

The influence of various phosphorus levels on varieties for growth, yield, and quality of Mustard [*Brassica juncea* (L.) Czern & Coss.]

Aman Pandey, Brindaban Singh, Ayodhya Prasad Pandey, Rajbeer Singh Gaur and Neeraj Verma

Department of Genetics and Plant Breeding, Faculty of Agriculture Science and Technology,

AKS University, Satna (M.P.)

Abstract

The growth rate increased from 30 DAS to 90 DAS, but the rate of growth characteristics lags until harvest. Plant height, number of leaves, and number of branches are strongly affected by optimal fertility levels. Phosphorus levels significantly impact plant height, branches, and leaves. The total number of leaves at 30 DAS is essential for photosynthetic production. The surge in branches per plant in crops sown at 60 kg/ha P2O5 could be due to superior temperature and weather conditions at later growth phases. Phosphorus application boosts vegetative growth, increasing siliquae per plant and seed per siliqua. Significant variances exist for 40, 60, and 90 kg P2O5/ha, with 60 and 80 kg P2O5/ha increasing siliquae and seed per siliqua numerically for Pusa Vijay and Pusa Mahak. Pusa Vijay and Pusa Mahak are significant Indian mustard varieties, renowned for their adaptability to diverse agro-climatic conditions and high biomass production. Economic factors, including planting time, phosphate consumption, assortment, gross and net returns, and B:C proportion, significantly impact these varieties. A detailed economic analysis can provide valuable insights into increasing these types.

Keywords: Mustard, Varieties, Phosphorus, Economic Analysis.

Introduction

Mustard, a Cruciferae family crop, is a significant oilseed crop in northern India during Rabi season. It is the second most important oilseed in India, after soybean. Mustard oil is used as fertilizer and cattle feed. Its spiciness makes it suitable for seasoning and preparing dishes like cucumbers, curries, and vegetables.

Mustard seed is India's second most significant oilseed crop, contributing 25-30% of the country's economic oilseed industry. With a vast cultivation area of 37.0 million hectares, 63.09 million tonnes of production, and a productivity of 11.90 quintals per hectare, it represents 28.3% of global acreage and 19.8% of oilseed production (Kumari and Saritha, 2017).

The Directorate of Economics and Statistics 2019-20 reports that the total cultivated area for Rapeseed-Mustard in India is 68.56 lakh hectares, resulting in 91.23 lakh tonnes of production, with an average yield of 1331 kilograms per hectare.

Material and Methods

The Rabi season 2020-21 experiment was conducted at the Research plot, Faculty of Agriculture Science and Technology, AKS University, Sherganj, Satna, India. The study was conducted in the semi-arid Satna District, with three primary seasons: summer (March-May), rainy (June-September), and winter (October-February). Twelve treatment combinations were

ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, November 2022

made with four phosphorus levels (control, 40, 60 and 80 kg P2O5/ha-1) and three varieties (Pusa Mahak, Pusa Vijay, Pusa Bold) of mustard seed, with recommended spacing of 45 cm X 20 cm and a seed rate of 5 kg/ha. The experiment aimed to observe growth, yield, quality, and economic factors.

Results and Discussion

Growth characters

The development and progression of mustard, which is distinguished by a certain crop growth habit, were frequently examined. The crop's vegetative and reproductive growth, which culminated in an economic yield, was the end result of growth that was influenced by ongoing interactions between the environment and the physiological processes of the plant. Differences in all development phases were attributable to phosphorus levels and variety. The crop growth rate increased from 30 DAS to 90 DAS, but the rate of rise in growth characteristics was lagging until harvest, regardless of treatment, indicating that the growth pattern followed a normal sigmoid curve. Plant height, number of leaves per plant and number of branches per plant were all strongly affected by optimal fertility levels during practically all stages of growth. Significantly higher results were obtained for plant height when the crop was treated with phosphorus @ 60 kg/ha in addition to the recommended doses of nitrogen and potassium under the variety Pusa Vijay. The various phosphorus levels had a substantial impact on plant height, the number of branches per plant, and the number of leaves per plant. The total number of leaves at 30 DAS accessible to the plant for photosynthetic production is an essential metric. The number of leaves rapidly increases up to 60 DAS and 90 DAS at 80 kg/ha of phosphorus with the variety of Pusa Bold and Pusa Mahak, respectively. The findings agreed with Nath et al. (2018), Potdar et al. (2019).

