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Muneshwar SR
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Kote GM
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Awasarmal VB
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Muneshwar SR
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Economics of sesamum in relation to sowing dates and fertilizer levels

Muneshwar SR, Kote GM and Awasarmal VB

Abstract
A field experiment was conducted at Instructional farm, Department of Agronomy, COA, Parbhani on a clayey soil during kharif season of 2018 to find out the effect of with two factors viz., sowing dates (four levels: D_1 (15th June), D_2 (30th June), D_3 (15th July) and D_4 (30th July)) and three fertilizer levels (F_1 (75% RDF), F_2 (100% RDF) and F_3 (125% RDF)) with twelve treatments combinations. Each experimental unit was repeated three times. The fertilizer dose of 50:25:00 NPK kg ha^{-1} was applied after sowing. Amongst sowing dates, Crop sown on 15th June recorded significantly higher growth attributes, yield attributes, seed yield (435 kg ha^{-1}), straw yield (1541 kg ha^{-1}), biological yield (1975 kg ha^{-1}),. Amongst fertilizer levels, 125 % RDF (F_3) recorded significantly higher growth attributes, yield attributes, seed yield (375 kg ha^{-1}), straw yield (1381 kg ha^{-1}), biological yield (1756 kg ha^{-1}), harvest index (21.36 %). From result it can be concluded that, sowing of sesamum on 15th June and 30th June was found beneficial as compared to other sowing dates. Among the various fertilizer levels the application of fertilizer level 100% RDF was more profitable.

Keywords: Sowing dates, fertilizer levels, sesamum

Introduction
Sesamum (*Sesamum indicum* L.) which is known variously as sesamum, til, gingerly, simsim, gergelim etc. is one of the most important oil seed crop grown extensively in India. Sesamum is the oldest indigenous oil plant with longest history of its cultivation in India. Africa has been considered as the center of origin of this crop (Joshi, 1961). It belongs to order Tubiflorae and family Pedaliaceae. Sesamum is having quality food, nutrition, edible oil, biomedicine and health care, all in one. Sesamum has remarkable antioxidant function due to the presence of lignin and tocopherol. The seed is highly rich in quality protein and essential amino acid especially methionine is considered rejuvenate and anti-adding for human body. Sowing time of sesame play an important role on its average production for different agro-climatic region which is mostly grown under rain fed conditions. Thus, the rainfall pattern (onset and termination of rainfall and distribution of rainfall) influence the growth and yield of crop. The late onset of monsoon generally delays the sowing resulting in to poor yield. This necessitates finding out suitable sowing time with the consideration to the effect of temperature on plant. Degree days concept based on the idea that plants have a specific temperature requirement for the completion of particular physiological stage will definitely provide ample scope to find the suitability of sowing time. Fertilizer is one of the most important inputs for successful crop production. A sustainable increase in production can be obtained by using balanced fertilizers. More scientific efforts are needed to increase the productivity of sesamum per unit area and per unit time with soil moisture conservation and optimum fertilizer dose. Therefore, it is necessary to study the behavior of sesamum under various fertilizer levels. The major plant nutrients applied through chemical fertilizers may not be taken up properly by plant roots of crop plants due to poor organic carbon content and water holding capacity of soil. The variability in crop performance arising from different sowing dates is a consequence of changes in the factors of environment in time. This study is therefore carried out to determine the optimum time of sowing and to identify suitable fertilizer levels

Material and methods
A field experiment was conducted during the period of 2018-19 at Experimental Farm of Agronomy at College of Agriculture, Parbhani. The soil was clayey in texture, low in available nitrogen (231 kg ha^{-1}), low in available phosphorus (12.64 kg ha^{-1}), rich in available potash

(474 kg ha-1), sulphur (15.25 kg ha-1) and slightly alkaline in reaction. The soil was moderately alkaline in reaction (8.13 pH). In general, weather conditions were favourable for plant growth and no severe pest and diseases noticed during experimentation. The study involved twelve treatment combinations consisting two factors viz, sowing dates (four levels: D1 (15th June), D2 (30th June), D3 (15th July) and D4 (30th July)) and three fertilizer levels (F1 (75% RDF), F2 (100% RDF) and F3 (125% RDF)) with twelve treatments combinations in split plot design with three replications. The Each experimental unit was repeated three times 5.40 m x 4.5 m2 size in gross plot and in net plot 4.5 x 4.0 m2. Sowing was completed as per treatments. The fertilizer dose of 50:25:00 NPK kg ha-1 was applied after sowing. The package of recommended practices was adopted to maintain the crop.

