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***RESEARCH PAPER***

# Effect of application of inorganic fertilizers and biofertilizers on growth components and yield traits of coriander (*Coriandrum sativum* L.)

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**Abstract :** Present investigation regarding the supplementation of chemical fertilizers with biofertilizers for coriander crop was carried out under field condition in Horticulture Research Farm, I.G.K.V. Raipur (C.G.). The experiment was planted in Randomized Block Design (RBD) with the three replications. There were fifteen treatments comprising of different bio-fertilizers with inorganic fertilizers (NPK). Plant height, number of primary branches, number of secondary branches, days taken of 50% flowering, number of umbels per plant, number of seeds per umbel, total number of seeds per plant and seed yield per plant (g) were the important growth and yield contributing characters taken under investigation. The results indicated that vegetative growth contributing characters (plant height, number of primary and secondary branches and leaf area per plant) were influenced by combination of 100%K and 75% NP along with *Azotobacter, Azospirillum* and PSB. Yield contributing characters were found maximum in by combination of 100%K and 75% NP along with *Azotobacter, Azospirillum* and PSB over the treatments. Hence, it is concluded that the treatment $T_8$ (75% NP+100%K+*Azotobacter, Azospirillum* and PSB) was found economically best (higher yield) than all others treatments studied in this investigation.

**Key Words :** Inorganic fertilizer, Biofertilizer, Growth, Coriander

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## INTRODUCTION

Coriander (*Coriandrum sativum* L.) is an important spice in Indian subcontinents. It is an annual herb of about half a metre in height, belonging to family Apiaceae. Applying of biofertilizers such as PSB, *Azotobacter, Azospirillum* has led to a decrease in the use of chemical fertilizers and has provided high quality products free of harmful agrochemicals for human safety (Salem and Awad, 2005; Mahfouz and Sharaf Eldin, 2007).

The average yield per unit area in India is low (10.27 q/ha) as against world average of 23.78 q/ha. In recent years, biofertilizers have emerged as an important component of integrated nutrient supply system and have shown promise to improve crop yields and nutrient supplies. Studies done on the use of biofertilizers in coriander is not only scare but also limited to pot experiments under sterilized soil conditions. Such condition cannot be extrapolated to field condition where the organism has to be complete with the native population. Keeping these facts in view, several studies have reported that nitrogen fixing bacteria such as *Azotobacter* and *Azospirillum* could cause increased growth and yield in a few medicinal plants such as fennel (Badran and Safwat., 2004; Abdou *et al.*, 2004; Mahfouz and Sharaf Eldin, 2007; Azzaz *et al.*,2009), sweet flag (Kalyanasundaram *et al.*, 2008). Regarding the effect of inoculation of biofertilizers with varying doses of chemical fertilizers on growth and yield attributes and N, P and K were carried out

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**Table A : Fifteen treatments with different combinations of bio-fertilizers and inorganic fertilizers**

| Treatments | Combinations (N: P: K + Bio-fertilizers) |
|---|---|
| $T_1$ | 60:40:40 (RDF) (control) |
| $T_2$ | 75% N + 100% PK +*Azotobacter* |
| $T_3$ | 75% N + 100% PK + *Azospirillum* |
| $T_4$ | 75% P + 100% NK + PSB |
| $T_5$ | 75% N + 100% PK + *Azotobacter* + *Azospirillum* |
| $T_6$ | 75% NP + 100% K + *Azotobacter* + PSB |
| $T_7$ | 75% NP + 100% K + *Azospirillum* + PSB |
| $T_8$ | 75% NP + 100%K + *Azotobacter* + *Azospirillum* + PSB |
| $T_9$ | 50% N + 100% PK + *Azotobacter* |
| $T_{10}$ | 50% N + 100% PK + *Azospirillum* |
| $T_{11}$ | 50% P + 100% NK + PSB |
| $T_{12}$ | 50% N + 100% PK + *Azotobacter* + *Azospirillum* |
| $T_{13}$ | 50% NP +100% K + *Azotobacter* + PSB |
| $T_{14}$ | 50% NP + 100% K + *Azospirillum* + PSB |
| $T_{15}$ | 50% NP +100% K + *Azospirillum* + *Azotobacter* + PS |

under field condition.

