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# Influence of sowing date, nitrogen and plant growth regulators on growth and yield of coriander (*Coriandrum sativum* L.)

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**Abstract**

Field experiments conducted at Udaipur (Rajasthan) indicated that coriander (*Coriandrum sativum*) crop sown on 15th October resulted in significantly higher growth and yield as compared to 15th November sown crop. Higher levels of nitrogen fertilization did not show any significant influence on growth and yield. Foliar spray of naphthalene aceticacid (25 ppm) at 30 days after sowing resulted in significantly higher growth and seed yield which was on par with gibberellic acid (50 ppm) spray at 30 days after sowing.

**Keywords:** *Coriandrum sativum*, coriander, nitrogen, plant growth regulators, sowing date, yield.

## Introduction

The productivity of coriander (*Coriandrum sativum* L.) is low in Rajasthan, a major coriander producing state in India. Plant growth and seed yield increased in coriander, when nitrogen was applied @ 60 kg $ha^{-1}$ and sprayed with naphthalene aceticacid (NAA) @ 25 ppm (Pareek 1996). Spraying of plant growth regulators in other seed spices such as NAA in fenugreek (Alagukannan & Vijaykumar 2003), and gibberellic acid ($GA_3$) in cumin (Omer *et. al.* 1997) have been reported for improving growth and seed yield. Hence, the present investigation was carried out to study the effect of sowing date, nitrogen level and plant growth regulators on the growth and yield of coriander under semi-arid and subtropical climatic zone of India.

## Materials and methods

The experiment was conducted at Horticulture Research Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan), during 2003–04 and 2004–05. The farm is situated at 24$^0$35' N latitude and 24$^0$42' E longitude at an elevation of 79.5 mm above MSL. The climate of this zone is typically semi-arid and subtropical and the average rainfall ranges from 650 to 750 mm of which 90% is received during July to September. The maximum and minimum temperatures during the study period were 23.0$^o$C to 38.3$^o$C and 5.8$^0$C to 23.0$^0$C, respectively (2003–04) and 21.5$^o$C to 36.8$^o$C and 5.1$^0$C to 22.1$^0$C, respectively (2004–05). The mean daily maximum and minimum relative humidity varied

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between 36% to 91% and 10% to 36% during 2003–04 and the corresponding values during 2004–05 were 32% to 88% and 8% to 52%, respectively. The soil of experimental site was clay loam in texture, with organic carbon 0.85–0.90%, available nitrogen 186.5–197.0 kg $ha^{-1}$, phosphorus 26.5–28.0 kg $ha^{-1}$, potassium 252.5–260.0 kg $ha^{-1}$, with EC of 0.40–0.45 $dSm^{-1}$ at 25°C and pH of 8.4. The soil was deficit in nitrogen and phosphorus but rich in available potassium, thus potassium was not applied. The experiment was laid out in a spilt plot design with four replications. Sowing dates (15th October, 30th October and 15th November) and levels of nitrogen (N @ 60 kg $ha^{-1}$ and 75 kg $ha^{-1}$) were in main plots, while foliar application of plant growth regulators (NAA @ 25 ppm) and $GA_3$ @ 50 ppm at 30 and 75 days after sowing (DAS) were in sub-plots.

Before sowing, the seeds were split into two halves and sowing was done manually in rows at a spacing of 50 cm, wherein plants were thinned to 10 cm after 20 days of sowing. The promising variety of the region namely, RCr-41 was used. A plant population of 150 plants 7.5 $m^{-2}$ area was maintained. A uniform dose of 45 kg $P_2O_5$ $ha^{-1}$ was applied through single super phosphate and 1/3rd nitrogen as per treatment as basal dose was drilled 10 cm deep at the time of sowing. The remaining dose of nitrogen through urea was applied in two equal splits before irrigation at 30 and 75 DAS. The plant growth regulator solutions prepared in desired stock solutions were applied as per treatments and untreated plots were sprayed with water twice.

Observations were recorded on growth characters like, plant height, number of green leaves $plant^{-1}$, fresh weight of leaves at 45 DAS, 90 DAS and at harvest, number of nodes on main shoot, number of branches $plant^{-1}$, yield and yield attributes.

