International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2025; 9(1): 351-354
www.biochemjournal.com
Received: 07-10-2024
Accepted: 10-11-2024

Manoj Kumar
Ph.D Scholar, Department of Agronomy, Monad University, Hapur, Uttar Pradesh, India

Partap Singh
HOD, School of Sciences and Agriculture, Monad University, Hapur, Uttar Pradesh, India

Jitendra Kumar Malik
Assistant Professor, Kisan PG College Simbhaoli, Hapur, Uttar Pradesh, India

Corresponding Author:
Manoj Kumar
Ph.D Scholar, Department of Agronomy, Monad University, Hapur, Uttar Pradesh, India

Effect of chemical and bio fertilizers on the economics of black mustard (*Brassica nigra* (L.)) cv. Rohani

Manoj Kumar, Partap Singh and Jitendra Kumar Malik

DOI: https://doi.org/10.33545/26174693.2025.v9.i1e.3502

Abstract
On this experiment Black mustard (*Brassica nigra* (L.)) cv. Rohani changed into dealt with with various bio and chemical fertilizers all through Rabi season 2022-2023 and 2023-2024. It changed into concluded that the prevailing take a look at of Rohini black mustard variety dealt with with bio and chemical retailers advanced yield parameters which include siliqua in line with plant, variety of seeds consistent with siliqua, 1000 seed weight (g), yield according to hectare (q), straw yield (q ha^{-1}), harvest index, oil content material and oil yield, protein content material and protein yield. The detected maximum variety yield in step with hectare (20.88 q, 20.72 q and 20.66 q), straw yield in keeping with hectare (64.94 q, 64.80 q and 64.87 q), maximum harvest index (24.33, 23.68 and 24.sixteen) the best oil content of black mustard seeds (45.94 percent, 45.80 percent, 45.85 percent) and the highest percentage of protein content material (%) in mustard seeds (25.24 percentage, 25.20 percent and 25.22 percentage) in T_{15} (one hundred% RDF + Azotobacter + PSB), while harvested in 2022-2023, 2023-2024 and combined or Economics of differential treatment, remedy T_{15} (one hundred% RDF+ Azotobacter + PSB) gives the best internet profit of Rs. ninety eight,056, Rs. 94920 and Rs. 96488 in line with hectare with the value benefit ratio being 1:2.23, 1:2.11 and 1:2.18 for 2022-2023, 2023-2024 and combined respectively. but a minimal net earnings of Rs. 59488 was recorded in the control treatment.

Keywords: Mustard seeds, split plot design, bio-fertilizers, RDF, Azotobacter, PSB, harvest index, oil and protein content

Introduction
On this context, ecologically sound biofertilizers, which minimize the use of fertilizers, have come to be beneficial. With growing fertilizer expenses and environmental worries, organic materials integration strategies which include green manuring make biofertilizers a crucial factor of such incorporated agriculture. They are Azospirillum, Blue inexperienced Algae, Azolla, Phosphobacteria are famous among farmers. To popularize the use of biofertilizers, 7000 experimental demonstrations were carried out and about 6000 farmers have been skilled inside the use of BGA and Rhizobium. Paddy yield increase because of BGA is within the range of thirteen-16.67%, even as for pulses and oilseeds Rhizobium utility resulted in yield increase in the range of five-thirteen%.

The manipulation of plant boom and development for agricultural and horticultural practices is an soaking up hobby of plant physiologists. in view that prehistoric times, human beings have discovered to manipulate the excessive vegetative growth of a few vegetation definitely by way of planting them out or through preventing them from receiving sufficient vitamins and water from the soil, i.e. via letting the flora enjoy a few kind of synthetic starvation. we are now completely privy to the fact that yield discount results in some crops because of their disproportionate extra power, which sooner or later deprives the reproductive sinks in their top of the line need for assimilates.

Phosphate solubilizing micro organism (PSB) provide an alternative biotechnological answer in sustainable agriculture to meet the phosphorus demand of plants. other than supplying P to vegetation, those organisms additionally facilitate plant boom via various mechanisms. Sulfur, now recognized as the 4th predominant nutrient after nitrogen, phosphorus, and potassium, is a part of the three sulfur-containing amino acids (cysteine, cystine, and methionine) that are the building blocks of proteins, and about 90% of plant sulfur is found in those amino acids. Sulfur improves the protein and oil content of seeds and is likewise associated with unique metabolism inside the plant and structural characteristics of the protoplasm. sufficient supply of sulfur has been reported to growth the photosynthetic efficiency and productiveness of Brassica genotypes. Black mustard replied significantly to sulfur fertilization in oilseeds. Chemical fertilizers used to complement the main nutrient are typically both inadequate or low in sulphur.

