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Effect of date of sowing and plant geometry on growth and yield of mustard [*Brassica Juncea* L. (Czern and Coss)]

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Abstract
A field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar to study the "Effect of date of sowing and plant geometry on growth and yield of mustard [*Brassica juncea* L. (Czern and Coss)]" during *Rabi* season of 2020-21. Total fifteen treatment combinations comprising three levels of date of sowing in main plot *viz.*, 20th October (D_1), 30th October (D_2) and 10th November (D_3) and five levels of plant geometry in sub-plot *viz.*, 30 cm × 15 cm (G_1), 45 cm × 15 cm (G_2), 45 cm × 30 cm (G_3), 60 cm × 15 cm (G_4) and 60 cm × 30 cm (G_5) laid out in split plot design with three replications. Plant height, number of secondary branches per plant, leaf area per plant, number of siliquae per plant, 1000-seeds weight, seed yield, straw yield, oil yield, net realization (₹ 69922/ha**)** and BCR (3.05) showed significantly higher values were obtained when crop was sown on 30th October. However, it was statistically on par with 20th October sowing. Significantly higher plant population/ha and plant height were under close plant geometry of 30 cm × 15 cm. On the contrary, numbers of secondary branches per plant, leaf area per plant, number of siliquae per plant and 1000-seeds weight were recorded significantly higher under wider spacing of 60 cm × 30 cm (G_5). Significantly higher seed yield (2100 kg/ha), straw yield (4372 kg/ha), oil yield (841 kg/ha), net realization (₹ 72240/ha) and BCR (3.07) were obtained 45 cm × 15 cm spacing being comparable with 30 cm × 15 cm spacing.

Keywords: Date of sowing, Plant geometry, Plant population, Seed yield, Oil content, Oil yield, Net returns

Introduction
Oilseed crops are the second most important determinant of agricultural economy next to cereals. Among various agronomic practices, time of sowing and plant geometry are two major non-monetary and agricultural practices that can affect the yield of mustard to great extent. Sowing of crop at optimum time gave higher yield due to suitable environment that prevails at all the growth stages (Alam *et al*., 2015) [1]. Delayed sowing of mustard crop can face unfavorable weather conditions at flowering and siliquae formation which shorten maturity period, decreased number of siliquae/plant as well as infestation of aphids that finally lead to reduction in seed yield. Under field conditions, mustard plant requires specific spacing for better growth and development that can maintained by inter and intra row spacing. So plant geometry that can govern the plant stand per unit area which is a most determinant non-monetary input for increasing seed yield of mustard. Uniform distribution of plants over an area results in efficient use of nutrients, moisture, sun light and suppression of weeds leading to high yield.

Materials and Methods
A field experiment was conducted at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* season of the year 2020-21 to study effect of date of sowing and plant geometry on growth and yield of mustard [*Brassica Juncea* L. (czern and coss)]". The experiment consisted of three dates of sowing (D_1: 20th October, D_2: 30th October, D_3: 10th November) as main plot treatments and five plant geometry (G_1: 30 cm × 15 cm, G_2: 45 cm × 15 cm, G_3: 45 cm × 30 cm, G_4: 60 cm × 15 cm, G_5: 60 cm × 30 cm as sub plot treatments. The experiment was laid out in split plot design with three replications. Mustard variety Gujarat Dantiwada Mustard (GDM 4) was used as a test crop.

The soil of the experimental field was loamy sand in texture, slightly alkaline, low in organic carbon, available nitrogen and medium in available phosphorus and potassium status. The various growth and yield attributes as well as quality parameters as per standard peocedure.

Results and Discussion

Effect of date of sowing

The data various growth and yield attributes were exhibited in Table 1. Mustard crop sown on 30th October significantly enhanced all growth and yield attributes. Significantly higher plant height (148.9 cm), number of secondary branches per plant (14.6), leaf area per plant (1885.3 cm^2), number of siliquae per plant (324) and 1000 seeds weight (5.18 g) accrued with sowing on 30th October which stood on par with earlier sowing date i.e. 20th October. Under late sown date of 10th November, majority of growth and yield attributes were found significantly lower due to unfavourable climate particularly temperature as well as infestation of aphid under late sowing (Alam *et al*., 2015) [1].

