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Effect of nipping, crop geometry and different levels of nitrogen on the growth and yield of sesame (*Sesamum indicum* L.)

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Abstract
A field experiment was conducted during the *Kharif* season of 2016 at the Crop Research farm, Department of Agronomy, Naini Agricultural institute, SHUATS, Allahabad (U.P.) to find out the effect of nipping, crop geometry and different levels of nitrogen on the growth and yield of sesame. The experiment consisted of sixteen treatments, comprising of nipping (N_0: no nipping and N_1: nipping at 25 DAS), crop geometry (P_1: 30 cm x 15 cm and P_2: 45 cm x 10 cm) and different levels of nitrogen (F_0: 0 kg N ha^{-1}, F_1: 20 kg N ha^{-1}, F_2: 40 kg N ha^{-1} and F_3: 60 kg N ha^{-1}), laid out in Randomised Block Design and thrice. The results showed that nipping at 25 DAS with a crop geometry of 45 cm x 10 cm and nitrogen level of 60 kg ha^{-1} showed higher growth parameters *viz.,* plant height (139.90 cm), plant dry weight (31.48 g), crop growth rate (50.8 g m^{-2} day^{-1}), relative growth rate (0.06 g g^{-1} day^{-1}) and higher yield attributes viz., capsule $plant^{-1}$ (87.18), seeds $capsule^{-1}$ (36.43), harvest index (0.28) and consequently, seed yield (662.67 kg ha^{-1}).

Keywords: Sesame, Nipping, crop geometry, nitrogen levels, growth parameters, yield attributes

Introduction
Sesame (*Sesamum indicum* L.) is one of the oldest and one of the important edible oilseed crop cultivated in the world and belongs to the family Pedaliaceae. Its seed are rich in oil (50%) and protein (18-20%). Among the oilseed crops, sesame ranks first for its higher oil content (46-64%) with 6335 K cal Kg^{-1} of dietary energy in seeds (Kumar and Goel, 1994) [8]. India ranks second in sesame production and first in area by contributing 23.2% and 13.1% of the world production and area, respectively. Sesame yield is the manifestation of various physiological processes occurring in plants and they are usually modified by management practices *viz.,* terminal clipping, plant geometry and fertilization, *etc.* which are an important aspect for determining the yield.

Nipping or clipping of terminal bud which activates the dormant lateral buds to produce more branches, is an important operation for increasing the sesame yield (Ramanathan and Chandrashekharan, 1998) [12]. This could be attributed to overall improvement in plant vigour leading to initiation of larger number of branches and ultimately better manifestation of yield attributes in sesame (Sarkar and Pal*.,* 2005) [13]. Crop geometry plays an important role on the growth and development of the plant. The spacing of the crop sown has influence on the amount of sunlight received by the plants and also the competition for light, nutrient, moisture and space between the plants. Wider crop geometry improved most of the yield attributes over lesser crop geometry owing to favourable geometric arrangement which helped better absorption of moisture and nutrients, and efficient photosynthesis, thereby resulting in better manifestation of yield attributes. (Sarkar and Pal*,* 2005) [13]. Sufficient application of nitrogen manifest plant growth in terms of plant height and number of branches per plant ultimately increases the seed and stalk yield of the plant. Application of higher dose of nitrogen showed higher increase in dry matter accumulation of the plant over lower dose of nitrogen. This might due to better response of sesame to higher doses of nitrogen. Increase in these parameters with higher doses of nitrogen might be due to favourable function of nitrogen to enlarge and multiply the cells with thinner cell walls, promotes vegetative growth and encourage the formation of good quality of foliage by producing more carbohydrates. The basic fact that the nitrogen being a major constituent of cell, helps in cell division and cell elongation which might have ultimately increased the plant growth. (Patel *et al.,* 2014) [11].

Keeping this in view, the present experiment was undertaken to study the effect of nipping, crop geometry and different level of nitrogen on the growth and yield of sesame.

