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Effect of Integrated Nutrient Management on Yield and Economics of Indian Mustard (*Brassica juncea* L.)

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Abstract

The experiment was conducted at Instructional cum Research Farm of DKS, College of Agriculture and Research Station, Bhatapara (Chhattisgarh) during *rabi* season of 2020-21. The experiment was laid out in Randomized Block Design with three replication and twelve treatments. The mustard variety Chhattisgarh Sarson was sown on 10th November 2020 at spacing of 30 cm × 10 cm row to row and plant to plant using 5 kg seed ha⁻¹. Result reveals that highest seed yield (1371.6 kg ha⁻¹), stover yield (2194.56 kg ha⁻¹) and B:C ratio (2.18) of mustard was recorded under treatment receiving 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg S (T₇) to other INM treatments.

Keywords: *Brassicca juncea*, integrated nutrient management, PSB, Azotobacter

Introduction

Oilseed is backbone of agriculture economic in India since long and consider as a 2nd highest agricultural goods in India after cereals. Mustard (*Brassica juncea* L.) belong to the family cruciferae. It is the most widely produce oilseed crop in India. Mustard is a green tender plant is make vegetables generally called as “Sarson Ka Sagg”. Mustard seed is used as spices in the preparation of pickle, flavoring curries and vegetables. It used as oil as well as prepared for ghee, hair oil, soaps, lubricating oil, medicines and in tanning industries. Minerals like calcium, manganese, copper, iron, selenium, zinc, vitamin A, B, C and proteins are rich in mustard. 100 g of mustard seed contains 508 kcal energy, 26.08 g proteins, 28.09 g carbohydrates, 36.24 g total fat and 9.55 g dietary fibre. Especially in oilseeds sulphur plays a significant role in increasing production (Upadhyay *et al.*, 2016) [10]. In India rapeseed and mustard grown in an area of 6.12 mha with production and productivity of 9.26 mt and 1512kg kg⁻¹ respectively. Major rapeseed and mustard producing state in india are Rajasthan, Haryana, Uttar padesh and Madhya Pradesh (Anonymous, 2020). In Chhattisgarh mustard covers in area of 43.43(000ha) with 18.11 (000tonnes) production and its productivity is 415.00kg ha⁻¹ (Anonymous 2017-18) FYM, abundant in organic matter can be supplement with NPKS fertilizes. Though, this is costly of inorganic fertilizers component underlay but other profitable effect which it has on soil ca compensate for the added cost. It not only provides most of the essential nutrients but also improves soil structure through binding effect on soil aggregates (Kumawat *et al.*, 2018) [6].

Materials and Methods

A field experiment was conducted at Instructional cum Research Farm, DKS, College of Agriculture and Research Station, Bhatapara, (Chhattisgarh) during *rabi* season of 2020-21. The experiment was carried out in Randomized Block Design with three replication. Treatment were *viz.* 100% RDF (T₁), 75% RDF + 4 t FYM (T₂), 50% RDF + 8 t FYM (T₃), 100%RDF + 30 kg S(T₄), 75% RDF + 4 t FYM + 30 kg S (T₅), 50% RDF + 8 t FYM + 30 kg S(T₆), 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg S (T₇), 50% RDF + 8 t FYM + Azotobacter + PSB + 30 kg S (T₈), 75% RDF + 4 t FYM + PSB + Azotobacter (T₉), 50% RDF + 8 t FYM + PSB + Azotobacter (T₁₀), 50% RDF + 8 t FYM + PSB + 30 kg S (T₁₁) and 75% RDF + 4 t FYM + Azotobacter + 30 kg S (T₁₂). The mustard variety Chhattisgarh Sarson was sown on 10th November, 2020 at inter and intra row spacing of 30 cm and 10 cm respectively with seed rate of 5 kg ha⁻¹. The weather data is recorded at meteorological observatory of DKS CARS Bhatapara, during the life span of mustard. The total rainfall received during crop growth period was 30.2 mm. Relative humidity ranged between 59.7% in 45th standard week in November to 51.2% in 9th standard week in February.

The mean weekly maximum and minimum temperature during the crop period ranged between 27.2 to 35.2 °C and 9.2 to 18.0 °C respectively. Wind speed varied from 2.1 to 4.4 km hr⁻¹. The average and cumulative open pan evaporation during study period was 2.3 and 6.8 mm respectively. The bright sunshine varied from 3.3 to 9.5 hrs day⁻¹.

