Growth, Yield attributes, yield and economics of mustard (*Brassica Juncea* L.) as affected by different varieties and spacing

ABSTRACT

A field experiment was conducted at Agricultural Research Farm, Narayan Institute Of Agricultural Sciences, Gopal Narayan Singh University, Jamuhar, Sasaram, Rohtas, (Bihar) during the rabi season of 2022-2023 to access the effect of different varieties and spacing on growth and yield of mustard. Treatment consisted of three varieties RH- 404, DRMR-1165-40 and NRCM-101 and three spacing viz. 30×10 cm, 40×10 cm and 50×10 cm. Experiment was conducted under randomized block design with three replications. The result of experiment showed that growth viz, plant height and dry weight and yield attributes viz, number of seeds/siliqua, biological yield (Kg/ha) and economics cost of cultivation (Rs/ha), gross return (Rs/ha), net return (Rs/ha) and B:C ratio and yield were significantly affected due to different varieties and spacing. The maximum plant height (165.72 cm), dry weight (35.32 g/plant), number of seeds/siliqua (15.97), gross return (124623.3 Rs/ha), net return (74004.5 Rs/ha) and B:C ratio of (1.48) was found in treatment combination of NRCM-101 + 40 cm × 10 cm and The maximum biological yield (6665.37 kg/ha) was recorded in treatment combination of DRMR-1165-40 + 30 cm ×10 cm.

Keywords :*Mustard, Different varieties, spacing, growth attributes, biological yield (kg/ha) and economics.*

Introduction

Indian mustard (Brassica juncea L.) is an important winter (rabi) season oil seed crop.Vegetable oil has one of the highest shares (40%) of the production of all agricultural commodities globally. Among the seven edible oil seed cultivated in India, Rapeseed mustard is the second-most important oilseed crop in India, next only to soybean, with almost one-fourth share in both area and production **(Jat *et al*. 2019)**.it was grown on 6.86 million ha in India, with a production of 9.12 million tonnes and a productivity of about 1329 kg/ha **(Anonymous, 2021).**Sowing time is a nonmonetary input for optimizing the maximum dry matter accumulation and to provide most congenial conditions for maximum light interception and the best utilization of moisture

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and nutrients to the better plant growth and seed yield (**Yadav *et al.*2018**). Thus optimum row spacing is very necessary for sunlight interception at each strata of leaves. This will result in the enhancement of the rate of photosynthesis which will consequently enhance dry matter production which will finally lead to increase in the crop yield. Establishment of optimum plant population by maintaining proper row spacing is one of the important factors to secure a better translocation of photosynthesis which render better yield of crop **(Kumar *et al.*, 2023).**

The present investigation is carried out to study on impact of different varieties and spacing on growth and yield of Mustard.

Material and Methods

A field experiment was conducted during the *Rabi* season 2022-23 at the Crop Research Farm, Department of Agronomy, NIAS, GNSU Jamuhar, Rohtas. The soil of the experimental field constituting a part of central Gangetic alluvial, greyish yellow in colour to the foothill of (kaimur) plateau. Pre-sowing soil samples were taken from a depth of 15 cm with the help of an auger and mixed thoroughly to prepare a composite sample. The soil was medium texture, low in organic carbon and medium in available nitrogen, phosphorus and low in potassium. The experiment was layout in randomized block design with 3 replications.The experiment consisted of 27 treatment combinations, comprising 3 spacing, viz. 30 × 10 cm, 40 × 10 cm and 50 × 10 cm and three varieties, RH-404, DRMR-1165-40 and NRCM-101. The growth and yield parameter and economics were recorded in equal interval of crop duration like plant height (cm), plant dry weight (g) at 90 DAS, number of seeds/siliqua, biological yield (kg/ha) . The data were analyzed statistically by using ANOVA and it is applicable for Randomized Block Design.

