



Effect of biofertilizers and growth regulators on oil content and oil yield in Indian mustard (*Brassica juncea* L.)

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Abstract

A field study was conducted during *Rabi* season of two consecutive years 2019 and 2020 in Crop Research Farm at Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, India to determine the effect of biofertilizers and growth regulators on yield and soil analysis of Indian mustard. The experiment consisted of two factors, biofertilizers and growth regulators, there were 16 treatments each being replicated thrice *viz.* *Azotobacter* + water spray, *Azotobacter* + Gibberellic acid at 50 ppm, *Azotobacter* + Salicylic acid at 100 ppm, *Azotobacter* + Indole Acetic acid at 50 ppm, PSB + *Azotobacter* + water spray, PSB + *Azotobacter* + Gibberellic acid at 50 ppm, PSB + *Azotobacter* + Salicylic acid at 100 ppm, PSB + *Azotobacter* + Indole Acetic acid at 50 ppm, VAM + *Azotobacter* + water spray, VAM + *Azotobacter* + Gibberellic acid at 50 ppm, VAM + *Azotobacter* + Salicylic acid at 100 ppm, VAM + *Azotobacter* + Indole Acetic acid at 50 ppm, PSB + VAM + *Azotobacter* + water spray, PSB + VAM + *Azotobacter* + Gibberellic acid at 50 ppm, PSB + VAM + *Azotobacter* + salicylic acid at 100 ppm and PSB + VAM + *Azotobacter* + Indole Acetic acid at 50 ppm laid down in Split Plot Design replicated thrice. For oil yield, among the biofertilizers results revealed significant and maximum in both the years are observed in seed inoculated with of PSB + VAM + *Azotobacter* recording (5.35 t/ha and 5.47 t/ha), similarly among the growth regulators results revealed significant and maximum in both the years are observed in foliar spray of growth regulators at Gibberellic acid at 50 ppm recording (5.28 t/ha and 5.33 t/ha).

Keywords: mustard, oil content, oil yield, biofertilizer, growth regulator

Introduction

India is one of the largest oilseeds producing country that covers one fifth of the entire area under this group of crops and also yields one-fifth of the total oilseed production in the world. Indian mustard is the most important winter season oilseed crop, which thrives best in light to heavy loam soil in areas having 25-40 cm of rainfall. Mustard is nutritionally very rich and its oil content varies from 37-49%.

Growth regulator is needed in small quantities at low concentration to accelerate plant growth and development. So, favorable condition may be induced by applying growth regulator exogenously in proper concentration at a proper time in a specific crop. Application of bio-fertilizer effect the yield due to presence of sufficient available nutrients and their better utilization often act as limiting factor in crop production on eroded land. It has been observed that fertilizer application to mustard has great importance in raising the production.

Oilseeds, the second largest agriculture commodity after cereals in India, play a significant role in India economy, sharing 14% of the gross cropped area and accounting for nearly 1.5% of the gross national production and 8% of the value of all agriculture products. A range of oilseed crop *viz.* groundnut, rapeseed and mustard, soyabean sesame, sunflower, safflower and nigher (edible) and lineseed and castor (non-edible) are cultivated in the

country. Demand for vegetable oil is increased industrialization and diversion for bio-fuels (Kumar *et al.* 2018) ^[2].

Materials and method

The experiment was carried out in Split Plot Design with the three replications having 16 treatments combination which are allocated randomly in all plots. The details of treatments are given below.

a. Biofertilizers

Azotobacter

Phosphate Solubilizing Bacteria + *Azotobacter*

Vesicular Arbuscular Mycorrhiza + *Azotobacter*

Phosphate Solubilizing Bacteria + *Vesicular Arbuscular Mycorrhiza* + *Azotobacter*

b. Growth regulators (foliar application at 40 DAS)

