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REVIEW ARTICLE

Effect of Sowing Dates and Varieties For Higher Productivity Of Indian Mustard (*Brassica juncea* L.) – A Review

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ABSTRACT
Rapeseed–mustard grown in diverse agro-climatic conditions ranging from north-eastern/ north-western hills to down south under irrigated/rainfed, timely/ late-sown, saline soils and mixed cropping. Sowing time is important in deciding the environmental conditions of crop, timing and rate of organ appearance while in crop growth analysis predicting of phenology is of prime importance. The crop is mainly grown during the winter season (October-March). Interpretation of physiological and phenological stages that causes reduction in yield with reference to date of sowing can help to develop strategies for improvement in the seed yield. Further, it will help in the assertion that productivity is constrained by development pattern and process physiology in response to environment. Moreover, response of different cultivars may differ under various sowing dates. Thus, optimum sowing date for a particular cultivar under consideration may play a great role in exploiting the yield potential of that cultivar.
***Key words**: Sowing dates, Varieties, Indian mustard, Productivity.*

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INTRODUCTION

Rapeseed-mustard is the third important oilseed crop in the world after soybean (*Glycine max* L.) and palm (*Elaeis guineensis* Jacq.) oil. It is grown in subtropical and tropical countries in the world comprise eight cultivated crops of tribe Brassiceae within the family Cruciferae (Brassicaceae). In India, it is the second most important edible oilseed after groundnut sharing 27.8% in the India's oilseed economy. The estimated area, production and productivity of rapeseed-mustard in the world was 30.74 million ha, 59.93 million tonnes and 1950 kg h^{-1}, respectively in 2009-10. 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 [5]. Globally, India account for 21.7% and 10.7% of the total acreage and production [56]. Indian mustard [*Brassica juncea* (L.) Czern and Coss.] is predominantly cultivated in Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh and Gujarat. Among these states, Rajasthan, Uttar Pradesh and Madhya Pradesh are the major rapeseed-mustard growing states with 45.5%, 13.1% and 11.1% contribution, respectively, to the national acreage during the last five years. The corresponding contribution to production was 48.6%, 13.4% and 9.8%, respectively [12].

Rapeseed–mustard crops are grown in diverse agro-climatic conditions ranging from north-eastern/ north-western hills to down south under irrigated/rainfed, timely/ late-sown, saline soils and mixed cropping. Production potentiality of Indian mustard can be fully exploited under these conditions with suitable agronomic practices and varieties. Among the different agronomic practices, optimum sowing time is very important for mustard production [28-30]. Research findings have also shown that sowing date is one of the critical components affecting mustard crop productivity. It 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 time is also important in deciding the environmental conditions of crop, timing and rate of organ appearance while in crop growth analysis predicting of phenology is of prime importance. Since the temperature and solar radiation play an important role in partitioning of biomass between various organs of plant which is related to, and often governed by phenological phase of the plant and the way in which a crop develops can affect the yield and this therefore an aspect with which agronomists are much concerned. The crop is mainly grown during the winter season (October-March). The recommended sowing calendar for mustard varies across the major growing regions. 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 [35]. If the mustard is sown late, duration is reduced due to the high temperature during the reproductive phase with concomitant reduction in yield [23, 24]. Some researchers demonstrated that the yield of mustard crop sown in second fortnight of September was significantly higher than that sown in first fortnight of October [16]. In general, it was observed that the mustard crop sown after October 30th resulted in lower yields [34, 36, 47, 52]. Understanding of physiological and phenological causes of yield reduction with reference to date of sowing can help to develop strategies for improvement in the seed yield. Further, it will help in the assertion that productivity is constrained by development pattern and process physiology in response to environment.

