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Short Communication

Assessment of nitrogen application and row spacing on growth and yield attributes of coriander (*Coriandrum sativum* L.)

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Coriander (*Coriandrum sativum* L.) is one among the most significant spice crop belonging to the family Apiaceae. It is popularly referred to as *Dhania* or *Dhana*. Cilantro belongs to the Eastern Mediterranean region and Southern Europe. It is primarily used as a condiment to prepare curry powder, sausages, pickles, and seasonings. The leaves and tender shoots, due to their aroma, are used for culinary preparations and the seeds for oleoresins, essential oils, confectionaries, liquor and cosmetic industries. Coriander possesses medicinal properties as seeds have carminative, diuretic and stomachic properties. India is the largest producer, consumer and exporter of coriander in the World. The crop is predominantly cultivated in Rajasthan, Madhya Pradesh, Uttar Pradesh and Uttarakhand. As per the estimates of 2017-18, the total area under coriander in India is 665.19 thousand ha with the production of 866.8 thousand tonnes. (Anon 2017) Madhya Pradesh is the leading state in area and production of seed coriander with 277.41 thousand ha and 391.46 thousand tonnes production respectively (Spice Board 2019). The productivity of Coriander in Madhya Pradesh was 1.40MT/ha whereas Meghalaya had the highest 4.25 MT/ha. Nitrogen, a vital plant element has a considerable effect on quality and quantity of the produce. It is required for proper growth and development and involved in the process of photosynthesis, respiration and protein synthesis. The application of nitrogen enhances essential oil, fixed oil and total carbohydrate and soluble sugar content. It promotes vegetative growth by imparting green colour to the leaves and leads to a higher productivity. Nitrogen deficiency affects yield as it leads to leaf yellowing and shading and stunted growth. Excess application of nitrogen promotes vigorous & lanky shoot growth thus making plants susceptible to pest and diseases, lodging due to poor root development thus, delaying crop maturity. Coriander is a photosensitive crop where flowering is governed by photoperiod. It does not compete well with the weeds. Thus, these characteristics make nitrogen and row spacing critical issues for the crop. The objective of the present investigation was to evaluate the relative advantages of different row spacing and nitrogen application on yield and yield attributes of coriander.

The field experiment was carried out to compare the relative advantages of different doses of nitrogen (50, 60, 70, 80 and 90 kg/ha) and row spacing (30, 40 and 50 cm) in coriander cultivation with reference to morphological, phenological and yield attributes at Vegetable Research Centre, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during the *Rabi* season in 2018-19. The experiment was laid out in complete randomized block design with three replications. The seeds of coriander variety Jawahar Dhaniya 10 were sown in the 2nd week of November with a spacing of 30×10 cm. FYM was applied to the field before sowing seeds based on treatments and also phosphorus and potassium were applied as basal during final land preparation. Nitrogen is provided to the soil in two splits *i.e.* at 15 days after sowing and at the time of flowering initiation as the top dressing. The seeds (fruits) of coriander were split into two halves by rubbing and were soaked in water for 24 hours to enhance better germination. The seeds were treated with Bavistin at 2g/kg before sowing. All recommended intercultural operations and plant protection measures were followed as needed by the experiment to raise a successful crop. The application of Nitrogen and Phosphorus was done in the form of Urea and SSP, respectively. Irrigation to 5 cm depth applied during cropping period. Five random plants were selected from each plot excluding the border row for taking observation on growth and yield attributes. The recorded data were subjected to statistical analysis.

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The results presented in Table 1 revealed that among the combinations N3S3 (nitrogen 70 kg/ha with row spacing 50cm) recorded significantly higher values for plant height (109.65 cm) followed by N80S30 (108.09 cm) and minimum (81.88 cm) was recorded in N1S2 (Nitrogen 50 kg/ha with row spacing 40cm). The plant height of the coriander crop was influenced by different levels of nitrogen and different row spacing. The increment in the plant height may be due to a higher level of nitrogen as it leads to the production of more chlorophyll content, enhanced photosynthesis and phytohormones which were used by the plants during growth and development. These results are in close conformity with the finding of Bedse et al. (2013), Moosavi et al. (2013), Nowak and Szempliński (2011), and Patel et al. (2013). An increase in the plant height and density was due to an increase in the inter-plant competition over light and other environmental parameters (Imam and Ranjbar 2000). Number of primary branches increased with a higher dose of nitrogen and closer spacing. Maximum number of 7.40 primary branches were observed in N4S1 (nitrogen 50 kg/ha with row spacing 40cm) which was subsequently followed by N80S50 having 7.34 primary branches and minimum (5.37) was noted with the application of 50kg nitrogen/ha having row spacing of 40cm. An adequate supply of nitrogen under wider spacing leads to vigorous vegetative growth. It was observed that more number of primary branches per plant enhanced the seed yield. The increase in the number of branches may be attributed to more space available to the plant due to wider spacing. Profuse branching leads to a larger canopy that increases the absorption and utilization of solar energy, leading to higher photosynthates and improved growth and development. These attributes stipulate an improved yield potential of coriander. Similar results were obtained by Pawar et al. (2007), Patel et al. (2013), Shanu et al. (2013) and Yousuf et al. (2014).

