Bangladesh Agron. J. 2021, 24(2): 31-41

PERFORMANCE OF SESAME*(Sesamumindicum* L.) VARIETIES UNDER VARIED NUTRIENT LEVELS

M. Malek[1], M.H. Ali[2], M.F. Karim[3], M.J. Ullah[3], A.K. Paul[4] and S.M. Masum[3]

[1]Farm Management Wing, [3]Department of Agronomy, [4]Department of Soil Science,
Sher-e-Bangla Agricultural University, [2]Fast Capital University of Bangladesh
Corresponding E-mail: smmasum607@sau.edu.bd

(**Received:** 01 August 2021, **Accepted:** 27 September 2021)

Keywords: Sesame, nutrient levels, varieties, high yield, Bangladesh

Abstract

The study was carried out to evaluate some sesame varieties under different nutrient levels for enhancing the productivity of sesame during March – June, 2014. The experiment was carried out in a split-plot design with three replications. The main -plot treatments had four nutrient levels *viz*., 75% of the recommended dose of fertilizer(RDF), 100% RDF, 125% of RDF, and 150% of RDF, and the sub - plot treatments included six sesame varieties *viz*., Laltil (Local), Atshira (Local), T_6, BARI Til-3, BARI Til-4 and Binatil-2. RDF indicates a nutrient schedule of 56:72:23 kg N, P_2O_5, and K_2O ha^{-1}. The effect of nutrient levels, varieties, and their interaction showed significant variation in respect of yield contributing parameters, yield, and harvest index. Results revealed that in nutrient levels, 100% of RDF produced the highest seed yield (1223 kg ha^{-1}). The least seed yield was observed with 150% of RDF (924 kg ha^{-1}). Among the sesame varieties,BARI Til-4 showed the optimum growth and yield contributing parameters as a result highest seed yield (1170 kg ha^{-1}). The lowest seed yield was obtained from Laltil (811.30 kg ha^{-1}). The interaction effect was found significant where highest seed yield of 1481 kg ha^{-1} with 100% of RDF combination of sesame var. BARI Til-4.

Introduction

Sesame (*Sesamumindicum* L.) commonly known as til in Bengali, belongs to the Sesamum genus of the Pedaliaceae family. It is grown mainly for seeds that contain 46% - 64% oil and 20% protein (Raja *et al*., 2007). Sesame oil contains good quality poly-unsaturated fatty acids viz., 47% oleic and 39% linoleic acid.

The crop is cultivated either as a pure stand or as a mixed crop with *aus* rice, jute, groundnut, millets, and sugarcane. In Bangladesh, sesame occupies a remarkable area under production and contributes second-ranked production after rapeseed and mustard. Although at present about 3, 21,338hectares of land are under sesame cultivation with a production of 19795 metric tons (BBS, 2020) but land area and production under sesame cultivation is decreasing day by day. In 2009-10, about 36 thousand hectares of land were under sesame cultivation where total production was 32306 metric tons (BBS, 2010). However, the climatic and edaphic conditions of Bangladesh are quite suitable for the cultivation ofsesame. Khulna, Jashore, Faridpur, Barisal, Patuakhali, Rajshahi, Pabna, Rangpur, Sylhet, Cumilla, Dhaka, and Mymensingh districts are the leading sesame producing areas of Bangladesh.

Lack of acclimatizing high yielding varieties, poor crop stand establishment, capsule shattering, uneven ripening, lesser fertilizer retorts, abundant branching, indeterminate growth habit, truncated harvest index, and vulnerability to diseases are the restrictivereasons in sesame production worldwide (Tripathy *et al.,* 2019). However, the environmental conditions, agricultural operations such as nutrition, and varieties have an impacton sesame seed yield and its harvest index (Bedigian *et al*., 1985). This probably indicates a great opportunity for a prolonged and higher increase in the productivity of sesame. To increase the productivity of sesame, various improved technologies are needed and among them, various agro-techniques, isolating location-specific varieties assumes greater significance (Myint *et al.*, 2020). In particular, variety, sowing time, population density and/or plant spacing, and fertilizermanagement in the soil play significant roles as determinants of seed yield. There are several modern varieties available in Bangladesh; but, the farmers are continuing to grow local varieties. Besides, inappropriate use of fertilizers is one of the major production constraints. Therefore, adoption of sustainable variety and maintenance of nutrient status in the soil would fulfill the maximizing yield of sesame (Monayem *et al.*, 2015). Higher productivity in any crop can be achieved through a combination of ideal variety associated with appropriate nutrient management practices.Besides, without or little use of fertilizers for sesame is a common practice in in Bangladesh. Keeping all the above facts, the study was undertaken to comparethe varietiesalong with the fertilizer management on sesame growth performance and productivity.

Materials and Methods

The experiment was carried out at the research field of the Agronomy Department, Sher-e-Bangla Agricultural University, Dhaka during March-June 2014. The experimental field was located at 90° 33′ E longitude and 23° 71′ N latitude at a height of 9 m above the sea level. The climate of the experimental area was sub-tropical and characterized by high temperature, heavy rainfall during Kharif-1 season (March-June), and scanty rainfall during Rabi season (October-March) associated with moderately low temperature (Khanam *et al.*, 2016). The land belongs to the Agro-ecological zone “Madhupur tract” (AEZ-28) having the Red Brown Trace Soils of Tejgaon series. The soil of the experimental site was well-drained and medium-high. The physical and chemical properties of the soil of the experimental site are silty clay in texture and having soil pH varied from 5.45-5.61. Organic matter content was very low (0.83). The soil physical components such as sand, silt, clay content were26%, 45%, and 29%, respectively, organic carbon 0.45, total N 0.61%, K 0.11 meq 100g soil^{-1}, and P, S, B, and Zn 0.65, 7.74, 0.35 and 3.99 µgg^{-1} ppm, respectively. The experiment consisted of split-plot design where nutrient levels was placed in main – plot and variety in sub- plot (Table 1). Laltil variety was collected from Ullapara, Sirajgonj where Atshira variety from Khoksha, Kushtia, and rest varieties. T_6, (BARI Til-3, and BARI Til-4) from Bangladesh Agricultural Research Institute (BARI), Joydeppur, Gazipur. The variety Binatil 2 was collected from the Bangladesh Institute of Nuclear Agriculture (BINA). The treatments in main –plot were nutrient levels viz.