This research entitled "impact of chemical and biological fertilizers on productivity and pleasant of black mustard (*Brassica nigra* (L.)) cv. Rohani" turned into carried out on the research farm of Monad college department of Agronomy in 2022-2023 and 2023-2024.

Research Methodology

The experiment has been completed at the studies Farm branch of Agronomy, Monad college during the yr 2022-2023 and 2023-2024. The experimental farm located inside the river basin of the Ganga. three hundred and sixty five days vintage wholesome seeds of black mustard (*Brassica nigra* (L.)) Rohani were added out from Indian Agricultural studies Institute (IARI), New Delhi.

After the final field preparation, the seeds of 'Rohani' black mustard have been sown on the price of five kg ha^{-1} at a row distance of 40 cm. The sowing turned into done in furrrows, opened with the assist of kudal and covered after sowing.

The assets of Nitrogen, phosphorus, potassium and sulfur were urea, DAP, MOP and elemental sulphur. The remaining half of the nitrogen was impregnated with urea at the one-month stage. Bio fertilizers such as RDF (waste fuel), Azotabactor and PSB (phosphate solubilizing bacteria) were applied to the soil according to the treatment just before sowing.

Table 1: Treatment combination

T_0	Control
T_1	50% RDF
T_2	75% RDF
T_3	100% RDF
T_4	Azotobacter
T_5	Phosphate Solubilizing bacteria (PSB)
T_6	Azotobacter +PSB
T_7	50% RDF + Azotobacter
T_8	50% RDF +PSB
T_9	50% RDF+ Azotobacter +PSB
T_{10}	75% RDF + Azotobacter
T_{11}	75% RDF +PSB
T_{12}	75% RDF+ Azotobacter +PSB
T_{13}	100% RDF + Azotobacter
T_{14}	100% RDF +PSB
T_{15}	100% RDF+ Azotobacter +PSB

Observations recorded

Sampling areas i.e. one for unfavourable and one for non-negative were marked for recording biometric commentary at everyday intervals. Observations together with plant and branch top had been taken from the non-detrimental sampling area, i.e. the smooth location of the plot, whilst observations consisting of dry remember accumulation in line with plant had been taken from the unfavorable location, i.e. the area separated from the easy area. To report the increase parameters, 5 plants were randomly selected from the clean plot location and marked and their observations have been recorded at 30, 60, 90 and one hundred twenty DAS (harvest).

Yield and yield attributing character have been recorded after harvest.

The vegetative and floral and fruiting characters had been mentioned our previous paper. here we mentioned yiel d and satisfactory parameters of the black mustered.

(A) Yield Parameters

1. Seed yield (kg ha^{-1})
2. Straw yield (kg ha^{-1})

(B): Economics of remedies

1. Gross returns
2. Net returns
3. Cost of cultivation.
4. Price advantage Ratio.

Seed yield (kg ha^{-1})

The seed yield of internet plot after cleansing and right drying changed into recorded in grams and transformed into kilogram consistent with hectare by multiplying with suitable conversion component.

Stover yield (kg ha^{-1})

After threshing stem and chaff weight in keeping with plot have been recorded and introduced treatment wise. These were transformed to kilogram according to ha by using multiplying with suitable conversion thing.

Laboratory Studies

a) Oil content in seed

Oil content in seed was estimated by Soxhlet method given by Sankaran (1966) [18].

$$\text{Oil content (\%)} = \frac{\text{Weight of oil (g)}}{\text{Weight of seed sample (g)}} \text{x } 100$$

Oil yield (kg ha^{-1})

Oil yield was obtained from oil content multiplied by seed yield and expressed in kg per hectare.

$$\text{Oil yield (kg ha}^{-1}\text{)} = \frac{\text{Oil content (\%) in seed} \times \text{seed yield (kg ha}^{-1}\text{)}}{100}$$

Results and Discussion

Observations had been made during both annual remedies at unique levels of bio and chemical fertilizers and are supplied in Tables 2A, B.

