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Yield and Quality of Sesame (*Sesamum indicum* L.) as Influenced by Nitrogen and Potassium Application

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A B S T R A C T

A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner in Jaipur district of Rajasthan during *kharif* season of 2016 on loamy sand soil. The experiment consisted of four levels each of N (0, 20, 40 and 60 kg/ha) and potassium (0, 10, 20 and 30 kg K_2O/ha). The total 16 treatment combinations were tested in randomized block design with three replication. Results indicated that progressive increase in level of nitrogen up to 40 kg/ha significantly increased the number of capsules/plant, seeds/capsule and seed, stalk and biological yield and oil content in seed over preceding levels. Further increase in nitrogen level to 60 kg/ha could not enhance the above parameters significantly. Results further revealed that progressive increase in level of potassium up to 20 kg/ha significantly increased yield determining characters of sesame viz., number of capsules/plant and seeds/capsule over lower levels. It recorded significantly higher seed, stalk and biological yield and oil yield over 10 kg K_2O/ha and control. The above treatment remained at par with 30 kg K_2O/ha.

Introduction

Sesame (*Sesamum indicum* L.) comes from the family pedaliaaceae and the genus sesamum. In India sesame is an edible oilseed crop next to groundnut and rape seed-mustard. It soil content generally varies from 46 to 52 per cent and protein content from 18-20 percent. Sesame protein is very important as a protein source for human consumption due to presence of the balanced amino acid composition, especially sulphur containing amino acid methionine, which is very rare in other plant protein.

Sesame is extensively cultivated in the states of Gujarat, West Bengal, Tamil Nadu, Maharashtra, Karnataka, Rajasthan and Madhya Pradesh. Gujarat alone accounts for 20 percent of the national production. Despite of being such an important sesame growing country, in India the average productivity is very low in comparison to global as well as national level. Cultivation of crop on marginal

and sub-marginal lands of poor fertility under rainfed condition, low and scanty rainfall, poor agronomic practices and inadequate or even no use of fertilizers are the major factors responsible for low productivity of the crop.

Poor nourishment especially of nitrogen, is the factor of low productivity of sesame. Nitrogen is university deficient plant nutrient in most of the Indian soils, particularly the light textured ones where most of sesame growing areas are confined (Chhonkar and Rattan, 2000). Besides nitrogen, potassium is an essential macronutrient that is taken up by plants from soil in relatively large amounts. Potassium plays a key role in many metabolic processes in plants. It is essential for photosynthesis, activates more than 60 enzymatic systems, promotes translocation and storage of assimilates, synthesis of proteins, controls tissue water balance for more efficient water use and favours a high energy status in the plants. In spite of the enormous role of potassium in plant physiological and metabolic processes as well as activation of many enzymatic systems, its application to field crops is being ignored with the understanding that our soils are not deficient in potassium. Considering the above facts in view, the present investigation was conducted during *kharif*, 2016.

Materials and Methods

A field experiment was conducted during the *kharif* season of 2016 at SKN College of Agriculture, Sri Karan Narendra Agricultural University, Jobner. The average annual rainfall of this tract varies from 400 mm to 500 mm and is mostly received during the months of July to September. The average annual rainfall of the tract is mostly received during the rainy season. Soils are loamy sand with 0.21% organic carbon, 126.3 kg/ha N, 19.23 kg/ha P_2O_5 and 150.26 kg/ha K_2O. Experiment was laid out in a radnomized plot design with three replications comprising 16 treatment combination. There commended dose of 25 kg P_2O_5 per ha through SSP was drilled as basal 10 cm deep and N and K_2O were applied as per treatment through urea and MOP, respectively. The dose of sulphur @ 20 kg/ha was applied through sulphur dust. Sesame cultivar 'RT- 346' was sown with standard package of practices. Three irrigation applied to the crop. All the plant protection measures were adopted to take healthy crop at maturity stage, after leaving two rows on each side as well as 50 cm along the width of each side, a net plot area was harvested separately for recording the yield attributes and yields. The harvested material was tied and tagged and kept on threshing floor sun drying. Different yield attributes *viz*., capsules/plant, seeds/capsule were reported at physiological maturity of the sesame. Yield of sesame were computed from the plants of net plot in each treatment and stalk yield was obtained by subtracting seed yield from total biomass yield. Yield was expressed in kg/ha. The harvest index was calculated by economic yield by biological yield and expressed in percentage. Oil percent in the sesame was determined by Soxhlet apparatus using petroleum ether (60-80ºC) as an extractant.

Results and Discussion

Effect of nitrogen

Yield attributes

Application of successive nitrogen up to 40 kg/ha significantly increased the yield attributes *viz*., number of capsules/plant, seeds/capsule (Table 1 and Fig. 1). Data presented in table 1 and figure 2 showed that the increasing levels of N upto the maximum dose i.e. 60 kg/ha brought linear increase in test weight of sesame. The overall improvement in vigour and crop growth as explained in preceding paragraphs due to

adequate supply of nitrogen early in the life of a plant is considered important in promoting rapid vegetative growth and biomass. Increasing growth in terms of plant height, dry matter accumulation and branches provided sufficient sites for number of capsules/plant and seeds/capsule. As seed yield is primarily a function of cumulative effect of yield determining characters, significantly higher values of these characters might be ascribed as the most probable reason of getting higher seed yield of sesame. These results are in close conformity with Sarala and Jagannatham (2002) in sesame.