N_1 = 75% of RDF(43:54:23 kg N, P_2O_5 and K_2O ha^{-1})
N_2 = 100% of RDF(58:72:30 kg N, P_2O_5 and K_2O ha^{-1})
N_3 = 125% of RDF(72:90:38 kg N, P_2O_5 and K_2O ha^{-1})
N_4 = 150% of RDF(86:108:45 kg N, P_2O_5 and K_2O ha^{-1})

and sub plot treatments were as

V_1 = Laltil (Local),
V_2 = Atshira (Local)
V_3 = T-6
V_4 = BARI Til-3
V_5 = BARI Til-4
V_6 = Binatil 2

The fertilizers used in the study were urea, Tripple superphosphate (TSP), and Muriate of potash (MoP) to supply N, P, and K, respectively (FRG, BARC, 2012). Before sowing seeds, the percentage of germination was found over 95. Row spacing was 30 cm with seed rate 5 Kg /ha. Seeds were placed 2-3 cm depth in rows and seeds were covered with loose soil properly. The thinning operation was done for ensuring the optimum plant populations. All other recommended agronomic practices were followed (BARI, 2013). Regular observations were made to observe the growth stages of the crop. The data collected on different parameters were statistically analyzed by using the MSTATC computer package program and treatment means were compared by LSD test at 5% level of probability (Gomez and Gomez, 1984).

Results and Discussion

Effect of nutrient levels on yield attributes

A significant variation was observed for the number of capsule plant^{-1}, number of seeds capsule^{-1}, capsule length, and weight of 1000- seedsdue to the application of different nutrient levels on sesame (Table 2). Regarding nutrient levels, the number of capsules plant^{-1} was maximum (77.28) from 100% of RDF (N_2) followed by N_3 (125% of RDF). loweR number of capsule plant^{-1} (63.83) was recorded from 75% of RDF (N_1) which was statistically similar with N_4 (150% of RDF). Bennet *et al.* (1996) also found an increased number of capsules plant^{-1} with Napplication up to 120 kg ha^{-1}. Each successive increase in the dose of N up to 60 kg ha^{-1} significantly increased the capsules plant^{-1} (Prakash *et al.*, 2001). Nahar *et al.* (2008) indicated that the number of capsules plant^{-1} increased significantly up to 100 kg N ha^{-1}. Significantly higher seed yield was recorded with 50 kg P_2O_5 ha^{-1} due to an increase in capsules plant^{-1} (Prakasha and Thimmegowda, 1992). Mian *et al.* (2011) opined that the highest number of capsules plant^{-1} was recorded with 90 kg P_2O_5 ha^{-1}. Increasing the level of K from 100 to 150 percent of the recommended dose, the number of capsules plant^{-1} of *Sesamum* increased significantly (Subrahmaniyan *et al.*, 2001).The number of seeds capsule^{-1} was maximum (79.53) from 100% of RDF (N_2) followed by N_3 (125% of RDF). The lowest number of seeds capsule^{-1} (72.76) was recorded from 150% of RDF (N_4) which was statistically similar with N_1 (125% of RDF). Nahar *et al.* (2008) also indicated that the seeds capsule^{-1} increased significantly up to 100 kg N ha^{-1}. Kathiresan (1999) indicated that the P level of 35 kg ha^{-1} influenced the number of seeds capsule^{-1} of *Sesamum*. Application of potassium markedly increased the number of seeds capsule^{-1} (Mandal *et al*., 1992). Tiwari *et al.* (1994) was found that the application of K_2O significantly increased the seeds capsule^{-1} of *Sesamum*. The capsule length was maximum (3.19 cm) from 100% of RDF (N_2) followed by N_3 (125% of RDF). The lowest capsule length (2.13 cm) was recorded from 150% of RDF (N_4) which was statistically similar with N_1 (75% of RDF). Mian *et al.* (2011) opined that the highest capsule length was recorded with 90 kg P_2O_5 ha^{-1} compared to 70 and 110 kg P_2O_5 ha^{-1}. Tiwari *et al.* (1994) was found that the application of K_2O significantly increased the capsule length of sesame. The weight of 1000-- seeds was highest (2.78 g) from 100% of RDF (N_2) followed by N_3 (125% of RDF). The lowest weight of 1000- seeds (2.60 g) was recorded from 75% of RDF (N_1) which was statistically similar with N_4 (150% of RDF). Ghosh and Patra (1994) recorded a higher 1000 -seeds weight of *Sesamum* upto 60 kg N ha^{-1}. Each successive increase in the dose of N up to 60 kg ha^{-1} significantly increased 1000 -seeds weight (Prakash *et al.*, 2001). Nahar *et al.* (2008) indicated that the 1000- seeds weight increased significantly up to 100 kg N ha^{-1}. Mian *et al.* (2011) opined that the highest 1000 -seeds weight was recorded with 90 kg P_2O_5 ha^{-1}. Application of potassium markedly increased the 1000- seeds weight (Mandal *et al*., 1992). Prakasha and Thimmegowda (1992) reported 53 percent increased seed yield with higher N rate due to enhanced value of yield attributes *viz*., capsules plant^{-1}, number of seeds capsule^{-1}, capsule length, and weight of 1000 -seeds.