Water spray

Gibberellic acid (GA₃) at 50 ppm

Salicylic acid (SA) at 100 ppm

Indole Acetic acid (IAA) at 50 ppm

Results and Discussion

Table 1 (a): Effect of bio-fertilizers and growth regulators on Oil content (%) and oil yield (t/ha) of Indian mustard

| Treatment | Post harvest | | | | | |
|--------------------------------|-----------------|---------|--------|------------------|---------|--------|
| | Oil content (%) | | | Oil yield (t/ha) | | |
| | 2019-20 | 2020-21 | Pooled | 2019-20 | 2020-21 | Pooled |
| <i>Biofertilizer</i> | | | | | | |
| <i>Azotobacter</i> | 37.06 | 37.97 | 37.51 | 5.07 | 5.11 | 5.09 |
| PSB + <i>Azotobacter</i> | 36.29 | 37.93 | 37.11 | 5.08 | 5.18 | 5.13 |
| VAM + <i>Azotobacter</i> | 37.07 | 38.01 | 37.54 | 5.12 | 5.19 | 5.15 |
| PSB + VAM + <i>Azotobacter</i> | 37.50 | 38.03 | 37.77 | 5.35 | 5.47 | 5.41 |
| F-test | NS | NS | NS | S | S | S |
| S.E.d(±) | - | - | - | - | - | - |
| CD (P = 0.05) | - | - | - | - | - | - |
| <i>Growth Regulators</i> | | | | | | |
| Water Spray | 36.73 | 37.67 | 37.20 | 5.13 | 5.18 | 5.16 |
| Gibberellic acid 50 ppm | 37.43 | 38.59 | 38.01 | 5.28 | 5.33 | 5.30 |
| Salicylic acid 100 ppm | 36.80 | 37.33 | 37.07 | 5.08 | 5.21 | 5.14 |
| Indole Acetic Acid 50 ppm | 36.96 | 38.34 | 37.65 | 5.12 | 5.23 | 5.18 |
| F-test | NS | NS | NS | S | S | S |
| S.E.d(±) | - | - | - | 0.04 | 0.06 | 0.05 |
| CD (P = 0.05) | - | - | - | 0.16 | 0.16 | 0.15 |

Table 2 (b): Interaction effect of bio-fertilizers and growth regulators on Oil content (%) and oil yield (t/ha) of Indian mustard

| Post-Harvest | | | | | | | | | | | |
|-----------------|----------------|----------------|----------------|----------------|-------|------------------|----------------|----------------|----------------|----------------|------|
| Oil content (%) | | | | | | Oil yield (t/ha) | | | | | |
| 2019-20 | | | | | | 2019-20 | | | | | |
| | B ₁ | B ₂ | B ₃ | B ₄ | Mean | | B ₁ | B ₂ | B ₃ | B ₄ | Mean |
| G ₀ | 36.70 | 36.23 | 37.57 | 36.40 | 36.73 | G ₀ | 4.97 | 5.03 | 5.70 | 4.83 | 5.13 |
| G ₁ | 37.83 | 36.13 | 37.87 | 37.90 | 37.43 | G ₁ | 5.40 | 5.47 | 4.87 | 5.37 | 5.28 |
| G ₂ | 36.57 | 36.13 | 36.63 | 37.87 | 36.80 | G ₂ | 5.00 | 4.83 | 5.03 | 5.47 | 5.08 |
| G ₃ | 37.13 | 36.67 | 36.20 | 37.83 | 36.96 | G ₃ | 4.90 | 4.97 | 4.87 | 5.73 | 5.12 |
| Mean | 37.06 | 36.29 | 37.07 | 37.50 | 36.98 | Mean | 5.07 | 5.08 | 5.12 | 5.35 | 5.15 |
| F-test | NS | | | | | F-test | S | | | | |
| S.E.d± | 0.21 | | | | | S.E.d± | 0.11 | | | | |
| CD (P=0.05) | 0.61 | | | | | CD (P=0.05) | 0.31 | | | | |
| 2020-21 | | | | | | 2020-21 | | | | | |
| | B ₁ | B ₂ | B ₃ | B ₄ | Mean | | B ₁ | B ₂ | B ₃ | B ₄ | Mean |
| G ₀ | 36.70 | 36.23 | 41.33 | 36.40 | 37.67 | G ₀ | 4.97 | 4.93 | 5.98 | 4.83 | 5.18 |
| G ₁ | 35.93 | 42.67 | 37.87 | 37.90 | 38.59 | G ₁ | 5.50 | 5.57 | 4.87 | 5.37 | 5.33 |
| G ₂ | 36.57 | 36.13 | 36.63 | 40.00 | 37.33 | G ₂ | 5.07 | 4.83 | 5.03 | 5.89 | 5.21 |
| G ₃ | 42.67 | 36.67 | 36.20 | 37.83 | 38.34 | G ₃ | 4.90 | 5.37 | 4.87 | 5.80 | 5.23 |
| Mean | 37.97 | 37.93 | 38.01 | 38.03 | 37.98 | Mean | 5.11 | 5.18 | 5.19 | 5.47 | 5.24 |
| F-test | NS | | | | | F-test | S | | | | |
| S.E.d± | 0.74 | | | | | S.E.d± | 0.12 | | | | |
| CD (P=0.05) | 2.12 | | | | | CD (P=0.05) | 0.33 | | | | |
| Pooled | | | | | | Pooled | | | | | |
| | B ₁ | B ₂ | B ₃ | B ₄ | Mean | | B ₁ | B ₂ | B ₃ | B ₄ | Mean |
| G ₀ | 36.70 | 36.23 | 39.45 | 36.40 | 37.20 | G ₀ | 4.97 | 4.98 | 5.84 | 4.83 | 5.16 |
| G ₁ | 36.88 | 39.40 | 37.87 | 37.90 | 38.01 | G ₁ | 5.45 | 5.52 | 4.87 | 5.37 | 5.30 |
| G ₂ | 36.57 | 36.13 | 36.63 | 38.93 | 37.07 | G ₂ | 5.03 | 4.83 | 5.03 | 5.68 | 5.14 |
| G ₃ | 39.90 | 36.67 | 36.20 | 37.83 | 37.65 | G ₃ | 4.90 | 5.17 | 4.87 | 5.77 | 5.18 |
| Mean | 37.51 | 37.11 | 37.54 | 37.77 | 37.48 | Mean | 5.09 | 5.13 | 5.15 | 5.41 | 5.19 |
| F-test | NS | | | | | F-test | S | | | | |
| S.E.d± | 0.43 | | | | | S.E.d± | 0.11 | | | | |
| CD (P=0.05) | 1.22 | | | | | CD (P=0.05) | 0.30 | | | | |

