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RESEARCH ARTICLE

Exploring the Relative Economics of Mustard Plant under Various Treatments

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ABSTRACT

All the major plant nutrients, namely nitrogen, phosphorus, and potassium, play an important role in increasing the production of mustard. A major part of the fertilizer nitrogen applied is lost as NH^3 through volatilization. The optimum supply of phosphorus to the plant stimulates root development and growth, thereby helps to establish seedlings quickly, and also reduces the harmful effect of excess nitrogen in plants. Potassium helps in maintaining a normal balance between carbohydrates and proteins. The economics of each treatment in relation to fertilizers were worked out taking into account the current prices of produces, fertilizers and the expenditure involved in all kinds of operations as per treatment on a per-hectare basis in ha ₹-1, and the cost of cultivation was calculated where gross returns, net returns, and benefit-cost ratios were considered. Economic returns were worked out by calculating the operational cost of individual treatments. A field experiment was initiated during Rabi, 2021–22 at Research Farm, Vivekananda Global University, Jaipur. The experiment was laid out in a factorial randomized block design with three replications comprising three fertilizer treatments, namely (F1) 0 kg/ha, (F2) 60 kg N + 30 kg P_2O_5/ha, and (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha as the first factor. On the basis of the experimental findings summarized, marked improvements in growth, yield traits, yield, quality, and nutrient uptake of mustard were observed with the application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha. On the basis of the B: C ratio, application of F3: 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha.

Key words: Fertilizer management, mustard plant, NPK treatments, nutrient management, relative economics

INTRODUCTION

India is the fourth-largest rapeseed-mustard-growing country in the world, occupying the fourth position in area and production after Canada, China, and the European Union. In India, among all the oilseed crops, rapeseed-mustard occupies 6.69 million ha of area and produces 10.11 million tons with an average productivity of 1511 kg/ha (Agricultural Statistics at a Glance, 2020–21).[1] Rajasthan is one of the major rapeseed and mustard-producing states in India. It ranked first both in terms of area and production of rapeseed and mustard among states in India. The area, production, and productivity of rapeseed-mustard in Rajasthan are 2.72 million ha, 4.51 million tons, and 1659 kg/ha (AICRP-RM, 2008).[2] All the major plant nutrients, namely nitrogen, phosphorus, and potassium, play an important role in increasing the production of mustard. Nitrogen is a structural part of the plant body, which helps in the synthesis of proteins and is important for photosynthetic activities in plants (Grant and Bailey, 1990).[6] Further, a major part of the fertilizer nitrogen applied is lost as NH^3 through volatilization. Likewise, the response to phosphorus is determined by soil phosphorus status, moisture availability, and the yield level attained. Phosphorus is the key element in the process of conservation

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of solar energy into chemical energy. The optimum supply of phosphorus to the plant stimulates root development and growth, thereby helps to establish seedlings quickly, and also reduces the harmful effect of excess nitrogen in plants (Kumar *et al*., 2011).[7] Adequate potassium results in superior plant quality of the whole plant due to the improved efficiency of photosynthesis, increased resistance to some diseases, and greater water use efficiency. Potassium helps in maintaining a normal balance between carbohydrates and proteins, and it is thought to be essential for the formation and translocation of carbohydrates, which are needed in large quantities by most crops (Dawson *et al*., 2009).[5] The economics of each treatment in relation to fertilizers were worked out taking into account the current prices of produces, fertilizers, and their expenditure. A field experiment was initiated during Rabi, 2021–22 at Research Farm, Vivekananda Global University, Jaipur.

MATERIALS AND METHODS

Cost of Cultivation

The cost of different operations was calculated for different treatments on the basis of existing market prices of inputs and operations, and the total cost was calculated by adding the expenditure involved in all kinds of operations as per treatment on a per-hectare basis in ha ₹-1.

- Gross returns
  The gross returns were calculated by multiplying the total seed and stover yield with the prevalent market prices of the items, and then, they were presented on a rupees hectare-1 basis as per the treatments (AOAC, 1990).[3]
- Net returns
  Treatment-wise net returns were computed by deducting the total cost of cultivation from the gross returns (AOAC, 1990).[3]
- Benefit: cost ratio
  Benefit: the cost ratio was calculated by dividing net returns by the cost of cultivation for each treatment (AOAC, 1990).[3]

$$Benefit : Cost\ ratio = \frac{Net\ returns\ \ (ha-1)}{Cost\ of\ cultivation\ \ (ha-1)}$$

RESULTS AND DISCUSSION

Relative Economics

Treatment-wise, economic returns were worked out by calculating the operational cost of individual treatments. The data obtained are presented in Table 1.