Performance of varieties in terms of yield attributes

The tested local and modern varieties of sesame varied significantly in number of capsule plant^{-1}, number of seeds capsule^{-1}, capsule length, and weight of 1000- seeds (Table 2). The maximum number of capsule plant^{-1}(77.33) was obtained from V_5 (BARI Til-4) followed by V_4 (BARI Til-3).

Table 2. Effect of nutrient levels, variety, and their interaction on yield contributing parameters of sesame

Treatment	**Yield contributing parameters**			
	Number of capsule plant^{-1}	**Number of seeds capsule^{-1}**	**1000 -seeds weight (g)**	**Capsule length (cm)**
Nutrient levels				

N_1	63.83 c	73.05 c	2.60 c	2.18bc
N_2	77.28 a	79.53 a	2.78 a	2.32 a
N_3	69.11 b	75.69 b	2.70 b	2.24 b
N_4	64.28 c	72.76 c	2.62 c	2.13 c
$LSD_{0.05}$	1.21	1.41	0.04	0.06
Varieties				
V_1	56.58 f	65.82 e	2.45 c	2.05 c
V_2	59.17 e	69.03 d	2.52 c	2.12 b
V_3	70.25 d	77.66 c	2.73 b	2.26 a
V_4	76.08 b	79.67 b	2.79ab	2.30 a
V_5	77.33 a	80.76 a	2.81 a	2.31 a
V_6	72.33 c	78.62 c	2.75ab	2.28 a
$LSD_{0.05}$	0.93	0.97	0.07	0.05
Combination of nutrient levels and varieties				
N_1V_1	58.67jk	68.30hij	2.47 h	2.15ghi
N_1V_2	63.67 hi	72.77 g	2.60 fg	2.17gh
N_1V_3	64.67ghi	72.90 g	2.63 fg	2.17gh
N_1V_4	65.00gh	75.57fg	2.63 fg	2.20fg
N_1V_5	66.33fgh	75.80fg	2.63 fg	2.23ef
N_1V_6	64.67ghi	72.97 g	2.63 efg	2.20fg
N_2V_1	56.33 kl	67.47hij	2.47 h	2.13 hi
N_2V_2	61.67ij	69.43 h	2.53 gh	2.16gh
N_2V_3	76.67 c	82.33bc	2.87 b	2.36bc
N_2V_4	93.00 a	85.33ab	2.97 a	2.42 a
N_2V_5	94.67 a	88.13 a	3.00 a	2.43 a
N_2V_6	81.33 b	84.50 b	2.87 b	2.41ab
N_3V_1	56.00 kl	65.97ij	2.43 h	2.10 i
N_3V_2	59.67 j	68.77 hi	2.50 h	2.15ghi
N_3V_3	72.00 d	78.40def	2.80 bc	2.27 e
N_3V_4	75.33 c	80.10cde	2.83 bc	2.32 cd
N_3V_5	76.67 c	81.20 cd	2.83 bc	2.35 c
N_3V_6	75.00 c	79.70 cd	2.80 bc	2.28 de
N_4V_1	55.33 l	61.53 k	2.43 h	1.82 k
N_4V_2	51.67 m	65.17 j	2.43 h	2.02 j
N_4V_3	67.67fg	77.00ef	2.63 efg	2.23ef
N_4V_4	71.00 de	77.67ef	2.73 cde	2.24ef
N_4V_5	71.67 d	77.90def	2.77bcd	2.24ef
N_4V_6	68.33ef	77.30ef	2.70 def	2.24ef
$LSD_{0.05}$	2.975	3.026	0.090	0.052

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability.

Note: N_1= 75% of RDF (43:54:23 kg N, P2O5 and K2O ha^{-1}), N_2= 100% of RDF (58:72:30 kg N, P2O5 and K2O ha_{-1}), N_3= 125% of RDF (72:90:38 kg N, P_2O_5 and K_2O ha^{-1}), N_4= 150% of RDF (86:108:45 kg N, P_2O_5 and K2O ha^{-1}); V_1 = Laltil (Local), V_2 = Atshira (Local), V_3 = T-6, V4 = BARI Til-3, V_5 = BARI Til-4, V_6 = Binatil 2

The lowest number of capsule $plant^{-1}$ (56.58) was observed from local variety V_1 (Laltil) followed by local variety V_2 (Atshira). El-Serogy *et al.* (1997), Deshmukh *et al.* (2005), Kokilavani *et al.* (2007), and Riaz *et al.* (2002) indicated that the number of capsules $plant^{-1}$ differed significantly by different varieties. The maximum number of seeds $capsule^{-1}$ (80.76) was obtained from V_5 (BARI Til-4) followed by V_4 (BARI Til-3). The lowest number of seeds $capsule^{-1}$ (65.82) was observed from local variety V_1 (Laltil) followed by local variety V_2 (Atshira). Variation in the number of seeds $capsule^{-1}$ was noticed significantly among varieties (Govindaraju and Balakrishnan, 2002). Ali and Jan (2014) and Chongdar *et al*. (2015) also observed variation in the number of seeds $capsule^{-1}$ due to different varietal performance. The maximum capsule length (2.31 cm) was obtained from V_5 (BARI Til-4) which was statistically similar with V_3 (T-6), V_4 (BARI Til-3), and V_6 (Binatil 2). The lowest capsule length (2.05 cm) was observed from local variety V_1 (Laltil) followed by local variety V_2 (Atshira). Riaz *et al.* (2002) and Lakshmi and Lakshmamma (2005) also found similar results regarding capsule length of sesame and observed that different varieties showed different capsule lengths.

