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Effect of different Nitrogen and Potassium Levels on Yield and yield attributes of Coriander (*Coriandrum sativum* L.)

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ABSTRACT: The studied was conducted during the *Rabi* season of 2019-20 at Vegetable Research Farm, Department of Horticulture, JNKVV, Jabalpur (M.P.). The treatment combinations consisting of three levels of nitrogen (70, 80 and 90 kg ha^{-1}) and four levels of potassium (0, 30, 40 and 50 kgha^{-1}) were replicated thrice. The highest yield and yield attributes were significantly observed in the treatment of nitrogen 90 kg ha^{-1} *viz.*, number of umbel plant^{-1}(17.71), number of umbellets umbel^{-1} (5.65), number of seeds umbel^{-1} (6.06), test weight (13.20g), seed yield plant^{-1} (5.72g), seed yield plot^{-1} (1.20kg), seed yield ha^{-1} (16.04q) and potassium 50 kg ha^{-1} *viz.*, number of umbels plant^{-1} (16.73), seed yield plant^{-1} (5.24g), seed yield plot^{-1} (1.16kg), seed yield ha^{-1} (15.56q) was obtained in coriander.

Keywords: Nitrogen, potassium, coriander, yield, yield attributes, etc.

INTRODUCTION

Coriander (*Coriandrum sativum* L.) a member of the Apiaceae family, was one of the first spices used by humans (Luaza *et al.*, 1996). The fresh green herb and the spice are the two main products of the coriander plant that are used as flavours. Both the odour and flavour of these two goods vary significantly. In Central and South America, the Middle East, and Asia, the herb is used to flavour food. Fruits are an important ingredient in curry powder (Ramadan *et al.,* 2002). Along with its fruits, its leaves are frequently used in raw or dried culinary applications. Its seed is used as a diuretic, refrigerant, and carminative in medicine. Vitamin C (135 mg/100 g), vitamin A (6918 g/100 g), and protein are all abundant in coriander leaves. Its leaves are employed to spice soups, sauces, and curries. Dry seeds contain 0.3-0.4% volatile oil, 19.6% non-volatile oil, 1.3% protein, and 24.6% carbs (Iwatani *et al.*, 2003). Herbal plants should be given the nutrients they need, especially those whose content in the soil is deficient, in order to produce a crop of good quality. The healthy development of plants is facilitated by the availability of these nutrients throughout the growing season, which also lessens the deficits of these nutrients in the soil (Radulov *et al.*, 2009). Vegetable production requires nitrogen (N) fertilization to provide adequate yield and superior quality. It participates in respiration, protein synthesis, carbohydrate synthesis, and photosynthesis. It gives the leaves a deep green hue and encourages rapid vegetative development; increased productivity may result from more effectively using the available nitrogen (Zhang *et al.*, 2015). Nitrogen is the most crucial primary nutrient for the growth and development of spice crops, while potassium (K) is the second-most critical nutrient element after that. In the formation of carbohydrates in spices and photosynthesis, potassium is known to be essential for the elongation of cells and probably for cell division in developing tissues (Sadanandan *et al.*, 1998). It is commonly known that potassium is necessary for both photosynthesis and the production of carbs in spices. Furthermore, it has been proven that potassium is necessary for the activation of more than 60 enzyme systems in plants. Potassium circulates readily in plants and is quite mobile, which is important for turgor pressure maintenance. It also supports a number of physiological processes. It improves the quantity and quality of spices (Sadanandan *et al.*, 1993).

MATERIALS AND METHODS

The experimental material for the present investigation was sown in a Factorial Randomized Block Design and it was comprised of thirteen treatments to observe growth and yield characters and estimate the economic viability. A representative sample of surface soil (0–15 cm depth) was collected from the experimental field before the start of the experiment and was analyzed. The soil characteristics of the experimental site were organic carbon (0.26%), available nitrogen (332.50 kg ha^{-1}), available phosphorus (42.85 kg ha^{-1}), available potash (312.08 kg ha^{-1}), soil pH 7.05, and electrical conductivity (m Mhos per cm) 0.16. Coriander seed was sown on 22nd November 2019 and harvested on the last week of March 2020. A basal dose of well-rotten farmyard manure @ 10tonnes ha^{-1} was incorporated into the soil before one month of sowing. In addition to this, a dose of 50 Kg P_2O_5 ha^{-1} through single super phosphate common to all plots was applied, and nitrogen and potassium were applied according to treatments. Potassium was applied as a basal dose through muriate of potash. Nitrogen was applied in two split doses. Half of the dose of nitrogen was applied as a basal and the remaining half was top-dressed 45 days after sowing. Nitrogen (basal) was applied through urea and top dressed through urea. The seeds (fruits) were rubbed to separate the two mericarps (seeds) and were soaked in water for 24 hours to enhance germination. The pure, healthy, disease and insect-free, vigorous, and good-quality coriander seed (Jawahar Dhaniya-10) 9.00 kg ha^{-1} was taken. The seed was cleaned, broken into two halves, and treated with carbendazim 50 WP (2 gm per kg seed). Seed was sown in furrows opened at 10 cm, keeping row spacing and covered with soil properly. All necessary intercultural operations were followed as needed by the experiment. Seed was harvested when half of the fruits on the plant changed from green to brown colour. To avoid the shattering of fruits during harvest, the seed plants were cut at the base by sickles in the early morning. Then the stalks with seed was dried in the sun. Seed was separated by beating with sticks, cleaned by winnowing, and dried properly up to 10% moisture of seed. To avoid the border effect, data on different parameters from five randomly selected plants from each treatment were collected and recorded in time from the inner rows of each plot.

