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Effect of Sowing Time and Plant Geometry on Growth, Yield and Quality of Chandrasur (*Lepidium sativum* L.)

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A B S T R A C T

The present study was undertaken to investigate "Effect of sowing time and plant geometry on growth, yield and quality of Chandrasur (*Lepidium sativum* L.)" was carried out at the "Horticulture Research Farm" College of Horticulture Mandsaur, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) from 2017 to 2018. In this experiment 3 dates of sowing (15th October, 30th October and 15th November) and 3 plant geometry (20x10 cm, 30x10 cm and 40x10 cm) with 3 replication, the was analyzed by Factorial RBD. The result was found that maximum plant height (119.60 cm), number of branch per plant (22.30) fresh weight of plant (74.25 g), dry weight of plant (39.99 g), number of racemes per plant (130.13), number of racemes per branch (13.12), racemes length (31.25 cm), racemes weight (0.87 g), weight of 1000 seed (1.88 g), seed yield per plant (21.15 g), seed yield (23.97 q/ha) biological yield (89.14 q/ha), harvest index (26.89%) and oil content in seed (23.83%) was recorded under treatment D_2S_2 (30th October and 30 cm) respectively.

Introduction

Chandrasur (*Lepidium sativum* L.) it is also known as asalio and garden cress the plant belongs to family Brassicaceae. It is a fast growing crop that can be ready to eat within 7 days of sowing the seed. The plant has traditional medicinal uses also and it is the source of edible oil that can be used for lighting. In India, it is cultivated as winter crop in selected parts of Rajasthan, Gujarat and Madhya Pradesh for their seeds. The seeds are galactagogue, laxative and diuretic. Seeds contain phytochemicals that resemble estrogen action. Hence it is used in treating amenorrhoea and irregular menstrual cycles.

It is fed to lactating mothers for improving breast milk production. Seed paste is used as poultice to relieve pain, worm infestation in wounds and useful in skin disorders associated with itching. The mucilage obtained from the seeds is used against intestinal irritations. The leaves are used as diuretic and to treat liver diseases. It is also used as salad for treating Anemia.

Materials and Methods

The experiments were carried out during 2017 to 2018, at the Research Farm, College of Horticulture, Mandsaur, RVSKVV, Gwalior (M.P.). Geographically Mandsaur is situated in Western part of Madhya Pradesh between latitude of 23 ^{o}45' to 24 ^{o}13' N and longitude of 74 ^{o}44' to 75 ^{o}18' E at an altitude of 435.2 Meter above MSL. The annual rainfall is 544.05 mm most of which is from 20th June to end of September. Dry spell is a common feature due to uneven distribution of rainfall. The soil of experimental field was medium black clay in texture with uniform topography. The treatments consisted of the three sowing time (15th October, 30th October and 15th November) and three plant geometry (20x10 cm, 30x10 cm and 40x10 cm) These treatments were sown in Factorial Randomized Block Design with three replications. Observations were recorded under investigation *i.e.* plant height, number of branch per plant, fresh weight of plant, dry weight of plant, number of racemes per plant, number of racemes per branch, racemes length, racemes weight, weight of 1000 seed, seed yield per plant, seed yield, biological yield, harvest index and oil content in seed.

Results and Discussion

Effect of sowing time

Among the growth attributes, sowing time significantly influenced all the growth parameters at different growth stages. Moreover, maximum plant height (11.82, 76.96, 115.84 and 117.852 cm), number of branches per plant (17.82, 21.24 and 21.57), fresh weight of plant (1.36, 72.18, 82.51 and 72.81 g) and dry weight of plant (0.45, 14.35, 28.69 and 38.55 g) were observed at 30, 60, 90 DAS and at harvest respectively due to sowing of seeds on 30th October (D_2) as compared to 15th October (D_1) and 15th November (D_3). This might be due to favorable weather conditions prevailed during their growing stages, which influenced the plants to grow taller by increasing cell division and cell elongation, where as the plant height was observed to be less in both early and delayed dates of sowing. Favorable weather conditions helped in formation of more lateral buds resulted in more number of branches per plant these results are consonance with Singh *et al.*, (2009), Choudhary *et al.*, (2013), Umale *et al.*, (2016), Meena *et al.*, (2017), Shanthipriya *et al.*, (2018) in chandrasur and Kumar *et al.*, (2004) in mustard and Bhutia and Sharangi (2018) in fenugreek and Mehmood *et al.*, (2018) and Sultana *et al.*, (2018) in Nigella.