Minimum days taken to 50% flowering (50.67) was observed in N1S3 (Nitrogen 50 kg/ha in row spacing 50 cm) and maximum (59.68) days taken to 50% flowering was enumerated with N5S1 (Nitrogen 90 kg/ha with row spacing 30 cm). A higher nitrogen level leads to higher C:N ratio which enhances vegetative growth and delays the reproductive growth. These results are in close proximity with the findings of Meena et al. (2013). The view was expressed that a successive increase in the spacing from S (30 × 10 cm) to S (50 × 10 cm) significantly improved various yield attributes of the crop; earliness, number of umbels plant^{-1}, number of umbellets plant^{-1}. The treatment combination of nitrogen 70 kg/ha with row spacing 40 cm showed earliness (92.89 days) whereas, the coriander crop grown in a combination with N60S40 took 98.65 days to mature.

Number of umbels per plant and seed yield improved due to closer spacing and a higher dose of nitrogen. The number of umbels (46.04) per plant was significantly higher for N80S30 and N90S50 (45.76) was at par. N50S30 recorded the lowest number of 29.52 umbels per plant. A substantial improvement in seed yield was due to vigorous plant growth and profuse branching due to higher nutrient uptake. The abundant branching induced heavy flowering and the metabolites helped in flower retention thus promoting seed formation and seed development. Wider spacing promoted better seed development due to appropriate supply of water and nutrients. The results so obtained are in conformity with the findings of Krishnamoorthy et al. (2000), Hans et

Table 1: Effect of different levels of nitrogen and row spacing on growth and yield parameters of coriander

Treatments	Plant height (cm)	Primary branches per plant	Days taken to 50% flowering	Days taken to maturity	No. of umbels/plant	Yield (q/ha)
N50S30	87.12	5.53	53.87	94.55	29.52	14.10
N50S40	81.88	5.37	51.31	93.01	32.13	11.12
N50S50	86.32	5.42	50.67	93.04	33.52	14.14
N60S30	87.65	6.04	55.54	96.57	33.31	11.52
N60S40	86.78	6.07	53.00	98.65	34.03	15.45
N60S50	97.21	6.92	58.32	93.01	36.88	11.41
N70S30	99.65	7.07	59.09	93.20	40.27	14.45
N70S40	102.66	7.14	56.77	92.89	40.30	15.12
N70S50	109.65	6.86	56.67	93.97	39.80	14.26
N80S30	108.09	7.40	55.79	96.59	46.04	15.51
N80S40	91.31	7.08	51.29	95.75	35.60	11.29
N80S50	93.28	7.37	57.12	96.69	35.89	13.21
N90S30	98.88	6.03	59.68	97.70	36.22	10.65
N90S40	93.99	5.94	55.63	97.83	40.87	6.74
N90S50	94.31	5.64	59.32	98.36	45.76	12.54
S.Em±	2.37	0.18	1.06	1.36	1.67	0.92
C.D.5% level	6.89	0.52	3.08	3.98	4.86	2.68

al. (2008) and Naruka et al. (2012). The maximum seed yield 15.51 q/ha were recorded in N4S1 (Nitrogen 80kg/ha with row Spacing 30cm) treatment followed by N60S40 (15.45 q/ha) and N70S40 (15.12 q/ha). Whereas, minimum seed yield was noticed in N90S40 (6.74 q/ha). Nitrogen application increased the supply of assimilates to the floral region of coriander crop thereby improving yield. The result observed is in close accordance with Gujar et al. (2005), Ghosh (2009), Nayak et al. (2009) and Javiya et al. (2017). An increase in the seed yield was due to the formation of strong sink and source activity. A boost in yield is characterized by better plant growth by virtue of better canopy development due to better use of solar radiation and higher photosynthesis. (Moosavi et al. 2013)

It may be concluded that coriander variety Jawahar Dhaniya-10 adequately responded to the different doses of nitrogen and varied spacing in terms of its morpho-phenological and yield attributes. For a better growth and yield of coriander, nitrogen dose of 80 kg/ha with closer spacing of 30 cm gave higher seed yield.

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