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Optimizing Sowing Date and Row Spacing for Newly Evolved Sesame (*Sesamum indicum* L.) Variety TH-6

Muhammad Tahir[1,*], Umer Saeed[1], Asghar Ali[1], Ishtiaq Hassan[2], Muhammad Naeem[3], Muhammad Ibrahim[4], Haseeb ur Rehman[1] and Hafiz Muhammad Rashad Javeed[1]
[1]Department of Agronomy, University of Agriculture, Faisalabad, Pakistan
[2] Agriculture Department (Ext.), Government of the Punjab, Lahore, Pakistan
[3]University College of Agriculture and Environmental Sciences, Islamia University, Bahawalpur, Pakistan
[4]College of Agriculture, Dera Ghazi Khan, Pakistan

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***Corresponding Author:**
drtahirfsd@hotmail.com

ABSTRACT

A field trial was conducted to evaluate the impact of sowing date and row spacing on the yield and quality of sesame variety TH-6. The experiment was laid out in randomized complete block design (RCBD) with split plot arrangement. Sowing dates (15th June, 25th June, 05th July and 15th July) were placed in main plots and row spacing (15, 30 and 45 cm) were assigned to the sub-plots. The crop was grown up to maturity and the data on yield and quality attributes was recorded using standard procedures. The results revealed that all the yield attributing parameters were significantly affected by different sowing dates with different row spacing. The maximum plant height (158.9 cm), number of plants per m^2 (60.33), number of capsule per plant (24.90), biological (4.003 Mg ha^{-1}) and seed yield (0.857 Mg ha^{-1}), harvest index (21.42%), and oil yield (0.371 Mg ha^{-1}) were recorded in plots where sesame was sown at 15th June with row spacing of 15 cm. TH-6 variety of sesame sown on 15th June with 15cm row spacing seems to be best to get higher yield under agro-climatic conditions of Faisalabad, Pakistan.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the important oil seed crops of Pakistan. The seed of sesame contains 20 to 30% protein (Khidir, 1997) and about 50% oil of high quality (Roy *et al.,* 2009). So far as the origin of the crop is concerned, Ethopia and India are said to be the origin of this plant (Bedigian, 2004). One benefit of sesame is its antibacterial properties. Specific bacteria are needed for proper health, be in the gut, mouth and on the skin and they help maintaining organ functioning and integrity (Tremblay, 2001). Pakistan is facing acute shortage of edible oil. Demand of edible oil in Pakistan is increasing with increase in population but production of edible oil is decreasing every year. The local production estimated at 0.680 million tons, meets only 24% of domestic requirement of edible oil while the remaining 76% is met through imports. Total availability from all sources is provisionally estimated at 1.749 million tons (GOP, 2010). Higher production of sesame may contribute towards edible oil and to meet country's requirement which may help in reducing the import. Low yield of sesame in Pakistan may be attributed to the lesser availability of good quality seed, sowing method (broadcast method), sowing time (early or late sowing) and less or over plant population (Ashri, 1998). Proper method of plantation is of primary importance as it determines the proper plant population in the field. Differential response of varieties to sowing dates showed that the yield of sesame was decreased with delay in sowing beyond third week of July (Mahdi et al., 2007). Roy et al. (2009) reported that higher yield of sesame was obtained when row to row distance was 30 cm and yield was decreased at 45 cm. To get high yield of a crop it is necessary to understand the interaction of crops with weather because weather plays important role in plant growth. All these factors are also affected by the planting geometry of the crop. The environmental factors and management practices influence sesame productivity (Adebisi, 2004). On reducing row space the plant height was increased but capsule numbers per plant decreased (Rahnama and Bakhshandeh, 2006). Sowing dates also affected the starch content in grain significantly (Keane, 2002).

Suitable environmental conditions are necessary for optimum growth of crop and in field the crop yield also depends upon the row spacing between plants. Recommended Technologies and Production Practices at Farm give good yield of crops (Ather et al., 2006). Due to decrease or increase in row space plant population of the crop varies and without optimum plant population one cannot get good crop yield. There are many approved varieties of this crop in our country but all are branched. The branched varieties need more space for sunlight and aeration as compared to mono stem.TH-6 is a new mono stem variety of sesame and there is need to standardize its production technology, especially optimum sowing time and row spacing. Keeping in view the importance of sowing date and row spacing, present study was carried out to determine the optimum sowing date and row spacing of sesame variety TH-6 to get higher yield of crop under agro-climatic conditions of Faisalabad, Pakistan.