The growth phase of the crop should synchronize with optimum environmental conditions for better expression of growth and yield. It is a fact that specified genotypes does not exhibit the same phenotypic characteristics in all environmental conditions. Bora [8] has reported that the yield potential of different mustard varieties may differ under different agro-climatic conditions because of their inherent capacity. The different genotype growth response varies to different environment and their relative ranking usually differ and ultimately decides the selection of genotypes for a particular or different sowing dates for stabilized higher yields [15, 37]. The effect of increasing productivity has been made by a number of research workers through different inputs and agro techniques in India and abroad under varied agro-climatic conditions. Maintenance of optimum sowing time and suitable variety during crop growth period is essential to get higher productivity of the crop.

Effect of sowing date

Sowing time is the most vital nonmonetary input to achieve target yields in mustard. Production efficiency of different genotypes greatly differs under different planting dates. Soil temperature and moisture influence the sowing time of rapeseed-mustard in various zones of the country. Sowing time influences phenological development of crop plants through temperature and heat unit. Sowing at optimum time gives higher yields due to suitable environment that prevails at all the growth stages. Though different varieties have a differential response to date of sowing, mustard sown on 14 and 21 October took significantly more days to 50% flowering (55 and 57) and maturity (154 and 156) compared to October 7 planting. Delayed sowing resulted in poor growth, low yield, and oil content. The reduction in yield was maximum in "RH-30" and minimum in "Rajat". Date of sowing influence the incidence of insect-pest and disease also. Sowing on October 21 resulted in least *Sclerotinia* incidence. The maximum (20.5–25.4°C) and minimum (3.9–10.7°C) temperatures at the flowering stage of crops established through sowing on October 21 were negatively correlated with the development of *Sclerotina* stem rot. Mustard aphid (*Lipaphis erysimi (Kaltenbach)*) has been reported as one of the most devastating pests in realizing the potential productivity of Indian mustard. Normal sowing (1st week of November) also helps in reducing the risk of mustard aphid incidence.

Tripathi *et al*. [54] at Hisar reported that the delayed sown mustard crop on 5th November took more days to emergence as compared to early sown on 20th October and 5th October. They also reported that the early sown mustard crop on 5th October significantly early attained the flower bud visible from above as compared to late sown on 20th October and 5th November. Bhuiyan *et al.* [6] at Rangpur (Bangladesh) revealed significantly earlier days taken to emergence in early sowing of 20th October as compared to late sown crop on 30th October, 10th November, 20th November and 30th November. Adak *et al*. [1] at IARI (New Delhi) also suggested that days to emergence in mustard were significantly earlier with 15th October sowing as compared to 30th October sowing. Tyagi *et al.* [55] observed that early sowing 20th October resulted in early vegetative and flowering stages than late sown conditions 10th November and 30th November. Nanda *et al.* [31] suggested that the crop sown on 21stOctober delayed the first flower initiation as compared to 9th December sowing. Kumar *et al.* [19] at Bawal (Haryana) quoted that crop sown on 14th and 21st October significantly reduced days taken to first flower initiation as compared to 7th October planting. Similarly, Panda *et al.* [33] also reported that delayed sowing after 16th October significantly reduced the days taken to first flower initiation. Kumari *et al*. [24] at Tirupati (A.P.) reported significantly earlier 50% flowering with 1st October sowing as compared to 15th September, 15th October and 1st November sowings. Shah *et al.* [41] at Peshawar (Pakistan) observed that the significantly earlier physiological maturity in mustard was recorded with 15th September sowing as compared to 25th September, 5th October, 15th October, 25th October, 5th November, and15th November sowings. Tobe *et al*. [53] at Ardabil (Iran) evaluated that early sown *B. napus* on 30th March resulted into delayed 50% flowering and 50% pod development stage as compared to late sowings on 14th April, 29th April and 14th May. They also concluded that 30th March sowing led to longest reproductive period whereas last sowing on 14th May had the shortest reproductive period.

