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Effect of sowing dates and varieties on yield attributes, yield and oil content of Indian mustard (*Brassica juncea* L.)

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Abstract

*A field experiment was conducted to study the effect of sowing dates and varieties on yield attributes, yield and oil content of Indian mustard (*Brassica juncea *L.) under irrigated conditions during* rabi *2012-13 at College of Agriculture, Tikamgarh (Madhya Pradesh). The experiment was laid out in split-plot design with three replications consisted three sowing dates* viz.*, October 20, November 4 and November 19 and three varieties* viz.*, Pusa Agrani, Pusa Bold and Varuna as main plot and sub-plot treatments, respectively. The crop sown on October 20 resulted into significantly more number of siliqua (plant^{-1}), 1000- seeds weight, seed yield (kg ha^{-1}), biological yield (kg ha^{-1}), stover yield (kg ha^{-1}), harvest index (%) and oil content (%) followed by November 4 and November 19 sown crops. Among varieties, Pusa Bold produced significantly more number of siliqua (plant^{-1}), number of seeds (siliqua^{-1}), 1000-seeds weight (g), seed yield (kg ha^{-1}) and harvest index (%) followed by* cvs. *Varuna and Pusa Agrani. However,* cv. *Varuna exhibited significantly higher oil content (42.0 %) followed by* cvs. *Pusa Bold (40.0 %) and Pusa Agrani (38.7 %).*

Key words: *Brassica juncea* L., Indian mustard, oil content, sowing dates, varieties, yield.

Introduction

Rapeseed-mustard is the second most important edible oilseed in India after groundnut sharing 27.8% in the India's oilseed economy. The area, production and productivity of rapeseed-mustard in India is 6.90 million ha, 8.18 million tonnes and 1185 kg h^{-1}, respectively during the 2009-10 (Anonymous, 2012). Indian mustard accounts for about 75–80% of the 6.90 million hectares under these crops in the country during 2009–10. The average productivity of rapeseed and mustard in the Madhya Pradesh is 1147 kg ha^{-1} (Anonymous, 2012). Production potentiality of Indian mustard in Madhya Pradesh can be fully exploited with suitable agronomic practices and varieties. Among different agronomic practices, research findings have shown that sowing date is one of the most important agronomic factor and non-monetary input which pave the way for better-use of time and play an important role to fully exploit the genetic potentiality of a variety as it provides optimum growth conditions such as temperature, light, humidity and rainfall. Sowing period information is needed for various other purposes like adjusting crop rotations; cropping patterns, crop growth simulations and climate change impact studies. Sowing at proper time allows sufficient growth and development of a crop to obtain a satisfactory yield and different sowing dates provide variable environmental conditions within the same location for growth and development of crop and yield stability. As sowing time is one of the most important factors affecting crop yield and other agronomic traits like oil content, the optimization of sowing time for mustard is essential. Sowing either too early or too late has been reported to be unfavorable (Uzun *et al.*, 2009). Improved cultivar is also an important tool, which have geared production of mustard in many countries of the world. In addition to many other factors responsible for achieving higher yields, cultivars with higher yield potential and a wide range of adaptability to edaphic and climatic conditions is essential for increasing yield per unit area, ultimately boosting up total production. Bora (1997) has also reported that the yield potential of different mustard varieties may differ under different agro-climatic conditions because of their inherent capacity. So keeping in view, the present study was therefore, undertaken to determine the effects of sowing dates on yield attributes, yield and quality of Indian mustard varieties under irrigated conditions of Tikamgarh district (Madhya Pradesh).

Materials and Methods

The field experiment was conducted at Research Farm, J.N.K.V.V., College of Agriculture, Tikamgarh (24° 43' N latitude and 78° 49' E longitude at an altitude of 358m above mean sea level), Madhya Pradesh during *rabi* 2012-13. The experiment was laid out in split-plot design with three replications. The main plot treatments consisted of three sowing dates *viz.*, October 20, November 4 and November 19 and the