MATERIALS AND METHODS

The experiment was carried out at Agronomic Research Area, University of Agriculture Faisalabad (31°21′52″N 72°59′40″E) to evaluate the effect of sowing date and row spacing on growth, yield and quality of newly evolved sesame variety TH-6, sown during 'Kharif' season 2010. The experiment was laid out under randomized complete block design with split plot arrangement and was replicated three times with net plot size of 5 m × 1.8 m. Sowing dates were randomized in main plots while row spacing in sub-plots. There were four sowing dates (15th June, 25th June, 5th July and 15th July) and three row spacings (15, 30 and 30 cm). The newly evolved sesame cultivar TH-6 was sown in lines with hand drill. Seed was treated with fungicide before sowing. All of the nitrogen and phosphorous at the rate of 60 kg ha^{-1} each was applied at the time of sowing in the form of urea and DAP, respectively. The collected data was analyzed statistically using Fisher's analysis of variance technique and treatment means were compared by Duncan's Multiple Range Test at 5% probability level (Steel et al., 1997). The data were analyzed by the "MSTAT-C" statistical package on a computer (Freed and Eisensmith, 1986).

RESULTS AND DISCUSSION

All sowing dates affected the plant height of sesame significantly. The crop which was sown at 15th June produced significantly taller plants (152.1 cm) than at other sowing dates. The crop which was sown earlier produced taller plants (Sarkar et al., 2007 and Anjum et al.,2004). The crop which was sown on 05th July produced significantly shortest plants (92.35 cm). This decrease in plant height in case of 5th July sowing date might be due to stress of very high rainfall after the germination of the crop. The crop which was sown at 15 cm row space produced tallest plant (127.9 cm) and that plant height was significantly high than the other row spacings. Minimum plant height (115.9 cm) was observed at 45 cm row space. This increase in plant height in case of 15 cm row space is due to more number of plants m^{-2}, when the number of plants m^{-2} increases then the competition for light increases and plant grows taller to intercept maximum light. Caliskan et al. (2004) has reported taller plant stems with increase in plant population. The crop which was sown at 15 cm row space and 15th June sowing date produced significantly tallest plant (158.9 cm). The maximum plant population (37.00 and 37.22) was on sowing dates 15th June and 25th June, respectively and the minimum plant population (18.56) was recorded in sowing date 5th July. This decrease in plant population might be due to high rainfall soon after the germination of the crop which resulted in the death of plants due to water stress. 15cm row spacing gave the maximum numbers of plants (49.33) while the minimum numbers of plants (15.58) were recorded at 45 cm row spacing ($P<0.05$). Similar results were also reported by Rahnama and Bakhshandeh (2006). The significant interactive effect of row spacing and sowing dates recorded the maximum plant population where crop was sown on 15th June with plant spacing at 15cm. Ali et al. (2009) has reported same interactive effect. Sowing dates, row spacing and the interaction of both have affected the number of capsules per plant of sesame significantly. Early sowing produced significantly more number of capsules per plant (Nath et al., 2000). Sowing dates have affected the seed weight per capsule significantly. The crop which was sown on 25th June produced significantly maximum seed weight per capsule (0.1617 g) which was statistically at par with sowing date15th June. With delayed sowing the seed weight per capsule was decreased (Olowe, 2007). The analysis of variance has shown that row spacings have affected the seed weight per capsule significantly. There was no significant effect of interaction of sowing dates and row spacings on seed weight per capsule. The crop which was sown on 15th June produced significantly maximum number of seeds per plant (1285).these result are accordance with Pedersen and Lauer (2004). Different row spacings have also affected the number of seeds per plant significantly. The crop which was sown at 45 cm row space produced significantly maximum number of seed per plant (918.5). This may b due to less plant population and had more chance to get nutrients but that high number of seeds at 45 cm was not enough to match the final yield at 15 cm row spacing due to more number of plants m^{-2}. The interactive effect of sowing dates and row spacings was

Table 1: Effect of sowing dates and row spacing on growth, yield, and yield contributing parameters of sesame