Growth and development: The genetic potential of a plant is fully expressed only under optimum environment conditions, which depends upon various factors *viz.*, temperature and radiation exposure, plant age, stage of development etc., under actual field conditions. However, environmental conditions change continuously and rarely the plant experiences optimum conditions at all stages of growth. Out of all possible environmental factors, radiation, temperature, water and nutrients have been recognized as the most important factors influencing course of plant growth and development. Sharma *et al.* [42] at Nagpur (Maharashtra) reported that the significantly greater plant height was observed at 75 DAS with 29th October sowing as compared to 22nd October, 12th October and 6th October sowings. Charak *et al.* [10] revealed that the plant height at harvest was significantly higher under first week of September sowing as compared to second week of September, third week of September and fourth week of September sowings. Bhuiyan *et al.* (2008) reported significantly higher plant height under 10th November sowing as compared to 30th October, 20th October, 20th November, 30th November sowings. Shah *et al.* [41] observed significantly higher plant height with 15th September (212.5 cm) sowing as compared to 25th September (203.8 cm), 5th October (183.2 cm), 15th October (188.3cm), 25th October (181.1 cm), 5th November (155.6 cm), and 15th November (126.1cm) sowings. Lallu *et al.* [26] revealed that November sowing caused the significant reduction in plant height (100.5 cm) as compared to October sowing (152.8 cm). Afroz, *et al*. [2] at (Bangladesh) observed that significantly higher plant height was found under 10th November sowing (99.4 cm) as compared to 20th November (93.0 cm) and 30th November (78.0 cm) sowings.

Kumar *et al.* [20] reported that the number of branches plant^{-1} were significantly greater in mustard were with 30th September (22.2 plant^{-1}) sowing as compared to 15th October (19.7 plant^{-1}), 30th October (16.6) and 14th November (14.3 plant^{-1}) sowings. Bhuiyan *et al.* [6] reported significantly higher primary branches in 20th October (6.85 plant^{-1}), as compared to 30th October (6.72 plant^{-1}), 20th November (6.25 plant^{-1}), 10th November (6.22 plant^{-1}) and 30th November (6.20 plant^{-1}) sowings. Lallu *et al.* (2010) observed that November sowing caused the significant reduction in total number of branches (21.4 plant^{-1}) as when compared to October sowing (31.6 plant^{-1}). Afroz *et al*. [1] observed that significantly higher branches were found in 10th November sowing (2.94 plant^{-1}) as compared to 20th November (2.50 plant^{-1}) and 30th November (1.89 plant^{-1}) sowings. Kumari *et al*. [44] observed that 10th October sowing recorded significantly higher primary and secondary branches plant^{-1} (7.8, 19.9) over 20th October sowing (7, 17.6) and 30th October sowing (6.4, 14.1).Panda *et al.* [34] reported that delayed sowing beyond 16th October significantly reduced LAI and leaf area duration. In Nagpur, Sharma *et al.* [42] reported that the significantly higher leaf area index was observed at 60 DAS with 29th October sowing (1.334) as compared to 22nd October (1.161), 12th October (1.100) and 6th October (1.008) sowings. Lallu *et al* [26] suggested that November sowing caused the significant reduction in the biomass production and it's partitioning at post flowering (14.2 g plant-^{1}) and at harvest (64.1 g plant^{-1}) as compared to October sowing at post flowering (19.2 g plant^{-1}) and at harvest (85.8 g plant^{-1}). Adak *et al*. [1] observed that the biomass production and its partitioning at flowering and pod filling stage in mustard was significantly higher with 15th October sowing (15.4 and 46.7g plant^{-1}) as compared to 30th October (14 and 37.7g plant^{-1}) sowing.

Yield attributes and yield: A crop yield is a measurement of the amount of a crop that was harvested per unit of land area. Crop yield is the measurement often used for a cereal, grain or legume and is normally measured in metric tons per hectare (or kilograms per hectare).

