Journal of Oilseed Brassica, 17 (1) : 89-92, January 2026

Yield attributes and yields of Indian mustard (*Brasssica Juncea* L.) varieties as influenced by different fertility levels under timely sown rainfed conditions

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https://doi.org/10.56093/job.v17i1.15
Received date : 28 November 2025 Accepted date : 23 December 2025

Abstract

A field experiment was conducted during *rabi* 2021-22 to study the yield attributes and yield of Indian mustard varieties at the research farm, College of Agriculture, CCSHAU, Hisar, Haryana. The experiment was laid out in split plot design with three replications consisted four mustard varieties (Kranti, RGN229, RH725 and RH1424) as main plots and three fertility levels (100% RDF, 125% RDF and 150% RDF) as subplots treatments. Results revealed that among varieties RH 1424 resulted in significantly higher yield attributes and yield as compared to Kranti, RGN 229 and RH 725. Among fertility levels, 150% RDF exhibited significantly more siliquae plant^{-1}, higher 1000 seed weight, seed yield and stover yield followed by 125% RDF and 100% RDF.

Keywords*: Fertility levels, varieties, Indian mustard, seed yield and oil content*

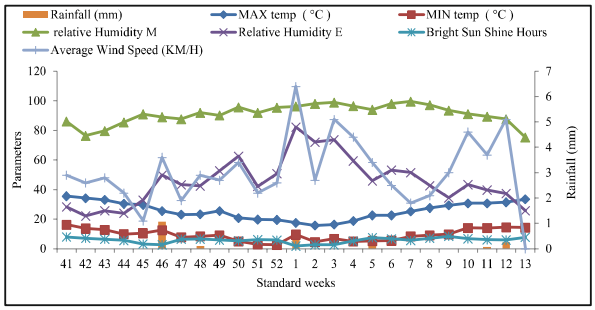
Introduction

India stands as the fourth-largest vegetable oil economy globally, following the USA, China, and Brazil. Oilseeds cultivated on approximately 41.95 million hectares worldwide, contributing around 88.35 million tonnes and an average yield of 2110 kg ha^{-1} (FAOSTAT 2022). The country cultivates R-M on about 8.75 mha, yielding 12.80 mt and an average yield of 1470 kg ha^{-1} (Anonymous 2024). Haryana is one of the major rapeseed and mustard growing state and crop occupied 0.67 mha of area, producing 1.47 mt with productivity of 2201 kg ha^{-1} in 2024-25 (Anonymous 2024). Among several factors causing low productivity, selection of suitable variety is an important input affecting crop yield and other agronomic traits. Exploitation of full yield potentiality of newly developed variety of crop depends on the extent of fertilizer levels of all primary and secondary nutrients are must to obtain higher yield and enhance fertilizer use efficiency. Among the agronomic factors, fertilizer stands first and is one of the most productive inputs in agriculture. Plant nutrition is a key input to increase the productivity of mustard crop (Keerthi *et al.*, 2016). Balanced fertilization is critically required for achieving higher yield from improved variety of mustard. The response of nitrogen in mustard has been reported from 60-120 kg ha^{-1} in different parts of country in various experiments. Primary nutrients *i.e.* nitrogen, phosphorus and potassium play a pivotal role in crop yield. About 98% of the cultivated Indian soils required phosphorus fertilization for getting better yield (Bhari *et al*., 2000 and Singh *et al.*, 2010). Various studies indicated that the increasing levels of nutrient resulted concomitantly increasing yield of mustard. Therefore, this study was initiated to evaluate the performance of different Indian mustard varieties in terms of yield attributing and yield and their response to different fertility levels.