## MATERIAL AND METHODS

The experiment was conducted using coriander variety, Pant Haritama in the Horticulture Research farm I.G.K.V. Raipur, Chhattisgarh ($21^0$16' N latitude and $81^0$26'E longitudes with an altitude of 289.59 m above the mean sea level) during *Rabi* season 2007-08 with loam soil. The experimental unit had design by fifteen treatments in Randomized block design with three replicates. The plot size and spacing were 1.58x 0.8 m. and 30x10 cm., respectively. Treatment plots received chemical fertilizer and biofertilizers depending on the treatment requirement (Table A).

## RESULTS AND DISCUSSION

The data on plant height, primary branches and secondary branches were influenced by various treatments as shown in Table 1. The plant height was significantly different at 45 and 90 days after imposing the treatments as well as at harvest. The plant height ranged 10.29 cm to 27.05 cm, 31.13 cm to 47.13 cm and 36.27 cm to 55.23 cm at 45, 90 DAS and at harvest, respectively. It was measured significantly highest 27.05 cm, 47.13 cm and 55.23 cm at 45, 90 DAS and at harvest, respectively in the treatment $T_8$ *i.e.*, combination of recommended dose of K and 75% NP along with *Azotobacter, Azospirillum* and PSB, followed by $T_{15}$ at 45 DAS and $T_6$ was at 90 DAS and at harvest.

According to the present analysis, biofertilizer have increased plant height by enhancing the nitrogen content and the rate of photosynthesis (Migahed *et al.,* 2004). The present result were derived from the improvement of nitrogen fixing bacteria activities in soil, which is agreement with the previous studies carried out on the fennel, turmeric and hyssop (Mahfouz and Sharaf Eldin, 2007; Koocheki *et al.,* 2009). Also, high plant density resulted in greater plant height that is in accordance with the observation Singh *et al.*

**Table 1 : Effect of bio-fertilizers with inorganic fertilizers on plant height, No. of primary branches and No. of secondary branches**

| Treatments | Average plant height (cm) | | | No. of primary branches | | | No. of secondary branches | | |
|---|---|---|---|---|---|---|---|---|---|
| | 45 DAS | 90 DAS | At harvest | 45 DAS | 90 DAS | At harvest | 45 DAS | 90 DAS | At harvest |
| $T_1$ 60:40:40 (RDF) (control) | 10.29 | 31.13 | 36.27 | 2.29 | 5.27 | 6.93 | 2.45 | 12.81 | 16.57 |
| $T_2$ 75%N +100% PK +*Azotobacter* | 15.31 | 35.50 | 42.41 | 3.95 | 7.19 | 10.38 | 6.37 | 17.27 | 21.77 |
| $T_3$ 75% N + 100% PK + *Azospirillum* | 16.19 | 35.27 | 41.53 | 4.73 | 8.52 | 11.02 | 8.77 | 19.55 | 23.00 |
| $T_4$ 75% P +100% NK + PSB | 16.50 | 36.61 | 43.35 | 3.73 | 8.46 | 11.04 | 6.51 | 17.79 | 23.20 |
| $T_5$ 75% N 100% PK + *Azotobacter* +*Azospirillum* | 21.46 | 41.51 | 48.42 | 4.27 | 8.27 | 12.92 | 7.74 | 19.90 | 24.87 |
| $T_6$ 75% NP + 100% K + *Azotobacter* + PSB | 23.36 | 43.40 | 50.24 | 5.73 | 9.77 | 13.20 | 11.23 | 22.40 | 25.00 |
| $T_7$ 75% NP + 100% K + *Azospirillum* +PSB | 19.68 | 39.79 | 46.77 | 4.20 | 8.20 | 11.81 | 6.66 | 17.68 | 23.87 |
| $T_8$ 75% NP + 100%K + *Azotobacter* + *Azospirillum* + PSB | 27.05 | 47.13 | 55.23 | 7.50 | 11.47 | 15.73 | 15.40 | 25.91 | 29.07 |
| $T_9$ 50% N + 100% PK + *Azotobacter* | 17.67 | 37.82 | 44.85 | 5.20 | 9.10 | 12.00 | 9.86 | 19.80 | 24.03 |
| $T_{10}$ 50% N +100% PK +*Azospirillum* | 20.42 | 40.56 | 47.48 | 5.18 | 8.75 | 12.33 | 9.77 | 21.54 | 24.27 |
| $T_{11}$ 50% P + 100% NK + PSB | 20.19 | 40.10 | 46.68 | 4.93 | 9.57 | 12.13 | 8.18 | 19.07 | 24.20 |
| $T_{12}$ 50% N + 100% PK + *Azotobacter* + *Azospirillum* | 15.30 | 36.37 | 44.16 | 2.84 | 6.82 | 9.79 | 4.39 | 15.96 | 21.20 |
| $T_{13}$ 50%NP +100% K + *Azotobacter* + PSB | 19.67 | 39.63 | 42.00 | 4.06 | 8.54 | 10.60 | 6.60 | 18.49 | 21.60 |
| $T_{14}$ 50% NP + 100% K + *Azospirillum* + PSB | 20.37 | 40.72 | 45.39 | 4.13 | 7.40 | 11.6 | 7.47 | 19.28 | 22.85 |
| $T_{15}$ 50% NP +100% K + *Azospirillum* + *Azotobacter* + PSB | 24.18 | 40.83 | 49.00 | 6.02 | 9.86 | 13.57 | 12.93 | 23.45 | 25.97 |
| Mean | 19.16 | 39.357 | 45.56 | 4.584 | 8.479 | 11.67 | 8.29 | 19.37 | 23.43 |
| S.E. ± | 0.147 | 0.090 | 0.43 | 0.019 | 0.041 | 0.011 | 0.07 | 0.07 | 0.13 |
| C.D. (P=0.05) | 0.40 | 0.251 | 1.19 | 0.055 | 0.113 | 0.03 | 0.21 | 0.21 | 0.37 |