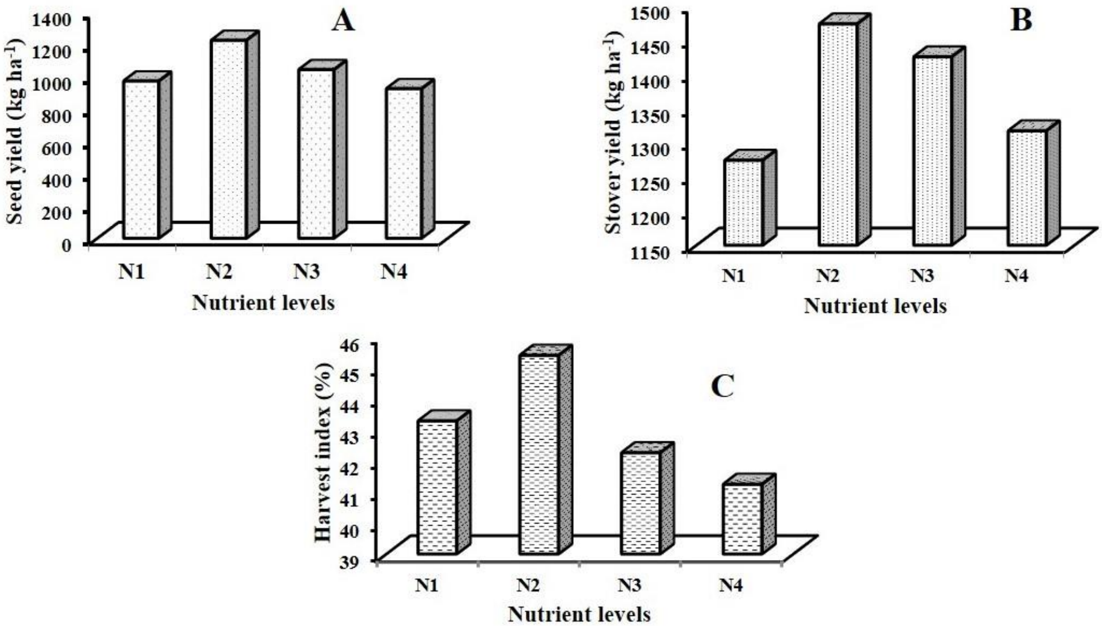
The maximum weight of 1000- seeds (2.81 g) was obtained from V_5 (BARI Til-4) which was statistically similar to V_4 (BARI Til-3) and V_6 (Binatil 2). The lowest weight of 1000 -seeds (2.45 g) was observed from local variety V_2 (Atshira) which was statistically similar with local varietyV_1 (Laltil). Similar results on 1000- seeds weight was found from Rao *et al.* (1990) and Yadav *et al.* (1991) which supported the present findings. They observed that the HYV variety gave a higher 1000-seed weight than the local variety.

Interaction effect of nutrient levels and varieties on yield attributes

Results showed that yield attributes due to the combination between different nutrient levels and varieties were significant (Table 2). The combination of N_2V_5 showed the maximum number of capsule plant^{-1} (94.67) which was statistically similar with N_2V_4 followed by N_2V_6. The lowest number of capsule plant^{-1} was recorded from N_4V_1 (55.33) which were statistically similar with $N_3V_1$and N_2V_1. The maximum number of seeds capsule^{-1} (88.13) from the N_2V_5 combination was statistically similar with N_2V_4 followed by N_2V_6. The lowest number of seeds capsule^{-1} was recorded from N_4V_1 (61.53) followed by N_4V_2 and N_3V_1. The maximum capsule length (2.43 cm) was recorded from N_2V_5which was statistically similar with N_2V_4 and closely followed by N_2V_6. The lowest capsule lengthwas recorded from N_4V_1 (1.82 cm) followed by N_4V_2. Different varieties had a significant response to different nutrient rates. Similarly, the variety T6 and BARI Til-3 showed increased capsule length up to 100 kg N ha^{-1} but the variety BARI Til 2 responded up to 150 kg N ha^{-1} (Nahar *et al.,* 2008).The maximum weight of 1000- seeds (3.00 g) was obtained from the N_2V_5which was statistically similar with N_2V_4 followed by N_2V_3 and N_2V_6. The lowest weight of 1000- seeds was recorded from N_4V_1 (2.47 g) which were statistically similar with N_2V_1, N_3V_1, N_3V_2, N_4V_1 and N_4V_2.