**Results and discussion**

*Effect of sowing date*

The plant growth attributes of coriander were highly influenced by sowing date (Table 1). The crop sown on 15th October significantly registered higher plant height (101.58 cm), number and weight of green leaves $plant^{-1}$ (19.65 and 24.45 g, respectively), number of branches (12.03) and number of nodes on main shoot $plant^{-1}$ (11.36) at harvest over 15th November sowing. This increase was ultimately reflected in overall improvement in growth of coriander crop quantified in terms of biomass accumulation at successive growth stages and at harvest. Hornok (1976) also observed that low temperature at the time of emergence caused slow germination of coriander. Plant height, number of green leaves $plant^{-1}$, fresh weight of green leaves $plant^{-1}$ and number of branches $plant^{-1}$ were maximum in 15th October sown crop and this was due to favourable agro-climatic conditions. The present study is in conformity with the findings of Naghera *et al.* (2000) and Tiwari *et al.* (2002) in coriander at Junagadh and Pantnagar, respectively. The 15th October sown crop exhibited significant improvement in yield attributes namely, highest number of umbels $plant^{-1}$ (28.50), umbellets $umbel^{-1}$ (6.45), seeds $umbel^{-1}$ (36.60), test weight (9.81), biological yield (35.62 q $ha^{-1}$) and stover yield (23.05 q $ha^{-1}$) and thus contributed towards highest seed yield of 12.57 q $ha^{-1}$ which was significantly higher than 15th November sown crop (Table 2). However, it was on par with 30th October sown crop. These results are in close agreement with findings of Naghera *et al.* (2000) in coriander.

*Effect of nitrogen*

Increasing levels of nitrogen fertilization did not show any significant influence on growth, yield and yield attributes of coriander (Tables 1 and 2).

*Effect of plant growth regulators*

The application of plant growth regulators (PGR) significantly improved vegetative growth of coriander (Table 1). Among the different PGR treatments, NAA 25 ppm at 30 DAS resulted in maximum plant height at 45 DAS (15.22 cm), 90 DAS (71.45 cm) and also

**Table 1.** Effect of date of sowing, nitrogen and plant growth regulators on vegetative growth characters of coriander (Pooled data of two years)

| Treatment | Plant height (cm) | | | No. of green leaves plant$^{-1}$ | | | Fresh weight of leaves (g plant$^{-1}$) | | | No. of nodes on main shoot | No. of branches |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 45 DAS | 90 DAS | At harvest | 45 DAS | 90 DAS | At harvest | 45 DAS | 90 DAS | At harvest | plant$^{-1}$ at harvest | plant$^{-1}$ at harvest |
| **Date of sowing** | | | | | | | | | | | |
| 15th October | 14.84 | 70.19 | 101.58 | 10..67 | 16.70 | 19.65 | 13.09 | 17.22 | 24.45 | 11.36 | 12.03 |
| 30th October | 14.55 | 69.15 | 99.94 | 10.43 | 16.39 | 19.28 | 12.78 | 16.91 | 23.97 | 11.11 | 11.78 |
| 15th November | 13.66 | 64.17 | 92.60 | 9.35 | 15.38 | 18.22 | 11.55 | 15.76 | 21.89 | 9.76 | 10.46 |
| SEm ± | 0.14 | 0.67 | 0.98 | 0.10 | 0.15 | 0.17 | 0.13 | 0.16 | 0.23 | 0.12 | 0.13 |
| CD (P=0.05) | 0.41 | 1.93 | 2.82 | 0.30 | 0.45 | 0.48 | 0.39 | 0.47 | 0.67 | 0.34 | 0.36 |
| **Nitrogen level** | | | | | | | | | | | |
| N @ 60 kg ha$^{-1}$ | 14.23 | 67.07 | 96.92 | 10.04 | 16.01 | 18.86 | 12.37 | 16.53 | 23.25 | 10.64 | 11.35 |
| N @ 75 kg ha$^{-1}$ | 14.48 | 68.60 | 99.16 | 10.26 | 16.31 | 19.24 | 12.58 | 16.73 | 23.62 | 10.84 | 11.50 |
| SEm ± | 0.12 | 0.54 | 0.80 | 0.08 | 0.13 | 0.14 | 0.11 | 0.13 | 0.19 | 0.09 | 0.10 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Plant growth regulator** | | | | | | | | | | | |
| Water spray (control) | 13.71 | 62.98 | 90.95 | 9.47 | 14.60 | 17.46 | 11.51 | 14.99 | 20.45 | 9.43 | 10.00 |
| NAA 25 ppm at 30 DAS | 15.22 | 71.45 | 103.24 | 11.04 | 17.04 | 20.10 | 13.84 | 18.02 | 26.03 | 11.84 | 12.48 |
| NAA 25 ppm at 75 DAS | 13.91 | 67.14 | 97.08 | 9.74 | 16.13 | 18.90 | 11.81 | 16.28 | 22.76 | 10.66 | 11.36 |
| $GA_3$ 50 ppm at 30 DAS | 15.11 | 70.80 | 102.30 | 10.93 | 16.95 | 19.95 | 13.58 | 17.75 | 25.53 | 11.58 | 12.24 |
| $GA_3$ 50 ppm at 75 DAS | 13.82 | 66.81 | 96.63 | 9.57 | 16.07 | 18.86 | 11.62 | 16.11 | 22.42 | 10.20 | 11.04 |
| SEm ± | 0.16 | 0.78 | 1.17 | 0.11 | 0.18 | 0.19 | 0.15 | 0.18 | 0.27 | 0.13 | 0.15 |
| CD (P = 0.05) | 0.44 | 2.19 | 3.26 | 0.31 | 0.50 | 0.53 | 0.43 | 0.51 | 0.75 | 0.37 | 0.42 |

