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EFFECT OF NITROGEN LEVEL AND LEAF CUTTING FREQUENCY ON FOLIAGE AND SEED YIELDS OF CORIANDER

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Abstract

A field experiment was conducted at BSMRAU farm, Gazipur to evaluate the effects of four nitrogen levels (0, 40, 80 and 120 kg/ha) and four levels of leaf cutting (no cutting, one cutting at 30 DAS), two cuttings at 30 & 45 DAS and three cuttings at 30, 45 & 60 DAS) on three genotypes of coriander (*Coriandrum sativum* L.) (CS001, CS002 and CS003). The genotype CS003 produced the highest foliage yield (8.92 t/ha) and the genotype CS001 gave the highest seed yield (0.93 t/ha). The maximum foliage and seed yields were obtained from the N application at 80 kg N/ha. The maximum foliage yield (11.21 t/ha) was recorded with the three cuttings, but the highest seed yield was noted with the one cutting (1.06 t/ha). The 80 kg N/ha coupled with three cuttings gave the top most foliage yield while the same rate accompanied with one cutting gave the top most seed yield for all genotypes.

Keywords: Nitrogen, leaf cutting, green leaf, seed yield, coriander, *Coriandrum sativum* L.

Introduction

Coriander (*Coriandrum sativum* L.*)* in Bangladesh is an important spice crop grown in *rabi* season and it is known as 'dhonia'. The young plant of coriander is used as appetizer in preparing fresh chutneys and sauces and leaves are used to flavour food, curries, soups, fish sauce, etc. and seeds are used in cakes, soups, sausage, pickles, curries, etc. (Janardhanan and Thoppil, 2004; Tiwary and Agarwal, 2004). Coriander seeds are also used in preparation of medicines (Sharma and Sharma, 2004). Two types of genotypes are available in respect of seed and foliage production purposes. Some genotypes are exclusively cultivated for seed purposes and some are cultivated for seed as well as foliage (leaf) production. The later is called dual purpose genotype. In Bangladesh, seed purpose varieties as well as dual purpose varieties are imported from foreign countries.

Leaf cutting and nitrogen application have been reported to increase the number of branches and umbels per plant which in turn increased the yield of leaves and seeds in coriander (Thakral *et al.* 1992; Tiwari *et al*., 2002). Application of nitrogen encourages vegetative growth which resulted in the increased yield of

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leaves and seeds of coriander (Datta *et al.* (2008). The present study was undertaken to find out the optimum dose of nitrogen for higher leaf and seed yield and to determine the frequency of leaf cutting in relation to leaf and seed yield of coriander.

Materials and Method

The experiment was conducted at the research farm of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur (AEZ-28) during November 2009 to May 2010. The experimental field comprised with the Piedmont plain soil having medium loamy to moderately fine texture (sandy clay loam). The soil was poor in organic matter (1.91%) and moderately acidic (pH 5.90). The total N, available P, exchangeable K, available S and B in soil were 0.079%, 30.77 ppm, 0.35 meq/100 g soil, 13.4 ppm and 0.31 ppm, respectively.

The experiment was laid out in a split-split plot design with three replications having three genotypes (CS001, CS002 and CS003) in main plots, four nitrogen levels (0, 40, 80 and 120 kg/ha) in sub-plots and four levels of leaf cutting (No cutting, one cutting at 30 DAS, two cuttings at 30 and 45 DAS and three cuttings at 30, 45 and 60 DAS) in sub-sub plots. The coriander genotypes were collected from Siddique Bazzar, Dhaka. The unit plot size was 3 x 1 m. The first and the second leaf cutting were done 4 cm above the ground leaving the terminal bud during the third cutting the suitable leaves are cut.

The land was fertilized @ 5 t cowdung, 40 kg P, 40 kg K and 20 kg S per hectare. Full amount of cowdung, TSP, MOP and gypsum was added as basal application. One- half of urea was applied during final land preparation and the rest of the urea was applied in three equal instalments after each cutting as top dress. The seeds (fruits) were rubbed for separating the two mericarps (seeds) and were soaked in water for 24 hours to enhance germination. Seed were also treated with Bavistin at 2g per kg of seeds before sowing. The seeds were sown in 20 cm apart lines continuously by hand @ 30 kg/ha. Sowing was done on November 9, 2009. First and second weedings were done after 25 and 60 days after sowing, respectively. Plant thinning was done at 25 DAS maintaining 10 cm distance between plants. Irrigation was done at 30, 45, 60 and 85 days after sowing. Malathion @ 1.5 ml/l was sprayed during fruiting stage to reduce the attack of aphid.