Materials and Methods

The experiment was conducted at the research farm of Chaudhary Charan Singh Haryana Agricultural University, Hisar India. The experimental site is located in Indo Gangetic Plains of North-West India at 215.2 meters above mean sea level with a latitude 29^{0}10' N and longitude 75^0 36' E during *rabi* 2021-22. During crop growing season the mean weekly maximum and minimum temperature ranged between 35.6 °C to 15.8 °C and 16.3 °C to 2.6 °C respectively. The total rainfall received was 43.1 mm with five rainy days. The maximum rainfall (18.2 mm at 46th standard week) was coincided with vegetative stage. The mean weekly bright sunshine hours ranged between 8.4 hrs to 1.2 hrs were recorded during 2021-22. The wind speed ranges from 6.4 km hr^{-1} to 1.1 km hr^{-1}. The soil of the experimental field was sandy loam, having 0.47% organic carbon and pH 8.5. It was low in available N (150 kg ha^{-1}), medium in available P_2O_5 (23.2 kg ha^{-1}) and rich in available K_2O (395.6 kg ha^{-1}). The experiment consisting of four varieties Kranti, RGN 229, RH 725 and RH 1424 in main plots and three fertility levels (100% RDF, 125%

RDF and 150% RDF), in sub plots were laid out in split plot design with three replications. The recommended doses of fertilizer were 40, 30 and 20 N, P_2O_5 and K_2O kg ha^{-1} under rainfed situation. The doses of nitrogen and phosphorous were applied in the form of urea and SSP. Entire dose of N and P was applied as basal dose at the time of sowing. The crop was sown during second fortnight of October. Thinning was done at 10 days after emergence to maintain optimum plant population. The intercultural operations and manual weeding were removed by long tine hoe at 30 and 60 days after sowing. Yield attributes were recorded from the selected five plants sample at the time of harvest. The crop harvested from net plot area was converted into seed and biological yield (kg ha^{-1}). The seed oil content of all samples was determined by nuclear magnetic resonance spectrometer (NMR) (Robertson and Morrison, 1974). All the data pertaining to the agronomic characters were subjected to the technique of analysis of variance (ANOVA) described by Cochran and Cox (1959) and if significant values were indicated, the treatment means were compared at 5 % probability level.



Results and Discussion

Yield attributes and yield

The results revealed that different varieties evaluated in the experiment exhibited considerable variation in terms of yield attributes. The variety RH 1424 recorded significantly highest yield and yield attributes. The maximum number of siliquae on main shoot (57.3), siliquae per plant (372), siliqua length (6.2 cm) and seeds/siliquae (17.8) registered under variety RH 1424 followed by RH 725, RGN 229 and Kranti. Highest test weight was observed in RH 1424 (6.89 g) followed by RH 725 (6.28 g) and RGN 229 (5.28 g). The difference in seed, stover and biological yield among the varieties was observed to be significant. Maximum seed, stover yield and biological yield were recorded in RH 1424 (2739, 8747 and 11486 kg ha^{-1}). Increase in seed yield and biological yield in RH 1424 was 8.69, 17.99, 31.65% and 8.57% 16.09%, 24.2% compared to RH 725, RGN 229 and Kranti, respectively.

Different fertility levels also exerted significant influence on yield attributes and yield. Highest number of siliquae on main shoot, number of siliquae per plant, silique length and number of seeds/siliqua, test weight, seed yield and biological yield were recorded with 150% RDF which was significantly higher than 125% RDF and 100 % RDF. All the above yield attributes were statistically at par between 125% RDF and 100 % RDF. The increase in seed (13.5%) and biological yield (8.67%) at 150% RDF over 100% RDF was attributed to more availability of nutrients for their growth and development for better yield attributes and yield. The increase in yield attributes by varietal effect and fertility levels can further be fortified with positive relationship between seed yield and yield attributes *viz*. number of siliquae on main shoot (r= 0.67), number of siliquae per plant (r=0.54), silique length (r=0.56) and

Table1: Yield attributes of mustard varieties influenced by different fertility levels under timely sown rainfed condition

Treatments	Siliquae/ main shoot (no.)	Siliquae/ plant (no.)	Siliqua length (cm)	Seeds/ siliqua (no.)	Test weight (g)
Entries/varieties					
Kranti	48.3	249	4.6	17.3	4.20
RGN 229	52.5	270	5.2	16.4	5.28
RH 725	54.8	361	6.1	17.7	6.28
RH 1424	57.3	372	6.2	17.8	6.89
LSD (p=0.05)	1.71	6.85	0.07	0.5	0.10
SEm±	0.49	1.94	0.02	0.14	0.03
Fertility levels					
F1- 100% RDF	52.2	308	5.5	17.0	5.57
F2- 125% RDF	53.0	311	5.5	17.3	5.68
F3- 150% RDF	54.5	321	5.6	17.7	5.73
LSD (p=0.05)	0.69	3.73	0.07	0.34	0.07
SEm±	0.32	1.24	0.02	0.11	0.02

