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Effects of nitrogen levels on plant growth and leaf yield of off season coriander under shade nets

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Abstract

Present investigation was carried out on influence of nitrogen levels on plant growth and leaf yield of off season coriander cultivar Ajmer Green Coriander-1 (AGCr-1) under shade nets at ICAR-National Research Centre on Seed Spices, Ajmer, Rajasthan during 2015-16. The experiment comprised five levels of nitrogen (30, 40, 50, 60 and 70 kg N ha^{-1}) with four replications under randomized block design keeping plot size 3.0m x 2.5m. Observations with respect to seed germination, plant growth, leaf yield in each treatment were recorded. The crop was cut four times during the cropping season and computed the total yield of green leaves. Results revealed that plant height, number of leaves per plant, leaf size and yield of green biomass of coriander crop was influenced significantly with the application of nitrogen and increased upto 60 kg N ha^{-1} and then decreased. Maximum total leaf yield (2599 g $plot^{-1}$ and 6930.67 kg ha^{-1}) with other parameters at highest level was recorded under the application of 60 kg N ha^{-1} (N_4 treatment) as compared to minimum (1640 g $plant^{-1}$ and 4373.33 kg ha^{-1}) with lowest level of other parameters under the application of 30 kg N ha^{-1} (N_1 treatment).

Key words : Coriander, nitrogen, plant growth, yield of green leaves.

Introduction

Coriander (*Coriandrum sativum* L.), is one of the important earliest known seed spice crop used by mankind belongs to family Apiaceae. In India, this is mainly cultivated in the arid and semi-arid tracts of Rajasthan, M.P., Gujarat and Andra Pradesh (Lal *et al*., 2012). Annually, it is grown in about 5,52,300 hectares area producing about 4,62,620 tonnes (Anonymous, 2016). Rajasthan state being largest producer, contributes more than 65 per cent of its total production. Average national productivity of this crop is still remaining very low (838 kg ha^{-1}). The coriander leaves are used as appetizer in preparing fresh chutneys and sauces and to flavour food, curries, soups, fish sauce, etc. and seeds are used in cakes, soups, sausage, pickles, curries, etc. Coriander seeds are also used in preparation of medicines (Sharma and Sharma, 2004). There is a regular demand of green coriander leaves throughout the year and especially in off season the price is high in market due to low supply. Coriander plants are highly sensitive to the abrupt variations in climatic parameters as it is delicate in nature. Therefore, off (summer) season crop in ambient temperature is prone to affect negatively by high temperature, loss in quantity as well as quality of this valuable crop to a limit of 100% could be there. In extreme climates or at high temperature during the months of April to July the crop cannot survive in open conditions. By growing under protected structures/ shade nets, this crop can be produced easily for the green leaf purpose and one can fetch more income. Shade nets are the second most widely used protected cultivation method in the country. It is well known that extreme climate especially high temperature in summer season is not conducive for the growth and development of coriander and fenugreek plant resulting into very less or sometimes no yield. Raising of these crops under protection of shade nets is beneficial, as the shade nets provide partial shade to the crop with reduction of temperature inside resulting into better plant growth and development, which consequently increased the foliage yield during off season. Nitrogen is the major nutrient that affects plant growth, yield and quality of the produce. Nitrogen deficiency decreases leaf size and photosynthetic rate and consequently radiation interception and use efficiency (Massignam *et al*., 2009). Adequate soil nitrogen availability is necessary to achieve better plant growth and yield, however excessive levels can decrease the plant growth and development. Hence, accurate nitrogen application is required. Application of nitrogen encourages vegetative growth which resulted in the increased yield of leaves and seeds of coriander (Datta *et al.,* 2008). To have consistently higher yield of quality produce of the leafy type coriander varieties, standardization of nitrogen requirement under shade nets during off season is very much pertinent. Hence, the present study was undertaken to find out the optimum dose of nitrogen for higher leaf yield of coriander.

