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International Journal of Current Research
Vol. 5, Issue, 10, pp.2744-2745, October, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

EFFECTS OF DIFFERENT LEVELS OF NITROGEN, PHOSPHORUS AND SULPHUR ON YIELD AND YIELD ATTRIBUTES OF SUMMER SESAME (*Sesamum indicum* L.)

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ARTICLE INFO

Article History:
Received 29th July, 2013
Received in revised form
10th August, 2013
Accepted 11th September 2013
Published online 10th October, 2013

Key words:
Nitrogen, Phosphorus, Sulphur, Sesame, Yield and Yield attributes.

ABSTRACT

Eighteen treatment combinations consisting of three levels of nitrogen (25, 50 and 75 kg ha^{-1}), three levels of phosphorus (12.5, 25 and 37.5 kg ha^{-1}) and two levels of sulphur (0 and 20 kg ha^{-1}) were tested in factorial randomized block design with three replications. A significant increase in growth and yield attributes viz; plant height, number of branches/plant, length of capsule, number of seeds/capsule and test weight was obtained with increase in nitrogen levels from 25 to 50 kg N/ha., phosphorus levels from 12.5 to 37.5 kg/ha, Sulphur levels from 0 to 20 kg ha^{-1}

INTRODUCTION

The oilseed crops play an important role in agriculture and industrial economy of our country. India occupies a very prominent place in the production of oilseed crops of the world as it produces a large variety of oilseed crops and ranks first in respect of total area and production. Among the six major oilseed crops viz. groundnut, sesamum, castor, rapeseed, mustard and linseed, sesamum stands next to groundnut so far as production of edible oil is concerned. A field experiment was conducted during the summer season of the year 2010 at Pulse Research Station, Anand Agricultural University, Model Farm, Vadodara, Gujarat. Soil of the experimental field was sandy loam with pH 7.5. It was very deep and fairly moisture retentive, low in available nitrogen, zinc and organic carbon and high in available phosphorus and potash. It is mainly grown in the tropics and sub-tropics. Principal sesame growing countries are India, China, Turkey, Burma and Pakistan in Asia; Egypt and Sudan in Africa; Greece in Europe; Venezuela, Argentina and Columbia in South America; Nicaragua and El-Salvador in Central America and Mexico and U.S.A. in North America. In India, it is mainly grown in Uttar Pradesh, Andhra Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Punjab, Kerala and Tamil Nadu. In Gujarat, it is mostly cultivated in Mehsana, Banaskantha, Sabarkantha, Kheda, Bhavnagar, Surendranagar, Amreli, and Junagadh districts of the state. It is sown throughout the year i.e. during Kharif, Summer and Semi-Rabi as a sole or mixed crop.

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METHODOLOGY

The sesamum variety GT-2 released from Oilseed Research Station, Junagadh Agricultural University, Amreli, for the general cultivation in the entire Gujarat state in 1999. This high yielding variety of sesamum was selected for present study due to very high degree of resistance against disease and pest. Eighteen treatment combinations consisting of three levels of nitrogen (25, 50 and 75 kg ha^{-1}), three levels of phosphorus (12.5, 25 and 37.5 kg ha^{-1}) and two levels of sulphur (0 and 20 kg ha^{-1}) were tested in factorial randomized block design with three replications. In order to record observations on various growth characters viz at different stages, five plants were selected and tagged at random from each net plot. Furrows were opened manually in each plot 2 to 3 cm and at 45 cm row spacing in dry conditions after through preparation of land. The full dose of phosphors and sulphur and half quantity of nitrogen according to treatments were applied at the time of sowing. The remaining half quantity of nitrogen was applied as top dressing after one month of sowing. Eight irrigations were given as when required. The experiment was sown with sesame 'GT-2' on 27th February 2010 and harvested on 24th May 2010.

RESULTS AND DISCUSSION

Effect of nitrogen levels on yield and yield attributes

A significant increase in growth and yield attributes viz; plant height, number of branches/plant, length of capsule, number of seeds/capsule and test weight was obtained with increase in nitrogen levels from 25 to 50 kg N/ha. Further increase in nitrogen levels beyond 75 kg N/ha

did not bring any significant increase in these parameters. The number of capsule/plant were also increased with each increase in nitrogen levels up to 75 kg N/ha. However, there was no significant difference between two consecutive levels of nitrogen. The seed and stalk yields were also significantly influenced by nitrogen applications. Application of 50 and 75 kg N/ha were at par and produced significantly higher seed and stalk yields as compared to 25 kg N/ha. The mean seed yield recorded under application of 50 and 75 kg N/ha were 1316 and 1331 kg/ha which accounted for 10.4 and 11.6 per cent increase over 25 kg N/ha. These findings are in accordance to the results observed by Tiwari *et al*. (2001), Patel (2000), Patra (2001) and Choubey *et al*. (2001).

of applied S on the synthesis of chloroplast and protein which in turn promoted greater photosynthesis ultimately resulted in higher seed yield. These results are in accordance with the findings of Mondal *et al*. (1993), Yadav *et al.* (1996), Tiwari *et al.* (2001) and Choudhari and Patel (2007).