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sub-plot treatments consisted of three varieties *viz*., Pusa Agrani, Pusa Bold and Varuna. The soil of experimental field was clay to clay loam with pH 6.9, low in available nitrogen (266 kg/ha), rich in available P_2O_5 (25.9 kg/ha), medium in available K_2O (255 kg/ha) and carbon content (0.5 %). The recommended doses of nitrogen (80 Kg N ha^{-1}), phosphorus (40 Kg P_2O_5 ha^{-1}) and potassium (20 kg k_2O ha^{-1}) along with sulphur (20 kg S ha^{-1}) were applied. The mustard crop was sown in lines 30 cm apart drawn by *kudali* using a seed rate of 5 Kg ha^{-1}. All other agronomic and plant protection measures were applied as per recommendations. Yield attributes were recorded from the five plants sample collected at the time of harvest. The crop harvested from net plot area was threshed after 4-5 days of sun drying and the seed yield of net plot was then converted into kg ha^{-1}. Before threshing of the crop harvested from net plot, the sun dried whole plant samples (biological yield) were weighed and then converted into kg ha^{-1}. Stover yield is obtained by subtracting seed yield (kg ha^{-1}) from biological yield (kg ha^{-1}). The harvest index (HI) was calculated as per formula:

$$HI\ (\%) = \frac{\text{Seed yield/economic yield (kg ha}^{-1})}{\text{Biological yield (kg ha}^{-1})} \times 100$$

The seed oil concentration of all samples was determined by nuclear magnetic resonance spectrometer (NMR) (Robertson & Morrison, 1979). The meteorological data prevailed during crop season (*rabi* 2012-13) was recorded at the Meteorological Observatory located at Farm, J.N.K.V.V, College of Agriculture, Tikamgarh (M.P.) and depicted in Fig. 1.

Results and Discussion

Yield attributes and yield

The data pertaining to yield attributes and yield as influenced by sowing dates and varieties are summarized in Table 1. Crop sown on October 20 resulted into significantly higher number of siliquae plant^{-1} and 1000 seed weight (g) followed by November 4 and November 19 sown crops. This may be attributed to favourable environmental effect on plant growth and development (Fig. 1). However, all sowing dates were failed to show significant differences for number of seeds siliqua^{-1}. Among different varieties, Pusa Bold produced significantly more number of siliquae (plant^{-1}), number of seeds siliqua^{-1} and 1000 seed weight (g) followed by *cvs*. Varuna and Pusa agrani. However, number of seeds siliqua^{-1} between *cvs*. Pusa Bold and Varuna; and between *cvs*. Pusa Agrani and Varuna were found non-significant. The varietal differences in yield attributes among different varieties of *Brassica* species had also been reported by Kumar *et al.* (2008).

Data in Table 1 also reveals that seed yield (kg ha^{-1}), stover yield (kg ha^{-1}), and biological yield (kg ha^{-1}) and harvest index (%) were recorded significantly higher under October 20 sown crop followed by November 4 and November 19 sown crops. The higher seed yield (2009 kg ha^{-1}) produced by October 20 sowing might be attributed to improved yield attributing characters *viz*., number of siliqua plant^{-1} and 1000-seeds weight. The favourable effect of early sowing (October 20) on sink component could be attributed to better development of the plants leading to increased bearing capacity due to optimum growth on account of favourable environmental conditions. The earlier findings of Kumari *et al*. (2012) corroborate these results. The reduction in seed yield under delayed sowing could be due to less translocation of current photosynthates towards reproductive parts, rapid initiation of inflorescence, flowering, fruiting and maturity, less number of siliqua and less siliqua filling duration because of non-fulfillment of temperature demands under late sowings. The reduction in biological yield under delayed sowing occurred primarily due to the decreased in growth characters in terms of plant height, LAI and lower biomass buildup plant^{-1} (data