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Materials and methods

A field investigation on the influence of nitrogen levels on plant growth and leaf yield of off season coriander cultivar Ajmer Green Coriander-1 (AGCr-1) under shade nets was carried out during 2015-16. The experiment comprised five levels of nitrogen (30, 40, 50, 60 and 70 kg N ha^{-1}) with four replications under randomized block design keeping plot size 3.0m x 2.5m. The soil of the experimental plot was sandy loam, with low organic carbon and nitrogen, medium in available phosphorus and sufficient in available potassium. Water holding capacity of the soil is low due to sandy nature, requires frequent application of irrigation. Hence, the irrigation was applied through drip system to increase the water use efficiency. Coriander cultivar AGCr-1 was sown in the walk-in-tunnels of green shade nets (50% shade) at 15 cm row to row spacing using 20 kg seed ha^{-1}. Plant to plant spacing was kept at 05 cm. One third of nitrogen through urea (46% N) was applied at the time of field preparation as basal dose. The remaining quantity was divided into three parts and each part was applied just after first, second and third number of leaf cutting as top dressing. Intercultural operations in the field were followed as standard agricultural practices to raise the healthy coriander crop. Observations with respect to seed germination, plant growth, leaf yield in each treatment were recorded. Four cuttings were taken to harvest the green crop and calculated the total yield. First cutting was done after 48 days of sowing and the subsequent cuttings were taken after each 15 days interval. The data were statistically analysed as per the method suggested by Panse and Sukhatme (1985).

Results and discussion

Seed germination

Results of the present investigation revealed that number of days to germination initiation after seed sowing were not influenced significantly with the application of nitrogen doses. However, number of days to completion of seed germination affected significantly (Table-1). It is inferred from this study that seed germination speed of AGCr-1 coriander was lower at lower doses of nitrogen and then it increased at medium doses and again it decreased at higher doses of nitrogen. The germination process completed earliest in 10.50 days after sowing (DAS) with the application of 40 kg N ha^{-1} (N_2 treatment) while it was latest in 11.75 DAS under application of 70 kg N ha^{-1} (N_2 treatment). Increased plant height due to higher levels of N and K might be due to the production of more chlorophyll, photosynthesis, phyto-hormones etc. which are utilized by the plant during growth and development resulting cell elongation. It corroborates the findings of Raghavaiash *et al.* (1985), Bhati (1998) and Pawar *et al.* (2007).

Vegetative growth

It is clear from this study (Table 1) that the plant height of coriander crop was influenced significantly with the application of nitrogen. It was increased upto 60 kg N ha^{-1} and then decreased. The maximum plant height (22.49 cm) at the time of first cutting was recorded with the application of 60 kg N ha^{-1} as compared to minimum (16.00 cm) under 30 kg N ha^{-1} treatment. Similarly, number of leaves per plant at the time of first cutting increased with the increasing doses of nitrogen upto 60 kg N ha^{-1} and then it decreased. The maximum number of leaves (23.43 $plant^{-1}$) were recorded under 60 kg N ha^{1} (N_4 treatment) as compared to lowest (18.28 $plant^{-1}$) under 30 kg N ha^{-1} (N_1 treatment). Adequate supply of nitrogen plays vital role in various metabolic processes which resulted in increased flowering and fruiting thereby improving umbels per plant due to favourable effect of these nutrients on growth parameters. Increase in plant height, leaf size due to increasing levels of N had direct and positive effect on biological yields of AGCr-1 coriander. These results are in corroboration of the findings of Patel *et al.* (2003) in fennel and Sherin & Ahuja (2009) in cluster bean.

Leaf characters

It is inferred from data presented in Table 2 that application of nitrogen to coriander crop influenced leaf size, number of basal leaves per plant and number of leaflets per leaf. These parameters increased with increasing levels of nitrogen upto 60 kg N ha^{-1} and reduced at higher dose. Maximum number of basal leaves (12.65 $plant^{-1}$) and number of leaflets (8.00 leaf-1) with longest first leaf (16.87 cm), second leaf (14.22 cm) recorded under the application of 60 kg N ha^{-1} as compared to minimum number of basal leaves (8.75 $plant^{-1}$) and leaflets (5.50 $plant^{-1}$) with smallest fist leant (12.42 cm), second leaf (10.08 cm) under the application of 30 kg N ha^{-1}.