Materials and Methods

A field experiment was conducted during *kharif* season of 2016 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P.), which is located at 25º24'41.27" N latitude, 81°51'3.42" E longitude and at 98 m altitude above the mean sea level. This area is situated on the right side of the river *Yamuna* and south east side of Allahabad City. The soil of experimental field was sandy loam having a *p*H of 7.39, with 0.39 (%) organic carbon. The experiment consisted of sixteen treatment combinations, comprising of nipping (N_0: no nipping and N_1: nipping at 25 DAS), 2 crop geometry (P_1: 30 cm x 15 cm and P_2: 45 cm x 10 cm) and 4 levels of nitrogen (F_0: 0 kg N ha^{-1}, F_1: 20 kg N ha^{-1}, F_2: 40 kg N ha^{-1} and F_3: 60 kg N ha^{-1}). The experiment was laid out in Randomnized Block Design and replicated thrice. Phosphorus (30 kg ha^{-1}) and potassium (20 kg ha^{-1}) was applied as basal in full dose while, nitrogen was applied half dose as a basal at the time of sowing and one-fourth at 30 DAS and the remaining one-fourth at the time of flowering. During the crop season, light irrigations were given and inter-culture operation were done to remove the weeds. The crop matured in 95 days and was harvested in the second fortnight of September. After harvesting, the data on yield attributes viz., capsule $plant^{-1}$, seeds $capsule^{-1}$, seed yield, stalk yield, harvest index, test weight were statistically analysed and critical differences were calculated.

Result and Discussions

Physiological growth parameters

Data pertaining to plant height are presented in Table 1, which revealed that the maximum plant height was observed in treatment T_8 (No nipping + 45 cm x 10 cm + 60 kg N ha^{-1}) with a plant height of 139.90 cm. As in terminal nipping practice, the apical bud is nipped and so the utilization of the photosynthates by the crop for lateral branches could be higher and this might be the reason for decreased plant height with nipping treatments, which was also reported by Singh *et al.,* 2013 [14]. Wider spacing of 45 cm x 10 cm was found to give a higher plant height compared to the closer spacing of 30 cm x 15 cm, which may be due to the fact that wider spacing gave the opportunity for all the resources to be available readily to the individual plants such as nutrients, light, space, moisture, etc and thus resulting in higher growth rate of the plant and this reason is supported by Ngala *et al.,* 2013 [10]. Plant height significantly increased with each successive increase in nitrogen (N) levels from 0 kg N ha^{-1} to 60 kg N ha^{-1}. The increase in plant height due to application of nitrogen may be attributed to better vegetative growth and these results are in conformity with the findings of Malik *et al.,* 2003 [9].

Dry matter accumulation was found to be the highest with a dry weight of 31.48 g plant-1 in treatment T_{16} (Nipping + 45 cm x 10 cm + 60 kg N ha^{-1}) as given in Table 1. Nipping of terminal buds at 25 days after sowing significantly increased the number of branches owing to higher dry matter accumulation compared to the plants with no nipping. The same findings were also reported by Duary and Ghosh, 2009 [3] and Sarkar and Pal, 2005 [13]. The dry weight of the plant increased significantly with the increase in crop spacing i.e, 45 cm x 10 cm. This is due to the availability of larger feeding area for nutrients, lights, moisture to the plants that were grown at wider spacing than the closer row spacing and are in conformity to the findings of Ngala *et al.,* 2013 [10]. Dry matter accumulation was found to increase with increased levels of nitrogen from 0 kg n ha^{-1} to 60 kg N ha^{-1}. Application of 60 kg N ha^{-1} gave higher plant dry weight, which might be due to the basic fact that the nitrogen being a major constituent of cell, helps in cell division and cell elongation, which might have ultimately increased plant growth. It promotes vegetative growth and encouraged the formation of good quality foliage and this result was in accordance to the findings of Patel *et al.,* 2014 [11].