Table 2: Seed yield, oil content and oil yield of mustard entries under different fertility levels timely sown rainfed condition

Treatments	Seed yield (kg/ha)	Stover yield (kg/ha)	Biological yield (kg/ha)	HI (%)	Oil content (%)	Oil yield (kg /ha)
Entries/varieties						
Kranti	1872	6834	8706	21.5	39.9	747
RGN 229	2246	7391	9637	23.3	39.6	888
RH 725	2500	8001	10501	23.8	39.5	989
RH 1424	2739	8747	11486	23.8	39.5	1083
LSD (p=0.05)	198	201	198	NS	NS	68
SEm±	56	57	56	0.53	0.1	23
Fertility levels						
F1- 100 % RDF	2173	8481	9621	22.5	39.6	854
F2- 125 % RDF	2345	8657	10092	23.1	39.7	919
F3- 150 % RDF	250	9103	10535	23.6	39.6	979
LSD (p=0.05)	162	182	245	NS	NS	65
SEm±	53	60	81	0.445	0.1	16

Table 3: Correlation coefficient (r) between seed yield and yield attributes

	Seed yield	Siliquae/ main shoot	Siliqua/ plant	Siliqua length	Seeds/ siliquae	Test weight	Stover yield	HI	Biological yield
Seed yield	1.00								
No of siliquae on main shoot	0.67	1.00							
No of siliquae/plant	0.55	0.87	1.00						
Siliquae length	0.57	0.91	0.99	1.00					
No of seeds/siliquae	0.36	0.42	0.62	0.52	1.00				
Test weight	0.62	0.95	0.95	0.98	0.44	1.00			
Stover yield	0.73	0.97	0.90	0.91	0.59	0.94	1.00		
HI	0.60	0.90	0.78	0.83	0.38	0.85	0.86	1.00	
Biological yield	0.72	0.97	0.90	0.92	0.58	0.95	1.00	0.89	1.00

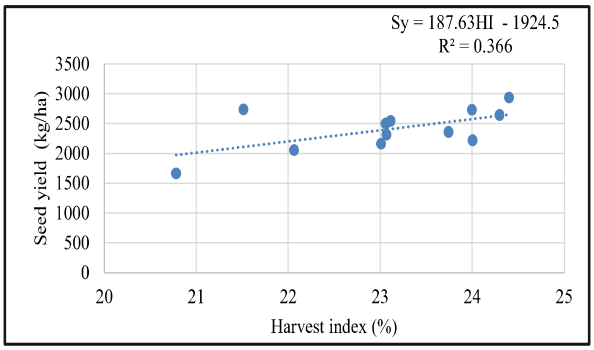


Fig. 2: Regression line showing the relationship of harvest index (%) with seed yield (kg ha^{-1})

number of seeds/silique (r=0.35) test weight (r=0.62), biological yield (r=0.72) and harvest index (0.60). Harvest index is the parameter which dependent on seed yield (r= 0.60) and stover yield (r=0.85). This shows that harvest index was more associated with stover yield than seed yield. The harvest index can also be computed from the seed yield with regression equation (SY=187.63 HI-1924.5) r^2=0.366, Fig, 1). Singh *et al*. (2014) and Keivendra *et al.* (2012) were also reported similar findings.

Oil content and oil yield

Oil content of mustard was not affected by varieties and fertility levels. RH 1424 gave the significant highest oil yield (1083 kg ha^{-1}), against the minimum oil yield recorded with Kranti (747 kg ha^{-1}). The maximum value of oil yield was recorded with 150% RDF (979 kg ha^{-1}), closely followed by 125% RDF. The results are in conformity with Mirzashahi *et al.* (2000).

Conclusion

Based on the results, in view of nutrient management and varietal selection in western Haryana, it was

concluded that Indian mustard variety was found suitable for obtaining optimum yields under rainfed conditions and optimum fertility level was 150% RDF.

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