Effect of nutrient levels on yield and harvest index

Seed yield, stover yield, and harvest index were significantly influenced due to different nutrient levels (Fig. 1). Seed yield ha^{-1} was maximum (1223 kg ha^{-1}) from 100% of RDF (N_2) followed by N_3 (125% of RDF). The lowest seed yield ha^{-1} (924 kg ha^{-1}) was recorded from 150% of RDF (N_4) followed by N_1 (75% of RDF). The highest seed yield from 100% of RDF (N_2) might be due to the higher number of capsules plant^{-1}, number of seeds capsule^{-1}, capsule length, and 1000 - seed weight. Jadhav *et al.* (1992) also reported that the highest grain yield was recorded when 120 kg N and 75 kg P_2O_5 ha^{-1} was applied on account of a higher number of capsules plant^{-1} and number of seeds capsule^{-1}, which was statistically on par with 120 kg N and 50 kg P_2O_5 ha^{-1}. Seed yield increased for every further increase in the rate of N and K application upto 80 and 60 kg ha^{-1}, respectively (Mandal *et al.,* 1992). Nahar *et al.* (2008) indicated that the seed yield increased significantly up to 100 kg N ha^{-1}. Kathiresan (1999) indicated that the P level of 35 kgha^{-1} influenced the seed yield of *Sesamum*.



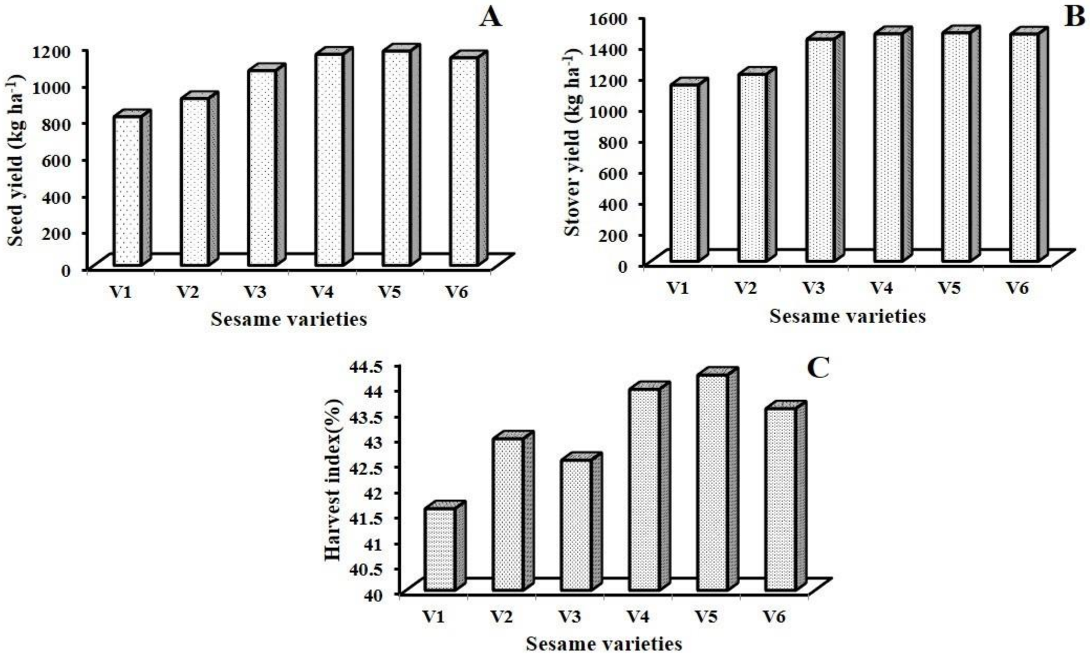
N_1 = 75% of RDF (43:54:23 kg N, P_2O_5 and K_2O ha^{-1}), N_2 = 100% of RDF (58:72:30 kg N, P_2O_5 and K_2O ha^{-1}), N_3 = 125% of RDF (72:90:38 kg N, P_2O_5 and K_2O ha^{-1}), N_4 = 150% of RDF (86:108:45 kg N, P_2O_5 and K_2O ha^{-1})

Fig.1**.** Seed yield (A), stover yield (B), and harvest index (C)of sesame as influenced by different levels of nutrients ($LSD_{0.05}$=13.43, 16.45, and 0.679, respectively)

The application of potassium markedly increased the seed yield (Mandal *et al*., 1992). Increasing the level of K from 100 to 150 percent of the recommended dose, the seed yield of sesame increased significantly (Subrahmaniyan *et al.,* 2001). The stover yield ha^{-1} was highest (1473 kg ha^{-1}) from 100% of RDF (N_2) followed by N_3 (125% of RDF). The lowest stover yield ha^{-1} (1274kg ha^{-1}) was recorded from 75% of RDF (N_1) which was followed by N_4 (150% of RDF). Ali and Jan (2014) reported that plots treated with 120 kg N ha^{-1} produced maximum stover yield (5351 kg ha^{-1}). Vaghani *et al*. (2010) reported that significantly higher stover yields were achieved with the fertilizer application of 100 kg N + 25 kg P_2O_5 + 80 kg K_2O + 40 kg S ha^{-1}. Mian *et al.* (2011) opined that the highest seed and stover yield was recorded with 90 kg P_2O_5 ha^{-1}.The harvest index was highest (45.36%) from 100% of RDF (N_2) followed by N_1 (75% of RDF). The lowest harvest index (41.23%) was recorded from 150% of RDF (N_4) which was statistically similar with N_3 (125% of RDF). Ali and Jan (2014) reported that 120 kg N ha^{-1} produced the highest harvest index. Khade *et al.* (1996) indicated that the harvest index increased with up to 50 kg P_2O_5 ha^{-1}. The highest harvest index was achieved by the application of 44 kg N and 44 kg $P_2O_5ha^{-1}$ (Abdel, 2008). Sarawagi *et al.* (1995) opined that significant seed yield, stover yield, and harvest index of summer sesame was 60 to 90 kg K_2O ha^{-1}.