Afroz *et al*. [2] quoted that significantly higher siliquae (plant^{-1}) were found in 10th November sowing (161.2) as compared to 20th November (148.0) and 30th November (128.9) sowings. Aziz *et al*. [3] reported that 15 November sown mustard crop produced the maximum number of siliquae (254 plant^{-1}) as compared to 25 November, 5 December and 15 December. Mondal *et al*. [30] reported that number of siliquae (plant^{-1}) were significantly higher with 1st November (97) as compared to 20th October (86), 10th November (71.0), 20th November (57.3) and 30th November (69.7) sowings. Kumari *et al*. [44] suggested that 10th October sowing recorded significantly higher number of siliquae (323 plant^{-1}) over 20th October sowing (302 plant-1) and 30th October sowing (238 plant^{-1}). Singh *et al.* [47] observed that the number of seeds (siliqua-1) were higher in 10th and 30th October sowing as compared to 20th November and 10th December sowing. Kurmi [25] suggested that the number of seeds (siliqua^{-1}) were recorded higher with 17th November sowing (17) as compared to 14th December sowing (14). Singh *et al.* [46] quoted that crop sown on 5th October resulted into higher number of seeds (13 siliqua^{-1}) as compared to 5th November sowing (11 siliqua^{-1}). Shivani and Kumar [45] reported that sowings on 25th September and 5th October resulted into significantly higher number of seedssiliqua^{-1}) as compared to 15th October, 25th October and 4th November sowings.

Kumar and Singh [21] at Patna (Bihar) reported that there was a significant decreased in the seed yield with the early sowing date. The greater seed yield was observed with 20th to 25th October sown crop (1735 kg ha^{-1}). Sihag *et al.* [46] at Bikaner (Rajasthan) and observed that the higher seed yield was obtained in 15th October sowing (2150 kg ha^{-1}). Kumar *et al.* [18] emphasized that greater seed yield of 2980 kg ha^{-1} was observed when the mustard crop was sown on 21st October and seed yield increased by 6.5% and 3.5% over that planted on 7th and 14th October. Panda *et al.* [34] quoted that delayed sowing after 16th October reduced the seed yield. The crop sown on 16th October resulted into higher seed yield (1945 kg ha^{-1}) than the crops sown on 31st October (1556 kg ha^{-1}) and 15th November (872 kg ha^{-1}). Singh and Singh [49] recorded higher stover yield with 14th October sowing as compared to 29th October, 13th November and 28th November sowing. Charak *et al.* [10] reported that the stover yield in toria crop was found significantly higher with first week of September sowing (4.37 t ha^{-1}) as compared to second week of September (4.28 t ha^{-1}), third week of September (4.19 t ha^{-1}) and fourth week of September (3.81 t ha^{-1}) sowings. Sharma *et al.* [42] conducted a field experiment and reported that the significantly higher stover yield was observed with 29th October sowing (34.3 q ha^{-1}) as compared to 22nd October (32.4 t ha^{-1}), 12th October (24.7 t ha^{-1}) and 6th October (19.5 t ha^{-1}) sowings.

Oil content (%): Oil content was significantly higher under 25th October sown crop as compared to 05th October and 25thSeptember sown crop Singh *et al.* [51]. Kumar *et al.* [20] revealed that the oil content in mustard was significantly higher with 30th September (40.9%) sowing as compared to 15th October (39.5%), 30th October (37.7%) and 14th November (36.0%) sowings. Adak *et al*. [1] suggested that the oil content in mustard was significantly higher with 15th October sowing (34.8%) as compared to 30th October (32.3%) sowing. Mondal *et al*. [20] reported that oil content was significantly higher with 20th October (43.9%), 1st November (43.8%) as compared to 10th November (42.5%), 20th November (41.7%) and 30th November (41.7%) sowings. Tobe *et al*. [53] reported that 30 March sown spring canola had significantly higher percentage of oil as compared to 14th April, 19th April and 14th May sown crops.

