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Studies on Response of Mustard Varieties to Different Sowing Dates under Humid Southern Plain Zone of Rajasthan

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ABSTRACT

Field experiments was conducted to assess the influence of different varieties and dates of sowing on growth and yield of mustard (Brassica juncea L). Mustard experiment was conducted with four varieties viz. Laxmi, Pusa Jaikisan (Bio-902), Pusa Bold and Pusa Agrani. Four dates of sowings viz., 15th September, 25th September,05th October and 15th October were used to evaluate their effect on productivity of different varieties. Highest yield was produced by mustard cv. Pusa Bold among the four varieties tested whereas third date of sowing i.e. 05th October was adjudged as the best time for mustard seeding since substantial decrease in grain yield was observed with delayed sowing. The analysis of variance showed that the difference in seed yield were statistically significant in the varieties and different dates of sowing in both the years. Pooled data shows that the significantly higher seed yield (1784 kg ha^{-1}), net return (Rs. 32909/- ha^{-1}) and B: Cratio (1.53) was recorded by sowing of mustard cv. Pusa Bold as compared to sowing of Pusa Agraniand Laxmi, respectively. However, it was found at par with sowing of mustard cv. Pusa Jaikisan (Bio-902) during both the years. The significantly reduction of seed yield in mustard, due to early sowing as well as in late sowing condition in comparison to timely sowing condition. The maximum seed yield (1784 kg ha^{-1}), net return (Rs. 32909/- ha^{-1}) and B: C ratio (1.53) was observed under sowing of third date on 05th October over early sowing on 15th September and late sowing on 15th October, but it was found at par with sowing of mustard on 25th September in the pooled analysis. In general, duration of each phenological stage was more in the second and third sowing as compared to other two sowing dates as a fortnight delay in sowing and early brought about a decrease in duration of phenological events.

Key words: *Dates of Sowing, Varieties, Yield, Harvest Index, Siliquae.*

INTRODUCTION

Mustard (*Brassica sp.*) is one of the most important oil crops of the world. Oil of plant origin constitute importantcomponent of human diet, ranking third after cereals & animal products and are nutritionally superior to animal oil[2]. About 13.2 percent of the annual world edible oil supply comes from this crop[6].

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Amongst important annual oilseed crops grown in the country, rapeseed and mustard occupy the second place in terms of average production after groundnut and contribute about 25 per cent to the oilseed production of the country. The country has been facing the problem of shortage of oils coupled with continuous increase in their prices. Improved varieties have been evolved, which can yield better with the use of high inputs of fertilizers, irrigation and suitable dates for sowing with other agronomic management practices. Generally, rapeseed and mustard are grown under rain fed conditions on receding soil moisture during *rabi* season. There is wide fluctuation in production owing to the vagaries of monsoon. Rapeseed and mustard are generally grown on marginal lands with poor fertility status. Hence, they also suffer from nutrient stress. Sowing time is one of the most important nonmonetary input which influences the productivity of seed and oil to a great extent[13]. Rapeseed and mustard are generally sown by last week of September to first week of October in Rajasthan. High diurnal temperature during early sown crops resulted in poor germination, improper growth and development of plants. Besides, pests viz., pointed bug (*Bagrada hilaris*), cut worm (*Agrotis* sps.), sow fly (*Athalial ugens proxima*). Late sown crop on the other hand, suffers from low temperature during its germinationand early growth phases and damages due to aphids (*Lipophis* sps.) during flowering and pod development stages[3,5]. With the development of new varieties of crop and adoption of multiple cropping systems under rain fed as well as in low irrigation water available conditions it has become essential to sowing at optimum time. Considering the above facts, field experiments were conducted to study the impact of different sowing dates on commonly grown mustard varieties of Rajasthan.