Effect of varieties on yield and harvest index

Significant influence was found for seed yield ha^{-1}, stover yield ha^{-1}, and harvest index (%) by different sesame varieties (Figure 2). The maximum seed yield ha^{-1} (1170 kg ha^{-1}) was obtained from V_5 (BARI Til-4) followed by V_4 (BARI Til-3). The lowest seed yield ha^{-1}(811.30kg ha^{-1}) was observed from local variety V_1 (Laltil) followed by local variety V_2 (Atshira). Production capacity of yield contributing characters *viz*. number of capsules $plant^{-1}$, number of seeds $capsule^{-1}$, capsule length and weight of 1000- seeds was highest compared to other tested variety and resulted in highest seed yield. Suryabala *et al.* (2008) and Monpara *et al. (*2008) also found the yield of sesame varied significantly due to different varieties according to producing capability of yield contributing parameters. The maximum stover yield ha^{-1} (1476kg ha^{-1}) was obtained from V_5 (BARI Til-4) which was statistically similar with V_4 (BARI Til-3) and V_6 (Bina-til 2) followed by V_3 (T-6). The lowest stover yield ha^{-1} (1139kg ha^{-1}) was observed from local variety V_1 (Laltil) followed by local variety V_2 (Atshira). Suryabala *et al.* (2008) and Hamdollah *et al.* (2009) opined that different *Sesamum* cultivars showed a significant variation in stover yield.



V_1 = Laltil (Local), V_2 = Atshira (Local), V_3 = T-6, V_4 = BARI Til-3, V_5 = BARI Til-4, V_6 = BINAtil 2

Fig. 2. Seed yield (A), stover yield (B), and harvest index (C) of sesame as influenced by different varieties ($LSD_{0.05}$=16.44, 14.82, and 0.713, respectively)

The maximum harvest index (44.22%) was obtained from V_5 (BARI Til-4) which was statistically similar toV_4 (BARI Til-3). The lowest harvest index (41.60%) was observed from local variety V_1 (Laltil) followed by local variety V_2 (Atshira). A similar result was also found by Balasubramaniyan *et al.* (1995) and they opined that different varieties had a significant effect on the harvest index. They also opined that HYV possesses a higher harvest index than the local variety. Ali and Jan (2014) also found significant variation with sesame varieties on seed yield, stover yield, and harvest index.

Interaction effect of nutrient levels and varieties on yield and harvest index

Statistically, significant variation was observed by the combined effect of different nutrients and varieties regarding seed yield ha^{-1}, stover yield $ha^{-1,}$and harvest index (%) (Table 3).Results signified that combination between different nutrient levels and varieties, N_2V_5 listed the maximum seed yield ha^{-1} (1481 kg ha^{-1}) which was statistically similar with N_2V_4 followed by N_2V_6. The lowest seed yield $ha^{-1}$was recorded from N_4V_1 (670kg ha^{-1}) which was followed by N_4V_2.The maximum stover yield ha^{-1}(1715kg ha^{-1}) resulted in N_2V_5which was statistically similar with N_2V_4 followed by N_2V_6, $N_2V_{3,}$and N_3V_5. The lowest stover yield ha^{-1} was recorded from N_4V_1(1043kg ha^{-1}) which was followed by N_4V_2 and N_3V_1. Finally, N_2V_5showed thatthe maximum harvest index (46.34%) followed by N_2V_6 and N_2V_4. The lowest harvest index was recorded from N_4V_2 (35.87%) followed by N_4V_1 and N_4V_5.Bhosale*et al.*

(2011) found that sesame cv. 'GujratTil 2' reported significantly highest seed yield, stover yield, harvest index with the fertilizer application of 25 kg N + 25 kg P_2O_5 + 50 kg K_2O ha^{-1}.

Table 3. Combined effect of different levels of nutrients and varieties on yield and harvest index of sesame

Treatment	Seed yield ha^{-1} (kg)	Stover yield ha^{-1} (kg)	Harvest index (%)
N_1V_1	908.00 i	1203.00jk	42.85bcde
N_1V_2	965.30 h	1247.00ij	42.66cde
N_1V_3	974.70gh	1280.00ij	44.42 a
N_1V_4	990.70fgh	1317.00gh	41.76 f
N_1V_5	1005.00fg	1343.00 g	40.22 g
N_1V_6	984.00gh	1286.00 hi	41.62 f
N_2V_1	868.00 j	1182.00 k	39.52gh
N_2V_2	961.30 h	1239.00 j	43.53bc
N_2V_3	1161.00 c	1622.00 c	42.10def
N_2V_4	1457.00 a	1706.00 b	43.18bc
N_2V_5	1481.00 a	1715.00 a	36.34 j
N_2V_6	1408.00 b	1664.00 c	42.11def
N_3V_1	798.70 k	1128.00 l	38.91 hi
N_3V_2	958.70 h	1238.00 j	43.62b
N_3V_3	1105.00 d	1512.00 d	42.17def
N_3V_4	1132.00 cd	1530.00 d	41.42 f
N_3V_5	1135.00 cd	1621.00 c	38.15 i
N_3V_6	1120.00 d	1519.00 d	40.32 g
N_4V_1	670.70 m	1043.00 m	36.92 j
N_4V_2	756.00 l	1106.00 l	35.87 k
N_4V_3	1011.0fg	1356.00 g	42.98bcd
N_4V_4	1027.00ef	1468.00ef	39.61gh
N_4V_5	1059.00 e	1489.00 de	39.18 h
N_4V_6	1021.00 f	1438.00 f	42.03ef
$LSD_{0.05}$	33.22	41.16	0.7933

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability.