Harvesting of leaves was done at 30, 45 and 60 days after sowing. Seeds were harvested when half of the fruits on the plant changed from green to brown colour (Singhania *et al*. 2006). Seeds were dried in the sun to attain 10% moisture.

Data were recorded umbels/plant, umbelletes/plant, seeds/umbel, 1000-seed weight (g), stover yield and seed yield (t/ha). Plot yield was converted to per

hectare yield. The data were analyzed statistically by MSTAT-C Program and mean comparison was done following the Duncan Multiple Range Test (DMRT).

Results and Discussion

Data on effects of genotypes, N levels and leaf cutting frequency have been shown in Tables 1-5.

Effect of genotypes: Umbels/plant (33.1), umbellates/umbel (5.47) and seeds/umbel (20.52) were found highest with CS001 followed by CS002 and then CS003 (Table 1). The CS002 gave the maximum 1000-seed weight (11.7 g) compared to other genotypes. The genotypes CS001 and CS003 gave the identical result in respect of 1000-seed weight. The genotype CS003 produced the highest foliage yield (8.92 t/ha) and the CS001 did the lowest (6.95 t/ha). The highest seed yield was recorded from CS001 (0.93 t/ha) followed by CS002 (0.89 t/ha) and then CS003 (0.79 t/ha). The genotype CS003 produced the higher stover yield (1.95 t/ha) and the CS001 and CS002 gave an identical yield (1.36 t/ha).

Effect of nitrogen level: Application of 80 kg N/ha produced the highest umbellates/umbel (5.75) followed by 120 kg N/ha (Table 1). The maximum seeds/umbel was recorded at both 80 and 120 kg N/ha (21.3) followed by 40 kg N/ha (20.3). The highest 1000-seed weight was obtained from the application of 80 kg N/ha. The yield of foliage increased progressively with the increase of N levels up to 80 kg N/ha beyond which it declined (Table 1). Similar trend was observed with N application at 80 kg N/ha (1.11 t/ha). Higher rate of N application (120 kg/ha) was not beneficial in respect of seed yield as it produced more vegetative growth and less reproductive growth. Thakral *et al.* (1992) reported the highest number of umbels/plant and seed yield (15.98 q/ha) at 60 kg N/ha and the highest green leaf yield at 90 kg N/ha. Datta *et al*. (2006) observed that number of umbels/plant, number of seeds/umbel green leaf yield and seed yield increased significantly up to 60 kg N /ha. The stover yield due to 80 and 120 kg N/ha was statistically similar (Table 1).The N control treatment for all parameters showed the lowest results.

Effect of leaf cutting frequency: Umbels/plant (36.5), umbellates/umbel (5.70) and seeds/umbel (24.3) were recorded as the highest from one cutting (C_1) followed by no cutting (C_0) and their lowest values were obtained from three cuttings (C_3). The 1000-seed weight was not influenced by cutting frequency. The yield of foliage increased with the increasing frequency of cuttings (Table 1). The significantly maximum foliage yield (11.21 t/ha) was obtained from three cuttings (C_3) and the minimum (9.24 t/ha) from one cutting (C_1). This result is in agreement with Thakral *et al.* (1992) and Datta *et al.* (2008) in coriander. The maximum seed yield was obtained from one cutting (C_1) (1.06 t/ha) followed by

Table 1. Effect of genotypes, nitrogen levels and leaf cutting frequency on yield attributes of coriander.