Yield

An appraisal of data (Table 2 and Fig. 3) clearly indicated that application of 40 kg N/ha was found to be significantly superior to control and 20 kg N/ha giving higher seed, stalk and biological yield. The increase in seed and stalk yields might be due to better nutritional status of the crop in the soil. The biological yield is a function of seed and stalk yields. Thus, significant increase in biological yield with the application of N could be ascribed due to increased seed and stalk yield, hence, harvest index remained unchanged due to varying levels of N. The results of present investigation are in line with those of Tripathi and Rajput (2007), Sarala and Jagannatham (2002) in sesame.

Quality

Results revealed that increasing levels of N significantly increase in oil percentage and oil yield with suitable dose of N *i.e*. 40 kg/ha was observed in the present investigation because of increased N content in seed which might be the result of increased availability of nitrogen to plants. These results are in close conformity with the findings of Mondal *et al.*, (2001), Patra (2001), Tripathy and Bastia (2012) in sesame.

Effect of potassium

Yield attributes

Yield attributing characters of sesame were significantly improved by potassium fertilization. Application of potassium at 20 kg/ha (Table 1 and Fig. 1) recorded 41.71 capsules/plant, 39.17 seeds/capsule that were 7.39 and 7.46 per cent more than 10 kg/ha and 16.67 and 16.30 per cent more compared to control, respectively.

Further increase in level of potassium to 30 kg/ha, though, attained the highest values of all yield determining characters, but variation was not significant from 20 kg K_2O/ha. The results are in agreement with those of Sarkar and Pal (2005), Jadav *et al.*, (2010) on sesame.

Yield

It is apparent from data presented in table 2 (Fig 3) that seed yield of sesame increased significantly with successive increase in level of potassium upto 20 kg/ha.

This level of potassium fertilization produced the seed yield of 958 kg/ha, thereby, registering a quantum increase of 81 and 247 kg/ha over 10 kg/ha and control, respectively. Stalk and biological yield also increase significantly with the above same level of potassium. These results are in close conformity with the findings with those of Sarkar and Pal (2005), Jadav *et al.*, (2010) on sesame.

Quality

Results revealed that increasing levels of potassium significantly increases oil content and oil yield in sesame. Data in table 2 indicated that the application of potassium at 20 and 30 kg/ha significantly improved the oil

content over control. The results are in agreement with those of Mollashahi *et al.*, (2013), Viradiya *et al.*, (2004) and Mondal *et al.*, (1997).

Table.1 Effect of nitrogen and potassium on yield attributes and test weight

Treatments	Yield attributes		
	No of capsules/ plant	No of seeds/ capsule	Test weight (g)
Nitrogen (kg/ha)			
0	33.40	30.96	2.48
20	39.67	36.95	2.59
40	42.63	40.20	2.67
60	43.66	41.28	2.70
SEm±	0.92	0.92	0.05
CD (P=0.05)	2.64	2.66	0.15
Potassium (K_2O kg/ha)			
0	35.75	33.68	2.49
20	38.84	36.45	2.59
30	41.71	39.17	2.66
40	43.06	40.09	2.70
SEm±	0.92	0.92	0.05
CD (P=0.05)	2.64	2.66	0.15

N= Nitrogen, K_2O= Potassium, HI= Harvest index

Table.2 Effect of nitrogen and potassium on yield, harvest index, oil content and oil yield of sesame

Treatments	Yield (kg/ha)			Oil		Harvest Index (%)
	Seed yield	Stalk yield	Biological yield	Oil Content	Oil Yield (kg/ha)	
Nitrogen (kg/ha)						
0	642	1812	2454	43.29	279.84	26.15
20	881	2470	3351	46.11	406.78	26.30
40	983	2821	3735	48.86	482.68	26.38
60	1020	2893	3896	49.48	506.94	26.12
SEm±	24	65	78	0.95	14.49	0.41
CD (P=0.05)	69	186	224	2.72	41.71	NS
Potassium (K_2O kg/ha)						
0	711	2009	2753	44.67	321.64	25.89
20	877	2477	3330	46.41	407.18	26.30
30	958	2727	3630	47.72	463.67	26.45
40	980	2783	3722	48.94	483.75	26.32
SEm±	24	65	78	0.95	14.49	25.89
CD (P=0.05)	69	186	22	2.72	41.71	NS

Abbreviations

@	**At the rate of**	**Ha**	**Hectare**
%	Per cent	*i.e.*	That is
DAP	Di ammonium phosphate	kg/ha	Kilogram per hectare
d.f	Degree of freedom	No.	Number
DAS	Days after sowing	Cm	Centimeter
et al.,	(et alibi) and else where	Ha	Hectare
G	Gramme	LAI	Leaf area index
Viz.,	Namely	M	Metre
^{0}**C**	Degree Celsius	M^2	Square
NS	Non-significant	SEm±	Standard error of mean