In oil content the data depicted non-significant effect of the factor. In both the years of 2019-20 and 2020-21 also, pooled data maximum non-significant effect of biofertilizers on oil content the data depicted non-significant effect of the factor. In both the years of 2019-20 and 2020-21 also, pooled data maximum non-significant effect of biofertilizers on oil content the data depicted

non-significant effect of the factor. In both the years of 2019-20 and 2020-21 also, pooled data maximum non-significant effect of biofertilizers on oil content was recorded in seed inoculation of *Phosphorous solubilizing bacteria + Vesicular Arbuscular Mycorrhiza+ azotobacter* having 37.50, 38.03 and 37.77 respectively and the lowest was seen in seed inoculation of

Phosphorous solubilizing bacteria + azotobacter having 36.29, 37.93 and 37.11 respectively similarly, the non-significant effect of growth regulator on harvest index in both the years of 2019-20 and 2020-21 also, pooled data maximum harvest index was recorded with foliar spray of gibberellic acid at 50 ppm having 37.43, 38.59 and 38.01 respectively and lowest 36.73, 37.67 and 37.20 respectively was observed in water spray(control). The interaction effect between the biofertilizers and growth regulator was non-significant during the years and pooled data also.

In oil yield the data depicted significant effect of the factor. In both the years 2019-20 and 2020-21 also, pooled data maximum significant effect of biofertilizers on oil yield was recorded in seed inoculation of *Phosphorous solubilizing bacteria + Vesicular Arbuscular Mycorrhiza + azotobacter* having 5.35, 5.47 and 5.41 respectively and the lowest was seen in seed inoculation of *azotobacter* having 5.07, 5.11 and 5.09 respectively similarly, the significant effect of growth regulator on oil yield in both the years of 2019-20 and 2020-21 also, pooled data maximum oil yield was recorded with foliar spray of gibberellic acid at 50 ppm having 5.28, 5.33 and 5.30 respectively and lowest 5.13, 5.18 and 5.16 respectively was observed in water spray (control).

Seed inoculation of biofertilizers did not show any significant effect on percent of oil content and oil yield of mustard. Similar finding was also reported by (Dutta *et al.* 2002)^[1]. This might be due to availability of nitrogen, phosphorus, sulphur and zinc form seed inoculation of biofertilizers. Similar finding was also reported by Meena *et al.*, 2013^[3]; Meena *et al.*, 2018^[4] reported that the quality parameter is mainly a varietal character. The interaction effect between the biofertilizers and growth regulator was significant during the years and pooled data also.

Conclusion

On the basis of during the course of investigation the oil yield of Indian mustard it is recommended that application of the use of biofertilizers and growth regulators are beneficial for the cultivation of Indian mustard crop is remunerative.

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