The maximum increase in crop-growth rate was recorded between 40 and 60 days after sowing in all the treatments as given in Table 1 and declined thereafter towards maturity due to natural senescence of leaves. Crop geometry of 45 cm x 10 cm recorded the highest crop-growth rate due to parallel increase in dry-matter production. Application of NPK increased crop growth rate up to the highest level of fertility at all growth stages and nipping resulted in higher crop growth rate over no nipping treatment due to increased accumulation of dry-matter owing to enhanced production of lateral branches and leaves, which was also in accordance to Sarkar and Pal, 2005 [13].

Yield attributes

As given in Table 2, the yield attributes *viz.,* capsule $plant^{-1}$ (87.18), seeds $capsule^{-1}$ (36.43), 1000 seed weight (3.34 g), stover yield (1650.33 kg ha^{-1}), seed yield (662.67 kg ha^{-1}) and harvest index (0.28) was found to be the highest in treatment T_{16} (Nipping + 45 cm x 10 cm + 60 kg N ha^{-1}).

Nipping of terminal bud has a huge impact in the higher yield of sesame. The practice of nipping of terminal bud done at 25 days after sowing might have efficiently altered the crop architecture by activating the dormant lateral branches which ultimately increased the lateral branches that led to increase in the number of capsule $plant^{-1}$, which ultimately leads to greater chance for development of source and sink features in sesame and thereby would have facilitated the significant increase in the yield attributes and yield of sesame and this has also been reported by Singh *et al.,* 2013 [14]. Crop geometry of wider spacing of 45 cm x 10 cm was found to enhance more yield which may be due to wider inter-row spacing thus, giving a better chance for the plant to grow with lesser competition for space and better absorption of light and nutrients thus, resulting in efficient photosynthesis of the plant and thereby, resulting in better manifestation of yield attributes. This finding was in accordance with the recommendation of Duary and Ghosh., 2009 [3], Ngala *et al.,* 2013 [10] and Sarkar and Pal, 2005 [13]. Increased nitrogen level from 0 kg N ha^{-1} to 60 kg N ha^{-1} increased the yield attributes significantly. Maximum yield attributes are recorded in 60 kg N ha^{-1} at all the crop stages. This may be due the fact that the increase in nitrogen level up to the highest rate of N may be ascribed to the overall improvement in plant vigour and production of sufficient photosynthates owing to greater availability of nutrients and thus results in better manifestation of yield attributes. These findings are in accordance with those of Sarkar and Pal, 2005 [13].

Seed Yield

The highest seed yield of 662.67 kg ha^{-1} was found in treatment T_{16} (Nipping + 45 cm x 10 cm + 60 kg N ha^{-1}).

Nipping of terminal bud increased seed yield by 20% over no nipping. The higher yield under terminal clipping treatment might be because the development of auxillary buds are inhibited normally by Indole Acetic Acid (IAA) produced in the apical meristem. If the source of auxin is removed by excising the apical meristem, the lateral branching gets accelerated, which resulted in increased number of capsules/plant thereby increased seed yield. This was also explained by Bharathi *et al.,* 2014 [1] and Patel *et al.,* 2014 [11]. Increase in yield with nipping compared with no nipping clearly indicates that the energy which was previously used by plant to become taller was diverted towards grain formation. (Sarkar and Pal, 2005) [13]. Seed yield is also influenced by planting geometry. The planting geometry of 45 cm x 10 cm recorded significantly higher seed yield, compared to 30 cm x 15 cm. These results are in agreement with the findings of Jan *et al*., 2014 [5] who reported that wider row spacing showed more potential to realize high seed yield than the closer spacing. Increase in seed yield at wider row spacing may be due to larger space and growth resources available per individual plant, which enhanced growth and development. The decrease in seed yield at narrow spacing could have resulted from the higher inter and intra plant competition for growth resources. Maximum seed yield plant^{-1} was recorded with 60 kg N ha^{-1} over the other nitrogen level. This may be due to more accumulation of nitrogenous substances and their translocation to reproductive organs and also, it might be due to efficient seed filling by better translocation of photosynthates on application of nitrogen dose.