MATARIAL AND METHODS

Field experiment was conducted during two consecutive years of *rabi* 2008-09 and 2009-10 at Agricultural Research Station, Borwat Farm, Banswara. The experiment was laid-out in split plot design with three replications having sixteen treatment combinations four varieties *viz*. Laxmi, Pusa Jaikisan (Bio-902), Pusa Bold and Pusa Agrani. Four dates of sowings *viz.*, 15th September, 25th September, 05th October and 15th October were used to evaluate their effect on productivity of different varieties. The soil belongs to clay loam (black cotton soil), these soils bulk density, pH and cation exchange capacity varies between 1.34-1.58 Mg/m^3, 7.0-7.5 and 31- 41Cmol/kg, respectively. The soils of the region are medium in organic carbon (0.50±0.08), available nitrogen (275±5 kg/ha), available P_2O_5 (24.2± 1.0 kg/ha) and high in available K_2O (290 ± 8 kg/ha).The normal annual rainfall is about 940 mm, most of which is received during the south-west monsoon season from July to September. Winter showers are occasionally received during the months from December to February from the western disturbances.

The experimental field was well prepared by two ploughing followed by harrowing & cultivator and one planking for uniform levelling were performed for sowing of mustard. Fertilizers were applied as per recommended agronomic package of practices for the zone IV b i.e. nitrogen @ 120 kg/ha, phosphorus 60kg/ha, potash 30 kg/ha and 30 kg/ha Sulphur. Full dose of phosphorus, potash and half dose of nitrogen, were drilled before sowing and remaining dose of nitrogen was applied in two splits first at thinning and second at flowering stage. Seeds were sown at the rate of 5 kg seed per hectare in rows spaced 30 cm apart and 3-4 cm deep by seed cum fertilizer drill. Weeding was carried out manually at about 40 days after seeding and thinning was done to maintain plant population of about 2,50,000 plants per hectare uniformly in all the plots. The crop was irrigated during the two most critical growth stages *viz*. flowering and pod formation stages, as per recommended irrigation package of practices for the crop. All production and protection measures were applied as per package and practices of the Humid Southern plain Zone of Rajasthan.

RESULT AND DISCUSSION

Crop Growth

It is evident from pooled data of two years shows that the effect of different sowing dates on duration of phenological stages of test varieties' significantly influence. Significant differences in plant height and primary branches were observed among cultivars at maturity stages (Table 1). At maturity,mustard cv. Pusa Bold and Bio-902 attained statistically similar plant height (162 and 159 cm) and primary branches (4.58 and 4.48) which was significantly superior over Pusa Agrani and Laxmi, respectively. Significant variations in cultivars of Indian mustard for plant height were reported by many workers earlier[4,12,17,20]. In general, duration of each phenological stage was optimum in the second and third sowing dates as compared to early and late sowing dates. This could be attributed to the fact that thermal regime prevailing at the early and later sowings hastened the crop growth period. The occurrence of different phenological events observed in this study is within the range reported by earlier workers for mustard cv. Pusa Bold and other cultivars[12,14]. A fortnight delay in sowing brought about a decrease in duration of phenological events. These findings are in agreement with those reported by Khushu and Singh[9].

When the treatment of dates of sowings is taken into account, it is clear that as the date of sowing were early and delayed from normal one, the plant height got reduced. The maximum plant height (159 and 160) and primary branches (4.48 and 4.59) were observed under sowing of mustard on 25th September and 05th October as compared to early sowing on 15th September and late sowing 15th October. This may be due to the fact that in delayed sowings, crops are subjected to relatively high thermal regime, which hastens the completion of phenological stages giving very short time for crop growth resulting in less biomass and yield. Pavlista *et al.*[13], also reported a reduction of biomass due to delayed sowing. The reduction in biomass due to late sowing is accompanied by reduction in stem height, branching, leaf area index and pod numbers[5,7]. The secondary branches plant^{-1} was found not significant under sowing of mustard cultivars and in different sowing dates during both the years.