It's far clean from the table that there are full-size variations among remedies in years 1, yr 2 and their précis statistics. According to their records, according to their statistics, considerably maximum in line with hectare yield (q) of 20.88 q, 20.44 q and 20.66 q turned into recorded in T_{15} (100% RDF, Azotobacter and PSB) for 2022-2023 and 2023-2024 and blended dates, respectively 19.72 q, 19.52 q and 19.62 q in T_6 (Azotobacter and PSB) for 2021–22, 2022–23 and pooled respectively, which had been at par with each different. but, the bottom in step with hectare yield of 14.38 q, 14.65 q and 14.52 q turned into recorded in T0 (encouraged dose of vitamins through chemical fertilizers) for 2022-2023 and 2023-2024 respectively.

Facts on straw yield in line with hectare (q) of black mustard as laid low with bio and chemical fertilizers (RDF, Azotobacter and PSB) are shown in desk 2 B. it's miles clean from the desk that there are substantial variations between treatments in 12 months 1, 12 months 2 and their aggregated information. in keeping with their facts, considerably maximum in keeping with hectare straw yield (q) of 64.94 q, 64.80 q and 64.87 q was recorded in T_{15} (one hundred% RDF, Azotobacter and PSB) for 2022-2023, 2023-2024 and mixed dates, respectively through 61.87 q, 60.93 q and 61.40 q in T_{14} (75% RDF, Azotobacter and PSB) for 2022-2023, 2023-2024 and combined which have been at par with every different. however, the bottom in keeping with hectare straw yield of 49.27 q, 49.87 q and 49.57 q was recorded in T0 (recommended dose of nutrients via chemical fertilizers) for 2022-2023, 2023-2024 and 2022-23 respectively.

It's miles clean from the table that there are giant variations between remedies in 12 months 1, year 2 and their summary statistics. in step with their facts, the drastically highest percent of protein content material (%) in mustard seeds of 25.24 percent, 25.20 percent and 25.22 percentage changed into recorded in T_{15} (one hundred% RDF, Azotobacter and PSB) for the years 2022-2023, 2023-2024 and pooled information and accompanied through 24.eighty four according to cent, 24.ninety three consistent with cent and 24.89 per cent in T_{14} (seventy five% RDF, Azotobacter and PSB) for 2022-2023, 2023-2024 and pooled which had been at par with every different. the bottom black mustard seed protein content material of 21.27 according to cent, 21.87 in line with cent and 21.57 according to cent turned into recorded in T0 (advocated dose of nutrients via chemical fertilizers) for 2022-2023, 2023-24 and pooled respectively.

flora receiving T_{15} (a hundred% RDF, Azotobacter and PSB) in combination took drastically fewer days to flower as compared to other treatment mixtures. Azotobacter caused a tremendous development within the satisfactory of agricultural production in phrases of siliqua length and color, elevated yield and elevated plant biomass. It additionally outcomes in reduced irrigation frequency, reduced fertilizer dosage and improved soil hydrophysical surroundings and a excessive benefit-value ratio. RDF will increase plant or crop yield, improves photosynthesis and plant metabolism, induces bud formation and flowering, allows manufacturing of larger leaves and a bigger root machine, will increase cell increase in roots and is used to provide stronger leaves and plant life, produce strong plant life greater proof against sickness, and pathogens, increase basal branching of rosette vegetation and permit greater basal breaks, improve status quo and increase of young plants produced from cuttings, seeds or plug and is used to help flowers tormented by nutrient deficiency and increase. PSB contains 11.8% chlormequat (2-chloroethyl) tri-methyl ammonium chloride. The commonplace call is chlormequat. Cycocel increases the aesthetic appeal of the crop and improves sturdiness during put up-manufacturing shipping and handling. treated crops are more compact with shorter internodes, thicker stems and greener leaves.

The advantageous effect of RDF, Azotobacter and PSB on yield changed into formerly defined for black mustard.

Table 2A: Effect of different treatments on Yield parameters at different level of bio and chemical fertilizers

Treatment	Yield per hectare (q)			Straw yield per hectare (q)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T_0	14.38	14.65	14.52	49.27	49.87	49.57
T_1	15.05	15.79	15.42	54.80	53.53	54.17
T_2	17.03	16.63	16.83	57.33	57.93	57.63
T_3	19.33	19.25	19.29	59.00	58.47	58.74
T_4	15.48	15.84	15.66	55.60	58.93	57.27
T_5	17.55	17.89	17.72	56.00	57.87	56.94
T_6	19.72	19.52	19.62	61.53	61.40	61.47
T_7	15.27	15.67	15.47	54.13	54.33	54.23
T_8	16.46	16.82	16.64	55.33	55.07	55.20
T_9	18.63	18.59	18.61	58.40	58.13	58.27
T_{10}	16.39	16.35	16.37	56.73	55.27	56.00
T_{11}	17.81	17.74	17.78	57.00	58.87	57.94
T_{12}	19.03	19.39	19.21	60.60	60.73	60.67
T_{13}	17.12	17.86	17.49	56.27	57.93	57.10
T_{14}	19.16	19.03	19.10	61.87	60.93	61.40
T_{15}	20.88	20.44	20.66	64.94	64.80	64.87
CD value	4.79	4.16	4.52	2.79	2.16	2.52
F Value	7.84**	6.41**	7.37**	9.45**	8.41**	9.37**