Note: N_1= 75% of RDF (43:54:23 kg N, P2O5 and K2O ha^{-1}), N_2= 100% of RDF (58:72:30 kg N, P2O5 and K_2O ha_{-1}), N_3= 125% of RDF (72:90:38 kg N, P_2O_5 and K_2O ha^{-1}), N_4= 150% of RDF (86:108:45 kg N, P_2O_5 and K2O ha^{-1}); V_1 = Laltil (Local), V_2 = Atshira (Local), V_3 = T-6, V4 = BARI Til-3, V_5 = BARI Til-4, V_6 = Binatil 2

Conclusion

The combined effect of nutrient levels, 100% of RDF (58 -72- 30 Kg N $P_20_5K_20$/ ha) with variety. BARI til-4produced the highest seed yield (1481 kg ha^{-1}) and oil yield (670 kg ha^{-1}). .Hence, it is concluded that the combination of 100% of RDF and var. BARI Til-4is conductive to produce maximum seed yield (kg ha^{-1}) of sesame in Bangladesh.

References

Abdel, R.A.E. 2008. Response of sesame to nitrogen and phosphorus fertilization in Northern Sudan. J. Appl. Biosci. 8(2): 304-308.

Balasubramaniyan, P., P. Gnanamurthy and V. Dharmalingam. 1995. Response oj irrigated sesame varieties to planting density and nitrogen. *Sesame Safflower Newsl*. 10: 59-62.

BARC (Bangladesh Agricultural Research Council). 2012. Fertilizer Recommended Guide, 2013. Farmgate, Dhaka, Bangladesh.

BARI (Bangladesh Agricultural Research Institute). 2013. KrishiProjuktiHatboi (in Bengali). Bangladesh Agricultural Research Institute, Gazipur, Bangladesh. pp. 215-225.

BBS (Bangladesh Bureau of Statistics). 1996. Statistical Yearbook of Bangladesh. Bureau of Statistics, Statistics Division, Ministry of Planning, Govt, of the People's Republic of Bangladesh. Dhaka.

BBS (Bangladesh Bureau of Statistics). 2010. Statistical Yearbook of Bangladesh. Bureau of Statistics, Statistics Division, Ministry of Planning, Govt, of the People's Republic of Bangladesh. Dhaka.

BBS (Bangladesh Bureau of Statistics). 2020. Statistical Yearbook of Bangladesh. Bureau of Statistics, Statistics Division, Ministry of Planning, Govt, of the People's Republic of Bangladesh. Dhaka. p.121.

Bedigian, D., D. S. Seigler and J. R. Harlan. 1985. Sesamin, sesamolin and the original of sesame biochem systematics. Biochem. Syst. Ecol. 13(2):133-139.

Bennett, M.R.,K. Thiagalingam and D.F. Beeck. 1996. Effect of nitrogen application on growth, leaf nitrogen content, seed yield and yield components of sesame. Sesame Safflower Newsl.11: 21-28.

Bhosale, N. D., B. M. Dabhi, V. P. Gaikwad and T. C. Poonia. 2011. Response of Sesamum (*Sesamumindicum* L.) to different levels of potash and sulphur under south Saurashtra region. Advance Res. J. Crop Impr. 2(1): 121-124.

Chongdar, S., B. Chhetri, S.K. Mahato and A. Saha. 2015. Production potentials and economic feasibility of improved sesame (*Sesamumindicum* L.) cultivars under varying dates of sowing in prevailing agro-climatic condition of north bengal. Int. J. Agric. Sci. 7(2): 434-439.

Deshmukh, M.R., H.C. Jasin and S.S. Duhoon. 2005. Relative performance of sesame *(Sesamumindicum* L.) varieties in Kymore plateau zone of Madhya Pradesh (India). J. Oilseeds Res. 22(1): 197-198.

El-Serogy, S.T., M.A. El-Emam and W.A.I. Sorour. 1997. The performance of two sesame varieties under difference sowing methods in two locations. Ann. Agric. Sci. 42(2): 355-364.

Ghosh, D.C. and A.K. Patra. 1994. Effect of plant density and fertility levels on productivity and economics of summer sesame (*Sesamumindicum* L.). Indian J. Agron.39(l):71-75.

Gomez, K.A. and A.A. Gomez. 1984. Statistical procedures for agricultural research. John Wiley and Sons, New York.

Govindaraju, P.K. and Balakrishnan. 2002. Effect of soil alkalinity on plant growth, yield and oil content of sesamum. Madras Agric. J.89(1-3): 133-135.

Hamdollah E., Z.S. Saeid, G.G. Kazem and H.G. Mohammad. 2009. Effects of water limitation on grain and oil yields of sesame cultivars. J. Food Agric. Environ. **7**(2): 339-342.

Jadhav, A.S., G.V. Chavan and S.R. Gungarde. 1992. Geometry of sesame *(Sesamumindicum* L.) cultivars under rainfed conditions. Indian J. Agron. 37(4): 857- 858.

Jebaraj, S. and M.N. Sheriff. 1996. SVPR 1 (TSS 6): A short duration high yielding white-seeded sesame for Tamil Nadu. Indian Fmg. 45(10): 5.

Kathiresan, G. 1999. Effect of growth regulators and clipping on sesame growth and yield in different seasons. Sesame Safflower Newsl. 14: 46-49.

Khade, V.N., S.N. Jadhav and S.A. Khanvilkar. 1996. Studies on scheduling of irrigation and phosphate fertilization to sesamum. J. Maharashtra Agric. Univ. 21(3): 410-411.