(2005).

The number of primary branches per plant ranged 2.29 to 7.50, 5.27 to 11.47 and 6.93 to 15.73 at 45, 90 DAS and at harvest, respectively. It was recorded significantly highest of 7.50, 11.47 and 15.73 at 45, 90 DAS and at harvest, respectively in the treatment $T_8$ followed by $T_{15}$ in comparison to rest of the treatments.

The maximum number of primary branches per plant were produced in the treatment $T_8$ (75% NP+100%K+ *Azotobacter* +*Azospirillum*+ PSB) which was 40 per cent more as compared to control. The treatment comprising recommended dose of NPK at 60:40:40 per cent recommended NPK without bio-fertilizers ($T_1$) recorded the least number of primary branches per plant 2.29, 5.27 and 6.93 at 45 DAS, at 90 DAS and at harvest, respectively. Similar trend of increase in number of branches due to treatment with bio-fertilizers and organic manures were also reported by Parmaguru and Natarajan (1993) in chilli.

The number of secondary branches per plant ranged 2.45 to 15.40, 12.81 to 25.91 and 16.57 to 29.07 at 45, 90 DAS and at harvest, respectively. It was measured significantly highest 15.40, 25.91 and 29.07 at 45, 90 DAS and at harvest, respectively in the treatment $T_8$ followed by $T_{15}$ *i.e.* 12.93, 23.45 and 25.97 at 45, 90 DAS and at harvest.

Treatment comprising recommended dose of NPK at 60:40:40 kg/ha. without bio-fertilizers ($T_1$) recorded the least number of secondary branches per plant (2.45 at 45 DAS, 12.81 at 90 DAS and 16.56 at harvest).Similar trend of increased number of secondary branches due to treatment with bio-fertilizers and organic manures was reported by Parmaguru and Natarajan (1993) in chilli and by Babu *et al*. (1988) in chilli with *Glomus margarita*.

The data on days taken for 50 % flowering, number of umbels per plant, No. of seed per umbel, total number of seeds per plant, seed yield per plant (g) and seed yield per hectare were influenced by various treatments as shown in Table 2.

There was advancement in the day taken for 50 per cent flowering in treatment ($T_8$) as compared to all other treatments. Fifty per cent flowering occurred 7.25 days earlier in treatment $T_8$ followed by treatment $T_{14}$ (7.20) as compared to control.

The number of umbels per plant in the treatment combination of ($T_8$) with 75% N+75% P+100% K along with *Azotobacter, Azospirillum* and PSB was found to be significantly superior (74.25) followed by $T_{15}$ (69.09) and $T_6$ (60.12). These findings are in accordance with the observations Abdou *et al.* (2004) and Mahfouz and Sharaf Eldin (2007) on *Foeniculum vulgare*.

The treatment $T_8$ recorded significantly maximum number of seeds per umbel (56.06). However, the minimum number of seeds per umbel (38.41) was recorded in $T_1$ treatment (60:40:40 NPK kg/ha).