Effect of varieties

Since, there is a vast variability in the climatic and edaphic conditions in the mustard growing areas of India, the selection of appropriate cultivars is important as it helps in increasing the productivity. Introduction of relatively short duration cultivar found favor with the environment where effective growing seasonal length is short. Improved varieties of mustard stabilize oil and seed yield through insulation of cultivars against major biotic and abiotic stresses enhance oil (low erucic acid) and seed meal (low glucosinolate) quality. The first Indian mustard hybrid, named "NRCHB- 506," has been developed at Directorate of Rapeseed-Mustard Research, Bharatpur which can catapult the output of the country's key oil crop. The new hybrid is meant for cultivation in Rajasthan and Uttar Pradesh. Other high yielding varieties include "JM-1," "JM-3," and "Pusa Bold," "NRCDR-2," "NRCDR 601." Their yield potentials vary from 16 to 25 q/ha. At IARI, an early-maturing and bold seeded mustard variety has been developed called "Mehak" (*B. juncea*). This improved variety is suitable for early sowing to replace *toria (B. rapa* var. *toria)* in Delhi and adjoining areas. *Gobhi sarson* has a good yield potential, wide adaptability and possesses high oil content of good quality. "Hyola" (PAC- 401) is canola type hybrid rapeseed, developed in India by Advanta India Ltd, Holland-based multinational company. "Neelam" (HPN-3) and "Sheetal" (HPN-1) are the popular varieties of *gobhi sarson*. Since inception of mustard research programme in India, number of tolerant varieties to various abiotic and biotic stresses of rapeseed-mustard has been developed.

"Pusa Jaikisan" of *B. juncea* is the first variety though tissue culture. "TL-15," a toria variety has been recommended as summer crop for high altitude of Himachal Pradesh. In an attempt to incorporate resistance/tolerance to biotic and abiotic stresses in high yielding varieties, aphid tolerant strains like "RH-7846," "RH-7847," "RH-9020" and "RWAR-842," *Alternaria* blight moderately resistant variety "Saurabh"; white rust resistant variety, "Jawahar Mustard- 1"; salt tolerant varieties "Narendra Rai" and "CS-52" frost tolerant "RH-781" and "RH-7361" varieties have been identified. "RH-781" is also drought tolerant and suitable for intercropping. For nontraditional areas, Indian mustard varieties "Rajat," "Pusa Jaikisan" and "Sej.2" have been recommended.

Sharma *et al.* [42] at Hisar (Haryana) observed that the first flower initiation (36.4 days) was earlier in *cv*. RH-30 as compared to *cv*. RH-819 (41.9 days). Adak *et al*. [1] observed that the days taken to first flower and 50% flowering in mustard genotype Pusa Jaikisan were significantly earlier (34 and 40 days, respectively) over the genotype BIO169-96 (39 and 45 days, respectively). Tobe *et al*. [53] revealed that *cv*. Sarigol had the longest time (52.3 days) for reaching first flower in *B. napus* as compared to *cvs.* Hayola-401 and RDF003. Shah and Rahman [41] observed that the significantly earlier physiological maturity was recorded in rapeseed genotype RM-152-2 (167.8 days) as compared to genotypes RM-182 (169.7 days), RM-159-2 (170.4 days) and Pak-Cheen (171.6 days). Adak *et al*. [1] observed that mustard genotype Pusa Jaikisan took significantly lesser days to reach physiological maturity (136 days) than genotype BIO169-96 (140 days). Chandrakar and Urkurkar [9] observed that *cv*. Pusa Bold took the minimum days to attain physiological maturity (103 days) than *cv*. Varuna (108 days). Tyagi *et al*. [55] reported that *cv*. Laxmi took significantly maximum days (142 days) to attain maturity followed by *cvs*. Vaurna (139 days) and RH-30 (138 days). Sharma *et al.* [42] noted that mustard cultivar RH-30 attained earlier physiological maturity (112.6 days) as compared to *cv*. RH8 19 (119.9 days). Kumar *et al.* (2008) reported that the days to maturity in *Brassica* spp. were found significantly greater with *B. carinata cv*. Kiran (173.3 days) as compared to *B. napus cv*. GSL-1(158.2 days), *B. napus cv*. Hyola-401 (145.7 days), *B. juncea cv*. Urvarshi (145.0 days), *B. juncea cv*. Kranti (140.5 days) and *cv*. NDYS-2 (*B. campestris)* (121.9 days).