DAS=Days after sowing

**Table 2**. Effect of date of sowing, nitrogen and plant growth regulators on yield attributes and yield of coriander (Pooled data of two years)

| Treatment | Days to initiation of flowering | Days to 50% flowering | No. of umbels plant$^{-1}$ | No. of umbellets umbel$^{-1}$ | No. of seeds umbel$^{-1}$ | Test weight (g) | Biological yield (q ha$^{-1}$) | Stover yield (q ha$^{-1}$) | Seed yield (q ha$^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|
| **Date of sowing** | | | | | | | | | |
| 15th October | 72.4 | 87.48 | 28.50 | 6.45 | 36.60 | 9.81 | 35.62 | 23.05 | 12.57 |
| 30th October | 73.9 | 89.98 | 28.05 | 6.30 | 35.85 | 9.59 | 34.91 | 22.64 | 12.27 |
| 15th November | 74.1 | 96.91 | 25.72 | 5.49 | 32.59 | 9.10 | 32.30 | 21.07 | 11.22 |
| SEm ± | 0.7 | 0.83 | 0.30 | 0.07 | 0.40 | 0.07 | 0.36 | 0.27 | 0.13 |
| CD (P=0.05) | NS | 2.40 | 0.86 | 0.20 | 1.13 | 0.20 | 1.04 | 0.78 | 0.40 |
| **Nitrogen level** | | | | | | | | | |
| N @ 60 kg ha$^{-1}$ | 72.6 | 90.59 | 27.24 | 6.04 | 34.72 | 9.45 | 34.06 | 22.10 | 11.97 |
| N @ 75 kg ha$^{-1}$ | 74.3 | 92.32 | 27.60 | 6.12 | 35.31 | 9.55 | 34.48 | 22.41 | 12.08 |
| SEm ± | 0.6 | 0.68 | 0.24 | 0.06 | 0.32 | 0.06 | 0.30 | 0.22 | 0.10 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Plant growth regulator** | | | | | | | | | |
| Water spray (control) | 76.2 | 96.83 | 24.35 | 5.36 | 30.78 | 8.77 | 30.18 | 19.76 | 10.42 |
| NAA 25 ppm at 30 DAS | 70.8 | 87.67 | 30.02 | 6.66 | 38.52 | 10.06 | 37.74 | 24.33 | 13.41 |
| NAA 25 ppm at 75 DAS | 75.3 | 92.63 | 26.76 | 6.01 | 34.11 | 9.48 | 33.58 | 21.88 | 11.70 |
| $GA_3$ 50 ppm at 30 DAS | 70.8 | 87.85 | 29.55 | 6.52 | 37.93 | 9.87 | 36.91 | 23.81 | 13.09 |
| $GA_3$ 50 ppm at 75 DAS | 74.4 | 92.29 | 26.44 | 5.85 | 33.73 | 9.31 | 32.96 | 21.48 | 11.48 |
| SEm ± | 0.9 | 0.99 | 0.33 | 0.07 | 0.43 | 0.08 | 0.40 | 0.30 | 0.15 |
| CD (P=0.05) | 2.5 | 2.78 | 0.91 | 0.20 | 1.20 | 0.23 | 1.10 | 0.83 | 0.41 |

DAS=Days after sowing

at harvest (103.24 cm), number of green leaves plant$^{-1}$ at 45 DAS, 90 DAS and at harvest (11.04, 17.04 and 20.10, respectively), number of nodes on main shoot (11.84) and number of branches plant$^{-1}$ (12.48). The performance of the above characters was on par with foliar application of 50 ppm $GA_3$ at 30 DAS. The yield and yield attributes were also influenced significantly as a result of PGR application (Table 2). The application of NAA 25 ppm at 30 DAS induced early flowering and took minimum days for initiation of flowering (70.75 days) and completion of 50% flowering (87.67 days). This treatment also exhibited maximum umbels plant$^{-1}$ (30.02), umbellets umbel$^{-1}$ (6.66), seeds umbel$^{-1}$ (38.52), test weight (10.06 g), biological yield (37.74 q ha$^{-1}$), stover yield (24.23 q ha$^{-1}$) and seed yield (13.41 q ha$^{-1}$) over control. However, the application of $GA_3$ 50 ppm at 30 DAS was on par with the above mentioned treatment for all the parameters.

It may be concluded that under semi-arid and subtropical agro-climatic conditions of Rajasthan, coriander crop should be sown on 15th October. Application of 60 Kg N ha$^{-1}$ and foliar spray of NAA 25 ppm at 30 DAS results in good vegetative growth and higher seed yield.

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