This may be attributed to better growth and nutrient availability, resulting in bigger sized umbels and ultimately giving more number of seeds per umbel. These result are in agreement with the investigation of Migahed *et al.* (2004) on *Apium graveolens*, Abdou *et al.* (2004) and Mahfouz and

**Table 2 : Effect of bio-fertilizers with inorganic fertilizers on seed yield and yield contributing characters of coriander cv. Pant Haritama**

| Treatments | Days taken for 50 % flowering | No. of umblels per plant | No. of seed per umbel | Total No. of seeds per plant | Seed yield per plant (g) | Seed yield per ha |
|---|---|---|---|---|---|---|
| $T_1$ 60:40:40 (RDF) (control) | 73.13 | 56.21 | 38.41 | 842.32 | 6.13 | 10.27 |
| $T_2$ 75%N +100% PK +*Azotobacter* | 69.77 | 58.02 | 43.01 | 1194.25 | 9.25 | 15.18 |
| $T_3$ 75% N + 100% PK + *Azospirillum* | 69.76 | 59.21 | 44.25 | 1296.73 | 10.17 | 17.52 |
| $T_4$ 75% P +100% NK + PSB | 67.33 | 64.03 | 49.01 | 1303.72 | 9.97 | 16.82 |
| $T_5$ 75% N 100% PK + *Azotobacter* +*Azospirillum* | 67.54 | 60.39 | 46.06 | 1426.37 | 11.41 | 19.04 |
| $T_6$ 75% NP + 100% K + *Azotobacter* + PSB | 67.05 | 60.12 | 45.11 | 1545.70 | 11.73 | 20.04 |
| $T_7$ 75% NP + 100% K + *Azospirillum* +PSB | 68.95 | 58.93 | 43.74 | 1298.99 | 10.50 | 17.44 |
| $T_8$ 75% NP + 100%K + *Azotobacter* + *Azospirillum* + PSB | 65.88 | 74.25 | 56.06 | 1720.36 | 14.31 | 23.78 |
| $T_9$ 50% N + 100% PK + *Azotobacter* | 71.53 | 61.81 | 46.50 | 1562.94 | 12.07 | 20.00 |
| $T_{10}$ 50% N +100% PK +*Azospirillum* | 66.68 | 66.28 | 50.84 | 1601.26 | 12.41 | 20.00 |
| $T_{11}$ 50% P + 100% NK + PSB | 70.47 | 61.94 | 45.45 | 1545.36 | 11.65 | 19.51 |
| $T_{12}$ 50% N + 100% PK + *Azotobacter* + *Azospirillum* | 69.24 | 64.25 | 44.00 | 1126.41 | 8.70 | 14.45 |
| $T_{13}$ 50%NP +100% K + *Azotobacter* + PSB | 69.98 | 61.64 | 47.46 | 1341.36 | 10.59 | 17.7 |
| $T_{14}$ 50% NP + 100% K + *Azospirillum* + PSB | 65.95 | 62.04 | 46.41 | 1403.89 | 10.9 | 18.0 |
| $T_{15}$ 50% NP +100% K + *Azospirillum* + *Azotobacter* + PSB | 70.38 | 69.09 | 51.42 | 1599.21 | 12.04 | 20.47 |
| Mean | 68.91 | 62.61 | 46.517 | 1388.77 | 10.789 | 18.01 |
| S.E. ± | 0.42 | 0.028 | 0.028 | 22.26 | 0.095 | 0.248 |
| C.D. (P=0.05) | 1.18 | 0.078 | 0.078 | 61.71 | 0.26 | 0.688 |

Sharaf Eldin (2007) on *Foeniculum vulgare* and Valadabadi and Farahani (2011) on *Nigella sativa*.

Maximum total number of seeds per plant (1720.36) was recorded in treatment T8 followed by the treatment ($T_{10}$, $T_{15}$ and $T_9$) combination (1601.26, 1599.21 and 1562.94), respectively. However, the minimum total numbers of seeds per plant (842.32) were recorded in $T_1$ treatment 60:40:40 kg/ha NPK.

Total number of seeds recorded per plant was found to be higher in bio-fertilizer treated plants compared to control. This may also be attributed to better growth and nutrient availability, better growth resulting in more number of umbels per plant and ultimately giving more total number of seeds per plant.

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