RESULTS ANDDISCUSSION

Typically, coriander is produced for its seed and leaves. In order to meet the rising demand for coriander seed for use in confections, perfumes, and medicines, attempts are being made to boost the coriander plant's seed yield through breeding initiatives, fertilizer management, etc. Among the factors investigated, fertilization with nitrogen and potassium clearly affected the ability of coriander to produce yield as well as the differentiation of morphometric aspects of plants included in the evaluation. Additionally, greater metabolic activity at the cellular level and improved nutrient availability in the root zone may have enhanced nitrogen and potassium uptake. The findings of the current investigation concur with those of Rao *et al.* (1983). The increased N and P uptake caused by the application of potash is attributed to the higher seed and stover output. The medium availability of potassium in the soil is primarily responsible for the increase in potassium uptake by coriander seed and stover as a result of its treatment. Additionally, its use in deficient conditions enhanced its availability to the plants and thus, its beneficial impacts on the process of a plant's existence. The results were consistent with those in Coriander from Tripathi (2006) ; Tripathi *et al.* (2009).

Yield Parameters

Effect of nitrogen. Data on coriander yield components under the influence of nitrogen application show that increasing nitrogen levels significantly increased the number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of seed umbel^{-1}, test weight (g), seed yield plant^{-1}(g), seed yield plot^{-1}(kg) and seed yield ha^{-1}(q). The maximum yield (Application of nitrogen, 90 kg ha^{-1} was recorded as the maximum number of umbels plant^{-1} (17.71), umbellets umbel^{-1}(5.65), seeds umbel^{-1}(6.06), seed yield plant^{-1} (5.72g), seed yield plot^{-1} (1.20 kg), seed yield ha^{-1} (16.04 q) and yield attributes were recorded with the application of 90 kg N because nitrogen is considered to be a vitally important plant nutrient. In addition to its role in the formation of proteins, nitrogen is an integral part of chlorophyll, which is the primary absorber of light energy needed for photosynthesis. Besides these, it is also a constituent of certain organic compounds of physiological importance. This might be due to the increased vigour of plants at the flowering stage and the increased ability of yield attributes might have been attributed to enhancing the seed yield under higher nitrogen levels. These findings were corroborated by Baboo and Rana (1995);Amin *et al.* (2005); Ayub *et al.* (2011) in fennel, Sharma *et al.* (2016); Javiya *et al.* (2017); Diwan *et al.* (2018) incoriander. Therefore, increased endogenous levels of nitrogen in the plant as a result of increased availability in the soil medium and, subsequently, efficient absorption and translocation in growth via active cell division and elongation result in greater umbels plant^{-1}, number of seed umbel^{-1}, seed yield plant^{-1}(g) and seed yield ha^{-1}(q), as obtained by Moniruzzaman *et al.* (2014) in coriander.

Test weight (weight of 1000 seeds) showed a positive correlation with the increased levels of nitrogen N_{70} to N_{90}. The treatment nitrogen at 90 kg ha^{-1}recorded the highest weight of 1000 seeds (13.20 g). This might be due to the effect of nitrogen, achieved indirectly through an increase in the supply of assimilation to the floral parts. This suggests that the maintenance of a large and photosynthetically efficient leaf area during the period of flowering is increasing for producing the maximum weight of seeds. Similar results were observed by Hansraj and Thakral (2008) in Fennel, Singh *et al.* (2009); Javiya *et al.* (2017); Diwan *et al.*(2018) in Coriander.