The surge in branches per plant in the crops sown at 60 kg/ha P2O5 with the interaction with Pusa Mahak outcome could have been for the reason that the crop encountered superior temperature and weather circumstances at later growth phases, particularly during the internode elongation stage, which is more suited at higher temperatures for 30 and 90 DAS. Also, Pusa Vijay expressed significant values for 60 DAS at 60 kg/ha of P2O5 had a prolonged vegetative and growth period as a result of which plants produced more photosynthates, which were used for the growth of the plant's vegetative stage for the branches of plant. The crop was sown with root length at 60 DAS with the variety Pusa Bold with 60 kg/ha P2O5, which resulted in the later phases of growth and low plant height. The findings agreed by Singh et al. (2017), Patidar et al. (2000) and Nath et al. (2018), Kumar and Yadav (2007), Nath et al. (2018), Potdar et al. (2019), Ravutla et al. (2020), and Patel et al.

Yield characters

Phosphorus application helped in increasing vegetative growth and hence number of siliquae per plant and number of seed per siliqua increased. The variances in number of siliquae per plant and number of seed per siliqua due to application of 40, 60 and 90 kg P2O5/ha were significant, and application of 60 and 80 kg P2O5/ha increased the number of siliquae per plant and number of seed per siliqua numerically for Pusa Vijay and Pusa Mahak,

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, November 2022

respectively. These results are in accordance with Nath et al. (2018), Ravutla et al. (2020) and Patel et al. (2022).

Quality

Conversely, Pusa Vijay and Pusa Mahak, though significant Indian mustard varieties, are not primarily grown for their oil content. Pusa Vijay is renowned for its adaptability to diverse agro-climatic conditions, while Pusa Mahak excels in high biomass production and disease resistance. Several workers in the past also studied and came to an conclusion are, Singh et al. (2017) .

Economic factors

Planting time has a significant impact on the financial aspects of mustard production, including phosphate consumption, assortment, gross and net returns, and B:C proportion. Business viability and profitability. Economic factors greatly impact the three main Indian mustard varieties: Pusa Vijay, Pusa Mahak, and Pusa Bold. A detailed economic analysis can provide valuable insights into the financial aspects of increasing these types. Previous research by Sah et al. (2013), Mallick and Raj (2015) align with our findings.

Conclusion

The study found that a combination of phosphorus application at 60 kg/ha and the specific mustard variety (Pusa Vijay) led to the highest plant height for mustard plants. The recorded values were 28.18 cm, 128.71 cm, and 168.79 cm at the growth stages of 30, 60, and 90 days after sowing (DAS). The combination also resulted in the highest number of branches per plant mustard plants, measuring 5.84 cm, 12.79 cm, and 18.49 cm at 30, 60, and 90 days after sowing (DAS). The specific mustard variety (Pusa Vijay, PusaBold, and Pusa Mahak) also outperformed all other treatments in terms of leaves per plant. The experiment found that applying phosphorus at 60 kg/ha to a specific crop variety (Pusa Bold) resulted in the highest seed production (16.51q/ha), significantly enhanced net returns (₹66179.73/ha), and the highest B:C ratio (2.41:1). Utilizing phosphorus at 60 kg/ha with the Pusa Bold crop variety, which has a B:C ratio greater than 2.4, can be a financially profitable strategy.

References

1. Directorate of Economics & Statistics (2020). *Ministry of Agriculture & Farmer Welfare*, Government of India, New Delhi.

2. Kumari, M.S. and Saritha, J.D. (2017). Effect of phosphorus on oil seed crops. Agriculture Update, 12:749-754.

3. Kumar H and Yadav D S (2007) Effect of phosphorus and sulphur levels on growth, yield and quality of Indian mustard (Brassica juncea) cultivars. Indian J Agron 52: 154-57.

4. Mallick, R.B. and Raj, A. 2015. Influence of phosphorus, Sulphur and boron on growth, yield, nutrient uptake and economics of rapeseed (Brassica Campestris L. var. yellow sarson). International Journal of Plant, Animal and Environmental Sciences, 5 (1): 22- 27.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, November 2022

5. Nath, S., Patel, B.T., Meena, O.P. and Jat, G.P., (2018). Effect of phosphorus and sulphur on yield attributes, yield and economics of mustard [Brassica juncea (L.) Czern & Coss] in loamy sand. Journal of Pharmacognosy and Phytochemistry; 7(5): 498-500.