The favourable climatic condition available to the crop when sown on 30th October which accelerated vegetative growth in terms of taller plants and more number of secondary branches per plant also contributed towards remarkable increase in number of siliquae per plant. The results are closely related with the findings of Alam *et al*. (2015) [1] and Kumar *et al*. (2018) [5]. Similarly higher leaf area per plant can be ascribed due to comparatively longer duration of vegetative growth period because of congenial environmental conditions, especially atmospheric temperature which formed a basis for rapid cell division in the meristematic tissues. These results are in conformity with the findings of Singh *et al*. (2017) [9].

Seed yield of mustard was significantly affected by different date of sowing. As the sowing was done earlier (20th October), there was reduction in seed and straw yields as compared to ten days delay in sowing i.e. 30th October (D_2) which produced seed yield of 2036 kg/ha and straw yield of 4306 kg/ha. Again, further delay in sowing up to 10th November (D_3) resulted significant reduction in seed yield (1644 kg/ha) as well as straw yield (3594 kg/ha) over preceding two dates of sowing. The drastic increase in seed yield might also be due to the fact that sowing of mustard on 30th October enjoyed higher amount of moisture and nutrients as well as higher total leaf area per plant which intercepted more sunlight and improvement in the rate of photosynthesis resulted in production of more photosynthates and better translocation of photosynthates from source to sink lead to remarkable increase in seed and straw yields of mustard. Singh *et al.* (2017) [9] also noted that higher seed and stover yield with sowing of mustard on 30th October.

Significantly higher oil yield (811 kg/ha) was noticed under 30th October sowing date over rest of the dates of sowing, except 20th October (D_1). The present results are in close agreement with the results of Jat *et al.* (2019) [4].

Sowing on 30th October (D_2) realized maximum net realization (₹ 69922/ha) and BCR (3.05). It might be due to maximum seed yield obtained under sowing date of 30th October. The results are in full agreement with those of Singh and Singh (2017) [9].

Effect of plant geometry

Plant population at harvest, plant height, number of secondary branches per plant and leaf area per plant were significantly influenced by different plant geometries (Table 1). Significantly the highest plant stand/ha was observed under closer spacing (30 cm × 15 cm) and the lowest under wider plant geometry of 60 cm × 30 cm. The plant population was decreased significantly with increase in inter and intra row spacing at harvest. These results are closely related with the findings of Pyare *et al*. (2008) [11]. Sowing of crop at plant geometry of 30 cm × 15 cm (G_1) resulted in the maximum plant height and proved significantly superior over rest of the treatments except treatment G_2 (45 cm × 15 cm). While, wider spacing treatment G_5 (60 cm × 30 cm) registered significantly lower plant height of 132.5 cm at harvest. The increasing in plant height in narrow spacing might be due to stiff competition for mainly light which facilitated vertical growth by producing weak, lanky and taller plants. The results are in agreement with the findings of Begum *et al*. (2005) [2] in mustard. In contrast with this, number of secondary branches and leaf area per plant were significantly higher in wider spacing of 60 cm × 30 cm than 30 cm × 15 cm, 45 cm × 15 cm and 60 cm × 15 cm but did not differ significantly over 45 cm × 30 cm spacing. It may be ascribed to the better growth of plant under border spacing because it resulted in better vegetative growth owing to less plant density and computation for nutrients, moisture and light resulted in more horizontal growth in term of secondary branches per plant and plant canopy area i.e. leaf area per plant than those under narrow spacing. So, the branch bearing capacity was increased, as also reported by Begum *et al*. (2005) [2] and leaf area per plant by Yadav *et al*. (2018) [10] in mustard.

Plant geometry revealed that significant variations in various yield determining characters *viz*., number of siliquae per plant and test weight (Table 1). The maximum number of siliquae per plant and 1000 seeds weight were recorded under the plant geometry 60 cm × 30 cm (G_5) which may be attributed to better growth i.e. secondary branches and leaf area per plant owing to availability of balanced and adequate nutrients, light spacing and moisture besides higher photosynthetic and stomatal activities due to higher leaf area per plant unlike in other spacing. Better utilization of available growth and yield responsible organs resulted in better development of yield attributes (Ozer *et al*., 2003 in rapeseed and Yadav *et al*., 2018) [7, 10]. The effect of different plant geometry was found non-significant with respect to length of siliqua and oil contant in seed.

