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EFFECT OF LAND CONFIGURATION AND SPACING ON *KHARIF* SESAME IN VERTISOLS

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ABSTRACT

An experiment was conducted at College of Agriculture, Nagpur to study the effect of different land configuration and spacing on growth and yield of sesame during *kharif* season of 2015-16 in split plot design with three different land configuration *viz.*, L_1- Flat bed, L_2-Opening of furrow after two rows and L_3- Broad bed furrow as main plot and four different spacings *viz.*, 30 cm x 10 cm, 30 cm x 20 cm, 45 cm x 10 cm and 45 cm x 20 cm as sub plot, replicated thrice. The soil was clayey, low in nitrogen, medium in phosphorus and high in potassium with normal pH 7.6. Growth and yield attributing characters *viz.*, Plant height, number of branches plant^{-1}, Dry matter accumulation, number of capsules plant^{-1}, Seed yield plant^{-1}, seed and straw yield (kg ha^{-1}), GMR and NMR were significantly more in broad bed furrow land configuration. In case of spacing, the growth and yield contributing characters, yield and monetary returns were significantly increased due to wider spacing of 45 cm x 20 cm which was at par with 45 cm x 10 cm and significantly more over closer spacing 30 cm x 10 cm and 30 cm x 20 cm.

(Key words : Sesame, Land configuration, spacing, growth)

INTRODUCTION

Sesame (*Sesamum indicum* L.) is the world's oldest oilseed crop. India is the world's largest producer of sesame, however the productivity is quite low. The total area of sesame in India during 2013-14 was 16.79 lakh ha and total production was 7.15 lakh tones with productivity of 426 kg ha^{-1} (Anonymous, 2014).

Proper land configuration is known for increasing moisture intake, its storage and resultant yield. The broad bed and furrow help in providing more opportunity for *in situ* soil water conservation in rainfed agriculture. Similarly, proper spacing provides free space to induce optimum growth in the plant resulting into increased yield of individual plant. Sufficient availability of space for each plant ensure most efficient utilization of all the available natural resources *viz.,* soil moisture, nutrients, sunlight, air etc. Hence, an attempt was made to study the effect of three different land configurations and four different spacings on growth and yield of sesame.

MATERIALS AND METHODS

A field experiment was conducted at Agronomy farm, College of Agriculture, Nagpur during *kharif* season of 2015-16. The experiment was laid out in split plot design with three different land configurations *viz.,* flat bed, opening of furrows after two rows and broad bed furrow as main plot treatment, and four different spacings *viz.*, 30 cm × 10 cm, 30 cm × 20 cm, 45 cm × 10 cm, 45 cm × 20 cm as sub plot treatments forming twelve treatment combinations replicated thrice. The soil of experimental plot was clayey in texture, low in available nitrogen (252.12 kg ha^{-1}), medium in phosphorus (19.21 kg ha^{-1}) and organic carbon (0.60 %) and very high in available potash (412.96 kg ha^{-1}) and slightly alkaline in reaction (pH 7.6).

The crop variety AKT-64 was used with gross plot size 5.0 m × 3.6 m and net plot size was 4.0 m × 3.0 m. Full dose of phosphorus and half dose of nitrogen were applied at sowing and remaining half dose of N was applied at 30 DAS. In order to represent the plot, five plants of sesame from each net plot were selected randomly, labeled properly. The growth attributing characters *viz.,* plant height, number of branches plant^{-1} and dry matter accumulation were recorded at harvest and yield attributing characters and yield *viz.,* number of capsules plant^{-1}, test weight, seed yield plant^{-1}, seed and straw yield (kg ha^{-1}) were also recorded at harvest. The gross monetary and net monrtary returns along with B:C ratio were calculated.

RESULTS AND DISCUSSION

Effect on growth attributes

The data pertaining to various growth attributes studied *viz.*, plant height, number of branches plant^{-1} and dry matter accumulation as influenced by various treatments are presented in table 1.

Effect of land configuration

Data in table 1 reveled that plant height, number of branches plant^{-1} and dry matter accumulation (g) significantly affected due to land configuration. It was

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significantly more in broad bed furrow compared to flat bed but found at par with treatment of opening of furrow after two rows.