Table 2B: Effect of different cost benefit ratio (C: B) of Different Treatment Combination with Mustard crop

Treatment No	Treatment	Cost of cultivation	Gross Return		Net Return		Benefit Cost Ratio	
			2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
		Rs. ha^{-1}	Rs. ha^{-1}		Rs. ha^{-1}			
T_0	Control	60880	120368	122498	59488	61618	2.02	1.99
T_1	50% RDF	62830	127270	131942	64440	69112	1.98	1.91
T_2	75% RDF	64890	142142	139582	77252	74692	1.84	1.87
T_3	100% RDF	66820	158910	158138	92090	91318	1.73	1.73
T_4	Azotobacter	66930	130600	134452	63670	67522	2.05	1.99
T_5	Phosphate Solubilizing bacteria (PSB)	67900	145250	148378	77350	80478	1.88	1.84
T_6	Azotobacter +PSB	70890	162652	161200	91762	90310	1.77	1.78
T_7	50% RDF + Azotobacter	68840	128542	131422	59702	62582	2.15	2.10
T_8	50% RDF +PSB	692820	137352	139768	67532	69948	2.03	2.00
T_9	50% RDF+ Azotobacter +PSB	704840	153770	153382	82930	82542	1.85	1.86
T_{10}	75% RDF + Azotobacter	70970	137422	136558	66452	65588	2.07	2.08
T_{11}	75% RDF +PSB	71480	147470	147728	75990	76248	1.94	1.94
T_{12}	75% RDF+ Azotobacter +PSB	72830	157450	160022	84620	87192	1.86	1.84
T_{13}	100% RDF + Azotobacter	73690	142348	148192	68658	74502	2.07	1.99
T_{14}	100% RDF +PSB	73920	158868	157582	84948	83662	1.87	1.88
T_{15}	100% RDF+ Azotobacter +PSB	74080	172136	169000	98056	94920	2.23	2.11

After the harvesting the crop has been selling in the market at the rate of Rs. 70/kg. and found maximum profit and cost benefit ratio in treatment T_{15} (100% RDF+ Azotobacter + PSB) as follows:

Net profit
2022-23: Rs. 98,056 per hectare
2023-24: Rs. 94920 per hectare
Pooled: Rs. 96488 per hectare

Cost benefit ratio
2022-23: 2.23 per hectare
2023-24: 2.11 per hectare
Pooled: 2.18 per hectare

Conclusion

Single chemical fertilizer affects the yield and best of mustard seed. So improving soil circumstance and increasing yield capability by way of making use of a combination of bio and chemical fertilizers in place of just chemical fertilizers. This observe shows that mustard seeds of Rohani variety dealt with with RDF, Azotobacter and PSB + 100% N:P:okay improved siliqua according to plant, range of seeds consistent with siliqua, one thousand seed weight (g), yield in line with hectare (q), straw yield (q ha^{-1}), harvest index, oil content and oil yield, protein content material and protein yield. The detected maximum wide variety of siliqua in step with plant (6.seventy three, 6.27 and six. 50), number of seeds in keeping with siliqua (thirteen.91, 13.forty four and 13.sixty eight), weight of a thousand seeds (five. 21 g, five. 20 g and five. 21 g), yield consistent with hectare (20.88 g) q and 20.66 q), straw yield consistent with hectare (64.94 q, sixty four.80 q and sixty four. 87 q), highest harvest index (24.33, 23. ninety eight and 24. sixteen) the very best oil content material of black mustard seeds (forty five. ninety four percentage, forty five. 80 percent, 8 percent) and the best percentage of protein content material (%) in mustard seeds (25.24 percentage, 25.20 percentage and 25.22 percentage) in T_{15} (a hundred% RDF + Azotobacter + PSB), while harvested in 2022-23, 2023-24 and blended or Economics of differential remedy, treatment T_{15} (one hundred% RDF+ Azotobacter + PSB) gives the highest net income of Rs. ninety eight,056, Rs. 94920 and Rs. 96488 according to hectare with cost gain ratio being 1:2.23, 1:2.11 and 1:2.18 for 2022-2023, 2023-2024 and blended respectively. however a minimum net profit of Rs. 59488 became recorded in the manage treatment. This research elucidates the effectiveness of utility of various fertilizers (bio and chemical) on increase traits, yield capacity and oil high-quality of mustard and encourages farmers to adopt mixed application of bio and chemical fertilizers to growth crop yield and excellent.

