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# Effect of Row Spacing and Nitrogen on Growth and Yield of Coriander (*Coriandrum sativum* L.)

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**Abstract**

A field experiment was conducted during *rabi* 2012-13 at the Research Farm, College of Horticulture, Mandsaur (Madhya Pradesh) to study the response of coriander to different row spacing and nitrogen levels. The experiment was laid out in factorial RBD design with three replications including three row spacing and four levels of nitrogen. The different treatments significantly influenced the growth, yield and quality attributes of coriander. Application of 90-120 Kg N/ha and 30 cm row spacing significantly improved plant height, number of branches/plant, fresh weight of leaves (g)/plant, dry weight of plant (g)/plant, days to 50 % flowering, number of umbels/plant, number of umbellets/plant, test weight, seed yield, straw yield, biological yield, harvest index, chlorophyll content in leaves (mg/g) and essential oil content (%) of seeds over their respective lower levels.

**Key Words:** Coriander, Growth, Nitrogen, Row spacing, Quality and Yield.



## INTRODUCTION

Coriander (*Coriandrum sativum* L.) fruits are globular, yellow brown when ripened and are 3 to 4 mm in diameter. The major growing districts in the Madhya Pradesh state are Guna, Mandsaur, Shajapur, Rajgarh and Vidisha. Row spacing is an important factor for better growth and yield of the plant. Optimum number of plants is required per unit area to utilize efficiently the available production factors such as water, nutrient, light and $CO_2$. Maximum exploitation of these factors is achieved when the plant population puts forth maximum pressure on all the factors of production. As, a results, individual plants are put under severe stress because of inter-plant competition. Thus, the entire community of plants considered for higher production rather than individual plant performance. Nitrogen is a constituent of proteins, enzymes, hormones, vitamins, alkaloids, chlorophyll etc. Adequate supply of N promotes higher photosynthetic activity and vigorous vegetative growth and as a result, the plants turn in to dark green colour. A high N supply favours the conversion of carbohydrate into protein which, in turn promotes the formation of protoplasm. Protoplasm, being highly hydrated, is conducive for the succulent plant growth. Keeping the above facts in view, an experiment was conducted to see the effect of row spacing and level of nitrogen on growth and seed yield of coriander.

## MATERIALS AND METHODS

The field experiment was conducted during *rabi* season 2012-13 at the Research Farm, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, College of Horticulture, Mandsaur (Madhya Pradesh) on light black loamy soil having pH 7.2, EC 0.35 dS/m, 243.2 Kg/ha available nitrogen (low), 19.75 Kg/ha available phosphorus (medium) and 448.0 Kg/ha available potassium (high). The average annual rainfall was 876 mm. The experiment was laid out in factorial randomized block design having three replications. There were twelve treatment combinations, consisted of three row spacing *viz*., 20 cm, 30 cm and 40 cm and four levels of nitrogen *viz*. 0 Kg/ha, 40 Kg/ha, 80 Kg/ha and 120 Kg/ha. A basal dose of 40 kg N/ha, 30 kg $P_2O_5$/ha and 20 kg $K_2O$/ha was applied for better growth and proper nutrition of coriander. The seed of coriander variety RCr 436 @ 15 kg/ha was used for sowing. Prior

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to sowing, seeds were cleaned and broken into two halves. Seeds were sown on 21st October, 2012 in furrows at different row spacing and were covered with soil properly. Two hand-weeding and hoeing were done, first at 30 DAS and second at 60 DAS to control the season bound weeds. In order to safe guard the plant against aphids, dimethioate (1.5 %) was sprayed on the plants twice and wettable sulphur (3 g/L) was sprayed to prevent the crop from powdery mildew.

The harvested material of each plot was tied up in bundles, tagged and kept on the threshing floor for sun drying. After sun drying the threshing of the individual plots was done with the help of wooden sticks and winnowed traditionally to separate seeds and straw. Seeds were weighed and plot wise samples were taken. Separate analysis was carried out for seed and straw. Quality attributes chlorophyll content in leaves (mg/g) and essential oil content (%) of seeds was estimated by Clevenger apparatus by stem distillation method (A O A C, 1995).



## RESULTS AND DISCUSSION

### Effect of row spacing

It was observed that row spacing significantly influenced different growth parameters (Table 1) *viz.,* plant height, number of branches per plant, fresh and dry weight of plant. Maximum plant height (cm) at 30, 60 and 90 DAS (7.31, 47.47 and 74.01) was attained by row spacing of 30 cm. Significant increase in plant height from early stage of crop growth under closer row spacing seem to be due to mutual shading due of the dense population. This might have decreased the availability of light to the plants. The reduced light intensity at the base of the plant stem might have accelerated elongation of lower internodes resulting in plant height. Although, plant elongates rapidly due to mutual shading but beyond a certain level, elongation is checked due to reduced availability of photosynthates. These observations are in close conformity with finding of Malav and Yadav (1997).