Kantwa *et al*. (2005) reported that pigeonpea planted on BBF showed significantly increased growth attributes *viz.,* plant height, number of branches and dry matter accumulation over flat bed sowing method. Significant increase in plant height might be due to adequate moisture conservation in soil, in broad bed furrows and opening of furrows after two rows, might had benefited the crop during growth period resulting in optimum cell division and their elongation which ultimately enhanced the plant height. Mankar and Nawlakhe (2013) stated that significant increase in plant height, number of branches plant^{-1}, and number of pods plant^{-1} was observed under opening of furrow in every row as compared to furrow after two rows and flat bed in pigeonpea.

Effect of spacing

Data revealed that plant height of sesame was significantly affected and highest plant height was recorded with treatment 30 cm ×10 cm spacing. It was significantly higher than the plant height obtained in 45 cm × 10 cm and 45 cm × 20 cm spacing, but remained at par with spacing of 30 cm × 20 cm. Arif *et al.* (2012) reported that taller plants were achieved in the plots where crop was planted in rows of 60 cm apart followed by 45 cm and 30 cm of row spacing in white mustard. This might be due to lesser availability of land area plant^{-1} under closer spacing. Lesser availability of free space might have induced vertical growth in the plant resulting into increased plant height.

Number of branches plant^{-1} and dry matter accumulation plant^{-1} were significantly more in wider spacing 45 cm × 20 cm over closer spacing of 30 cm × 20 cm and 30 cm × 10 cm and was at par with 45 cm × 10 cm. Shaikh *et al.* (2007) conducted a field experiment on sowing time and spacing of summer sesame at Junagadh and revealed that highest number of branches plant^{-1} and dry matter accumulation were found with 45 cm x 10 cm spacing, however, it remained at par with 30 cm x 10 cm spacing. Umar *et al.* (2012) observed that the number of primary branches and shoot dry matter showed highest value at 15 cm intra row spacing as compared to 5 and 10 cm intra row spacings in sesame crop. These results were expected since under wider planting distance, there would be less competition among the plants for growth factors such as moisture, nutrients, space and light, which in turn, might increase potentiality of plants to produce more branches.

Effect on yield attributes

Data pertaining to various yield attributes studied are present in table 1.

Effect on land configuration

Different land configurations significantly influenced yield attributes of sesame. Highest number of capsules plant^{-1} was recorded with broad bed furrows, but it was at par with opening of furrows after two rows and significantly superior over flat bed.

Suryawanshi *et al*. (2008) reported that mean number of pods plant^{-1} of groundnut under broad bed and furrow (BBF) planting with two lines was significantly higher than flat bed and BBF with three lines. Patil *et al.* (2011) revealed that number of capsules plant^{-1} and other growth attributing characters were significantly increased with BBF planting as compared to flat bed method of planting. The increased number of capsules plant^{-1} might be due to enhanced branching under broad bed furrow sowing.

Seed yield plant^{-1}, test weight, seed and straw yield were significantly influenced due to land configuration treatments. Broad bed furrow treatment recorded significantly more seed yield plant^{-1} and straw yield over flat bed but it remained at par with the treatment of opening of furrow after two rows. Test weight remained unaffected.

Kantwa *et al.* (2005) revealed that sowing of pigeonpea in BBF method resulted in significantly higher number of pods plant^{-1}, grains pod^{-1}, 1000 grain weight and grain and straw yield ha^{-1}over flat bed method. It is well known fact that, broad bed furrows helps in moisture conservation and provides good drainages whereas opening of furrow, after two rows facilitates drainage of excess water, which might be the reasons in producing more yields in these treatments, as sesame crop is very sensitive to excess moisture and water stagnation.

Effect of spacing

Various spacings significantly influenced yield attributes of sesame. Highest number of capsules plant^{-1} and seed yield plant^{-1} were obtained in wider spacing of 45 cm × 20 cm, which was at par with spacing of 45 cm × 10 cm and significantly more over closer spacing 30 cm × 10 cm and 30 cm × 20 cm.

Shaikh *et al.* (2007) conducted a field experiment on sowing time and spacing of summer sesame at Junagadh and revealed that number of capsules plant^{-1}, test weight, seed and straw yield were significantly highest in 45 cm x 10 cm spacing, however, it remained at par with 30 cm x 10 cm spacing. This might be due to relatively lesser inter-plant competition for space, light, nutrient and moisture etc. Further, owing to better geometric arrangement, the above factors would have also helped in enhanced photosynthetic rate which consequently might have manifested higher number of capsules plant^{-1} and ultimately more seed yield plant^{-1}. Test weight was not affected due to various spacings.