Factor	Umbels / plant (no.)	Umbellates /umbel (no.)	Seeds /umbel (no.)	1000 -seed weight (g)	Foliage yield (t/ha)	Dry seed yield (t/ha)	Stover yield (t/ha)
Genotype							
CS001	33.13 a	5.47 a	20.52 a	10.88 b	6.95 c	0.93 a	1.36 b
CS002	29.52 b	5.20 b	19.96 b	11.74 a	7.35 b	0.89 b	1.36 b
CS003	26.82 c	5.03 c	18.69 c	10.85 b	8.92 a	0.79 c	1.95 a
Nitrogen levels							
N_0	20.63 c	4.64 d	16.09 c	10.87 d	4.99 d	0.49 d	1.02 c
N_1	28.88 b	4.92 c	20.28 b	11.23 b	7.40 c	0.83 c	1.47 b
N_2	34.81 a	5.75 a	21.26 a	11.34 a	10.07 a	1.11 a	1.87 a
N_3	34.97a	5.63 b	21.26 a	11.19 c	8.49 b	1.06 b	1.88 a
Cutting frequency							
C_0	31.46 b	5.48 b	21.69 b	11.16	0.00 d	0.97 b	1.68 b
C_1	36.48 a	5.70 a	24.26 a	11.16	9.24 c	1.06 a	1.94 a
C_2	25.92 c	5.25 c	19.91 c	11.15	10.51 b	0.81 c	1.46 c
C_3	25.23 d	4.51 d	13.03 d	11.18	11.21 a	0.65 d	1.14 d
CV (%)	4.60	3.25	5.41	2.62	3.00	6.87	9.14

Means showing different letters are significantly different at 5% level of probability by DMRT

N_0 = 0 kg/ha, N_1 = 40 kg/ha, N_2 = 80 kg/ha and N_3 = 120 kg/ha

C_0 = No foliage cutting

C_1 = One foliage cutting at 30 DAS

C_2 = Two foliage cutting at 30 DAS (except terminal portion) and 45 DAS

C_3 = Three foliage cutting at 30, 50 (except terminal portion) and 60 (only the suitable leaves) DAS

Table 2. Interaction effect of nitrogen levels and foliage cutting on yield and yield attributes of coriander.

Treat. comb.	Umbels/plant (no.)			Umbellates/umbel (no.)			1000-seed weight (g)		
	CS001	CS002	CS003	CS001	CS002	CS003	CS001	CS002	CS003
N_0C_0	23.20 h	21.50 g	20.80 g	5.03 f	4.80 ef	4.72 gh	10.70 f	11.37f	10.63f
N_0C_1	26.91 fg	24.94 f	24.13 ef	5.40 e	4.99 d	4.91 ef	10.73ef	11.27g	10.60f
N_0C_2	16.02 i	17.63 h	17.05 h	4.83 g	4.66 f	4.56 h	10.60 g	11.30fg	10.53g
N_0C_3	18.55 i	17.20 h	16.64 h	4.16 i	3.84 h	3.76 j	10.80 e	11.33fg	10.70e
N_1C_0	32.01 d	29.70 e	28.70 c	5.50 e	5.09 d	4.98 e	10.93cd	11.93bc	10.80d
N_1C_1	37.13 b	34.41 d	36.19 a	5.72 d	5.29 c	5.19 d	10.90d	11.90bcd	10.83d
N_1C_2	26.24 g	24.33 f	25.58 d	5.11 f	4.94 de	4.76 fg	10.87d	11.93bc	10.93c
N_1C_3	25.61 g	23.74 f	22.96 f	4.40 h	4.08 g	3.98 i	10.93cd	11.87cd	10.97c
N_2C_0	34.80 c	44.50 b	31.20 b	6.29 b	5.81 b	5.69 b	11.00c	11.97b	11.10b
N_2C_1	40.36 a	51.62 a	36.19 a	6.51 a	6.04 a	5.93 a	11.10a	12.05a	11.17a
N_2C_2	28.53 e	36.49 c	25.57 d	5.87 cd	5.64 b	5.52 c	11.07ab	12.04a	10.97c
N_2C_3	27.84 ef	35.61 cd	24.95 de	5.03 f	4.65 f	4.55 h	11.08ab	12.07a	10.73e
N_3C_0	35.17 c	44.60 b	31.30 b	6.30 b	5.82 b	5.70 b	10.90d	11.73e	10.83d
N_3C_1	40.43 a	51.65 a	36.25 a	6.50 a	6.03 a	5.95 a	10.77ef	11.83d	10.93c
N_3C_2	28.50 e	36.55 c	25.60 d	5.90 c	5.69 b	5.50 c	10.93cd	11.73e	10.93c
N_3C_3	29.37 ef	35.66 cd	26.00 d	4.99 fg	5.83 b	4.89 efg	10.90d	11.73e	11.00c
CV (%)		4.60			3.25			2.62	