The mustard seed, straw and oil yield (Table 2) were significantly affected by plant geometry. Narrow plant geometries of 45 cm × 15 cm and 30 cm × 15 cm produced significantly higher seed, straw and oil yields over rest of the plant geometries, but both plant geometries found equally good. The increase owing 20.97, 20.24 and 18.79 % under 45 cm × 15 cm and 18.90, 12.76 and 10.88 % under 30 cm × 15 cm spacing in seed, straw and oil yields over low density planting at 60 cm × 30 cm, respectively. The main reason was dense plant population under closer spacing treatments, which accelerated the compitation within crop plant for space, light, nutrients and moisture as well as adequate interception of sunlight by crop capony consequently enhanced rated of photosynthesis which ultimately produced higher seed and straw yield of mustard. The higher yield in wider plant spacing might be due to better development of yield attributes of mustard (Ozer *et al*., 2003 and Begum *et al*., 2005) [7, 2]. Similarly, higher oil yield under narrow spacing (45 cm × 15 cm and 30 cm × 15 cm) owing to higher seed yield of mustard

was obtained under both these treatments. These result are in conformity with the results reported by Jat *et al.* (2019) [4].

It is evident from the data depicted in Table 2 showed that sowing of mustard at 45 cm × 15 cm (G_2) spacing secured maximum net realization (₹ 72240/ha) as well as BCR (3.07) followed by 30 cm × 15 cm (G_1) spacing which earned net realization of ₹ 64185/ha. The increase in net returns was mainly due to higher seed yield in the treatments (Chaniyara *et al*., 2002) [3].

Table 1: Effect of different date of sowing and plant geometry on growth and yield attributes of mustard

Treatments	Plant population/ha	Plant height (cm)	Number of secondary branches per plant	Leaf area per plant (cm^2)	Number of siliquae per plant	Length of siliqua (cm)	1000 seeds weight (g)
	At harvest	At harvest		At harvest			
Date of sowing (D)							
D_1: 20th October	118299	146.7	14.1	1773.5	302	5.16	4.87
D_2: 30th October	120429	148.9	14.6	1885.3	324	5.19	5.18
D_3 10th November	117119	131.1	12.5	1409.5	267	5.00	4.52
S.E.M.±	3288	3.7	0.4	52.4	7.6	0.13	0.12
C.D. (p = 0.05	NS	14.5	1.5	205.6	29.7	NS	0.46
C.V. %	10.74	10.04	10.90	12.00	9.86	9.99	9.41
Plant geometry (G)							
G_1: 30 cm × 15 cm	215593	151.5	12.9	1331.7	178	4.90	4.54
G_2: 45 cm × 15 cm	144020	149.7	13.1	1579.6	247	5.05	4.76
G_3: 45 cm × 30 cm	71948	134.6	14.3	1854.9	376	5.19	4.96
G_4: 60 cm × 15 cm	107666	142.8	13.3	1677.2	289	5.21	4.93
G_5: 60 cm × 30 cm	53851	132.5	15.0	2003.8	397	5.23	5.09
S.E.M.±	3394	3.8	0.4	53.8	7.5	0.16	0.13
C.D. (p = 0.05)	9907	11.2	1.3	157.0	22.0	NS	0.37
C.V. %	8.58	8.08	9.72	9.56	7.61	9.38	7.79
Interaction (D × G)	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of date of sowing and plant geometry on yield, quality attributes and economics of mustard

Treatments	Seed yield (kg/ha)	Straw yield (kg/ha)	Oil Content (%)	Oil yield (kg/ha)	Cost of cultivation (₹/ha)	Net realization (₹/ha)	BCR
Date of sowing (D)							
D_1: 20th October	1945	4057	39.05	759	34022	65236	2.91
D_2: 30th October	2036	4306	39.67	811	34022	69922	3.05
D_3: 10th November	1644	3594	38.59	634	34486	49518	2.44
S.E.M.±	59	103	0.72	2	-	-	-
C.D. (p = 0.05	232	405	NS	108	-	-	-
C.V.%	12.19	10.02	7.17	14.55	-	-	-
Plant geometry (G)							
G_1: 30 cm × 15 cm	1982	4100	39.64	785	36962	64185	2.74
G_2: 45 cm × 15 cm	2100	4372	39.96	841	34931	72240	3.07
G_3: 45 cm × 30 cm	1807	3858	38.66	699	32898	59397	2.81
G_4: 60 cm × 15 cm	1818	3963	38.91	708	33774	59101	2.75
G_5: 60 cm × 30 cm	1667	3636	38.34	639	32318	52871	2.64
S.E.M.±	54	122	0.78	23	-	-	-
C.D. (p = 0.05)	157	357	NS	68	-	-	-
C.V.%	8.61	9.22	6.00	9.53	-	-	-
`Interaction (D × G)							
S.E.M.±	93	212	-	-	-	-	-
C.D. (p = 0.05)	272	NS	NS	NS	-	-	-