Yield attributes

Differences among cultivars for number of siliquae plant^{-1}and seeds siliquae^{-1}were significant (Table 2). Cultivar Pusa Bold produced highest number of siliquae plant^{-1}(261), seeds siliquae^{-1} (10.40) and test weight (5.72 g) which was significantly higher than mustard cv. Laxmi and Pusa Agrani, but it was found at par with mustard cv. Bio-902, siliquae plant^{-1}(259), seeds siliquae^{-1}(10.36) and test weight (5.43 g) in both the years. Significant difference between cultivars for number of siliquae, seeds siliquae^{-1} and seed weight in the present study corroborate with the findings of Reddy and Kumar[17], Sharma *et al.*[19], Laxmi narayana and Poorna chand[11] and Rana and Pachauri[16].

The analysis of variance revealed that the difference in yield attributes were statistically significant due to different sowing dates. In both the years, the maximum, siliquae plant^{-1}(260 and 262), seeds siliquae^{-1} (10.34 and 10.40) and test weight (5.57 and 5.67 g) were observed under sowing of mustard on 25th September and 05th October which was significantly superior to the sowing of mustard on 15thSeptember and 15th October, respectively. These results suggest that pre-an thesis growth and development of mustard were adversely affected by high temperature in earlier sowing and later cold frosty nights and reduced sunshine in the crop sown late after first fortnight of October in these areas. Singh *et al.*[21], observed the similar trend and reported that late sown crop experienced sub-optimal temperature regime which retarded their growth compared to normal date or mid-sown crops on earlier dates. Also, post fertilization development suffered from forced maturity due to rapid rising in temperature[8,10].

Yield

Differences among cultivars for seed yield, stover yield and harvest index were significant (Table 3). Mustard cv. Pusa Bold produced highest seed yield (1784 kg/ha), stover yield (5632 kg/ha) and harvest index (24.06 %)

which was significantly higher than mustard cv. Laxmi and Pusa Agrani, seed yield (1544 and 1575 kg/ha), stover yield (5117 and 5142 kg/ha) and harvest index (23.18 and 23.45%) in the pooled analysis. However, it was found at par with mustard cv. Bio-902, seed yield (1646 kg/ha), stover yield (5224 kg/ha) and harvest index (23.96 %) in both the years. Significant difference between cultivars for number of siliquae, seeds siliquae^{-1} and seed weight in the present study corroborate with the findings of Reddy and Kumar[17], Sharma *et al.*[19], Laxmi narayana and Poorna chand[11] and Rana and Pachauri[16].

The analysis of variance revealed that the difference in yield was statistically significant due to different sowing dates. In both the years, the maximum, seed yield (1715 kg/ha), stover yield (5711 kg/ha) and harvest index (23.09 %) was recorded under sowing of mustard on 05thOctober which was significantly superior to the sowing of mustard on 15th September and 15th October, seed yield (1398 and 1471 kg/ha), stover yield (4821 and 4997 kg/ha) and harvest index (22.48 and 22.74 %), respectively. Sowing of mustard on25th September was found at par with sowing on05th October in terms of seed yield (1676 kg/ha), stover yield (5556 kg/ha) and harvest index (23.18 %), in the pooled analysis. These results suggest that pre-an thesis growth and development of mustard were adversely affected by high temperature in earlier sowing and later cold frosty nights and reduced sunshine in the crop sown late after first fortnight of October in these areas. Singh *et al.*[21], observed the similar trend and reported that late sown crop experienced sub-optimal temperature regime which retarded their growth compared to normal date or mid-sown crops on earlier dates. Also, post fertilization development suffered from forced maturity due to rapid rising in temperature[8,10].