Khanam, M., M.S. Islam, M.H Ali., I.F. Chowdhury and S.M. Masum. 2016. Performance of soybean under different levels of phosphorus and potassium. Bangladesh Agron. J.19: 99-108.

Kokilavani, S., R. Jagannathan and S.K. Natarajan. 2007. Manual terminal clipping on yield and nutrient uptake of sesame varieties. Res. J. Agric. Biol. Sci.3(6): 987-999.

Lakshmi, P. and P. Lakshmamma 2005. Growth and yield of sesame *(Sesamumindicum)* as influenced by seasons. J. Oilseeds Res.22(1):228-230.

Mandal, S.S., D. Verma and S. Kuila. 1992. Effect of organic and inorganic sources of nutrients on growth and seed yield of sesame (*Sesamumindicum* L.). Indian J. Agric. Sci.62(4): 258-262.

Mian, M.A.K., M.K. Uddin, M.R. Islam, N.A. Sultana and H. Kohinoor. 2011. Crop performance and estimation of the effective level of phosphorus in sesame (*Sesamumindicum* L.). Academic J. Plant Sci. 4(1): 1-5.

Monayem, M.A., A. Sadia, M.A. Rashid and S.A.M. Shiblee. 2015. Factors affecting adoption of improved sesame technologies in some selected areas in Bangladesh: An empirical study. The Agriculturists. 13(1): 140-151.

Monpara, B.A., M.D. Vora, B.M. Chovatiya and B.V. Radadia. 2008. G. Til3: A white and bold seeded sesame *(Sesamumindicum* L.) variety for Saurashtra region of Gujarat. J. Oilseeds Res.25(2): 186-187.

Myint D., A. Syed, Gilani, M. Kawase and K.N. Watanabe. 2020. Sustainable sesame (*Sesamumindicum* L.) production through improved technology: An overview of production, challenges, and opportunities in Myanmar. Sustainability. 12: 3515. doi:10.3390/su12093515

Nahar, Z., K.K. Mistry, A.K. Saha and Q.A. Khaliq. 2008. Response of nitrogen levels on yield of sesame (*Sesamumindicum* L.). SAARC J. Agri.6(1): 1-7.

Prakash, O.M., B.P. Singh and P.K. Singh. 2001. Effect of weed control measures and nitrogen fertilization on yield and yield attributes of sesamum*(Sesamumindicum* L.) under rainfed condition. Indian J. Agric. Sci.71(9): 610-612.

Prakasha, N.D. and S. Thimmegowda. 1992. Effect of irrigation and fertilizer levels on nutrient concentrations and protein yield of sesame *(Sesamumindicum* L.). Indian J. Agron.37(2): 387-388.

Raikwar, R.S. and P. Srivastva. 2013. Productivity enhancement of sesame (*Sesamumindicum* L.) through improved production technologies. African J. Agric. Res. 8(47): 6073-6078.

Raja, A., K.O. Hattab, L., Gurusamy and S.Suganya 2007. Sulphur levels on nutrient uptake and yield of sesame varieties and nutrient availability. Int. J. Soil Sci. 2: 278-285.

Rao, K.L., D.V.N. Raju and C.P. Rao. 1990. Response of sesamum varieties to rate and method of nitrogen application under rainfed condition. The Andhra Agric. J.37(2): 352-356.

Riaz A., M. Tariq, S.M. Farrukh and A. Shamim. 2002. Comparative performance of two sesamum (*Sesamumindicum* L.) varieties under different row spacings. Asian J. Plant Sci.1(5): 546-547.

Sarawagi, S.K., N. Lai, R.S. Tripathi and K.K. Purohit. 1995. Effect of nitrogen, potassium, sulphur on growth and yield of sesame in summer season. Ann. Agric. Res. 16(1): 101-103.

Subrahmaniyan, K., D. Dinakaran, P. Kalaiselven and N. Arulmozhi. 2001. Response of root rot resistant cultures of sesame (*Sesamumindicum* L.) to plant density and NPK fertilizer. Agric. Sci. Dig. 21(3): 176-178.

Suryabala Y., A.B. Abidi, R.P. Singh and A. Singh. 2008. Response of sulphur nutrition on nutritional characteristics of oil and cake of sesame (*Sesamumindicum* L.) varieties. J. Oilseeds Res. 25(1): 38-40.

Tiwari, K.P., R.K. Jain and R.S. Raghuwanshi.1994. Effect of sowing dates and plant densities on seed yield of sesame cultivars. Crops Res. (Hisar). 8(2): 404-406.

Tripathy, S.K., J. Kar and D. Sahu. 2019. Advances in Sesame (*Sesamumindicum* L.) Breeding. In Advances in Plant Breeding Strategies: Industrial and Food Crops. Eds. Al-Khayri, J.M., S.M. Jain and D.V. Johnson. Springer, Cham, Switzerland. pp. 577–635.

Vaghani, J.J., K.B. Polara, P.K. Chovatia, B.V. Thumar and K.B. Parmar. 2010. Effect of nitrogen, potassium and sulphur on yield, quality and yield attributes of Kharif sesame (*Sesamumindicum* L.). Asian J. Soil Sci. 5(2): 318-321.

Yadav, L.N., A.K. Keshurwani, B.K. Verma and Y.D. Tiwari. 1991. September sown sesamum gives high yields in Madhya Pradesh. Indian Fmg. 41: 34-35.

Ali, S. and A. Jan. 2014. Sowing dates and nitrogen level effect on yield and yield attributes of sesame cultivars. Peshawar, Pakistan: Agricultural University Peshawar. Sarhad J. Agric. 30(2): 203-209.