Interaction effect

It inferred from the examination of data highlighted in Table 3 revealed that treatment combination D_2G_2 (sowing on 30th October at spacing of 45 cm × 15 cm) produced significantly maximum seed yield (2247 kg/ha) which was equally comparable with treatments combinations D_2G_1, D_1G_1 and D_1G_2 as compared to rest of the treatment combinations. The optimum plant density maintained under closer spacing as well as harnessing of congenial climate effect by sowing of mustard between 20th to 30th October resulted in efficient use of resources (nutrient, moisture, light and space) which led to better growth and development of plant resulted in higher seed yield. These results are in close agreement with those reported by Lakra *et al.* (2018) [6].

Table 3: Interaction effect of date of sowing and plant geometry on seed yield of mustard

Plant geometry	Date of sowing			Mean
	D_1 20th October	D_2 30th October	D_3 10th November	
G_1: 30 cm × 15 cm	2209	2219	1518	1982
G_2: 45 cm × 15 cm	2207	2247	1846	2100
G_3: 45 cm × 30 cm	1845	1950	1627	1807
G_4: 60 cm × 15 cm	1844	1855	1754	1818
G_5: 60 cm × 30 cm	1617	1909	1476	1667
Mean	1945	2036	1644	
S.E.M.±	93			
C.D. (p = 0.05)	272			
C.V. %	8.65			

Conclusion

From the one year experimentation, it is concluded that mustard crop can be sown between 20th to 30th October at plant geometry of 45 cm × 15 cm or 30 cm × 15 cm spacing gave higher yields and net returns in loamy sand.

References

1. Alam MJ, Ahmed KS, Mollah MRA, Alam J. Effect of planting dates on the yield of mustard (*Brassica napus* L.) seed. International Journal of Applied Science and Biotechnology. 2015;3(4):651-654.
2. Begum F, Rahman M, Islam N. Effect of seed rate and row spacing on the yield and yield components of mustard (*Brassica napus* L.). Thesis submitted to Bangladesh Agricultural University, Mymensingh; c2005 May.
3. Chaniyara NJ, Solanki RM, Bhalu VB. Effect of inter and intra row spacings on yield of mustard. Agricultural Science Digest. 2002;22(1):48-50.
4. Jat A, Desai AG, Rathore BS. Effect of different sowing schedule and crop geometry on productivity and profitability of Indian mustard (*Brassica juncea* L.). Journal of Oilseeds Research. 2019;36(1):17-18.
5. Kumar A, Lal M, Mohan N, Kumar M, Kumar N. Effect of different sowing dates on yield and yield attributes of Indian mustard (*Brassica juncea* L.). International Journal of Pure and Applied Bioscience. 2018;6(2):848-853.
6. Lakra RK, Alam P, Nayar A. Effect of sowing time and crop geometry on productivity of mustard (*Brassica juncea* L.) under irrigated condition of Jharkhand. International Journal of Microbiology and Applied Science. 2018;7:777-781.
7. Ozer H. Effect of plant population densities on growth, yield and yield components of two spring rapeseed cultivars. Plant Soil Environment. 2003 Sep 1;49(9):422-426.
8. Singh AK, Singh H, Singh G, Singh VP, Singh NV, Singh R. Effect of sowing dates and varieties for higher productivity of Indian mustard (*Brassica juncea* L.). Journal of Applied and Natural Science. 2017a Jun 1;9(2):883-887.
9. Singh RK, Singh CV. Studies on response of mustard (*Brassica napus* L.) varieties to different sowing dates under alluvial soils of Indo-Gangetic plains. International Journal of Applied and Natural Sciences. 2017;6(3):9-14.
10. Yadav A, Singh AK, Chaudhry R, Mishra SR. Effect of planting geometry on growth and yield of mustard varieties. Journal of Pharmacognosy and Phytochemistry. 2018;7(3):2624-2627.
11. Ray I, Chakraborty S, Chowdhury A, Majumdar S, Prakash A, Pyare R, Sen A. Room temperature synthesis of γ-Fe2O3 by son chemical route and its response towards butane. Sensors and Actuators B: Chemical. 2008 Mar 28;130(2):882-8.