Leaf yield

Findings of our study again revealed that green leaf yield of AGCr-1 coriander was influenced significantly with the application of nitrogen. There were four number cuttings performed at different times and collectively taken into consideration to compute total yield. Maximum leaf yield per plot was recorded in first cutting irrespective of treatments applied and then after, it decreased with the advancement of age of the plants and number cuttings and the minimum was recorded in fourth cutting. It is obvious from the findings (Table 3) that leaf yield increased with increasing levels of nitrogen upto 60 kg N ha^{-1} and then it decreased. Maximum total leaf yield (2599 g $plot^{-1}$ and 6930.67 kg ha^{-1}) was recorded with the application of 60 kg N ha^{-1} (N_4 treatment) as compared to minimum (1640 g $plant^{-1}$ and 4373.33 kg ha^{-1}) with the application of 30 kg N ha^{-1}(N_1 treatment).

Table 1. Effect of different nitrogen levels on germination and plant height of AGCr-1 coriander under shade nets.

Treatment	No. of days to germination initiation	No. of days to final germination	Plant height at harvest (cm)	No of leaves plant^{-1}
N_1	7.75	11.00	16.00	18.28
N_2	7.50	10.50	18.55	20.53
N_3	7.25	10.75	19.16	22.40
N_4	7.50	11.00	22.49	23.43
N_5	7.50	11.75	20.81	22.50
S Em±	0.30	0.33	1.09	0.66
CD (*P=0.05*)	0.92	1.02	3.36	2.03
CV %	7.98	6.04	11.24	6.14

Table 2. Effect of different nitrogen levels on leaf characters of AGCr-1coriander under shade nets.

Treatment	1st leaf length	2nd leaf length (cm)	No. of Basal leaves plant^{-1}	Leaflet plant^{-1}
N_1	12.42	10.81	8.75	5.50
N_2	13.94	11.76	9.83	6.00
N_3	15.08	13.55	11.30	7.25
N_4	16.87	14.22	12.65	8.00
N_5	15.86	13.37	11.60	7.50
S Em±	0.81	0.71	0.59	0.57
CD (*P=0.05*)	2.49	2.19	1.81	1.77
CV %	10.89	11.13	10.84	16.75

Table 3. Effect of nitrogen levels on leaf yield of AGCr-1 coriander under shade nets.

Treatment	1st cutting yield plot^{-1} (g)	2nd cutting yield plot^{-1} (g)	3rd cutting yield plot^{-1} (g)	4th cutting yield plot^{-1} (g)	Leaf yield (g plot^{-1})	Leaf yield (kg ha^{-1})
N_1	638.25	393.75	420.75	187.25	1640.00	4373.33
N_2	748.75	433.50	482.25	193.50	1858.00	4954.67
N_3	886.50	516.75	549.00	275.00	2227.25	5939.33
N_4	911.75	667.25	696.00	324.00	2599.00	6930.67
N_5	907.50	615.00	563.00	313.50	2399.00	6397.33
S Em±	96.86	51.21	37.51	34.95	107.16	285.75
CD (*P=0.05*)	298.46	157.80	115.58	107.70	330.18	880.48
CV %	23.67	19.50	13.84	27.03	9.99	9.99