Means showing different letters are significantly different at 5% level of probability by DMRT

N_0 = 0 kg/ha, N_1 = 40 kg/ha, N_2 = 80 kg/ha and N_3 = 120 kg/ha

C_0 = No foliage cutting, C_1 = One foliage cutting at 30 DAS, C_2 = Two foliage cuttings at 30 DAS (except terminal portion) and 45 DAS

C_3 = Three foliage cutting at 30, 45 (except terminal portion) and 60 (only the suitable leaves) DAS

Table 2. contd.

Treatment combination	Foliage yield (t/ha)			Seed yield (t/ha)		
	CS001	CS002	CS003	CS001	CS002	CS003
N_0C_0	0.00 l	0.00 k	0.00 l	0.60 i	0.54 i	0.45 j
N_0C_1	5.70 k	5.76 j	6.31 k	0.55 i	0.53 i	0.52 i
N_0C_2	6.06 j	6.16 i	7.77 j	0.49 j	0.48 i	0.43 j
N_0C_3	6.70 i	6.77 h	8.69 i	0.41 k	0.52 i	0.42 j
N_1C_0	0.00 l	0.00 k	0.00 l	0.89 f	0.91 ef	0.81 e
N_1C_1	7.41 h	9.31 g	9.76 h	1.03 e	1.03 d	0.90 d
N_1C_2	8.61 f	10.43 e	11.27 g	0.87 f	0.81 g	0.65 g
N_1C_3	8.71 f	10.90 d	12.42 e	0.77 g	0.53 i	0.72f
N_2C_0	0.00 l	0.00 k	0.00 l	1.37 b	1.32 b	1.19 b
N_2C_1	11.77 c	11.01 d	13.75 d	1.45 a	1.42 a	1.30 a
N_2C_2	13.19 b	12.05 b	15.68 b	1.11 d	1.22 c	0.95 d
N_2C_3	14.24 a	12.55 a	16.64 a	0.70 h	0.65 h	0.70 fg
N_3C_0	0.00 l	0.00 l	0.00 l	1.27 c	1.25 c	1.11 c
N_3C_1	8.02 g	10.01 f	12.02 f	1.42 ab	1.32 b	1.22 b
N_3C_2	9.91 e	11.08 d	13.85 d	1.05 de	0.95 e	0.70 fg
N_3C_3	10.85 d	11.64 c	14.44 c	0.91 f	0.89 f	0.58 h
CV (%)		3.00			6.87	

Means showing different letters are significantly different at 5% level of probability by DMRT
N_0 = 0 kg/ha, N_1 = 40 kg/ha, N_2 = 80 kg/ha and N_3 = 120 kg/ha
C_0 = No foliage cutting
C_1 = One foliage cutting at 30 days after sowing (DAS)
C_2 = Two foliage cuttings at 30 DAS (except terminal portion) and 45 DAS (except terminal portion)
C_3 = Thrice foliage cuttings at 30, 45 DAS and 60 DAS (only suitable leaves)

no cutting (0.97 t/ha) and the lowest seed yield was recorded from three cuttings at 30, 45 and 60 DAS (C_3). The single cutting (30 DAS) did not affect the vegetative and reproductive growth that resulted in the highest seed yield. The plants of no cutting had a lot of leaves at the basal portion of the stems; these older leaves actually acted as sink that reduced the seed yield. This finding also corroborates with the findings of Thakral *et al.* (1992). On the contrary, Datta *et al.* (2008) obtained significantly higher seed yield from no cutting compared to one cutting. Tiwari *et al*. (2002) observed the highest number umbels per plant and the highest seed yield with two leaf cuttings. Rema *et al*. (1997) reported that once leaf plucking at 50 DAS did not significantly reduce seed yield compared to the control treatment. In case of stover yield similar trend was also observed with cuttings where one cutting (C_1) produced the maximum stover yield (1.94 t/ha) significantly compared to other cuttings.