Growth and development: Shah and Rahman [41] observed that significantly higher plant height in rapeseed genotype RM-159-2 (180.8 cm) as compared to genotype RM-152-2 (180.7 cm), Pak-Cheen (177.1 cm) and RM-182 (176.0 cm). Lallu *et al.* [26] at Kanpur (U.P) observed that among different mustard genotypes, plant height of genotype RGN-152 was significantly higher (184.7 cm) as compared to other genotypes in normal sowing and in late sown condition *cv*. RGN- 145 exhibited significantly higher (118.5 cm) plant height. Singh *et al.* [48] emphasized that the number of primary branches was observed significantly higher in *cv*. Varuna (7 plant^{-1}) over *cv*. BJH-1 (5 plant^{-1}). Kumar *et al.* [20] reported that the number of branches in *Brassica* spp. was significantly greater in *B. juncea cv*. Kranti (14.8 plant^{-1}) as compared to *B. juncea cv*. Urvarshi (14.6 plant^{-1}), *B. napus cv*. GSL-1(11.9 plant^{-1}), *B. napus cv*. Hyola- 401 (8.5 plant-1), *B. carinata cv*. Kiran (5.42 plant^{-1}) and *B. campestris cv*. NDYS-2 (5.2 plant^{-1}). Datta *et al.* [13 at Burdwan (W.B.) revealed that the leaf area index at 25 DAS was observed significantly higher in *cv*. NC-1 and Ragini (0.270) as compared to *cvs*., YST-151 (0.260), B9 (0.250) and WBBN-1 (0.240) and at 50 DAS, leaf area index was observed significantly higher in *cv*., Ragini (0.586) as compared to cv., YST-151 (0.556), B9 (0.533), (0.240), NC-1 (0.533) and WBBN-1 (0.483) and at 75 DAS leaf area index was observed significantly higher in *cv*. Ragini (0.266) as compared to *cvs*. NC-1 (0.260), YST-151 (0.256), WBBN-1 (0.246) and B9 (0.240). Lallu *et al.* [26] at Kanpur (U.P.) observed that mustard *cv*. HUJM-05-5 exhibited significantly higher biomass production (25.3 g plant^{-1}) as compared to other genotypes in normal sowing at post flowering stage whereas, in late sown condition, *cv*. RH - 0119 produced significantly higher dry biomass (18.9 g plant^{-1}) at post flowering as compared to other genotypes. Similarly, at harvest, *cv*. RH- 0116 produced significantly higher dry biomass (133.3 g plant^{-1}) as compared to other genotypes in normal sowing and in late sown, dry biomass was significantly higher in *cv*. BPR-541-2 (83.4 g plant^{-1}) as compared to other genotypes. Rashid *et al*. [39] in a field experiment reported that dry biomass accumulation for mustard was significantly differed between the varieties on all days after sowing. At 75–85 DAS, they observed that *cv*. BARI sharisa-12 showed a 9.52% higher dry biomass (g plant^{-1}) over *cv*. BARI sharisa-9, whereas *cv*. BARI sharisa-15 gave the lowest dry biomass, which was 20.9 % lower than that of *cv*. BARI sharisa-12. Jha *et al.* [17] at IARI, New Delhi observed that mustard *cv*. Pusa Jagannath exhibited significantly higher biomass production (647 g m2) as compared to *cv*. Pusa Agrani (450 g m2).