Economics

The pooled data of two years shows that (Table. 4) the monetary returns was significantly influence by sowing of mustard cultivars and different date of sowing. Sowing of mustard cv. Pusa bold and Bio-902 were found at par with each other in terms of net return (Rs. 32909 and 28701/- ha^{-1}) and B: C ratio (1.53 and 1.35) as compared to sowing of mustard cv. Laxmi and Pusa Agrani in both the years. Significantly reduction in monetary return in early and late sowing in comparison to sowing of mustard at optimum time. The maximum net return (Rs. 31302/-) and B:C ratio (1.49) was recorded under timely sowing at 05th October over sowing at 15th September and 15th October, but it was found at par with sowing of mustard at 25th September, net return (Rs. 30114/- ha^{-1}) and B:C ratio (1.43) in the pooled analysis. These results support the finding of Shargi *et al.*[18], and Rafiei *et al.*[15]. The reduction in 1000 seed weight in first and fourth sowing in both the varieties is probably due to very short grain filling period and seeds could not develop fully in late sowings[1].

Table 1: Effect of different sowing dates on growth parameters of Indian mustard varieties

Treatments	Plant height (cm)			Primary branches			Secondary branches		
	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled
Variety									
Laxmi	156.08	154.90	155	4.12	4.05	4.09	8.81	8.80	8.81
Bio-902	159.43	158.75	159	4.50	4.46	4.48	8.85	8.82	8.84
Pusa Bold	162.40	161.70	162	4.60	4.55	4.58	8.90	8.85	8.88
Pusa Agrani	156.32	155.92	156	4.15	4.10	4.13	8.83	8.81	8.82
Sem+	1.20	1.16	1.09	0.10	0.09	0.08	0.19	0.21	0.18
CD (p=0.05)	3.66	3.55	3.25	0.32	0.30	0.26	NS	NS	NS
Sowing date									
15th Sept.	154.34	154.06	154	4.07	4.02	4.05	8.85	8.82	8.84
25th Sept.	158.75	158.44	159	4.53	4.43	4.48	8.88	8.86	8.87
05th Oct.	160.23	159.90	160	4.61	4.56	4.59	8.92	8.89	8.91
15th Oct.	155.02	154.78	155	4.20	4.08	4.14	8.87	8.85	8.86
Sem+	0.75	0.70	0.68	0.08	0.08	0.07	0.20	0.18	0.17
CD (p=0.05)	2.31	2.14	2.00	0.24	0.25	0.22	NS	NS	NS

Table 2: Effect of different sowing dates on yield attributes of Indian mustard varieties

Treatments	Siliquae plant^{-1}			Seeds siliquae^{-1}			1000 seed weight (g)		
	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled
Variety									
Laxmi	234	230	232	10.07	10.09	10.08	5.10	5.07	5.09
Bio-902	259	258	259	10.35	10.37	10.36	5.47	5.39	5.43
Pusa Bold	262	260	261	10.40	10.39	10.40	5.76	5.68	5.72
Pusa Agrani	236	233	235	10.12	10.13	10.13	5.36	5.30	5.33
Sem±	6.0	7.0	6.0	0.05	0.06	0.05	0.13	0.12	0.11
CD (p=0.05)	20	22	18	0.16	0.18	015	0.40	0.36	0.35
Sowing date									
15th Sept.	226	225	226	10.04	10.05	10.05	5.01	5.00	5.01
25th Sept.	260	259	260	10.33	10.35	10.34	5.58	5.55	5.57
05th Oct.	263	261	262	10.39	10.41	10.40	5.70	5.64	5.67
15th Oct.	230	228	229	10.13	10.11	10.12	5.14	5.06	5.10
Sem±	9.0	8.0	8.0	0.05	0.06	0.05	0.09	0.10	0.08
CD (p=0.05)	28	26	23	0.17	0.20	0.15	0.28	0.31	0.26

Table 3: Effect of different sowing dates on yield and harvest index of Indian mustard varieties