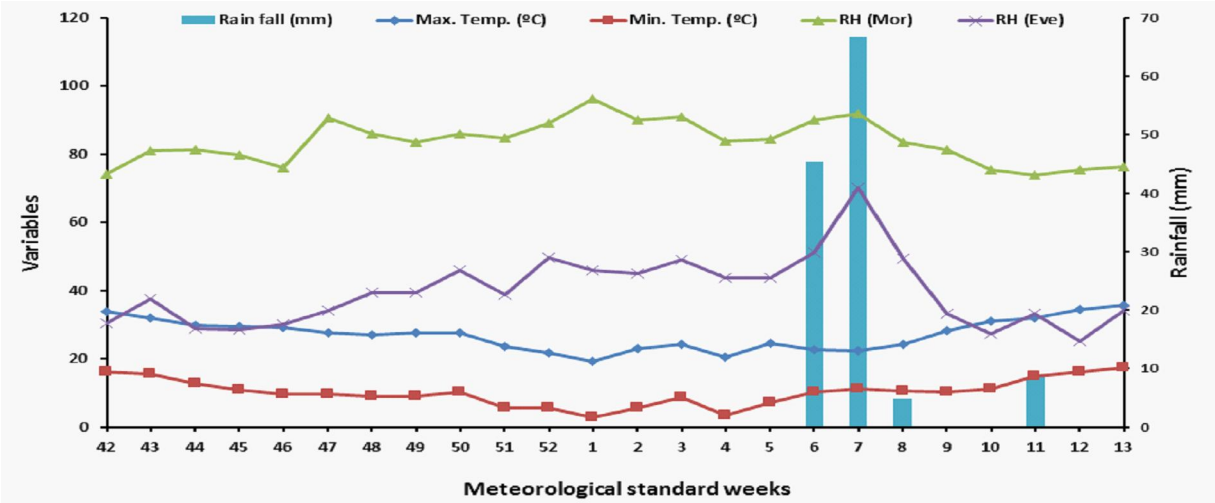

Fig. 1: Mean weekly weather data during crop sesaon (rabi 2012-13) at Tikamgarh

Table 1: Effect of different treatments on yield attributes, yield and oil content of Indian mustard

Treatments	No. of siliqu (plant^{-1})	No. of seeds (siliquae^{-1})	1000- seed weight (g)	Seed yield (kgha^{-1})	Stover yield (kg ha^{-1})	Biological yield(kgha^{-1})	Harvest index	Oil content (%)
Sowing dates								
20th Oct. 2012	198.7	13.1	6.17	2009	4887	6895	29.3	42.1
4th Nov. 2012	185.4	12.3	5.73	1597	4364	5961	27.2	40.5
19th Nov. 2012	153.6	11.2	5.43	1224	4062	5286	23.0	38.1
S.Em±	5.5	0.5	0.08	73	129	187	0.32	0.32
CD at 5%	22.0	NS	0.32	294	517	754	1.14	1.14
Varieties								
Pusa Agrani	163.4	11.5	4.97	1389	4347	5,735	38.7	38.7
Pusa Bold	196.4	13.4	6.37	1803	4828	6,630	40.0	40.0
Varuna	178.1	12.5	6.00	1638	4139	5,777	42.0	42.0
S.Em±	5.4	0.4	0.09	89	272	333	0.36	0.36
CD at 5 %	16.8	1.0	0.29	277	NS	NS	1.12	1.12

not given). The slower growth on account of lower temperature during early vegetative growth phase and the overall shorter life span of crop caused reduction biomass production. The earlier findings of Tobe *et al*. (2013) corroborate these results. The significantly higher harvest index under early sowing of October 20 was due to relatively greater seed yield than two latter sowings. Similar results had also been reported by Kumari *et al*. (2012).

Among different varieties, Pusa Bold produced significantly higher seed yield (1803 kg ha^{-1}) followed by *cvs*. Varuna (1638 kg ha^{-1}) and Pusa Agrani(1389 kg ha^{-1}). However, *cvs*. Pusa Bold and Varuna were found non-significant. Cultivar Pusa Bold recorded 29.8% and 8.24% higher seed yield over Pusa Agrani and Varuna, respectively. The higher seed yield in *cv*. Pusa Bold was ascribed due to improved yield attributes *viz*., more number of siliqua plant^{-1}, more number of seeds (siliqua^{-1}) and 1000-seeds weight. The varietal differences in seed yield had also been reported by Kumari *et al*. (2012). Varieties were failed to affect stover yield and biological yield significantly. The cultivar Varuna recorded significantly higher harvest index followed by *cvs*. Pusa Bold and Pusa Agrani. However, *cvs*. Varuna and Pusa Bold were at par. The varietal differences in harvest index had also been reported by Kumari *et al*. (2012).

Oil content

Data pertaining to oil content (%) as influenced by sowing dates and varieties are presented in Table 1. October 20 sown crop exhibited significantly higher content of oil (42.1%) followed by November 4 (40.5%) and November (38.1%). The longer duration of reproductive phase under October 20 sowing had a positive influence on the development of seed and therefore, increased oil content. These results are in conformity with the findings of Tobe *et al*. (2013). Among different varieties, Varuna recorded significantly higher oil content (42.0%) followed by *cvs*. Pusa Bold (40.0%) and Pusa Agrani (38.7%). The differences in oil content among different varieties could be attributed to their genetic constitution. The varietal difference in oil content was also earlier reported by Das *et al*. (1998).

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