This research elucidates the effectiveness of utility of various fertilizers (organic and inorganic) on increase traits, yield potential and oil quality of mustard and encourages farmers to undertake mixed utility of manure and fertilizers to lessen dependence on inorganic fertilizers.

References

1. Anonymous. Department of Agriculture, Govt of Maharashtra; 2017.
2. Anonymous. Directorate of Rapeseed and Mustard Research; 2018.
3. Anonymous. Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Directorate of Economics & Statistics; 2021.
4. Hagos R, Shaibu AS, Zhang L, Cai X, Liang J, Wu J, *et al*. Ethiopian mustard (*Brassica carinata* A. Braun) as an alternative energy source and sustainable crop. Sustainability. 2020;12(18):7492.
5. Rafiei S, Delkhosh B, Shirani AH, Zandi H. Effect of sowing dates and irrigation regimes on agronomic traits of Indian mustard in a semi-arid area of Takestan. Journal of Science. 2011;7(10):721-728.
6. Balasu Janaki RS, Indu T. Effect of biofertilizers and potassium on growth and yield of yellow mustard (*Brassica campestris* L.). The Pharma Innovation Journal. 2022;11(7):3033-3036.
7. Gudadhe NN, Mankar PS, Khawale VS, Dongarkar KP. Effect of biofertilizers on growth and yield of mustard (*Brassica juncea* L.). Journal of Soils and Crops. 2005;15(1):160-162.
8. Dhage SJ, Kachhave KG. Effect of dual inoculation of rhizobium and PSB on yield contributing characters and seed yield of soybean. Journal of Maharashtra Agricultural Universities. 2008;33(2):209-211.
9. Hadiyal JG, Kachhadiya SP, Ichchhuda PK, Kalsaria RN. Response of Indian mustard (*Brassica juncea* L.) to different levels of organic manures and bio-fertilizers. Journal of Pharmacognosy and Phytochemistry. 2017;6(4):873-875.
10. Kumar V, Singh S. Effect of fertilizers, biofertilizers and farmyard manure on sustainable production of Indian mustard (*Brassica juncea*). Annals of Plant and Soil Research. 2019;21(1):25-29.
11. Kang SC, Hat CG, Lee TG, Maheshwari DK. Solubilization of insoluble inorganic phosphates by a soil-inhabiting fungus *Fomitopsis* sp. PS 102. Current Science. 2002;82:439-442.
12. Narula N, Deubel A, Gransee A, Behl R, Merbach W. Impact of fertilizers on total microbiological flora in planted and unplanted soils of long-term fertilization experiment. Archives of Agronomy and Soil Science. 2002;48(3):171-180.
13. Sharma JK, Jat G, Meena RH, Purohit HS, Choudhary RS. Effect of vermicompost and nutrients application on soil properties, yield, uptake and quality of Indian mustard (*Brassica juncea*). Annals of Plant and Soil Research. 2017;19(1):17-22.
14. Singh SB, Thenua OVS. Effect of phosphorus and sulphur fertilization on yield NPS uptake by mustard. International Journal of Agronomy. 2016;11(01):80-83.
15. Singh D, Gangwar R, Singh A. To study the effect of organic manures on nutrient uptake and economics of mustard crop. International Journal of Chemical Studies. 2020;8(4):257-259.
16. Ditzler C, Scheffe K, Monger HC. Soil Science Division Staff. Soil Survey Sand. In: USDA Handbook. Government Printing Office, Washington, D.C. 2017.
17. Verma H, Dawson J. Yield and economics of mustard (*Brassica campestris* L.) as influenced by sowing methods and levels of sulphur and boron. International Journal of Current Microbiology and Applied Science. 2018;7:380-386.
18. Sankaran CR. Determination of the ultimate 'unit'of speech. Phonetica. 1966 Mar 1;14(2):82-90.