Fig.1 Effect of nitrogen and potassium on yield attributes of sesame

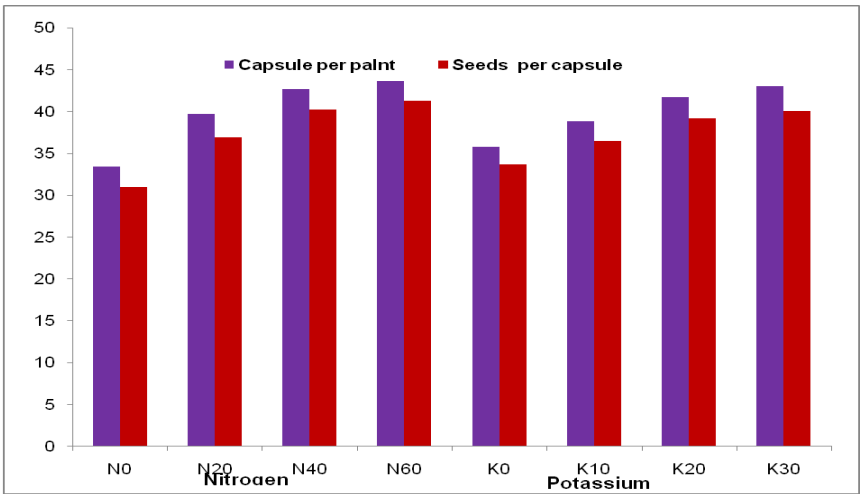


Fig.2 Effect of nitrogen and potassium on test weight

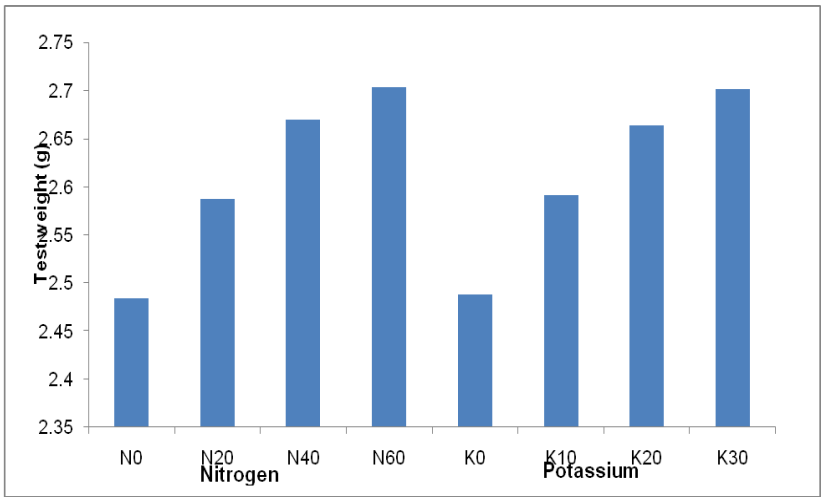
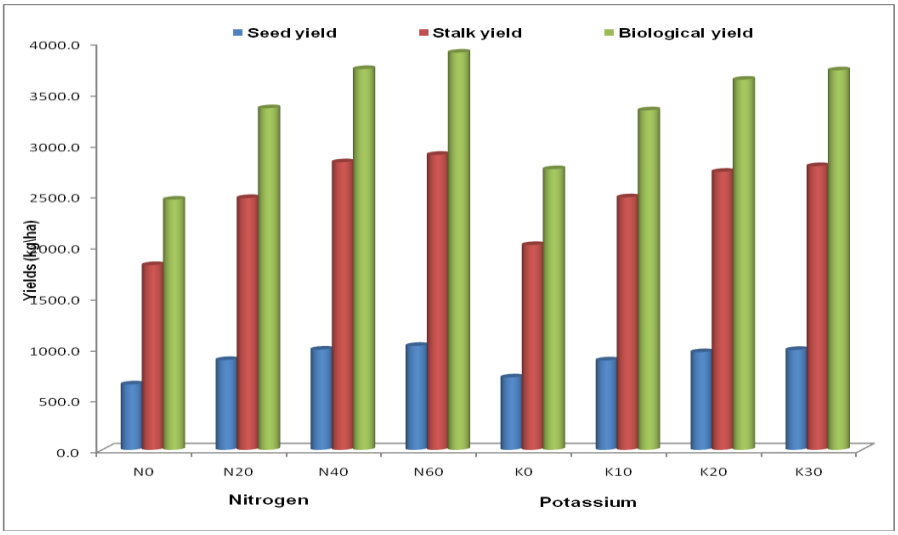


Fig.3 Effect of nitrogen and potassium on seed, stalk and biological yield



Application of research/Future perspective

Based on the one year of study it is recommended that 40 kg/ha N and Potassium at 30 kg K_2O should be applied for better nutrient management in *kharif* season respectively, for obtaining higher growth in Sesame.

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