Economics

A persual of the Table 3 clearly reveals that treatment T_{16} (Nipping + 45 cm x 10 cm + 60 kg N ha^{-1}) recorded maximum net return (₹44284.51), followed by treatment T_{12} (Nipping + 30 cm x 15 cm x 40 kg N ha^{-1}) giving a B:C ratio of 2.00 and 1.95 respectively.

Table 1: Effect of nipping, crop geometry and levels of nitrogen on growth attributes of sesame

Treatment	60 DAS		
	Plant Height (cm)	Dr(g plant-1) y weight	CGR (40-60 DAS) (g m-2 day-1)
T_1: No nipping + 30 x 15 cm + 0 kg N ha^{-1}	130.07	12.10	45.08
T_2: No nipping + 30 x 15 cm + 20 kg N ha^{-1}	132.97	15.50	45.47
T_3: No nipping + 30 x 15 cm + 40 kg N ha^{-1}	135.60	18.59	46.76
T_4: No nipping + 30 x 15 cm + 60 kg S ha^{-1}	138.67	21.31	45.89
T_5: No nipping + 45 x 10 cm + 0 kg N ha^{-1}	131.83	13.40	44.28
T_6: No nipping + 45 x 10 cm + 20 kg N ha^{-1}	134.13	16.63	45.93
T_7: No nipping + 45 x 10 cm + 40 kg N ha^{-1}	137.03	19.85	46.73
T_8: No nipping + 45 x 10 cm + 60 kg N ha^{-1}	139.90	22.80	46.08
T_9: Nipping + 30 x 15 cm + 0 kg N ha^{-1}	94.67	27.32	48.78
T_{10}: Nipping + 30 x 15 cm + 20 kg N ha^{-1}	96.70	28.72	49.81
T_{11}: Nipping + 30 x 15 cm + 40 kg N ha^{-1}	98.40	29.85	50.16
T_{12}: Nipping + 30 x 15 cm + 60 kg N ha^{-1}	100.53	30.49	48.73
T_{13}: Nipping + 45 x 10 cm + 0 kg N ha^{-1}	95.70	27.97	49.68
T_{14}: Nipping + 45 x 10 cm + 20 kg N ha^{-1}	97.93	29.38	49.71
T_{15}: Nipping + 45 x 10 cm + 40 kg N ha^{-1}	99.47	30.38	50.09
T_{16}: Nipping + 45 x 10 cm + 60 kg N ha^{-1}	101.63	31.48	50.87
F test	S	S	S
SEm±	0.81	0.46	0.43
CD (P=0.05)	2.33	1.32	1.25

Table 2: Effect of Nipping, Crop Geometry and Levels of Nitrogen on yield attributes of Sesame