The recommended package of practice except the nutrient management were followed. Observation on seed and stover yield were recorded following the standard procedure To work out the harvest index of mustard, economical yield (seed yield) was divided by the respective biological yield (total produce) which is then expressed in term of percentage. Economics were worked out based on prices of output and input in the crop season. The data Where subjected to standard analysis of variance technique (Gomez and Gomez, 1984). The mean treatment were compared at $P < 0.05$ level of significance

Results and Discussion

In mustard significantly influenced the seed and stover yield Table 1 Significantly the higher seed yield (1371.6 kg ha⁻¹) of mustard was recorded under 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg S (T₇) which was at par with (1312.6kg ha⁻¹) 75%RDF +4 t FYM + Azotobacter + 30 kg S (T₁₂) whereas 100% RDF (T₁) produced significantly minimum seed yield (944.0 kg ha⁻¹). Result revealed that the differences in straw yield were found significant due to different treatments. Though significantly higher straw yield (2194.56 kg ha⁻¹) of mustard was recorded under treatment

receiving 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg S (T₇). Which was at par with 75%RDF + 4 t FYM + Azotobacter + 30 kg S (T₁₂) whereas 100% RDF (T₁) produced significantly lower straw yield (1939.71 kg ha⁻¹). The highest harvest index (38.46) was recorded in treatment 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg sulphur (T₇) followed by (38.38) 50% RDF + 8 t FYM + Azotobacter + PSB+ 30 kg sulphur (T₈) and (37.73) 75% RDF + 4 t FYM + Azotobacter + 30 kg sulphur (T₁₂). Whereas 100% RDF (T₁) produced minimum harvest index (32.88).

The seed yield was increases because integration of organic as well as inorganic combination this report was concluded by Premi *et al.*, (2004) [7] reported the “effect of farmyard manure (5.0, 10.0 and 15.0 t ha⁻¹) and vermicompost (2.5, 5.0 and 7.5 t ha⁻¹) on the yield, yield components of Indian mustard cv. RH-30 and reported maximum seed yield (1460 kg ha⁻¹) of Indian mustard with recommended dose of NPK fertilizer @ (80: 40: 40 kg ha⁻¹) and it was at par with 7.5 t ha⁻¹ vermicompost (1310 kg ha⁻¹) and FYM @ 15.0 t ha⁻¹ (1340“kg ha⁻¹). The grain yield increased gradually and significantly 22.98 q/ha due to the application of RDF + 2 kg Boron + 40 kg Sulphur over the control treatment. These findings are in agreements with the reports of Jaiswal *et al.*, (2015) [4].

The highest stover yield (36.12 q ha⁻¹) of mustard was recorded with the “application of 80N₂O, 80P₂O₅, 40K₂O kg ha⁻¹ in combination with sulphur @ 60 kg ha⁻¹ through SSP. These finding is similar to Chattopadhyay and Ghosh, (2012) [3].

Table 1: Effect of integrated nutrient management on yield attributes of mustard

| Treatments | Grain yield (kg ha ⁻¹) | Straw yield (kg ha ⁻¹) | Harvest index (%) |
|--|------------------------------------|------------------------------------|-------------------|
| T ₁ 100% RDF | 944.0 | 1939.71 | 32.78 |
| T ₂ 75% RDF + 4 t FYM | 1072.6 | 2145.20 | 33.33 |
| T ₃ 50% RDF + 8 t FYM | 1058.0 | 2106.00 | 33.33 |
| T ₄ 100% RDF + 30kg S | 1125.1 | 2137.69 | 34.48 |
| T ₅ 75% RDF + 4 t FYM + 30kg S | 1150.5 | 2070.90 | 35.71 |
| T ₆ 50% RDF + 8 t FYM + 30 kg S | 1168.5 | 1986.45 | 37.04 |
| T ₇ 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg S | 1371.6 | 2194.56 | 38.46 |
| T ₈ 50% RDF + 8 t FYM + Azotobacter + PSB + 30 kg S | 1252.1 | 2010.36 | 38.38 |
| T ₉ 75% RDF + 4 t FYM + Azotobacter + PSB | 1235.1 | 2099.67 | 37.03 |
| T ₁₀ 50% RDF + 8 t FYM + Azotobacter + PSB | 1197.5 | 2043.00 | 36.96 |
| T ₁₁ 50% RDF + 8 t FYM + PSB + 30 kg S | 1179.9 | 2009.83 | 36.99 |
| T ₁₂ 75% RDF + 4 t FYM + Azotobacter + 30 kg S | 1312.6 | 2165.79 | 37.73 |
| S.Em ± | 73.75 | 0.36 | 0.31 |
| CD (P = 0.05) | 217.80 | 1.08 | 0.93 |