Cost of cultivation (ha ₹-1)

A perusal of the data in Table 1 and Figure 1 indicates that the maximum cost of cultivation (19236 ha ₹ -1) was recorded with the application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha, followed by (F2) 60 kg N + 30 kg P_2O_5/ha. However, the minimum cost of cultivation was found under (F1) 0 kg/ha.

Gross returns (ha ₹-1)

A perusal of the data in Table 1 and Figure 1 indicates that significantly higher gross returns (100852 ha ₹-1) were recorded with the application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha, followed by (F2) 60 kg N + 30 kg P_2O_5/ha. However, minimum gross returns were found under (F1) 0 kg/ha.

Net returns (ha ₹-1)

Among the treatments, application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O ha1 fetched maximum net returns (₹ 81616/ha), followed by (F2) 60 kg N + 30 kg P_2O_5/ha while minimum net returns were obtained under (F1) 0 kg/ha during the experimentation.

Table 1: Relative economics (₹ ha-1) of mustard as influenced by fertilizers

Treatments	Economics (₹ ha-1)			B:C ratio
	Cost of cultivation	Gross returns	Net returns	
Fertilizers (kg/ha)				
F1: 0 kg/ha	15020	67324	52304	3.59
F2: 60 kg N + 30 kg P_2O_5/ha	18893	91927	73034	3.95
F3: 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha	19236	100852	81616	4.33
SEm±	-	2915	2440	0.12
LSD (*P*=0.05)	-	8745	7321	0.36

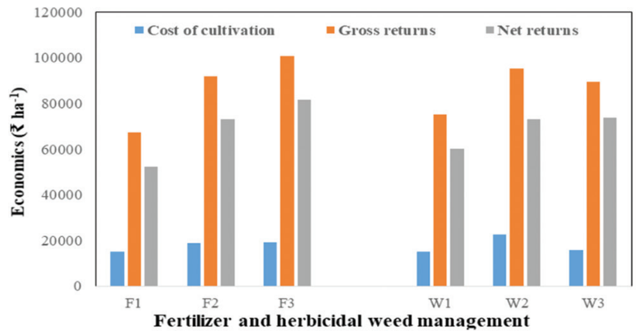

Figure 1: Relative economics (₹ ha^{-1}) of mustard as influenced by fertilizers and herbicidal weed management

Benefit: Cost ratio

Among the fertilizer treatments, the highest B: C ratio of magnitude 4.33 was obtained with the application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha, followed by (F2) 60 kg N + 30 kg P_2O_5/ha. However, a minimum B: C ratio was found under (F1) 0 kg/ha.

CONCLUSION

A field experiment was initiated during Rabi, 2021–22 at Research Farm, Vivekananda Global University, Jaipur. The soil of the experimental field was loamy sand in texture, slightly alkaline in reaction with EC in a safe range, low in organic carbon and nitrogen but with medium phosphorus and potassium. The experiment was laid out in a factorial randomized block design with three replications comprising three fertilizer treatments, namely (F1) 0 kg/ha, (F2) 60 kg N + 30 kg P_2O_5/ha, and (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha as the first factor. Application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha recorded significantly higher plant height, number of branches plant-1, and dry matter accumulation plant-1 over the rest of the treatments. Yield attributing characters such as number of siliqua (plant-1), number of seeds (siliqua-1), and siliqua length (cm) improved significantly with the application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O ha-1 over the rest of the treatments.

Application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha caused perceptible variation in seed yield (kg/ha), stover yield (kg/ha), and biological yield (kg/ha) over the rest of the treatments. Quantitatively, application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha recorded significantly higher oil yield, protein content, and protein yield over the rest of the treatments. The nutrient content in seed and stover could vary due to fertilizer application. Significantly higher nutrient content and uptake by seed and stover were noted under the application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha. Application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha fetched the highest gross returns, net returns, and B: C ratio of mustard.

On the basis of the experimental finding summarized, marked improvements in growth, yield traits and yield, quality, and nutrient uptake of mustard were observed with the application of (F3) 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha. On the basis of the B: C ratio, application of F3: 60 kg N + 30 kg P_2O_5 + 20 kg K_2O/ha.

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