6. Potdar, D.S., Purohit, H.S., Meena, R.H., Kaushik, M.K., Jain, H.K. & Ameta, K.D. (2019). Effect of integrated phosphorus management on growth, yield and quality of mustard (Brassica juncea L.) Journal Pharmacognosy & Phytochemistry. 8 (04), 1700-1704.

7. Patidar, M., Singh, M.P., Singh, B. and Singh, R. (2000). Varietal performance of Indian mustard under different fertility levels in arid zone. Current Agric. 24:9-91.

8. Ravutla, S.K., Singh, R., Singh, E. and Singh, A.C., (2020). Effect of levels of phosphorus and molybdenum on growth and yield attributes of mustard (Brassicajuncea L.). Int. J. Curr. Microbiol. App. Sci. 9(12): 3410-3415.

9. Sah, D., Sewak, R., Singh, A.K. and Swami, S. (2013). Growth, yield and profitability of Indian mustard (Brassica juncea (L.) Czern & Coss) with different weed control measures and sulphur levels. Agricultural Science Digest, 33 (1): 15- 20.

10. Singh, A. K., Singh, H., Rai, O.P., Singh, G., Singh, V.P., Singh. N.P. and Singh, R., (2017). Effect of sowing dates and varieties for higher productivity of Indian mustard (Brassica juncea L.). Journal of Applied and Natural Science; 9(2): 883-887.

11.Sumi, P., Meena, S.C., Meena, R.H. and Choudhary, J. (2021). Effect of gibberellic acid and sulphur on growth and yield of mustard (Brassica juncea L.). The Pharma Innovation Journal, 10(8): 1214-1217.

ISSN PRINT 2319 1775 Online 2320 7876
  UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, November 2022

Analysis of Variance for Plant height at 90 DAS for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	0.50	0.25	0.03
P	3	2309.29	769.76	98.05
V	2	68.03	34.01	4.33
P×V	6	27.40	4.56	0.58
Error	22	172.73	7.85	
Total	35	2577.95	73.65	

Analysis of Variance for Number of branches at 90 DAS for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	0.06	0.03	0.27
P	3	17.49	5.83	53.00
V	2	1.55	0.77	7.00
P×V	6	3.48	0.58	5.27
Error	22	2.42	0.11	
Total	35	25.01	0.71	

Analysis of Variance for No. of siliquae per plant for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	10.18	5.09	0.53
P	3	6973.66	2324.55	243.40
V	2	272.04	136.02	14.24
P×V	6	180.23	30.03	3.14
Error	22	210.12	9.55	
Total	35	7646.23	218.46	

Analysis of Variance for Seed yield per plant (g) for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	4.13	2.06	3.07
P	3	102.20	34.06	50.83
V	2	22.05	11.02	16.44
P×V	6	10.90	1.81	2.70
Error	22	14.90	0.67	
Total	35	154.17	4.40	

Analysis of Variance for No. of seeds per siliqua for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	3.16	1.58	0.61
P	3	243.11	81.03	31.77
V	2	19.44	9.72	3.81
P×V	6	41.67	6.94	2.72
Error	22	56.30	2.55	
Total	35	363.68	10.39	

Analysis of Variance for Test weight (g) for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	0.80	0.40	8.00
P	3	14.56	4.85	97.00
V	2	0.77	0.38	7.60
P×V	6	0.27	0.04	0.80
Error	22	1.28	0.05	
Total	35	17.69	0.50	

Analysis of Variance for Harvest index (%) for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	16.20	8.10	2.79
P	3	718.84	239.61	82.62
V	2	25.48	12.74	4.39
P×V	6	30.38	5.06	1.74
Error	22	63.85	2.90	
Total	35	854.74	24.42	

Analysis of Variance for Oil content (%) for Mustard.

S.V.	df	SS	MSS	F Cal
Replication	2	0.18	0.09	0.13
P	3	138.75	46.25	67.02
V	2	6.47	3.23	4.68
P×V	6	1.39	0.23	0.33
Error	22	15.31	0.69	
Total	35	162.10	4.63	

Analysis of Variance for Seed yield (q ha^{-1}) for Mustard.

.V.	df	SS	MSS	F Cal
Replication	2	0.42	0.21	0.72
P	3	251.09	83.69	288.58
V	2	16.00	8.00	27.58
P×V	6	5.27	0.87	3.00
Error	22	6.40	0.29	
Total	35	279.20	7.97	

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 11, November 2022