Interaction effect of nitrogen levels and foliage cutting: For all genotypes, the maximum umbels/plant was recorded from N_3C_1 closely followed by N_2C_1 and N_1C_1 in CS003. The second highest umbels/plant was obtained from N_3C_0 closely followed by N_2C_0. The maximum number of umbellates/umbel was obtained from N_2C_1 closely followed by N_3C_1 in each genotype. The N_3C_1 and N_2C_1 gave the identical second maximum umbellates/umbel. The maximum 1000-seed weight was obtained from N_2C_1 closely followed by N_2C_2 and N_2C_3 in CS001 and CS002 except CS003. The N_3 treatment failed to give the maximum 1000-seed weight irrespective of cutting treatments in all genotypes. The maximum foliage yield was obtained from N_2C_3 in CS001 (14.2 t/ha), CS002 (12.6 t/ha) and CS003 (16.6 t/ha). The N_3C_3 was unable to give the highest foliage yield probably due to non utilization of the whole nitrogen. The second highest foliage yield was recorded from N_2C_2 in all genotypes followed by N_3C_3 in CS002 and CS03 and by N_2C_1 in CS001. The result was in close conformity with Thakral *et al.* (1992). But the result differed from Datta *et al*. (2008) who obtained the maximum leaf yield from the interaction of 90 kg N/ha and two leaf cuttings. The combination N_2C_1 produced the maximum seed yield in all genotypes, highest in CS001. In CS001, N_2C_1 and N_3C_1 gave the identical seed yield. The second highest seed yield was recorded from N_2C_1. The lowest yield was noticed in N_0C_3. Although the combinations of N_3C_1 and N_2C_1 showed identical results with regard umbels/plant and umbellates/umbel, N_3C_1 failed to give the maximum 1000-seed weight compared to N_2C_1. For this reason the N_3C_1 combination gave lower yield (1.32 t/ha. Thakral *et al.* (1992) reported that significantly the highest yield of seeds was obtained from the application 60 kg N/ha with one leaf cutting in coriander.

From the investigation, it appears that the response of coriander crop to nitrogen levels and leaf cuttings was fairly well in terms of the production of foliage (green leaves) as well as seed in Salna areas (AEZ-28). It was evident that the

application of 80 kg N/ha with two cuttings of foliage at 30 and 45 DAS was the most suitable for coriander cultivation. Application of 80 kg N/ha with one cutting of foliage at 30 DAS might also be advocated for coriander production for foliage as well as seed.

References

Datta, S and P. Choudhuri. 2006. Evaluation of coriander germplasm under tetra zone of West Bengal. *Haryan J. Hortic. Sci.* **35**(3 & 4): 348-349.

Datta, S., K. Alam and R. Chatterjee. 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.

Janardhan, M. and J. E. Thoppil. 2004. Herb and Spice Essential Oils. Discovery Publishing House, New Delhi-110002. Pp. 40-42.

Rema, M. M. A. Khader and R. Menon. 1997. Effect of leaf plucking on the growth and grain yield of coriander. Indian Cocoa, *Arecanut Spices J.* **21** (3): 74-75.

Sharma, M. M and R. K. Sharma. 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.

Singhania, D.L., D. Singh and R. S. Raje. 2006. Coriander. In: Ravindran, P. R., K. N. Babu, K. N. Shiva. and J. A. Kallupurackal (eds.). Advances in Spices and Achievments of Spices Research in India since Independence. pp. 678-695. Agrobios (India), Agro House, Behind Nasrani Cinema. Chopasani Road. Jodhpur 342002.

Thakral, K. K., G. R. Singh, U. C. Pandey and V. K. Srivastava. 1992. Effect of nitrogen levels and cuttings on the production of green leaves and seed yield of coriander cv. Narnaul Selection. *Haryana Agril. Univ. J. Res.* **22** (1): 35-39.

Tiwari, R. S. and A. Agrawal. 2004. Production Technology of Spices. 1st ed. International Book Distribution Co. Chaman Studio Building, 2nd floor, Charbagh, Lucknow, 2260004 U. P., India. Pp. 254-271.

Tiwari, R. S., Ankur Agarwal, S. C. Sengar and A. Agarwal. 2002. Effect of dates of sowing and number of cuttings on growth, seed yield and economics of coriander cv. Pant Haritima. Crop Res. Hisar. **23** (2): 324-329.