The results indicated that crop raised under row spacing 30 cm recorded significantly higher number of branches at 60 and 90 DAS (3.77 and 4.19), fresh weight per plant (g) at 60 DAS (16.21) and dry weight per plant (g) at 60 and 90 DAS (2.24 and 10.71) as compared to row spacing of 20 cm and 40 cm. Whereas, the row spacing of 30 cm and 40 cm were at par with each other at fresh weight per plant (g) at 30 and 90 DAS and dry weight per plant (g) at 30 DAS. Significant improvement in aforesaid parameters due to increase in spacing or in other words reduction in plant population per unit area could be ascribed to availability of more area per plant which implied that individual plant at wider spacing received higher growth inputs (sunlight, water and nutrients) with least competition compared to the plants grown under two closer spacing. Thus greater inputs under wider spacing resulted in profuse branching which might have helped in larger canopy development and delayed plant to attain reproductive phase. The larger canopy development associated with profuse branching had increased interception, absorption and utilization of solar energy resulting information of higher photosynthates and finally dry matter per plant. A significant improvement in growth with close spacing was conformity with the findings of Singh and Buttar (2005) and Kumar *et al* (2006).

It was observed that at row spacing of 30 cm various yield attributes significantly improved i.e. days to 50 per cent flowering (55.25), number of umbels per plant (42.68) and number of umbellate/ plant (206.63) and test weight (2.78 g) (Table.2). The maximum value for these estimates were obtained at the row spacing 30 cm i.e. number of umbels per plant, number of umbellate per plant while minimum days taken to 50 per cent flowering was observed with row spacing of 20 cm . Significantly highest seed yield (14.99 q/ha) and biological yield (41.52 q/ha) were recorded with row spacing of 30 cm compared to other spacing (20 cm and 40 cm). Marked improvement in yield and yield attributes of the crop with increase in spacing appear to be on account of vigorous growth of the plants as evident from profuse branching and higher biomass accumulation per plant. The profuse branching seem to have led to greater initiation of flowering and adequate supply of metabolites due to the increase in biomass per plant might have helped in retention of flower thereby greater seed formation and seed growth. These results justify that overcrowding of plants at closer spacing significantly reduced growth and yield attributes of the crop but compensated the yield to a certain level. On the other hand, due to more plants/unit area though, improved over all growth of crop but failed to record highest yield due to less number of plants per hectare.

Significantly higher chlorophyll content of leaves and essential oil content of seed under wider spacing could be ascribed due to availability of large space per plant resulted in profuse vegetative growth and delayed plant to attain productive growth.



### Effect of nitrogen levels

Significantly higher plant height at 30, 60 and 90 DAS, number of branches per plant, fresh and dry weight per plant at 60 and 90 DAS were recorded as a result of higher levels of nitrogen fertilization (Table. 1). It is an established fact that nitrogen is required for the synthesis of protein, chlorophyll and other organic compounds of physiological significance. Thus, increased level of nitrogen in plant by virtue of its increased availability in the soil medium and there after efficient absorption and translocation in various growth by way of active cell division and elongation resulting in greater plant height and number of branches.

The nitrogen application might had resulted in larger canopy development and presumably higher chlorophyll content of leaves as nitrogen actively participate in its formation with profound influence on photosynthetic efficiency of plants, this might had led to higher accumulation of fresh and dry matter. The findings of this investigation were in close conformity with those of Channabasavanna *et al* (2002), Tehlan and Thakral (2008), Ghosh (2009), Bhunia *et al* (2009) and Sharangi *et al* (2011).

Data on yield components of the crop under influence of nitrogen application indicated that increasing level of nitrogen up to 80 Kg/ha

**Table 1. Effect of row spacing and nitrogen on different growth parameters of coriander**

| Treatment | Plant height (cm) | | | Number of Branches/Plant | | Fresh Weight of Plant (g) | | | Dry Weight of Plant (g) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | 60 DAS | 90 DAS | 30 DAS | 60 DAS | 90 DAS | 30 DAS | 60 DAS | 90 DAS |
| Row Spacing (cm) | | | | | | | | | | | |
| 20 | 6.84 | 45.02 | 67.93 | 3.22 | 3.63 | 0.55 | 13.89 | 27.82 | 0.24 | 2.17 | 10.02 |
| 30 | 7.31 | 47.47 | 74.01 | 3.77 | 4.19 | 0.65 | 16.21 | 34.26 | 0.34 | 2.40 | 10.71 |
| 40 | 7.00 | 46.50 | 71.72 | 3.30 | 3.80 | 0.60 | 14.88 | 31.86 | 0.30 | 2.31 | 10.43 |
| SEm ± | 0.208 | 0.549 | 0.571 | 0.022 | 0.042 | 0.026 | 0.275 | 0.820 | 0.013 | 0.017 | 0.072 |
| CD at 5% | NS | 1.612 | 1.677 | 0.066 | 0.125 | 0.076 | 0.807 | 2.406 | 0.039 | 0.050 | 0.212 |
| Nitrogen (N Kg/ha) | | | | | | | | | | | |
| 0 | 6.57 | 43.51 | 65.68 | 3.15 | 3.42 | 0.51 | 13.21 | 24.18 | 0.19 | 2.08 | 9.72 |
| 40 | 6.83 | 45.68 | 70.49 | 3.22 | 3.73 | 0.55 | 13.94 | 28.73 | 0.24 | 2.20 | 10.28 |
| 80 | 7.32 | 47.72 | 73.59 | 3.33 | 4.07 | 0.63 | 15.62 | 34.87 | 0.35 | 2.36 | 10.60 |
| 120 | 7.47 | 48.38 | 75.11 | 3.46 | 4.26 | 0.70 | 17.17 | 37.94 | 0.38 | 2.52 | 10.93 |
| SEm ± | 0.204 | 0.634 | 0.660 | 0.026 | 0.049 | 0.030 | 0.317 | 0.947 | 0.015 | 0.019 | 0.083 |
| CD at 5% | 0.705 | 1.862 | 1.936 | 0.076 | 0.144 | 0.088 | 0.932 | 2.778 | 0.045 | 0.057 | 0.245 |