Results and Discussion

Effects on growth attributes

Sowing dates

Plant height, number of branches, mean total dry matter plant-1, and number of capsules per plant were significantly influenced due to sowing dates. Amongst the sowing dates, crop sown on 15th June recorded maximum plant height, mean number of branches and total dry matter plant-1 at all growth stages, followed by 15th and 30th July, respectively. The better performance of 15th June may be attributed to its better vegetative growth over 15th and 30th July, respectively.

Fertilizer levels

Fertilizer levels significantly influenced all the growth attributes viz, plant height, mean number of branches and mean total dry matter plant-1 at harvest. The application of 125% RDF recorded more plant height, mean number of branches and mean total dry matter plant-1 which was found at par with the application of 100 % RDF. The significantly lowest mean number of branches and mean total dry matter plant-1 were recorded by application of 75% RDF at all stages of the crop growth. Application of 125% RDF was found significantly effective over 100% RDF and 75% RDF in increasing growth attribute of sesamum. Similar results were found by Rao et al. (1993) [8], Paramasivam et al. (2003) [7], Barik and Fulimali (2011) [1] and Tripathy and Bastia (2012).

Effect on Yield attributes and yield

Sowing dates

Various yield attributes viz., number of capsules plant-1, weight of capsules plant-1, weight seed yield plant-1 and test weight were significantly influenced due to four sowing dates under study, except number of seeds per pod which was not significantly influenced due to varieties. Crop sown on 15th June recorded significantly maximum number of capsules plant-1, weight of capsules plant-1, weight seed yield plant-1 and test weight than 15th and 30th July, respectively. The data showed that the sowing date of 15th June (D1) recorded significantly higher seed yield (435 kg ha-1) than crop sown on 15th and 30th July, but it was found at par with the sowing date of 30th June (D2) (405 kg ha-1).

Fertilizer levels

Amongst fertilizer levels, fertilizer levels exerted significant influence on number of capsules plant-1, weight of capsules plant-1, weight seed yield plant-1 and test weight. The application of 125% RDF and 100 % RDF produced significantly higher number of capsules plant than 75% RDF. The application of 75% RDF recorded significantly lowest number of bcapsuls plant-1 than fertilizer levels. The application of 125% RDF recorded significantly higher seed yield (375 kg ha-1) which was found at par with the application of 100 % RDF (356 kg ha-1). Application of 75% RDF (312 kg ha-1) recorded significantly lowest seed yield. Such type of results are found by Deshmukh et al. (2002) [2], Haruna (2011) [4], Sawant et al. (2013) [9] and Kashani et al. (2015) [5].

Effect on economics

Sowing dates

The perusal of data on gross monetary returns revealed that the sowing date of 15th June (D1) gave highest GMR (51514 Rs ha-1) which was found at par with 30th June (D2) sowing date (48030 Rs ha-1). The significantly lowest GMR were observed in 30th July sowing date (28497 Rs ha-1). The data on net monetary returns reported that the sowing date of 15th June (D1) gave highest NMR (27394 Rs ha-1) which was found at par with 30th June (D2) sowing date (23910 Rs ha-1). The significantly lowest NMR was observed in 30th July (D4) sowing date (4377 Rs ha-1). Such type of results were reported earlier by Siva gamy and Ram Mohan (2013) [10].Data on benefit: cost ratio revealed that the sowing date of 15th June (D1) gave highest benefit: cost ratio (2.14) followed by the sowing date of 30th June (D2) (1.99) and lowest benefit: cost ratio found in 30th July (D4) sowing date (1.18).