Date of sowing significantly influenced all the yield and yield attributing traits except weight of 1000 seed (g) and harvest index under investigation. Maximum number of racemes per plant (127.14), number of racemes per branch (12.95), racemes length (29.12 cm), weight of single racemes (0.83 g), weight of 1000 seed (1.84 g), yield per plant (18.75 g), yield (22.44 q/ha), biological yield (87.30 q/ha), harvest index (25.70%) and oil content in seed (22.53%) were recorded due in chandrasur on 30th October (D_2) as compared other two dates of sowing.

The possible reason for lower yield attributes in early sowing might be attributed to unfavorable temperature during the crop season *i.e.* high temperature at the time of germination in 15th October sowing (D1). The reduction in yield due to delay in sowing might be attributed to less flowering and seed setting on account of unfavorable temperature accompanied by winds coinciding with flowering and seed setting stage of the late sown crop responsible for reduction in seed yield with delayed sowing. Similar results in chandrasur crop were also reported by Choudhary *et al.*, (2013), Sarsawati and Vidya (2013), Meena *et al.*, (2017) and Shanthi Priya

et al., (2018) and Khobragade *et al.,* (2008), Kumar *et al.,* (2004) in mustard and Bhutia and Sharangi (2018) in fenugreek and Mehmood *et al.,* (2018) and Sultana *et al.,* (2018) in Nigella.

Effect of plant geometry

Among the various plant geometry, spacing S_2 (30 cm) was exhibited significant maximum value for plant height (10.53, 72.91, 109.78 and 111.26 cm), fresh weight of plant (1.30, 62.98, 72.00 and 62.40 g) and dry weight of plant (0.40, 9.72, 19.44 and 28.14 g) as compared to S_1 (20 cm) and S_3 (40 cm) at all the growth stages respectively. However, number of branches (14.63, 16.07 and 16.74) was recorded highest values with the same spacing but non-significantly at all the growth stages respectively as compare to other spacing (Table 1).

This effect might to be due to wider spacing plant get more better light, better availability of space, aeration and soil moisture as well as better nutrient for growth and development of the plant. Similar results were also reported by Meena *et al.,* (2017) in Chandrasur, Suthar *et al.,* (2017) in broccoli, Arif *et al.,* (2012), Kumar *et al.,* (2004) in mustard and Manasa *et al.,* (2017) in red cabbage and Giridhar *et al.,* (2017) in Nigella.

Plant geometry was significantly influence all the yield and yield attributing traits except racemes weight, weight of 1000 seed and harvest index. The maximum number of racemes per plant (115.08), number of racemes per branch (11.06), racemes length (26.06 cm), racemes weight (0.77 g), weight of 1000 seed (1.80 g), seed yield per plant (17.91 g), seed yield (18.94 q/ha), biological yield (75.53 q/ha), harvest index (25.08%) and oil content in seed (22.15%) were observed in S_2 (30 cm) as compare to S_1 (20 cm) and S_3 (40 cm). The plants sown at wider spacing were better exposed to sunlight and also took moisture and nutrients from a larger area which intern could result into vigours plant growth, leading to more number of racemes per plant. These results are in close conformity with the findings of Choudhary *et al.,* (2013) and Meena *et al.,* (2017) in chandrasur, Patel *et al.,* (2017) Kumar *et al.,* (2004) in mustard and Anupama *et al.,* (2017) in Kasuri Methi.

Interaction effect of sowing time and plant geometry

Under the interaction of sowing time and plant geometry, all the growth attributes were significantly influence under the whole lifespan development except initial stage of growth. However, the highest plant height (12.63, 78.47, 119.47 and 119.60 cm), number of branch per plant (18.13, 22.07 and 22.30) fresh weight of plant (1.42, 74.80, 84.40 and 74.25 g) and dry weight of plant (0.55, 16.93, 33.87 and 39.99 g) were recorded at 30, 60, 90 DAS and at harvest respectively in D_2S_2 (30^{th} October and 30 cm) as compare to other combinations. Maximum plant height, number of branches, fresh weight and dry weight were recorded with (D_2S_2) 30th October under 30x10 cm spacing. These results are in conformity with those reported by Meena *et al.,* (2017) in chandrasur crop and Suthar *et al.,* (2017) in broccoli. Sowing time and plant geometry was significantly influence all the yield and yield attributing traits except racemes weight, weight of 1000 seed and harvest index. The maximum number of racemes per plant (130.13), number of racemes per branch (13.12), racemes length (31.25 cm), single racemes weight (0.87 g), weight of 1000 seed (1.88 g), seed yield per plant (21.15 g), seed yield (23.97 q/ha) biological yield (89.14 q/ha), harvest index (26.89%) and oil content in seed (23.83%) were observed with D_2S_2 (October 30^{th} and 30 cm) as compare to other combinations (Table 2).

