass-wool coated electric heating element for 8 hours. Oil was collected to the bottom of the flask and clear ether was distilled over and removed before siphoning after the completion of extraction. The flask with oil and the thimble with residue were then dried in an oven to remove traces of petroleum-ether and were weighed separately. The weights of oil and residue were estimated by subtracting the corresponding weights of the flask and the thimble respectively.

Results and Discussion

At the early stage plant height was not very much affected by NPK application either individually or in combination (Table 1). The native nutrient status of the soil appears to have been enough to meet the plant needs in the early stages of their growth and thus there was no response to added fertilizer. The effect of N as well as the first order interaction between N and P were found to be statistically significant on plant height at maturity (Table 1). Application of K with or without N failed to increase height. The response to P alone was more or less the same as K but with low doses of N increased height. Puntamker and Bathmal (1967) and Maples and Keogh (1969) observed that NPK application influenced the vegetative growth of oil yielding plants. The individual effects of N, P and K as well as the interactions between NK and PK were statistically significant in increasing dry weight of plants but NP interaction was not significant. A contrasting result was reported by Goldin and Har-Tzook (1966) who observed that NP application with organic matter increased the dry weight of oil yielding plants.

N alone and in combination with P and K produced significant effect on the pod setting of sesame plants (Table 1). N significantly increased the number of pods but the response

Table 1 : Impact of NPK fertilizers on the growth of sesame plants

	Treatments	N_0K_0	N_1K_0	N_2K_0	N_0K_1	N_1K_1	N_2K_1	N_0K_2	N_1K_2	N_2K_2	CD p=0.05
	Height* cm/plant	34.4	42.4	41.8	39.8	44.4	44.9	40.6	35.0	39.7	9.20
	Height** cm/plant	59.0	79.0	89.0	65.0	62.0	78.0	63.0	68.0	74.0	20.15
	Dry weight g/plant	5.9	8.2	8.1	6.9	7.9	6.9	6.7	6.6	6.6	1.10
	No. pods/plant	9.5	18.0	19.0	9.0	10.5	16.5	12.0	8.5	14.0	5.80
	Height* cm/plant	43.6	46.7	37.1	40.8	47.5	40.3	42.8	51.6	42.9	
P_1	Height** cm/plant	69.0	82.0	74.0	65.5	77.0	69.0	76.0	76.0	67.0	
	Dry weight g/pot	6.9	8.2	7.8	6.7	7.7	7.5	7.8	8.8	7.4	
	No. pods/plant	10.0	13.5	13.0	7.5	14.0	10.0	12.5	12.0	8.0	
	Height* cm/plant	43.7	42.7	47.8	39.9	43.9	34.4	45.1	44.3	47.7	
	Height** cm/plant	72.0	69.0	79.0	62.0	68.0	65,0	78.0	78.0	44.0	
P_2	Dry weight g/pot	7.4	9.8	7.9	7.6	7.8	6.9	7.2	6.9	7.7	
	No. pods/plant	6.0	17.0	17.5	7.0	11.0	12 0	8.5	15.5	13.5	

0, 1 and 2 indicate three rates of 0, 112 and 224 kg/ha, respectively.
*, ** indicate heights at 45 days and maturity, respectively.

Table 2 : Impact of NPK fertilizers on the seed yield and oil content of sesame seeds

	Treatments	N_0K_0	N_1K_0	N_2K_0	N_0K_1	N_1K_1	N_2K_1	N_0K_2	N_1K_2	N_2K_2	CD p=0.05
	Yield g/plant	1.0	1.1	2.6	1.1	3.2	1.6	1.4	1.3	1.3	1.30
P_0	% Oil	34	62	0	46	55	55	53	50	5.7	14-00
	Total oil g/pot	1.1	2.0	4.9	1.4	52	2.7	2.1	2.0	2.2	2.14
	Yield g/plant	1.2	3.2	1.2	1.3	2.6	1.2	1.3	2.6	1.5	
P_1	% Oil	47	57	57	54	42	37	46	59	46	
	Total oil g/pot	1.7	5.5	1.9	2.1	3.3	1.3	1.8	4.5	2.1	
	Yield g/plant	1.2	3.4	2.9	1.3	1.6	2.3	2.1	1.3	3 3	
P_2	% Oil	44	50	53	48	54	50	48	52	60	
	Total oil g/pot	1.5	4.0	4.5	1.9	2.6	3.4	3.0	2.0	5.8	

0, 1 and 2 indicate three rates of 0, 112 and 224 kg/ha, respectively.

was limited to only the first level of application (112 kg N/ha). The demand of N for pod setting was enhanced when P and K were added. NK combinations produced better result than K alone. The results were in conformity with Singh *et al.* (1960) who found increased pod number with the application of NPK to sesame plants. But kinman and Stark (1954) observed increased number of pods/plant and seeds/plant by NP application.

N added with P seemed to be more conductive to higher yield of seeds (Table 2). N as its combinations with P or K at all levels increased the oil content significantly (Table 2).P ranked itself next to N in this respect. NPK (each at 224 kg/ha) treatment decreased seed yield and oil content. The damage caused by plant diseases at NPK (each at 224 kg/ha) level was serious. The present results agreed fairly well with the findings of other investigators. Navia *et al.* (1957) reported that NPK application increased yield and oil content of sesame plants.

Apparently K appears to have detrimental effect on growth and yield of sesame plants did not respond well to phosphatic fertilizer. In the case of oil content, K appeared to be important and better than P and its combination with N.

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