Fertilizer levels

The data on gross monetary returns and net monetary returns per hectare revealed that the application of 125 %RDF gave significantly higher gross and net monetary returns (44524 and 19854 Rs ha-1) than application of 75 % RDF. But it was found at par with the application of 100 % RDF (42230 and 18110 Rs ha-1). Similar results were reported by Kushwaha (2013) [6], Deshmukh et al. (2014) [3] and Thentu et al. (2014) [11].Data on Benefit: Cost ratio revealed that the application of 125 % RDF gave significantly highest benefit: cost ratio (1.80) followed by the application of 100 % RDF (1.75) and 75 % RDF (1.57).

Table 1: Growth and yield attributes of sesamum at harvest as influenced by various sowing dates and fertilizer levels

Treatments	Plant height (cm)	Number of branches plant^{-1}	Dry matter production (g plant^{-1})	Number of capsule plant^{-1}	Weight of capsule plant^{-1} (g)	Wt. of seed plant^{-1} (gm)	Test weight (gm)
Sowing dates (04)							
D_1 (15th June)	115.44	3.91	22.05	26.11	7.62	2.52	2.92
D_2 (30th June)	108.88	3.60	19.44	24.22	7.22	2.20	2.81
D_3(15thJuly)	98.00	3.28	15.05	20.00	6.51	1.76	2.71
D_4 (30th July)	90.00	2.78	12.66	17.33	5.59	1.38	2.62
SE $\pm$	2.28	0.094	0.76	0.64	0.19	0.10	0.17
CD at 5 %	7.89	0.326	2.62	2.21	0.67	0.35	NS
Fertilizer levels (03)							

F_1 (75%RDF)	94.00	3.05	14.20	19.67	6.30	1.61	2.54
F_2(100%RDF)	104.66	3.49	17.83	22.16	6.84	2.06	2.80
F_3(125%RDF)	110.58	3.68	19.87	23.91	7.06	2.22	2.95
SE±	2.44	0.102	0.72	0.65	0.16	0.08	0.12
CD at 5%	7.32	0.305	2.16	1.95	0.49	0.22	NS
Interaction							
SE ±	4.88	0.203	1.44	1.29	0.33	0.14	0.24
CD at 5 %	NS	NS	NS	NS	NS	NS	NS
General Mean	103.08	3.40	17.30	21.91	6.73	1.96	2.76

Table 2: Yield and economics of sesamum at harvest as influenced by various sowing dates and fertilizer levels

Treatments	Seed yield (kg ha $^{-1}$)	Straw yield (kg ha $^{-1}$)	Gross monetary returns (Rs ha^{-1})	Cost of cultivation (Rs ha^{-1})	Net monetary returns (Rs ha^{-1})	B:C ratio
Sowing		**dates**				
D_1 (15th June)	435	1541	51514	24120	27394	2.14
D_2 (30th June)	405	1468	48030	24120	23910	1.99
D_3(15thJuly)	312	1205	37072	24120	12952	1.54
D_4 (30th July)	239	961	28497	24120	4377	1.18
SE±	11.69	38.79	1358.77	-	1358.77	
CD at 5 %	40.47	134.24	4702.16	-	4702.16	
Fertilizer		**levels**				
F_1 (75%RDF)	312	1181	37080	23570	13510	1.57
F_2(100%RDF)	356	1319	42230	24120	18110	1.75
F_3(125%RDF)	375	1381	44524	24670	19854	1.80
SE±	8.08	43.02	930.34	-	930.34	-
CD at 5%	24.23	128.97	2789.30	-	2789.30	-
Interaction		**(D X F)**				
SE±	16.16	86.04	1860.69	-	1860.69	-
CD at 5 %	48.47	NS	NS	-	NS	-
GM	347.6	1293.80	41278	24120	17158	1.71

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