Table.1 Effect of different sowing time, plant geometry and their interaction on growth attributes of chandrasur

Treatment	Plant height (cm)				Number of branches			Fresh weight of plant (g)				Dry weight of plant (g)			
	30 DAS	60 DAS	90 DAS	AT Harvest	60 DAS	90 DAS	AT Harvest	30 DAS	60 DAS	90 DAS	AT Harvest	30 DAS	60 DAS	90 DAS	AT Harvest
Sowing dates (D)															
D_1- 15 Oct.	7.00	68.22	101.07	101.75	11.56	12.29	12.91	1.28	62.09	72.56	63.22	0.39	7.42	14.84	28.96
D_2- 30 Oct.	11.82	76.96	115.84	117.82	17.82	21.24	21.57	1.36	72.18	82.51	72.81	0.45	14.35	28.69	38.55
D_3- 15 Nov	11.26	68.53	105.51	109.05	13.76	14.51	14.89	1.03	48.49	56.47	47.18	0.14	5.57	11.14	12.92
S.Em ±	**0.57**	**0.86**	**0.44**	**0.47**	**0.08**	**0.60**	**0.31**	**0.08**	**0.34**	**0.32**	**0.31**	**0.05**	**0.30**	**0.60**	**0.31**
CD at 5%	**1.70**	**2.57**	**1.31**	**1.40**	**0.25**	**1.79**	**0.91**	**0.24**	**1.01**	**0.97**	**0.93**	**0.15**	**0.89**	**1.79**	**0.93**
Plant geometry (S)															
S_1-20x10 cm	10.36	71.98	108.53	110.58	13.96	15.96	16.20	1.11	59.59	68.65	59.77	0.23	8.33	16.67	25.51
S_2- 30x10 cm	10.53	72.91	109.78	111.26	14.63	16.07	16.74	1.30	62.98	72.00	62.40	0.40	9.72	19.44	28.14
S_3- 40x10 cm	9.18	68.82	104.11	106.79	14.54	16.02	16.42	1.25	60.19	70.89	61.05	0.36	9.28	18.56	26.79
S.Em ±	**0.57**	**0.86**	**0.44**	**0.47**	**0.08**	**0.60**	**0.31**	**0.08**	**0.34**	**0.32**	**0.31**	**0.05**	**0.30**	**0.60**	**0.31**
CD at 5%	**NS**	**2.57**	**1.31**	**1.40**	**0.25**	**NS**	**NS**	**NS**	**1.01**	**0.97**	**0.93**	**NS**	**0.89**	**1.79**	**0.93**
Interaction (DxS)															
D_1S_1	8.43	69.20	103.67	104.80	11.50	12.93	13.07	1.01	42.90	54.80	45.49	0.13	4.97	9.93	11.23
D_1S_2	7.30	67.00	102.13	102.77	11.27	11.80	12.37	1.07	48.21	55.49	46.53	0.16	5.47	10.93	12.27
D_1S_3	5.27	62.20	97.40	97.68	11.90	12.13	13.30	1.02	54.37	59.12	49.53	0.14	6.27	12.54	15.27
D_2S_1	12.00	77.40	114.47	117.53	17.53	20.47	20.80	1.08	70.70	80.26	71.00	0.17	12.53	25.07	36.74
D_2S_2	12.63	78.47	119.47	119.60	18.13	22.07	22.30	1.42	74.80	84.40	74.25	0.55	16.93	33.87	39.99
D_2S_3	10.66	75.00	113.60	116.33	17.80	21.20	21.60	1.41	71.03	82.87	73.18	0.45	13.57	27.15	38.92
D_3S_1	10.49	71.73	107.47	110.60	13.07	14.47	14.73	1.26	59.87	70.20	61.77	0.39	7.00	14.00	27.51
D_3S_2	11.67	73.27	107.73	111.40	14.00	14.33	14.60	1.33	62.87	73.47	63.41	0.50	7.27	14.53	29.15
D_3S_3	11.80	66.87	101.33	105.15	14.20	14.73	15.33	1.40	63.53	74.00	64.48	0.48	8.00	16.00	30.22
S.Em ±	**0.98**	**1.48**	**0.76**	**0.81**	**0.15**	**1.03**	**0.53**	**0.14**	**0.59**	**0.56**	**0.54**	**0.09**	**0.52**	**1.03**	**0.54**
CD at 5%	**NS**	**4.44**	**2.27**	**2.42**	**0.44**	**NS**	**NS**	**NS**	**1.76**	**1.68**	**1.62**	**NS**	**1.55**	**3.10**	**1.62**

