International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 2181-2185

Received: 17-07-2018
Accepted: 18-08-2018

Md. Muzaffor Hossain
Department of Spices and Plantation Crops, Faculty of Horticulture, Mohanpur, Nadia, West Bengal, India

Anupam Pariari
Department of Spices and Plantation Crops, Faculty of Horticulture, Mohanpur, Nadia, West Bengal, India

Correspondence
Md. Muzaffor Hossain
Department of Spices and Plantation Crops, Faculty of Horticulture, Mohanpur, Nadia, West Bengal, India

Effect of different levels of nitrogen and phosphorus on growth and seed yield of coriander (*Coriandrum Sativum* L.) *cv*. Ajmer coriander-1

Md. Muzaffor Hossain and Anupam Pariari

Abstract
The present investigation was carried out during Rabi season of 2015-2016 and 2016-17 at Horticultural Research Station, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, to determine the requirement of nitrogen and phosphorus for coriander variety Ajmer Coriander-1 for achieving maximum seed yield and quality parameter. Two different levels of nitrogen (40, and 60 kg/ha) and four different levels of phosphorus (30, 40, 50 and 60 kg P_2O_5/ ha) in different combination were distributed in the plots. The experiment was laid out in Factorial Randomized Block Design with 3 replications. The results indicated that yield parameters were declined with very high rate of nitrogen and phosphorous combination. Therefore, significantly maximum number of umbels per plant (66.30), umbellate per umbel (7.67), seeds per umbel (26.50), and seed yield per hectare (795.85 kg/ha), was recorded with treatment N_2P_2 (60 kg Nitrogen/ha + 40 kg P_2O_5/ha. Therefore, The treatment combination of (N60 + P40 kg/ha) was observed to be the best and most profitable dose for coriander cultivation on new alluvial zone of West Bengal.

Keywords: Coriander, growth, nitrogen, phosphorous, quality, yield

Introduction
Coriander (*Coriandrum sativum* L.) is an annual herb and it is one of the first seed spice to be used by mankind. Coriander (which belongs to the family Umbelliferae) is mainly cultivated from its seeds throughout the year (Mhemdi *et al*. 2011) [5]. It is also known as the Chinese parsley, Cilantro, Dizzycorn and Japanese Parsley. It is considered both as herb and spice as its leaves and seeds are used as a seasoning condiment. Its leaves as well as fruits are commonly used raw or dried for culinary purposes. Seeds are mainly round to oval in shape, golden brown to brown in color with vertical ridges and have a distinct flavour. The seeds are important ingredient of curry powder (Ramadan *et al*. 2002) [8]. Dried coriander seeds are one of the common spice ingredients used worldwide. In India ground powder of coriander seeds is a common household spice powder that is used in pickling, chutney, stews curries, marinades as well as in sausages. 100g fresh of coriander leaves contain: Moisture 87.9%, protein 3.5%, fat 0.6%, carbohydrates 6.5%, mineral matter 1.7%, Ca 0.14%, P 0.06%, Fe 10 mg and vitamin A 10,460 to 12,600 I.U.

Coriander is an important seed spice crop, it is regularly consumed as a leaf spice by Indians but its use as seed spice is still need to be enhanced. Production of coriander seed is very low because of less attention was given in last few decades for its cultivation aspects, and nutrient management. Plant nutrition plays an important role in overall production of plant and determination of nutritional needs of any crop species. For improvement of seed yield the management practices of cultivation aspects needs to be standardized so that wastage of resources can be minimized and per unit area production can be increased. As the coriander seeds are gaining importance due to its commercial, medicinal and industrial value, it is very necessary to cope up increasing demand with increase production of coriander seeds and this can be achieved by using proper levels of nutrients. In West Bengal, coriander is generally grown during Rabi season on residual soil fertility as irrigated crop for seed purpose. Hence, chemical fertilizers are seldom used. It is reported that nitrogen and phosphorus had some influence on the yield of seed. However no systematic work has been carried out regarding the nitrogen and phosphorus fertilizer management in recently released Coriander *cv*. Ajmer Coriander-1.

Therefore, the study was conducted to test the effects of two major nutrient Nitrogen and Phosphorus on seed yield of coriander.

