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Influence of Different Nitrogen Levels on Productivity of Sesame (*Sesamum indicum* L.) under Varying Planting Patterns

M. ASGHAR MALIK, M. FARRUKH SALEEM, MUMTAZ AKHTAR CHEEMA AND SHAMIM AHMED
Department of Agronomy, University of Agriculture, Faisalabad–38040, Pakistan

ABSTRACT

Study was conducted to see the influence of different nitrogen levels on productivity of sesame under varying planting geometry during 2001. The experiment comprised of three nitrogen levels (0, 40 and 80 kg ha^{-1}) and four planting methods (single row flat sowing, paired row planting, ridge sowing and bed sowing). Various growth and yield parameters of the crop were influenced differently by various nitrogen levels and planting methods. Among nitrogen levels, N_2 (80 kg ha^{-1}) treatment gave maximum seed yield (0.79 t ha^{-1}) and maximum seed oil content (45.88%) while among sowing methods bed sowing (50/30 cm) gave highest seed yield (0.85 t ha^{-1}) and seed oil contents (44.06%).

Key Words: Sesame; Nitrogen; Planting pattern

INTRODUCTION

Sesame is an important edible oilseed crop. The seed contains all essential amino acids and fatty acids. It is a good source of vitamins (pantothenic acid and vitamin E) and minerals such as calcium (1450 mg/100 g) and phosphorous (570 mg/100 g) and the seed cake is also an important nutritious livestock feed (Balasubramaniyan & Palaniappan, 2001). But unfortunately, its use as an oilseed crop has not been explored fully in our country (Hatam & Abbasi, 1994).

Planting pattern/method is considered an important aspect of advanced production technology which not only ensures better crop establishment but also results in water saving when the crop is sown on ridges or beds. Sowing of sesame crop on ridges with 10 cm distance between hills and ridges 70 cm apart gave highest values for number of capsules $plant^{-1}$, seed weight $plant^{-1}$ and 1000-seed weight. Similarly nitrogen fertilization has also been reported to have profound effect on oilseed crops. Application of 45 kg N ha^{-1} increased the number of branches and capsules $plant^{-1}$ and seeds $capsule^{-1}$ in sesame (Subramanian *et al*., 1979). Parwar *et al*. (1993) reported that seed yield in sesame was increased with 120 kg N ha^{-1} while Sumathi and Jaganadham (1994) obtained maximum sesame yield with 60 kg N ha^{-1}. Seed oil contents were increased by N application except at the highest rate (90 kg N ha^{-1}) which slightly reduced oil content compared with the control (Ramakrishnan *et al*., 1994). The tallest plants, highest number of capsules $plant^{-1}$ and highest seed yield were obtained with an application of nitrogen @ 45 kg ha^{-1} (Saharia & Bayan, 1996). Keeping these facts in view, a study was conducted to evaluate suitable N level and optimum planting method for sesame crop to harvest its maximum potential under Faisalabad conditions.

MATERIALS AND METHODS

Study to determine the nitrogen use efficiency of sesame (*Sesamum indicum* L.) grown under varying planting patterns was carried out at the Agronomic Research Farm, University of Agriculture, Faisalabad. The experimental soil was sandy clay loam with initial fertility status of 0.056 % N, 9.4 ppm available phosphorus and 138 ppm potassium.

The experiment was laid out in Randomized Complete Block Design (RCBD) with split plot arrangement with three replications. The net plot size was 7 x 2.4 m. Experiment comprised of four planting patterns viz. flat sowing (40 cm apart), paired row planting (60/20 cm), Ridge sowing (40 cm apart) and bed sowing (50/30 cm i.e. 50 cm wide beds with 30 cm ditch between the beds) and three nitrogen levels viz. control, 40 and 80 kg ha^{-1}. Planting patterns were kept in main plots while nitrogen levels were kept in sub plots.

Sesame variety TS-3 was sown on July 6, 2001 on a well-prepared fine seedbed using a recommended seed rate of 4 kg ha^{-1}. Fertilizers (nitrogen and phosphorous) were side drilled in the form of Urea and Tripple Super Phosphate (TSP). Phosphorous was applied at the rate of 60 kg ha^{-1} as a basal dose while nitrogen was applied as per treatment. Thinning was done after two weeks of sowing to maintain plant-to-plant distance. First irrigation was given after 25 days of sowing while subsequent irrigations were applied according to the need of the crop. Hoeing was done twice to keep the crop free from weeds. All other agronomic practices were kept constant and uniform for all the treatments.