Yield attributes and yield: The seed yield of mustard mainly depends on the number of siliqua plant-1, length of siliqua, number of seed siliqua-1and test weight as these characters have high degree of positive correlation with seed yield. The variety with Coral-437 produced higher value of seed and stover yield, which was significantly higher to Kranti, Maya and Rohini Singh *et al.* [50]. Kumar *et al.* [20] suggested that the number of siliquae (plant^{-1}) in *Brassica* spp. were significantly higher in *B. carinata cv*. Kiran (277) as compared to *B. napus cv*. GSL-1(219), *B. juncea cv*. Kranti (215), *B. juncea cv*. Urvarshi (206), *B. napus cv*. Hyola-401 (131), and *B. campestris cv*. NDYS-2 (66). In Mymensingh (Bangladesh), Afroz *et al*. (2011) observed significantly higher number of siliquae (plant^{-1}) in *cv*. BARI Sarisha-9 (153.3) as compared to *cv*. BARI Sarisha-6 (138.8). Kumari *et al*. [32] observed that hybrid DMH-1 recorded significantly higher number of siliquae (342 plant^{-1}) over hybrid NRCHB-506 (286 plant^{-1}) and *cv*. Kranti (235 plant^{-1}). Kumar *et al.* [20] reported that the number of seeds (siliqua^{-1}) in *Brassica* spp. were found significantly greater in *B. campestris cv*. NDYS-2 (24) as compared to *B. napus cv*. Hyola-401(21), *B. napus cv*. GSL-1 (14), *B. carinata cv*. Kiran (12) and *B. juncea cv*. Kranti (11), *B. juncea cv*. Urvarshi (11). Afroz *et al*. [2] observed that significantly higher Number of effective seeds (siliqua^{-1}) was found in *cv*. BARI Sarisha-6 (20.6) as compared to *cv*. BARI Sarisha-9 (13.5). Kumari *et al*. [22] observed that hybrid DMH-1

recorded significantly higher number of seeds (13.8 siliqua^{-1}) over hybrid NRCHB-506 (13.6 siliqua^{-1}) and *cv*. Kranti (11.7 siliqua^{-1}).
Singh *et al.* [49] recorded significantly higher seed yield in cultivar RH 30 (2390 kg ha^{-1}) over Varuna (2240 kg ha^{-1}). Similarly, Pal *et al.* [32] reported that seed yield was higher in *cvs*. RH 30 and Laxmi over *cv*.Varuna. The varietal differences in seed yield were also reported by Dehghani, *et al*. [14]. Kumar *et al.* [20] reported that the seed yield in *Brassica* spp. were found significantly greater in *B. carinata cv*. Kiran (1685 kg ha^{-1}) as compared to *B. napus cv.* Hyola- 401 (1441 kg $^{ha-1}$), *B. juncea cv.* Urvarshi (1402 kg ha^{-1}), *B. napus cv.* GSL-1 (1369), *B. juncea cv.* Kranti (1300 kg ha^{-1}) and *B. campestris cv.* NDYS-2 (742 kg ha^{-1}). Yadav *et al.* [57] observed that stover yield was higher in *cv*. Vaibhav (4430 kg ha^{-1}) as compared to *cv*. Vardan (4000 kg ha^{-1}). Reddy and Kumar (1997) quoted that *cv.* Varuna recorded significantly higher stover yield (2096 kg ha^{-1}) over *cv.* GM-1 (1806 kg ha^{-1}). Afroz *et al*. [2] observed that significantly higher stover yield was found in *cv*. BARI Sarisha-9 (2.76 t ha^{-1}) as compared to *cv*. BARI Sarisha-6 (2.68 t ha^{-1}).
Oil content (%): Bishnoi and Singh [7] recorded significantly higher oil content in *cv.* RH-30 (38.4 %) over *cv.* RL-18 (38.7 %). Sharma [43] reported significantly higher oil content in *cv.* Pusa Bold (40.8%) over *cv.* Krishna (38.8 %). Tyagi *et al*. [55] also observed varietal variation in oil content in three mustard varieties and reported that *cv*. RH-30 had significantly higher oil content (36.4 %) followed by *cvs*. Varuna (34.3 %) and Laxmi (34.1 %). Rana and Pachauri [38] observed that *cv.* TERI R 15 recorded higher oil content (42 %) as compared to *cv.* Bio 902 (37.9 %). Adak *et al*. [1] observed that oil content was significantly higher in mustard genotype BIO169-96 (38.3 %) over the genotype Pusa Jaikisan (35.0 %). Tobe *et al*. [53] revealed that *cv*. RDF003 exhibited the highest percentage of oil (39.9 %) as compared to *cvs*. RDF003 and Sarigol whereas latter two varieties had no significant statistic difference with each other.

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