Materials and Methods

The experiment was carried out during Rabi season of 2015-2016 and 2016-17 at Horticultural Research Station, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, The gross plot size was 1.8×1.8 m2 and the net plot size was 2.0 X 1.5 m^2. The experiment was set up in FRBD. There were 2 levels of nitrogen (40 and 60 kg/ha) and four levels of phosphorus (30, 40, 50 and 60 kg/ha). The experiment was laid out with 12 treatment combinations and replicated 3 times. Nitrogen and phosphorus was applied in each plot together in different combinations viz. N_1P_1 :(40 kg Nitrogen/ha + 30 kg P_2O_5/ha), N_1P_2 :40 kg Nitrogen/ha + 40 kg P_2O_5/ha), N_1P_3 : (40 kg Nitrogen/ha + 50 kg P_2O_5/ha), N_1P_4 : (40 kg Nitrogen/ha + 60 kg P_2O_5/ha), N_2P_1 : (60 kg Nitrogen/ha + 30 kg P_2O_5/ha), N_2P_2 : (60 kg Nitrogen/ha + 40 kg P_2O_5/ha), N_2P_3 : (60 kg Nitrogen/ha + 50 kg P_2O_5/ha), N_2P_4 : (60 kg Nitrogen/ha + 60 kg P_2O_5/ha). Seeds of coriander variety Ajmer Coriander-1 (ACr-1) is a new variety developed by ICAR-NRCSS, Ajmer. This variety is a dual purpose, which can be grown both for leaves and seeds as spices. It is a medium maturity group variety which is suitable for cultivation in all coriander growing areas in the country. This variety is suitable for loamy and clay loam soils having good drainage facility. Dry cool and frost free environment particularly in January is most suitable for exploitation of full genetic potential. This variety is stem gall resistant and it gave near immune response (No disease) even when grown in hot spot area under most favorable condition of disease spread where no other commercial variety can give good production. Urea (40% N) and single super phosphate (16%) were the main fertilizers used as source of nitrogen and phosphorus respectively. Top dressing of fertilizers in each plot was done at the time of sowing. Light irrigation was given immediately after sowing and subsequent irrigation was given to the plots at an interval of 3-4 days during the period of experiment. The status of soil nutrients before sowing was determined by alkaline permagnate method (Subbaiah and Asija, 1956) [12] and Olsen's method of nitrogen and phosphorus respectively. Different yield parameters viz., number of umbels /plant, umbellate/umbel, seeds/ umbel, seed yield /plant, seed yield/ha were recorded on six randomly selected plants. Observational plants were tagged from each plot. Boarder rows plants were avoided for recording observations. The average of different recorded observations was subjected to statistical analysis by Panse and Sukhatme, (1985).

Results and discussion

Effect of nitrogen and phosphorous levels on growth parameters

Plant height, no. of primary branches plant^{-1}and no. of secondary branches plant^{-1}

The data pertaining to plant height, number of primary branches plant^{-1} and number of secondary branches plant^{-1} as significant influenced by different levels of N and P are presented in Table 1. The maximum plant height of coriander (100.56 cm), number of primary branches (5.83 cm) and number of secondary branches (7.80) was recorded in N_2 treatment followed by N_1 (91.78 cm, 4.33 and 7.26) respectively. This might be due to the adequate supply of nitrogen associated with high photosynthetic activity to vigorous vegetative growth and physiologically more stout and healthy plant morphology. The results of the present investigations are close agreement with the findings of Lokhande *et al.*, (2015) [3] and Sahu *et al.*, (2014) [10] in Coriander. In the same table, the application of different levels of phosphorous showed the significance difference on all growth parameters. The highest plant height (100.35 cm), number of primary branches plant^{-1} (5.58) and number of secondary branches plant^{-1} (8.07) was recorded in P_2 treatment followed by P_3 (100.11 cm, 5.50 and 8.07) treatment respectively. The lowest plant height (85.37 cm), number of primary branches plant^{-1} (4.50) and number of secondary branches plant^{-1} (6.42) was recorded in P_1 treatment. The height of plant was also influenced positively with P application. This might be due to RUBISCO enzyme activity either directly or indirectly due to adequate supply of phosphorus resulting in increased photosynthetic activity of the plant. Similar results were reported by Usuda and Shimogawara (1991) [14].

The interaction effects due to application of different levels of nitrogen and phosphorous was found to be significant on all growth parameters in Table 2. The maximum plant height (114.18 cm), number of primary branches plant^{-1} (6.83) and number of secondary branches plant^{-1} (9.42) was recorded in N_2P_2 treatment which was followed by N_2P_3 (101.72cm, 6.17 and 8.27) treatment respectively, and the minimum plant height (84.21 cm), number of primary branches plant^{-1} (3.67) and number of secondary branches plant^{-1} (7.67) was recorded in N_1P_1 treatment. This was probably due to availability of adequate nutrients to plant at which plant could develop more height and branches. Similar results were obtained by Ghosh (2009) [2].

Table 1: Effect of different levels of nitrogen and phosphorus on plant height (cm), number of primary branches/ plant and number of Secondary branches/ plant of Coriander *cv*. Ajmer coriander-1 (mean data of two years).

Treatments	Plant height (cm)	No. of primary branches/ plant	No. of Secondary branches/ plant
Nitrogen levels			
N_1	91.78	4.33	7.26
N_2	100.56	5.83	7.80
C.D.	1.09	0.98	0.89
SE(m)	0.36	0.32	0.27
Phosphorous levels			
P_1	85.37	4.50	6.42
P_2	100.35	5.58	8.71
P_3	100.11	5.50	8.07
P_4	98.86	4.75	6.92
C.D.	1.55	1.12	0.02
SE(m)	0.51	0.45	0.30

Table 2: Interaction effect of different levels of nitrogen and phosphorus on plant height (cm), no. of primary branches/ plant and no. of secondary branches/ plant of Coriander *cv*. Ajmer coriander-1 (mean data of two years).