Treatment	Capsule plant^{-1}	Seeds capsule^{-1}	Test weight (g)	Seed Yield (kg ha^{-1})	Stalk Yield (kg ha^{-1})	Harvest Index (%)
T_1: No nipping + 30 x 15 cm + 0 kg N ha^{-1}	51.78	19.33	2.14	434.67	1197.67	26.63
T_2: No nipping + 30 x 15 cm + 20 kg N ha^{-1}	53.27	22.40	2.25	453.67	1217.00	27.15
T_3: No nipping + 30 x 15 cm + 40 kg N ha^{-1}	55.86	24.78	2.74	474.00	1233.67	27.76
T_4: No nipping + 30 x 15 cm + 60 kg N ha^{-1}	57.52	26.11	3.11	496.67	1253.67	28.37
T_5: No nipping + 45 x 10 cm + 0 kg N ha^{-1}	52.59	21.60	2.23	447.67	1207.00	27.05
T_6: No nipping + 45 x 10 cm + 20 kg N ha^{-1}	54.23	23.20	2.55	456.00	1229.67	27.06
T_7: No nipping + 45 x 10 cm + 40 kg N ha^{-1}	56.22	25.56	2.84	484.33	1244.33	28.02
T_8: No nipping + 45 x 10 cm + 60 kg N ha^{-1}	58.33	27.22	3.22	508.00	1256.33	28.79
T_9: Nipping + 30 x 15 cm + 0 kg N ha^{-1}	81.66	35.67	2.24	547.60	1550.67	26.10
T_{10}: Nipping + 30 x 15 cm + 20 kg N ha^{-1}	82.66	32.80	2.22	578.33	1579.67	26.80
T_{11}: Nipping + 30 x 15 cm + 40 kg N ha^{-1}	84.85	33.40	2.78	607.17	1606.00	27.43
T_{12}: Nipping + 30 x 15 cm + 60 kg N ha^{-1}	86.45	34.70	3.18	638.27	1636.67	28.06
T_{13}: Nipping + 45 x 10 cm + 0 kg N ha^{-1}	83.05	31.57	2.24	558.07	1568.33	26.25
T_{14}: Nipping + 45 x 10 cm + 20 kg N ha^{-1}	83.70	33.03	2.67	597.10	1564.67	27.63
T_{15}: Nipping + 45 x 10 cm + 40 kg S ha^{-1}	85.74	34.17	2.82	584.50	1620.33	26.48
T_{16}: Nipping + 45 x 10 cm + 60 kg S ha^{-1}	87.18	36.43	3.34	662.67	1650.33	26.48
F test	S	S	S	S	S	S
SEm±	3.81	0.64	0.15	9.72	9.60	0.38
CD (P=0.05)	11.00	1.83	0.43	28.06	27.72	1.10

Table 3: Effect of Nipping, Crop Geometry and Levels of Nitrogen on Economics of Sesame

Treatment	Cost of Cultivation(₹ ha^{-1})	Gross return (₹ ha^{-1})	Net Return(₹ ha^{-1})	B:C ratio
T_1: No nipping + 30 x 15 cm + 0 kg N ha^{-1}	23238.11	32316.50	9078.35	1.40
T_2: No nipping + 30 x 15 cm + 20 kg N ha^{-1}	24013.31	33045.50	9032.19	1.38
T_3: No nipping + 30 x 15 cm + 40 kg N ha^{-1}	24288.51	33045.50	8756.99	1.37
T_4: No nipping + 30 x 15 cm + 60 kg N ha^{-1}	24563.71	36740.50	12176.80	1.50
T_5: No nipping + 45 x 10 cm + 0 kg N ha^{-1}	23238.11	33100.50	9862.39	1.42
T_6: No nipping + 45 x 10 cm + 20 kg N ha^{-1}	24013.31	34394.50	10381.20	1.43
T_7: No nipping + 45 x 10 cm + 40 kg N ha^{-1}	24288.51	35886.50	11597.99	1.48
T_8: No nipping + 45 x 10 cm + 60 kg N ha^{-1}	24563.71	36954.50	12390.79	1.50
T_9: Nipping + 30 x 15 cm + 0 kg N ha^{-1}	23238.11	40672.00	17433.90	1.75
T_{10}: Nipping + 30 x 15 cm + 20 kg N ha^{-1}	24013.31	43459.50	19446.20	1.80
T_{11}: Nipping + 30 x 15 cm + 40 kg N ha^{-1}	24288.51	44969.00	20680.49	1.85
T_{12}: Nipping + 30 x 15 cm + 60 kg N ha^{-1}	24563.71	47941.00	23377.30	1.95
T_{13}: Nipping + 45 x 10 cm + 0 kg N ha^{-1}	23238.11	41412.50	18174.39	1.78
T_{14}: Nipping + 45 x 10 cm + 20 kg N ha^{-1}	24013.31	44193.00	20179.70	1.84
T_{15}: Nipping + 45 x 10 cm + 40 kg S ha^{-1}	24288.51	47141.75	22853.23	1.94
T_{16}: Nipping + 45 x 10 cm + 60 kg S ha^{-1}	24563.71	49235.45	24671.79	2.00

Conclusion
From the above findings, it can be concluded that for obtaining higher yields and better profit from sesame cultivation, the crop should be nipped at 25 DAS, sown at a spacing of 45 cm x 10 cm and fertilized with 60 kg N ha^{-1}, in addition to the recommended dose of phosphorus and potassium.