Nitrogen is so vital because it is a major component of chlorophyll, which is the site of carbohydrate formation (photosynthesis). It is also a major component of amino acids, the building blocks of proteins. Without proteins, plants wither and die. Some proteins act as structural units in plant cells while others act as enzymes, making possible many of the biochemical reactions on which life is based. Nitrogen is a component of energy-transfer compounds, such as ATP (adenosine triphosphate). ATP allows cells to conserve and use the energy released in metabolism. Finally, nitrogen is a significant component of nucleic acids such as DNA, the genetic material that allows cells (and eventually whole plants) to grow and reproduce. Without nitrogen, there would be no life as we know it (Anonymous, 2016). Nitrogen fertilization increases leaf size enhancement, which resulted in an increase in rededication interception by the crop. Balanced supply of nutrients plays a vital role in various metabolic processes, which resulted in increased plant growth and development thereby improving yield. These processes might be

favourably improved with readily available nitrogen through inorganic chemical fertilizers and finally resulted in higher yield and harvest index. Bhati *et al.* (1988) recorded similar findings at higher level of N in fennel and Diovisalvi *et al.* (2016) in sunflower. Patel *et al*. (2000) also reported higher yield with RDN applied through fertilizers in fennel.

Conclusion

From the results and discussion of this investigation, it is concluded that application of 60 kg nitrogen per hectare found most suitable for maximization of seed germination speed, plant growth and green leaf yield of AGCr-1 coriander under off season cultivation with the help of green shade nets (50% shade) in arid and semi-arid conditions of Rajasthan.

References

Anonymous. 2016. http://www.cropnutrition.com/efu-nitrogen#overview.

Bhati, D. S. 1998. Effect of nitrogen application and row spacing on coriander production under irrigated condition in semi-arid Rajasthan. *Indian J. Agric. Sci*., 58: 568-569.

Datta, S., Alam, K. and Chatterjee, R. 2008. Effect of different levels of nitrogen and leaf cutting on growth, leaf and seed yield of coriander. *Indian J. Hort.* 65(2): 201-203.

Diovisalvi, N., Reussi Calvo, N., Divito, G., Izquierdo, N., Echeverrfa, H. E. and Garcia, F. 2016. Can we improve nitrogen management for sunflower? Better Crops with Plant Food: A Publication of International Plant Nutrition Institute, Parkway Lane, Suite 550, Peachtree Corners, Gorgia.

Lal, G., Vashisth, T., Mehta, R. S. and Ali, S. F. 2012. Studies on different organic modules for yield and quality of coriander (*Coriandrum sativum* L.). *Int. J. Seed Spices* 2 (1): 1-6.

Massignam, A. M., Chapman, S. C., Hammer, G. L., Fukai, S. 2009. Physiological determinants of maize and sunflower grain yield as affected by nitrogen supply. *Field Crops Res.* 113(3): 256-267.

Panse, V. G. and Sukhatme, P. V. 1985. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi.

Patel, B. S., Amin, A. U., Patel, K. P. and Patel, M. M. 2003. Influence of organic manures or in combination with inorganic fertilizers on productivity of winter drilled fennel (*Foeniculum vulgare). Indian J. Agron*. 48(3): 232-234.

Patel, B. S., Patel, K. P., Patel, I. D. and Patel, M. 2000. Response of fennel (*Foeniculum vulgare)* to irrigation, nitrogen and phosphorus. *Indian J. Agron.* 45: 429-432

Pawar, P. M., Naik, D. M., Damodhar, V. P., Shinde, V. N. and Bhalerao, R.V.L. 2007. Influence of graded levels of spacing and nitrogen on growth and yield of coriander (*Coriandrum sativum* L.). *The Asian J. of Hort*., 2(1): 58-60.

Raghavaiash, V. R., Reddy, P. S., Rao, D. S. K. and Ramaiash, K. 1985. Response of coriander varieties to nitrogen fertilization. *South Indian Hort.,* 33: 341-343.

Sharma, M. M. and Sharma, R. K. 2004. Coriander. In Handbook of herbs and spices. Vol. 2 (ed.) Peter K. V. Woodhead Pub. Abington Hall, Abington Cambridge CBI 6AH, England. Pp.145-161.

Sherin, S. and Ahuja, S. 2009. Effect of organic and inorganic fertilizers on yield and yield attributes of cluster bean. *Field Crop Abs.* 62: 596.

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