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RESULTS AND DISCUSSION

Growth Attributes of mustard

Plant height (cm)

At 90 DAS Plant height of mustard were significantly affected due to different varieties and spacing.However, significantly maximum plant height (165.72 cm) was recorded in treatment combination of NRCM-101 + 40 cm × 10 cm which was statistically at par with treatment combination of RH-404 + 40 cm × 10 cm (162.17 cm), DRMR-1165-40 + 30 cm × 10 cm (159.20 cm),DRMR-1165-40 + 40 cm × 10 cm (156.37 cm),NRCM-101 + 30 cm × 10 cm (154.39 cm),RH-404 + 30 cm × 10 cm (152.03 cm),RH-404 + 50 cm × 10 cm (151.74 cm) andDRMR-1165-40 + 50 cm × 10 cm (150.26 cm).

The probability in increase in plant height due to widest plant spacing might be due to the fact that the increased spacing between plants resulted in, sun-light, nutrients and soil moisture for increased photosynthesis, metabolic activities, growth and development**Anuroop *et al*.,(2022)**

Dry weight (g/plant)

At 90 DAS Dry weight of mustard were significantly affected by different varieties and spacing. However maximum dry weight of **(**35.32 g) was recorded in treatment combination of NRCM-101 + 40 cm × 10 cm, which was statistically at par with treatment combination of RH-404 + 40 cm × 10 cm (34.76 g), DRMR-1165-40 + 30 cm × 10 cm (34.45 g) and DRMR-1165-40 + 40 cm × 10 cm (33.30 g).The probable reasons for better growth might be due to relatively competition free environments prevail, hence more availability of nutrients, greater light interception, efficient utilization of soil moisture and space under lower degree of inter-plant competition ultimately leads to increased synthesis of carbohydrate and production of more dry matter per plant. Similar findings also reported by **Jangir *et al.*(2017).**

Better growth observed under wider row spacing compared to closer spacing might be due to efficient use of light, soil moisture and nutrients under wider spacing. Results are in conformity with findings of **Lalruatfeli*et al.*(2021).**

Yield attributes of mustard

Number of seeds/siliqua

Number of seed/siliqua of mustard was significantly affected due todifferent varieties and spacing (Table 1). However the maximum number of seeds/siliqua (15.97) was recorded under the treatment combination of NRCM-101 + 40 cm × 10 cm, which was statistically at par with

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treatment combination of RH-404 + 40 cm × 10 cm (15.93), DRMR-1165-40 + 30 cm × 10 cm (15.35), DRMR-1165-40 + 40 cm × 10 cm (15.13), NRCM-101 + 30 cm × 10 cm (14.87),RH-404 + 30 cm × 10 cm (14.67), RH-404 + 50 cm × 10 cm (14.47) and NRCM-101 + 30 cm × 10 cm (14.20).

It might be due to vigorous growth of crop and more supply of photosynthate to large number of sinks under favourable agrometeorological conditions. Similar findings reported by Singh and Singh (2017) and De *et al*. (2021)

Biological yield

Biological yield of mustard was significantly affected by different varieties and spacing (Table No. 1). Whereassignificantly maximum biological yield (6665.37 kg/ha) was recorded in treatment combination of DRMR-1165-40 + 30 cm ×10 cm. which was statistically at par with treatment combination of DRMR-1165-40 + 50 cm × 10 cm (6658.10 kg/ha), RH-404 + 50 cm × 10 cm (6646.90 kg/ha), RH-404 + 30 cm × 10 cm (6599.33 kg/ha), NRCM-101 + 40 cm × 10 cm (6570.55 kg/ha), RH-404 + 40 cm × 10 cm (6569.61 kg/ha), DRMR-1165-40 + 40 cm × 10 cm (6567.27 kg/ha) and NRCM-101 + 30 cm × 10 cm (6550.22 kg/ha).

The results are in conformity with **Kaur and kumar (2022)** who reported significantly higher biological yield at narrow intra row spacing treatment as compared to other wider row spacing.

The higher yield in wider plant spacing might be due to better development of yield attributes of mustard **Patel and Patel(2022).**The increase in biological, grain, stover yield and harvest index were mainly due to increase in the plant population unit area due to closer spacing between rows**Dhruw*et al*.(2023).**

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Table No. 1.Growth and yield mustard influenced by different varieties and spacing.