Effect of potassium. Data regarding yield components of the coriander under the influence of P application indicates that increasing the level of potassium significantly increased the number of umbels plant^{-1}, seed yield plant^{-1}(g), seed yield plot^{-1}(kg), and seed yield (q ha^{-1}). Maximum yield and yield attributes were recorded with the application of 50 kg K. Because an adequate supply of potassium early in the plants life cycle is important in laying down the primordial of its reproductive part. It also increases the initiation of both first and second-order rootlets and their development. It was associated with stimulated root development, increased stalk and stem strength, improved flower formation and other yield attributes, more uniform and earlier crop maturity, improvements in crop quality, increased resistance to plant diseases, and photosynthetic efficiency. The extensive root system helps in exploiting the maximum nutrients and water from the soil. These result was in conformity with those reported by Mishra *et al.* (2018) in coriander. The highest growth metrics may be attributable to favourable agro-climatic circumstances throughout the crop growth period, which may have resulted in improved moisture and nutrient availability, which may have led to luxuriant growth due to better potassium availability, as observed by Solanki *et al.* (2017).

Table 1: Interaction Effects of Different Nitrogen and Potassium Doses on yield parameters of coriander.

Treatments	Number of umbel plant^{-1}	Number of Umbellets Umbel^{-1}	Number of Seeds Umbel^{-1}	Test weight (g)	Seed yield plant^{-1} (g)	Seed yield Plot^{-1} (kg)	Seed Yield ha^{-1} (q)
T_1-N_0K_0	11.33	5.14	5.40	11.96	3.56	0.82	10.97
T_2-$N_{70}K_0$	15.26	5.38	5.71	12.06	4.37	1.10	14.71
T_3-$N_{70}K_{30}$	15.66	5.48	5.82	12.10	4.55	1.11	14.88
T_4-$N_{70}K_{40}$	15.73	5.56	5.88	12.36	4.65	1.13	15.15
T_5-$N_{70}K_{50}$	15.93	5.57	5.98	12.56	5.00	1.15	15.37
T_6-$N_{80}K_0$	16.00	5.46	6.00	12.46	5.32	1.16	15.46
T_7-$N_{80}K_{30}$	17.20	5.58	6.04	13.11	5.54	1.17	15.69
T_8-$N_{80}K_{40}$	17.40	5.65	6.07	13.20	5.76	1.20	16.09
T_9-$N_{80}K_{50}$	18.53	5.73	6.08	13.30	5.86	1.22	16.35
T_{10}-$N_{90}K_0$	17.20	5.53	6.18	12.51	5.92	1.24	16.53
T_{11}-$N_{90}K_{30}$	19.33	5.96	6.22	13.34	6.29	1.25	16.66
T_{12}-$N_{90}K_{40}$	20.26	6.06	6.26	13.50	6.46	1.27	16.97
T_{13}-$N_{90}K_{50}$	18.60	5.85	6.23	13.31	6.06	1.25	16.75
S.Em.±	**0.48**	**0.11**	**0.14**	**0.22**	**0.35**	**0.06**	**2.73**
C.D. @%	**1.43**	**0.32**	**0.41**	**0.65**	**1.05**	**0.20**	**0.87**

Table 2: Effect of different nitrogen and potassium levels on yield parameters of coriander.

Treatments	Number of umbel plant^{-1}	Number of umbellets umbel^{-1}	Number of seeds umbel^{-1}	Test weight (g)	Seed yield plant^{-1}(g)	Seed yield plot^{-1} (kg)	Seed Yield ha^{1} (q)
Nitrogen doses (Kg ha^{-1})							
N_{70}	14.08	5.33	5.64	12.04	4.16	1.01	13.52
N_{80}	15.88	5.53	5.95	12.46	4.99	1.15	15.33
N_{90}	17.71	5.65	6.06	13.20	5.72	1.20	16.04
S.Em.±	**0.18**	**0.05**	**0.09**	**0.14**	**0.12**	**0.03**	**0.46**
C.D.@ 5%	**0.54**	**0.15**	**0.28**	**0.42**	**0.36**	**0.10**	**1.41**
Potassium doses (Kg ha^{-1})							
K_{30}	14.75	5.43	5.77	12.48	4.58	1.04	13.93
K_{40}	16.20	5.53	5.92	12.61	5.04	1.15	15.38
K_{50}	16.73	5.56	5.96	12.62	5.24	1.16	15.56
S.Em.±	**0.18**	0.05	0.09	0.14	**0.12**	**0.03**	**0.46**
C.D.@ 5%	**0.54**	NS	NS	NS	**0.36**	**0.10**	**1.41**

CONCLUSIONS

Based on the results of the study, it can be said that the coriander variety Jawahar Dhaniya-10 responded favourably in terms of yield and yield-attributing traits. In terms of yield and yield attributing features, the treatment combination $N_{90}K_{40}$ was determined to be much better. Accordingly, from the perspective of yield, it is determined that the coriander crop should be fertilized with a treatment combination of 90 kg N ha^{-1} and 40 kg K ha^{-1} in order to ensure increased yield.

FUTURE SCOPE

Coriander has to be studied for its response to various nutrient sources, both organic and inorganic. Water-soluble fertilizer applications to foliage should be investigated. Research should be conducted in the future to examine quality factors, including seed protein and essential oil content.

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Conflict of Interest. None.

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