Highest seed yield was obtained with spacing of 45 cm x 20 cm than 30 cm x 10 cm and 30 cm x 20 cm. However, it was at par with the spacing of 45 cm x 10 cm. Similar trend was observed for straw yield.

Ahmad *et al.* (2002) reported that, in sesame 45 cm was the best distance for increased seed and straw yield ha^{-1} among the row spacing of 30 and 40 cm between plants. Nagala *et al.* (2013) observed that in sesame crop seed yield was significantly higher at 50 cm spacing as compared to 25 cm or 75 cm spacing. Increase in seed yield at wider spacing might be due to larger space and growth resources available

Table 1. Growth and yield attributes, yield and economics of *kharif* sesame as influenced by different land configuration and spacings

Treatments	Growth attributes			Yield attributes			Yield		Economics		
	Plant height (cm)	No. of branches plant^{-1}	Dry matter accumulation plant^{-1} (g)	No. of capsules plant^{-1}	Test weight (g)	Seed yield plant^{-1} (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Gross Monetary return (Rs ha^{-1})	Net Monetary return (Rs ha^{-1})	B:C Ratio
Land configuration (L)											
L_1- Flat bed	101.6	4.6	23.40	31.6	2.84	7.7	398	1194	59700	44569	3.9
L_2 -Opening of furrow after two row	104.0	5.2	24.70	35.9	2.84	8.1	494	1497	74212	58581	4.7
L_3 -Broad bed furrow	104.5	5.3	24.95	38.2	2.86	8.3	515	1554	77262	61011	4.7
SE (m) ±	0.5	0.1	0.48	0.7	0.1	0.1	7.1	18.4	1072	1072	-
CD at 5%	2.0	0.3	1.53	2.7	-	0.2	28.0	72.3	4206	4206	-
Spacing(S)											
S_1 (30×10 cm)	104.9	4.6	23.77	25.3	2.82	5.3	458	1397	68833	53162	4.3
S_2 (30×20 cm)	104.1	4.9	23.13	32.1	2.80	8.5	440	1328	66016	50354	4.2
S_3 (45×10 cm)	102.2	5.1	25.05	38.8	2.83	7.6	478	1440	71783	56112	4.5
S_4 (45×20 cm)	102.1	5.6	25.34	42.7	2.96	10.7	499	1495	74933	59262	4.7
SE (m) ±	0.7	0.1	0.52	1.3	0.1	0.1	11.6	24.8	1752	1752	-
CD at 5%	2.2	0.4	1.54	3.9	-	0.4	34.7	73.8	5204	5240	-
Interaction (L X S)											
SE (m) ±	1.3	0.2	0.90	2.3	0.1	0.2	20.2	43.0	3034	3034	-
CD at 5%	-	-	-	-	-	-	-	-	-	-	-

per individual plant, which enhanced growth and development, whereas decrease in seed yield at narrow spacing could have resulted from the higher inter plant competition for growth resources.

Economic studies

Data on gross monetary return, net monetary return and B:C ratio as affected by various treatments are presented in table 1.

Effect of land configuration

Gross monetary return (77262 Rs.ha^{-1}) and net monetary return (61011 Rs.ha^{-1}) were highest in the treatment of broad bed furrows which was significantly superior over flat bed but remained at par with opening of furrow after two rows. Highest B:C ratio was obtained with broad bed furrow and opening of furrow after two rows (4.7) as compared to flat bed (3.9). Paul *et al*. (2016) also reported that GMR, NMR and B:C ratio were highest where furrows were opened in every row in linseed crop.

Effect of spacing

The gross monetary return and net monetary returns were significantly influenced due to various spacings. Wider spacing of 45 cm × 20 cm recorded significantly higher net monetary return over closer spacing of 30 cm × 10 cm and 30 cm × 20 cm but it was at par with spacing of 45 cm × 10 cm.

Interaction effect

Interaction effects between land configuration and spacing were found non-significant in case of growth and yield attributes, yield and monetary returns of sesame.

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