	Plant Height (cm)	No of Plants (m^{-2})	No. of capsule per plant	Seed weight per capsule (g)	No. of seeds per plant	Biological yield (Mg ha^{-1})	Seed yield (Mg ha^{-1})	H.I%	Oil Yield (Mg ha^{-1})
Sowing date									
15th June	152.1 a	37.00 a	28.46 a	0.1541 a	1285 a	3.170a	0.687a	21.63a	0.303a
25th June	141.9b	37.22a	21.88b	0.1617a	883.7b	2.886b	0.476b	16.53b	0.210b
5th July	92.3d	18.56c	14.05c	0.1400b	624.3c	0.842d	0.087d	10.43d	0.092c
15th July	99.4c	24.78b	12.41c	0.1310b	524.7c	1.462c	0.204c	12.94c	0.039d
LSD	0.95	2.094	2.170	0.0105	190.8	0.2502	0.105	0.32	0.40
Row Spacing									
15 cm	127.9a	49.33a	17.25b	0.1426b	783.3b	2.760a	0.479a	15.81b	0.208a
30 cm	120.5b	23.25b	18.49b	0.1443b	786.8b	1.872b	0.346b	16.13a	0.152b
45 cm	115.9c	15.58c	21.86a	0.1532a	918.5a	1.551c	0.266c	14.20c	0.123c
LSD	1.64	1.249	1.257	0.0068	79.02	1.087	0.058	0.313	0.39
Interaction									
15th June × 15 cm	158.9a	60.33a	24.90b	0.148	1206	4.003a	0.857a	21.42b	0.371a
15th June × 30 cm	152.3b	30.67c	27.03b	0.155	1255	2.942c	0.688b	23.41a	0.298b
15th June × 45 cm	145.1c	20.00d	33.46a	0.159	1395	2.566f	0.514d	20.07c	0.239c
25th June × 15 cm	150.4b	60.33a	18.20d	0.156	809	3.481b	0.555c	15.95e	0.236c
25th June × 30 cm	139.5d	30.33c	21.13c	0.160	791	2.750d	0.485e	17.64d	0.216d
25th June × 45 cm	135.8e	21.00d	26.33b	0.169	1051	2.426g	0.388g	16.00e	0.178e
05th July × 15 cm	96.87gh	31.00c	14.53e	0.141	617	0.925i	0.096i	10.39g	0.042g
05th July × 30 cm	91.72ij	13.67e	13.10ef	0.131	623	0.820j	0.086i	10.59g	0.038g
05th July × 45 cm	87.47j	11.00f	14.53e	0.148	633	0.780k	0.080i	10.30g	0.036g
15th July × 15 cm	105.6f	45.67b	11.40f	0.125	501	2.630e	0.407f	15.49e	0.185e
15th July × 30 cm	98.27g	18.33d	12.70ef	0.131	478	0.975h	0.125h	12.90f	0.055f
15th July × 45 cm	94.28hi	10.33f	13.13ef	0.137	595	0.781k	0.081i	10.42g	0.037g
LSD	3.28	2.498	2.51	NS	NS	0.079	0.017	0.62	0.1079

Means not sharing the same letter in column differ significantly at 5% probability level. H.I., Harvest index

observed non significant in case of number of seeds per plant. Sowing dates and row spacings affected biological yield significantly. The crop sown on 15th June with 15 cm row spacing produced significantly maximum biological yield (4.00 Mg ha^{-1}).

The reason for maximum biological yield at 15th June sowing date with 15 cm row spacing might be due to high number of plants m^{-2}. Seed yield of the crop was affected significantly due to different sowing dates and row spacings and the interactive effect was also observed significant. The crop which was sown on 15th June with 15 cm row spacing produced significantly high seed yield (0.857 Mg ha^{-1}).Same results were reported by Ali et al. (2009).

Harvest index (%) was affected significantly by varying sowing dates and row spacings. The crop which was sown on 15th June have significantly maximum harvest index (21.63%). The row spacing 30cm showed significantly maximum harvest index (16.13%) and the interaction of both sowing date (15th June) and row spacing 30cm have significantly maximum harvest index (23.41%).These results are in line with those of Pedersen and Lauer (2004). Oil yield of the crop was also affected significantly by different sowing dates and row spacings. The crop which was sown on 15th June produced significantly maximum(0.303 Mg ha^{-1}) oil yield and row spacing of 15cm should significantly maximum oil yield (0.208 t ha^{-1}) the interaction of sowing date (15th June) and row spacing 15cm produced significantly maximum (0.371 Mg ha^{-1}) oil yield. On the basis of these results it is concluded that the newly evolved mono stem sesame variety TH-6 should be cultivated in on 15th June with 15 cm row spacing under agro-climatic conditions of Faisalabad.

Conclusion

From present study it can be concluded that TH-6 variety of sesame may produce higher yield when sown on 15th June with 15 cm row spacing as it improved almost all the growth and yield related attributes.

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