Growth and yield parameters such as plant height at maturity, number of capsules $plant^{-1}$, number of seeds $capsule^{-1}$, 1000-seed weight, seed and oil yield were recorded using standard procedures during the course of these studies. The seed oil contents were determined by

using Soxhlet Fat Extraction Method with the help of Soxhlet Apparatus in the laboratory of Animal Nutrition, Faculty of Animal Husbandry, University of Agriculture, Faisalabad. Data collected were then subjected to the Fisher's analysis of variance technique. Treatments' means were compared by using Duncan's new multiple range (DNMR) test at 5% level of probability (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Data pertaining to plant height are presented in Table I, which indicate that plant height was significantly affected by nitrogen levels. N_2 (80 kg ha^{-1}) treatment produced the tallest plants with 136.34 cm height, followed by N_1 (40 kg ha^{-1}) with 131.66 cm tall plants. The minimum plant height (127.48 cm) was recorded in N_0 (control) treatment. The increase in plant height due to application of nitrogen may be attributed to better vegetative growth. These results are in conformity with the findings of Malik *et al.* (1988) who also reported that plant height increased with increasing levels of nitrogen. The interaction between planting patterns and nitrogen levels were found to be non-significant. Sharma (1994) reported similar non-significant results.

The data given in Table I represent that the number of capsules plant^{-1} was significantly affected by different nitrogen levels and varying planting patterns whereas, interaction between them was non-significant. Maximum number of capsules plant^{-1} (97.88) was produced at the nitrogen level of 80 kg ha^{-1}, followed by 40 kg N ha^{-1} which produced 92.50 capsules per plant. Minimum number of capsules plant^{-1} (88.55) was recorded in control treatment. It can be attributed towards more availability of nitrogen resulting in enhanced vegetative growth, leading to improved fruiting. These results are in line with those reported by Sharma and Kewat (1995). Maximum number of capsules plant^{-1} (94.33) was produced in P_4 (bed sowing) treatment, followed by P_3 (ridge sowing) treatment that produced 94.13 capsules plant^{-1}. Minimum number of capsules plant^{-1} (91.11) was found in P_2 (paired row planting) treatment. These results are in line with the findings of El-Serogy *et al.* (1997) who reported that sowing sesame on beds of 50 cm width gave highest value for number of capsules plant^{-1}. This may be due to the reason that plants on beds have suitable spacing for light penetration and this arrangement may also reduce competition among plants.

There is highly significant difference among nitrogen levels for number of seeds capsule^{-1} (Table I). Maximum number of seeds capsule^{-1} (62.83) was produced when nitrogen was applied at the rate of 80 kg ha^{-1}. While minimum number of seeds capsule^{-1} (61.42) was produced in N_0 (control) treatment. Increase in number of seeds per capsule in N_2 (80 kg ha^{-1}) treatment might be attributed to better growth of the plant which ultimately increased number of seeds as compared to control. These results are in line with the findings of Subramanian *et al.* (1979). Varying planting pattern as well as interaction between different nitrogen levels and planting pattern, however could not reach a level of significance with respect to number of seeds capsule^{-1}.

Table I reveals that 1000-seed weight was significantly affected by nitrogen levels. The highest 1000-seed weight (3.42 g) was recorded in N_2 (80 kg ha^{-1}) treatment, followed by N_1 (40 kg ha^{-1}) treatment that resulted in 3.22 g of 1000-seeds. While control resulted in

Table I. Effect of different nitrogen levels and planting geometry on plant height, number of capsules plant^{-1}, number of seeds capsule^{-1}, 1000 seed weight (g) and seed oil content of sesame