Treatments	Seed yield (kg ha^{-1})			Stover yield (kg ha^{-1})			Harvest Index (%)		
	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled
Variety									
Laxmi	1547	1540	1544	5136	5097	5117	23.15	23.20	23.18
Bio-902	1650	1642	1646	5495	5468	5224	23.93	23.99	23.96
Pusa Bold	1790	1778	1784	5978	5885	5632	23.97	24.15	24.06
Pusa Agrani	1581	1569	1575	5122	5162	5142	23.59	23.31	23.45
Sem±	50	47	45	165	144	142	0.07	0.11	0.08
CD (p=0.05)	156	143	134	502	438	426	0.22	0.35	0.25
Sowing date									
15th Sept.	1409	1387	1398	4678	4563	4821	22.41	22.55	22.48
25th Sept.	1685	1667	1676	5577	5534	5556	23.20	23.15	23.18
05th Oct.	1726	1704	1715	5748	5674	5711	23.09	23.10	23.09
15th Oct.	1481	1460	1471	4961	4833	4997	22.64	22.84	22.74
Sem±	36	35	33	67	56	57	0.09	0.06	0.07
CD (p=0.05)	110	102	98	198	170	170	0.26	0.18	0.20

Table 4: Effect of different sowing dates on economics of Indian mustard varieties

Treatments	Net return (Rs. /- ha^{-1})			B:C ratio		
	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled
Variety						
Laxmi	24910	26240	25575	1.16	1.22	1.19
Bio-902	28000	29402	28701	1.30	1.37	1.33
Pusa Bold	32200	33618	32909	1.50	1.56	1.53
Pusa Agrani	25930	27139	26535	1.21	1.26	1.23
Sem±	1802	1723	1622	0.08	0.07	0.06
CD (p=0.05)	5398	5072	4881	0.25	0.22	0.20
Sowing date						
15th Sept.	21270	21997	21634	1.01	1.05	1.03
25th Sept.	29550	30677	30114	1.41	1.46	1.43
05th Oct.	30780	31824	31302	1.47	1.52	1.49
15th Oct.	23430	24260	23845	1.12	1.16	1.14
Sem±	1526	1491	1388	0.05	0.06	0.05
CD (p=0.05)	4559	4475	4170	0.17	0.18	0.15

CONCLUSION

It may be concluded from the results of the study that productivity of the mustard is influenced by genotypes as well as time of sowing. In both the years, sowing of mustard cv. Pusa Bold and Bio-902 gave higher seed yield and monetary returns with 25th September to 05th October was adjudged as the best time for mustard seeding and gradual decrease was noted in the seed yield when sown on first and fourth date of sowing.