Conclusion

In light of the results obtained from this investigation, it can be concluded that for securing maximum seed yield and yield attributes, it is advisable to apply 50 kg N, 25 kg P_2O_5 and 20 kg S $ha^{-1}$to summer sesame var. GT-2 under middle Gujarat Agro-climatic conditions.

Table 1. Growth and yield attributes as well as seed and stalk yield of summer sesame as influenced by nitrogen, phosphorus and sulphur levels

Treatment	Plant height (cm)	Number of branches /plant	Number of capsules /plant	Length of capsule (cm)	Number of seeds /capsule	Test weight (g 1000 seeds)	Seed yield (kg/ha)	Stalk yield (kg/ha)	Harvest Index (%)
Levels of nitrogen, kg/ha (N)									
N_1: 25	104.10	3.73	49.8	2.639	55.24	3.30	1192	2613	31.60
N_2: 50	105.61	4.06	53.0	2.687	58.13	3.33	1316	2843	31.74
N_3: 75	106.85	4.17	54.4	2.741	59.34	3.34	1331	2894	31.61
S Em ±	0.770	0.091	0.44	0.021	0.719	0.010	27.60	79.61	0.65
CD at 5%	2.210	0.261	1.28	0.0592	2.06	0.028	79.23	228.55	NS
Levels of phosphorus, kg/ha (P)									
P_1 : 12.5	104.08	3.76	51.6	2.632	56.31	3.30	1222	2578	32.32
P_2 : 25	105.66	4.09	52.1	2.692	57.51	3.32	1322	2869	31.64
P_3 : 37.5	106.82	4.11	53.3	2.743	58.90	3.34	1296	2902	30.99
S Em ±	0.770	0.091	0.44	0.021	0.719	0.010	27.60	79.61	0.65
CD at 5%	2.210	0.261	1.28	0.0592	2.06	0.028	79.23	228.55	NS
Levels of sulphur, kg/ha (S)									
S_1 : 0	104.51	3.87	51.8	2.663	56.67	3.31	1226	2683	31.48
S_2 : 20	106.53	4.10	52.9	2.715	58.47	3.33	1334	2883	31.82
S Em ±	0.629	0.074	0.36	0.017	0.587	0.008	22.53	65.00	0.53
CD at 5%	1.805	0.213	1.04	0.0483	1.68	NS	64.69	186.61	NS
Sig. Interaction	-	-	-	-	-	-	-	-	-
CV %	3.10	9.69	3.60	3.25	5.30	1.24	9.15	12.14	8.71

Effect of phosphorus levels on yield and yield attributes

There was a significant effect of phosphorus on growth and yield attributes of sesame (Table 1). All the characters like plant height, number of branches/plant, length of capsule, number of seeds/capsule and test weight increased significantly with increase in phosphorus levels. Application of 25 kg P_2O_5/ha and 37.5 kg P_2O_5/ha was at par and gives higher growth and yield attributes, whereas number of capsule/plant increased significantly up 37.5 kg P_2O_5/ha. The seed yield of sesame increased steadily with increase in phosphorus levels. Application of 37.5 kg P_2O_5/ha being at par with 25 kg P_2O_5/ha produced significantly higher seed yield as compared to lower level of P_1 (12.5 kg P_2O_5 ha^{-1}). The mean seed yield recorded under application of 25 and 37.5 kg P_2O_5/ha were 1322 and 1296 kg/ha which accounted for 8.18 and 6.05 per cent increase over 12.5 kg P_2O_5/ha. The favorable effect of phosphorus on seed yield of sesame might be due to the stimulating effect of phosphorus on different yield attributing characters *viz;* number of capsules $plant^{-1}$, number of seeds $capsule^{-1}$ and test weight etc. The results are in conformity with those reported by Choudhary and Patel (2007), Mondal *et al.* (1992).

Effect of sulphur levels on yield and yield attributes

Sulphur application significantly influenced all the attributes of sesame (Table 1). The plant height, number of branches/plant, number of capsule/plant, length of capsule, number of seeds/capsule and test weight were significantly higher in 20 kg S/ha as compared to control. It also significantly increased seed and stalk yields as compared to control. The per cent increased was to the tune of 8.81 in case of seed and 7.45 in case of stalk yield. The stimulatory effect

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