DAS - Days after sowing

**Table 2. Effect of row spacing and nitrogen on yield, different yield and quality attributes of coriander**

| Treatments | Days to at 50 % flowering | No. of umbels/ plant | No. of umbellets/ plant | Test Weight (g) | Seed yield (q/ha ) | Straw yield (q/ha ) | Biological yield (q/ha) | Harvest index (%) | Chlorophyll contents in leaves (mg/g) | Essential oil contents of seed (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Row Spacing (cm) | | | | | | | | | | |
| 20 | 55.25 | 35.39 | 172.45 | 2.47 | 13.28 | 25.11 | 38.39 | 34.45 | 1.10 | 0.44 |
| 30 | 57.25 | 42.68 | 206.63 | 2.78 | 14.99 | 26.53 | 41.52 | 36.06 | 1.17 | 0.55 |
| 40 | 55.58 | 39.14 | 185.18 | 2.64 | 14.07 | 26.11 | 40.18 | 35.00 | 1.16 | 0.50 |
| SEm + | 0.533 | 0.677 | 3.289 | 0.032 | 0.231 | 0.165 | 0.290 | 0.426 | 0.010 | 0.021 |
| CD at 5% | 1.564 | 1.985 | 9.647 | 0.094 | 0.678 | 0.485 | 0.852 | 1.251 | 0.032 | 0.062 |
| Nitrogen (N Kg/ha) | | | | | | | | | | |
| 0 | 53.66 | 32.72 | 155.08 | 2.40 | 12.51 | 24.55 | 37.07 | 33.71 | 1.03 | 0.41 |
| 40 | 55.00 | 35.15 | 173.44 | 2.56 | 13.66 | 25.30 | 38.97 | 34.98 | 1.11 | 0.46 |
| 80 | 57.55 | 43.17 | 208.86 | 2.76 | 14.72 | 26.37 | 41.09 | 36.11 | 1.19 | 0.53 |
| 120 | 57.88 | 45.22 | 214.95 | 2.77 | 15.55 | 27.42 | 42.98 | 35.87 | 1.22 | 0.57 |
| SEm + | 0.615 | 0.781 | 3.798 | 0.037 | 0.267 | 0.119 | 0.335 | 0.492 | 0.012 | 0.024 |
| CD at 5% | 1.806 | 2.293 | 11.139 | 0.108 | 0.783 | 0.560 | 0.984 | 1.445 | 0.037 | 0.072 |



significantly improved days to 50 % flowering, number of umbels per plant, number of umbellate per plant, test weight and seed yield per plant, whereas, straw yield and biological yield were significantly higher at 120 kg N/ha. In general, the faster growth of plant with nitrogen evidence from increased biomass per plant at successive stages of crop growth showed better availability of metabolites and nutrients, which synchronized to the demand for the growth and development of reproductive structure of plant. The present trend of increased in seed yield, straw yield and biological yield of coriander with the application of nitrogen was in close conformity with the findings of Naghera *et al* (2000), Tripathi *et al* (2001) Nowak and Szemplinski (2011).

The result indicated that increasing level of nitrogen significantly improved chlorophyll content of leaves and essential oil of seed. This might be attributed to better nutritional environment in the root zone as well as in the plant system. The mark improvement in quality characters due to nitrogen is in close agreement with finding of Nehra *et al* (1998), Tripathi *et al* (2001).

## CONCLUSION

It may be conclude that the growth parameter such as plant height, number of branches/plant, fresh and dry weight of plants were significantly increased upto row spacing 30 cm and nitrogen level of 80 kg/ha. Yield and yield attributes also recorded similar trends. Even the chlorophyll content and essential oil content of seed were also highest at 30 cm row spacing and nitrogen levels of 80 kg/ha, which was at par with 120 kg/ha.

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