References

1. Bharathi K, Panneerselvam P, Bhagya HP. Effect of Clipping and Plant Growth Regulator along with different kind of fertilizers on yield and yield parameters in sesame (*Sesamum indicum* L.) during monsoon period. Indian Journal of Agricultural Research. 2014; 48(3):232-236.
2. Damdar RR, Bhale VM, Deshmukh KM. Effect of irrigation and nitrogen levels on consumptive use, water use efficiency, available nutrients and uptake of summer sesame (*Sesamum indicum* L.). International Journal of Agricultural Sciences. 2016; 12(1):28-31.
3. Duary B, Ghosh AK. Effect of Nipping on Productivity and Economics of Summer Sesame (*Sesamum indicum* L.) under Varying Levels of Plant Density. Madras Agric. J. 2009; 96(7-12):386-388.
4. Ghosh DC, Patra AK. Effect of plant density and fertility levels on productivity and economy of summer sesame (*Sesamum indicum* L.). Indian Journal of Agronomy. 1994; 39(1):71-5.
5. Jan A, Ali S, Adail M, Khan A. Growth and yield components of sesame (*Sesamum indicum* L.) as influenced by phosphorus levels under different row spacing. Journal of Environment and Earth Science. 2014; 4(22):150-154.
6. Kalaiselvan P, Subrahmaniyan K, Balasubramanian TN. Effect of nitrogen on the growth and yield of Sesame - a review. Agric. Rev. 2001; 22(2):137-200.
7. Kumara BH, Chittapur BM, Hiremath SM, Malligwad IH, Nadaf H, Koti RV. Effect of fertilizer levels and planting geometry on the performance of sesame (Sesamum indicum L.) genotypes. Karnataka J. Agric. Sci. 2014; 27(3):289-292.
8. Kumar S, Goel PD. A great ancient oilseed sesamum. Farmer and Parliament. 1994; 12:6-7.
9. Malik MA, Saleem MF, Cheema MA, Ahmed S. Influence of different nitrogen levels on productivity of sesame (*Sesamum indicum* L.) under varying planting patterns. International Journal of Agriculture and Biology. 2003; 5(4):490-492.
10. Ngala AL, Dugle IY, Yakubu H. Effects of inter-row spacing and plant density on performance of sesame (*Sesamum indicum* L.) in a Nigerian Sudan Savana. Science of International. 2013; 25(3):513-519.
11. Patel HK, Patel RM, Desai CK, Patel HB. Response of summer sesamum (*Sesamum indicum* L.) to different spacings and levels of nitrogen under north Gujarat condition. International Journal of Agricultural Sciences. 2014; 10(1):336-343.
12. Ramanatlian SP, Chandrasliekharan B. Effect of nipping, plant geometry and fertilizer on summer sesame (*Sesamum indicum* L). Indian Journal of Agronomy. 1998; 43(2):329-32.
13. Sarkar RK, Pal PK. Effect of crop geometry, fertility level and nipping on physiological parameters in relation to productivity of sesame (*Sesamum indicum* L.). Indian Journal of Agricultural Sciences. 2005; 75(3):143-6.
14. Singh B, Singh S, Kumar V, Kumar Y. Nitrogen and nipping schedule for higher productivity of sesame (*Sesamum indicum* L.) on aridisols of South - Western Haryana. Haryana J. Agron. 2013; 29(1&2):1-5.
15. Sivagamy K, Rammohan J. Effect of sowing date and crop spacing on growth, yield attributes and quality of sesame (*Sesamum indicum* L.). IOSR Journal of Agriculture and Veterinary Science. 2013; 5(2):38-40.