A. Nitrogen levels	Plant height at maturity (cm)	No. of capsules plant^{-1}	No. of seeds capsule^{-1}	1000-seed weight (g)	Seed oil content (%)
N_0 (Control)	127.48c*	88.55c	61.42c	2.97c	39.58c
N_1 (40 kg ha^{-1})	131.66b	92.50b	62.33b	3.22b	44.33b
N_2 (80 kg ha^{-1})	136.37a	97.88a	62.83a	3.42a	45.88a
B. Planting Geometry					
P_1 (Flat sowing)	125.76$^{N.S}$	92.33c	61.89$^{N.S}$	3.10$^{N.S}$	42.28b
P_2 (Paired row planting)	129.24	91.11c	62.11	3.15	42.72b
P_3 (Ridge sowing)	136.63	94.13b	62.56	3.31	44.00a
P_4 (Bed sowing)	135.71	94.33a	62.22	3.26	44.06a

* Any two means, not sharing a letter in common differ significantly at 0.05 level of probability (DNMR); N.S = Non-significant

Table II. Effect of different nitrogen levels and planting geometry on seed yield of sesame

Planting Geometry	Nitrogen levels			Means
	N_0 (Control)	(40 kg ha^{-1})	N_2 (80 kg ha^{-1})	
P_1 (Flat sowing)	0.50f*	0.56ef	0.65d	0.57c
P_2 (Paired row planting)	0.48f	0.61de	0.66b	0.59c
P_3 (Ridge sowing)	0.63de	0.80c	0.89b	0.77b
P_4 (Bed sowing)	0.67d	0.89b	0.98a	0.85a
Means	0.57c	0.72b	0.79a	

* Any two means, not sharing a letter in common differ significantly at 0.05 level of probability (DNMR)

lowest 1000-seed weight (2.97 g). These results are in line with those of Mankar *et al*. (1995) who reported that 1000-seed weight increased with increasing rate of N. Varying planting patterns had non-significant effect on 1000-seed weight. Bonsu (1977) reported a non-significant effect of planting arrangement on 1000-seed weight but El-Serogy *et al*. (1997) obtained highest 1000-seed weight of sesame by sowing the crop on ridges.

A perusal of Table II exhibits that different nitrogen levels, planting patterns and the interaction between them significantly affected seed yield. The treatment N_2 (80 kg ha^{-1}) produced maximum seed yield (0.794 t ha^{-1}), followed by N_1 (40 kg ha^{-1}) treatment that gave 0.716 t ha^{-1}. Minimum seed yield (0.572 t ha^{-1}) was noted in case of N_0 (control) treatment. Maximum seed yield obtained in N_2 is attributed to the combined effect of yield components. Increase in seed yield with increasing level of nitrogen was observed by Parihar *et al*. (1999) and Tiwari *et al*. (2000). In case of planting geometry, maximum seed yield (0.848 t ha^{-1}) was obtained by bed sowing (50/30 cm), followed by ridge sowing (40 cm apart) that gave 0.772 t ha^{-1} seed yield. Minimum seed yield (0.571 t ha^{-1}) was produced in flat sowing (40 cm apart). Higher seed yield in bed sowing may be attributed to more number of capsules produced by plants sown on beds. These results confirm the findings of Jain *et al*. (1999) and Ahmad (2000). The significant interaction between the factors under study showed that maximum seed yield (0.977 t ha^{-1}) was produced when crop was sown with 80 kg N ha^{-1} at beds (50/30 cm), while minimum seed yield (0.483 t ha^{-1}) was recorded when crop was sown in flat rows (40 cm apart) without nitrogen application.

The oil contents were significantly affected by different nitrogen levels and planting geometry whereas, interaction between them was found to be non-significant (Table I). The treatment N_2 (80 kg ha^{-1}) resulted in the highest oil content (45.88%), followed by N_1 (40 kg ha^{-1}) that gave 44.33% oil content. These results are in accordance with those of Tiwari and Namdeo (1997) who reported increase in seed oil content with increasing nitrogen application rate while contrary to those of Cheema *et al*. (2003) who recorded decrease in seed oil content with increasing rate of nitrogen. The highest oil contents (44.06%) were obtained in bed sowing (50/30 cm). The lowest oil content (42.28%) were obtained when crop was sown on flat rows (40 cm apart). These results are similar to those of Abuja *et al*. (1971).

It can be concluded that sesame crop should be sown on beds (50/30 cm) with nitrogen application rate of 80 kg ha^{-1} to obtain maximum return per unit rate.

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