REFERENCES

1. Akhter, S., Singh, L., Rasool, R. and Ramzan, S., Effect of date of sowing and varieties on brown sarson(*Brassica repa*L.) under temperate Kashmir. *Int. J. Eng. Sci. Invention,* **4(3):** 65-69 (2015).
2. Alam, M. J., Ahmed, K. S., Mollah, M. R. A., Tareq, M. Z. and Alam, J., Effect of Planting Dates on theYield of Mustard Seed. *Int. J. Applied Sci. Biotech.,* **3(4):** 651-654, DOI:10.3126/ijasbt.v3i4.13974 (2015).
3. Aziz, M.A., Chakma, R., Ahmed, M., Rahman, A.K.M.M. and Roy, K., Effect of sowing dates on thegrowth, development and yield of mustard in the hilly areas. *J. Experimental Biosci.* **2(1):** 33-36 (2011).
4. Bhat S A, Khan F. A. and Khan, M. I., Effect of nitrogen and phosphorus on growth,nutrient content, seed yield and quality of mustard. *Indian J Pl Physiol* **11:** 281-86 (2006).
5. Bhuiyan, M. S., Mondol, M. R. I., Rahaman, M. A., Alam, M. S. and Faisal A. H. M. A., Yield and yieldattributes of rapeseed as influenced by date of planting. *Int. J. Sustainable Crop Production* **3(3):** 25-29 (2008).
6. FAO (Food and agricultural Organization)., FAO Production year Book. Rome, Italy, 61, p.64 (2007).
7. Hokmalipour, S., Tobe, A., Jafarabad, B., and Darbandi, M. H., Effect of sowing date on dry matteraccumulation trend, yield and some agronomic characteristics in canola (*Brassica napus*L.) cultivars. *World Applied Sci. J.* **19 (7):** 996-1002 (2011).
8. Iraddi, V.S. Response of mustard (*Brassica juncea* L. Czernj and Cosson) Varieties to date of sowing androw spacing in Northern transition zone of Karnataka. M.Sc. Thesis, University of Agricultural Sciences, Dharwad, pp. 55-81 (2008).
9. Khushu, M.K. and Singh, M., Thermal response of mustard under rainfed condition of Jammu.*Environment and Ecology,* **23(3):** 683-686 (2005).
10. Kushwaha, H. S., Singh, S. and Rai, H. K., Evaluation of Brassica model for simulating the performanceof Rapeseed-Mustard under tarai conditions of Uttarakhand. In: National Seminar on "Agro meteorology Development", Department of Agricultural Meteorology, CCS HAU, Hisar. pp. 9, 11 and 15 (2009).
11. Laxmi Narayana, P. and Poorna C., Response of mustard varieties to time of sowing inNorthern Telangana. *J. Res.*,ANGRAU **28:** 75-77 (2000).
12. Panda, B.B., Bandyopadhyay, S.K. and Shivay, Y.S., Effect of irrigation level, sowing dates and varieties onyield attributes, yield, consumptive water use and water-use efficiency of Indian mustard (*Brassica juncea*). *Indian Journal of Agricultural Sciences* **74(6):** 339-342 (2004).
13. Pavlista, A. D., Isbell, T. A., Baltensperger, D. D. and Hergert, G. W., Planting date and development ofspring-seeded irrigated canola, brown mustard and camelina. *Industrial Crops and Products* **33:** 451- 456 (2011).
14. Prasad, R. 1989. Response of Brassica species to the thermal environment under Delhi conditions. Ph.D. Thesis,Division of Agricultural Physics, I.A.R.I, New Delhi.
15. Rafiei, S., Delkhosh, B., Rad, A. H. S. and Peiman, Z., Effect of Sowing dates and Irrigation regimes onAgronomic traits of Indian mustard in semi-arid area of Takestan, *J. American Sci.* **7(10):** 721-728 (2011).
16. Rana, D. S. and Pachauri, D. K., Sensitivity of zero erucic acid genotypes

of *OleiferousBrassica* to plant population and planting geometry. *Indian J.Agron.,***46:** 736-40 (2001).

17. Reddy, M. D. and Kumar, A. K., Effect of dates of sowing on performance of mustardvarieties in non- traditional areas of Andhra Pradesh. *J. Oilseeds Res* **14:** 207-09 (1997).
18. Shargi, Younes., Rad, A. H. S., Band, A. A., Noor Mohammadi, G. and Zahedi, H., Yield and yieldcomponents of six canola (*Brassica napus*L.) cultivars affected by planting date and water deficit stress. *AfricanJournal of Biotechnology*, **10(46):** 9309-9313 (2011).
19. Sharma, J. K., Ram Mohan Rao, D. S. and Singh, D. P., Effect of crop geometry andnitrogen on yield and attributes of *Brassica* species. *Ind. J.Agron.,***42:** 357-60 (1997).
20. Siddiqui, M. H., Mohammad, F., Khan, M. N. and Khan, M. M. A., Cumulative effect of soiland foliar application of nitrogen, phosphorus, and sulphur on growth, physic biochemicalparameters, yield attributes, and fatty acid composition in oil of erucic acid-free rapeseed-mustard genotypes. *J.P.l.Nutr.,* **31:** 1284-98 (2008).
21. Singh, A.K., Singh, R.R., Singh, A.K. and Singh, P. K., Influence of dates of sowing and irrigationscheduling on growth and yield of mustard (*Brassica juncea* L). *Int.J. Farm Sci.* **4(2):** 80-85 (2014).
22. Walton, G., Si, P. and Bowden, B., Environmental impact on canola yield and oil. *J.American Sci.***7(10):** 728 (2011).