Table.2 Effect of different sowing time, plant geometry and their interaction on Yield attributes of chandrasur

Treatment	Number of racemes per plant	Number of racemes per branch	Racemes length (cm)	Racemes weight (g)	Weight of 1000 seed (g)	Seed yield per plant (g)	Seed yield (q/ha)	Biological yield (q/ha)	Harvest index (%)	Oil content in seed %
Sowing dates (D)										
D_1- 15 Oct.	93.42	8.40	21.89	0.69	1.73	14.98	16.75	67.39	24.86	20.21
D_2- 30 Oct.	127.14	12.95	29.12	0.83	1.84	18.75	22.44	87.30	25.70	22.53
D_3- 15 Nov	115.31	9.31	24.37	0.72	1.76	17.78	16.84	69.98	24.06	21.35
S.Em ±	**0.45**	**0.24**	**0.39**	**0.02**	**0.03**	**0.47**	**0.25**	**0.36**	**2.09**	**0.38**
CD at 5%	**1.36**	**0.73**	**1.18**	**0.07**	**NS**	**1.42**	**0.75**	**1.06**	**NS**	**1.13**
Plant geometry (S)										
S_1- 20x10 cm	109.47	9.25	24.63	0.73	1.74	16.04	18.38	74.02	24.83	20.70
S_2- 30x10 cm	115.08	11.06	26.06	0.77	1.80	17.91	18.94	75.53	25.08	22.15
S_3- 40x10 cm	111.32	10.35	24.69	0.75	1.77	17.56	18.70	75.12	24.89	21.24
S.Em ±	**0.45**	**0.24**	**0.39**	**0.02**	**0.03**	**0.47**	**0.25**	**0.36**	**2.09**	**0.38**
CD at 5%	**1.36**	**0.73**	**1.18**	**NS**	**NS**	**1.42**	**0.75**	**1.06**	**NS**	**1.13**
Interaction (DxS)										
D_1S_1	90.87	7.40	20.65	0.67	1.71	13.61	15.68	64.92	24.15	18.42
D_1S_2	97.42	9.27	25.65	0.69	1.75	14.60	16.45	67.94	24.21	20.42
D_1S_3	91.97	8.52	24.55	0.70	1.72	16.71	15.82	69.29	22.83	21.80
D_2S_1	127.91	12.93	28.68	0.82	1.84	19.22	21.85	87.79	24.89	23.73
D_2S_2	130.13	13.12	31.25	0.87	1.88	21.15	23.97	89.14	26.89	23.83
D_2S_3	123.37	12.80	27.43	0.81	1.80	15.90	21.50	84.98	25.30	22.30
D_3S_1	125.35	7.41	23.73	0.71	1.72	18.60	17.96	68.29	26.30	21.45
D_3S_2	100.85	10.79	21.29	0.73	1.79	17.99	18.43	73.65	25.02	21.47
D_3S_3	119.73	9.73	22.91	0.74	1.76	16.76	16.41	67.92	24.16	18.84
S.Em ±	**0.79**	**0.42**	**0.68**	**0.04**	**0.06**	**0.82**	**0.43**	**0.62**	**3.62**	**0.65**
CD at 5%	**2.36**	**1.26**	**2.04**	**NS**	**NS**	**2.47**	**1.30**	**1.84**	**NS**	**1.95**

These findings are also supported by Meena *et al.*, (2017) in chandrasur, Suthar *et al.*, (2017) in broccoli and Gawariya *et al.*, (2015) in mustard and Giridhar *et al.*, (2017) in Nigella.

On the basis of one year research It could be concluded that the D_2S_2 (October 30th and 30 cm) sowing time and plant geometry and their combination are the best for good plant growth, yield and quality of chandrasur under Malwa condition of Madhya Pradesh.

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