Treatments	Growth Attributes of mustard		Yield attributes	Yield
	Plant height (cm) 90 DAS	Dry weight/ plant (g) 90 DAS	Number of seeds/siliqua	Biological yield (Kg/ha)
RH-404 + 30 cm × 10 cm	152.03	31.30	14.67	6599.33
RH-404 + 40 cm × 10 cm	162.17	34.76	15.93	6569.61
RH-404 + 50 cm × 10 cm	151.74	29.30	14.47	6646.90
DRMR-1165-40 + 30 cm × 10 cm	159.20	34.45	15.35	6665.37
DRMR-1165-40 + 40 cm × 10 cm	156.37	33.30	15.13	6567.27
DRMR-1165-40 + 50 cm × 10 cm	150.26	29.25	14.20	6658.10
NRCM-101 + 30 cm × 10 cm	154.39	32.78	14.87	6550.22
NRCM-101 + 40 cm × 10 cm	165.72	35.32	15.97	6570.55
NRCM-101 + 50 cm × 10 cm	140.51	28.75	13.93	6069.11
SEM±	6.22	0.82	0.61	193.34
CD	18.64	2.46	1.83	579.64

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Table No. 2. Economics of mustard as influenced by different varieties and spacing.

Treatments	Cost of Cultivation (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ ha)	B:C Ratio
RH-404 + 30 cm × 10 cm	50618.80	117356.70	66737.90	1.32
RH-404 + 40 cm × 10 cm	50318.80	123533.30	72914.50	1.45
RH-404 + 50 cm × 10 cm	50018.80	116993.30	66374.50	1.32
DRMR-1165-40 + 30 cm × 10 cm	50468.80	123170.00	72551.20	1.44
DRMR-1165-40 + 40 cm × 10 cm	50193.80	119718.30	69099.50	1.37
DRMR-1165-40 + 50 cm × 10 cm	49918.80	116811.70	66192.90	1.33
NRCM-101 + 30 cm × 10 cm	50318.80	118628.30	68009.50	1.35
NRCM-101 + 40 cm × 10 cm	50068.80	124623.30	74004.50	1.48
NRCM-101 + 50 cm × 10 cm	49818.80	101006.70	50387.90	1.01

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Cost of Cultivation

The maximum Cost of cultivation (50618.8 Rs./ha) was recorded in treatments combination and minimum cost of cultivation (50138.8 Rs./ha).

Gross return

The gross return (Rs./ha) is shown in table no.2. However, the treatment combination of NRCM-101 + 40 cm × 10 cm produced the highest gross return (124623.3 Rs./ha), whereas the treatment combination of NRCM-101 + 50 cm × 10 cm produced the lowest gross return (101006.7 Rs./ha).

Successive enhancement in yieldattributes with widening row spacing could be attributedto minimum exploitation of resources among crop.The highest gross as well as net returns could be attributed to higher grain yield. Similar results also reported by **Jat *et al*.,(2019)** and**Chaudhary *et al*. (2023).**

Net return

The net return has been presented in table no.2. the highest net return (74004.5 Rs./ha) was recorded in treatment combination of NRCM-101 + 40 cm × 10 cm,whereas the treatment combination of NRCM-101 + 50 cm × 10 cm produced the lowest net return (50387.9 Rs./ha).

The increase in net return was due to the increase in yield attributing character and grain yield of rapeseed and mustard varieties. This collaborates the finding of**Yambem*et al.* (2020)**

B: C Ratio

The Maximum benefit cost ratio of (1.48) was recorded in the treatment of NRCM-101 + 40 cm × 10 cm and minimum of (1.01) was found in treatment combination of NRCM-101 + 50 cm × 10 cm.

Conclusion:

Considering the findings of present investigation, it can be concluded that among different treatment combination NRCM-101 + 40 cm × 10 cm recorded significantly higher growth

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attributes, yield attributes, and thereby fetched maximum returns. Thus NRCM-101 + 40 cm × 10 cm should preferably be sown to obtain maximum productivity and profitability.

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