Economics

The result on total cost of cultivation, gross return, net return and B: C ratio were computed and presented in Table 2. The highest gross return (77906 Rs ha⁻¹), highest net return (53439 Rs ha⁻¹) and highest B:C ratio (2.18) was found under treatment 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg sulphur (T₇), followed by 75% RDF + 4 t FYM + Azotobacter + 30 kg S (T₁₂) (2.05).

The highest gross income (77906.88 Rs ha⁻¹) and highest net profit (53439.08 Rs ha⁻¹) of mustard was noted with the application of 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg sulphur and also the highest B:C ratio (2.05) was recorded with the application of 75% RDF + 4 t FYM + Azotobacter + 30 kg Sulphur. These findings are in close conformity of Ramesh *et al.*, (2009) [9], Kumpawat *et al.*, (2004) [5] and Rao (2003) [8].

Table 2: Total cost of cultivation (Rs/ha)

| Treatment No. | Treatments | Total cost of cultivation (Rs) | Gross Return (Rs) | Net Return (Rs) | B: C Ratio |
|-----------------|---|--------------------------------|-------------------|-----------------|------------|
| T ₁ | 100% RDF | 22324.00 | 53833.85 | 31509.85 | 1.41 |
| T ₂ | 75% RDF + 4t FYM | 23567.80 | 61138.20 | 37570.40 | 1.59 |
| T ₃ | 50% RDF + 8t FYM | 24951.85 | 60301.00 | 35349.15 | 1.42 |
| T ₄ | 100%RDF + 30 kg S | 23074.00 | 64074.44 | 41000.44 | 1.77 |
| T ₅ | 75% RDF + 4 t FYM + 30 kg S | 24317.80 | 65463.45 | 41145.65 | 1.69 |
| T ₆ | 50% RDF + 8 t FYM + 30 kg S | 25701.85 | 66429.22 | 40727.37 | 1.58 |
| T ₇ | 75% RDF + 4 t FYM + Azotobacter + PSB + 30 kg S | 24467.8 | 77906.88 | 53439.08 | 2.18 |
| T ₈ | 50% RDF + 8 t FYM + Azotobacter + PSB + 30 kg S | 25851.85 | 71122.78 | 45270.93 | 1.75 |
| T ₉ | 75% RDF + 4 t FYM + PSB + Azotobacter | 23717.80 | 70215.43 | 46497.63 | 1.96 |
| T ₁₀ | 50% RDF + 8 t FYM + PSB + Azotobacter | 25101.85 | 68081.50 | 442979.65 | 1.71 |
| T ₁₁ | 50% RDF + 8 t FYM + PSB + 30 kg S | 25776.85 | 67079.31 | 41302.46 | 1.60 |
| T ₁₂ | 75% RDF + 4 t FYM + Azotobacter + 30 kg S | 24392.80 | 74588.49 | 50195.69 | 2.05 |
| S.Em ± | | | 165.64 | 1730.56 | 0.1557 |
| CD (P = 0.05) | | | 489.37 | 5112.57 | 0.459 |

Conclusion

The gross return (77906.88 Rs ha⁻¹) and net return (53439.08Rs ha⁻¹) was realized under treatment 75% RDF +4t FYM+Azotobacter+PSB+30 Kg S (T₇). In respect of B:C ratio, treatment 75% RDF +4t FYM+Azotobacter+PSB+30 Kg S (T₇) shows maximum value (2.18).

On the basis of above findings, treatment 75% RDF +4t FYM+Azotobacter+PSB+30 Kg S (T₇) significantly higher. There for it may be concluded that treatment. 75% RDF +4t FYM+Azotobacter+PSB+30 Kg sulphur (T₇) may be prefer for integrated nutrient management in mustard.

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