Treatments	Plant height (cm)	No. of primary branches/ plant	No.of Secondary branches/ plant
N_1P_1	84.21	3.67	7.67
N_1P_2	86.52	4.17	8.00
N_1P_3	98.51	5.00	7.87
N_1P_4	97.91	4.50	6.83
N_2P_1	86.53	5.33	7.83
N_2P_2	114.18	6.83	9.42
N_2P_3	101.72	6.17	8.27
N_2P_4	99.81	5.00	7.00
C.D.	2.19	1.21	1.01
SE(m)	0.71	0.64	0.55

Effect of nitrogen and phosphorous levels on yield and yield attributes parameters

Days to 50% flowering and Days to seed maturity

The data regarding days to 50% flowering and days to seed maturity as influenced by different levels of nitrogen and phosphorus is presented in the Table 3. The effect of different levels of nitrogen on days to 50% flowering and days to seed maturity was found to be significant. The minimum d days to 50% flowering (83.92) and days to seed maturity (113.49) was recorded in N_2 treatment and the maximum days in N_1 treatment (84.08 and 113.98) respectively. In the same table, the significance difference on days to 50% flowering and days to seed maturity due to application of different levels of phosphorous. The minimum days to 50% flowering (83.42) and days to seed maturity (111.45) in the treatment P_2 where as the maximum days to 50% flowering in the treatment P_3 (84.75) and maximum days to seed maturity in P_1 (115.83) treatment. Whereas the interaction effect of different levels of phosphorous on days to 50% flowering and days to seed maturity was found to be non-significant. This might be due to the fact that days taken to flowering are determined by C: N ratio. The plants tend to flower earlier with higher C: N ratio. Similar results were reported by Malav and Yadav (1997) [4] in coriander

Number of umbels plant^{-1}, number of umbellets umbel^{-1} and number of seeds umbel^{-1}

The inflorescence of coriander is called umbel. Umbel contain umbellate where seed setting takes place. The numbers of umbel were directly responsible for a good yield of coriander. More umbel per plant ensures more seed yield. The results of experiment conducted, are presented in Table 3 and it indicates that nitrogen and phosphorus levels significantly affected the number of umbels per plant, number of umbellets per umbel and number of sees per umbel. Significantly maximum number of umbels plant^{-1} (61.86), number of umbellets (9.19) and number of seeds umbel^{-1} (23.30) was due to application of nitrogen @ 60 kg/ha (N_2) and the minimum number of umbels plant^{-1} (57.52), number of umbellets (5.55) and number of seeds umbel^{-1} (22.58) was recorded in N_1 treatment. Whereas, the application of phosphorous with 40 kg/ha (P_2) showed maximum number of umbels plant^{-1} (61.98), number of umbellets (6.47) and number of seeds umbel^{-1} (24.38) followed by P_3 treatment. The minimum number of umbels plant^{-1} (56.48), number of umbellets (5.08) and number of seeds umbel^{-1} (23.18) was recorded in P_1 treatment followed by P_4 treatment. The interaction effects due to application of different levels of nitrogen and phosphorous was found to be significant for all yield attribute parameters in Table 4. The maximum number of umbels plant^{-1} (66.30), number of umbellets umbel^{-1} (7.67) and number of seeds umbel^{-1} (26.50) due to application with 60 kg Nitrogen/ha + 40 kg P_2O_5/ha (N_2P_2) which was followed by N_2P_3 (60 kg Nitrogen/ha + 50 kg P_2O_5/ha). Whereas the minimum umbels plant^{-1} (54.00), number of umbellets umbel^{-1} (4.92) and number of seeds umbel^{-1} (21.17) due to application with 40 kg Nitrogen/ha + 30 kg P_2O_5/ha (N_1P_1) which was followed by N_1P_2 (40 kg Nitrogen/ha + 60 kg P_2O_5/ha) treatment. More number of seeds per umbel depends on number of umbels per plant and number of umbellate per umbel that is why maximum seeds were recorded with the dose which gave highest number of umbels per plant. Similar results were observed by Salarajai *et al.* 2005 [11] and Mohammad *et al*. 2011 [6] in anise.

Table 3: Effect of different levels of nitrogen and phosphorus on yield and yield attributes of Coriander *cv*. Ajmer coriander-1 (mean data of two years).

Treatments	Days to 50% flowering	Days to seed maturity	No. of umbels plant^{-1}	No. of umbellets umbel^{-1}	No. of seeds umbel^{-1}	No. of seeds umbellet^{-1}	1000 seed weight (g)	No. of seeds plant^{-1}	Seed yield ha^{-1} (kg)
Nitrogen levels									
N_1	84.08	113.98	57.52	5.55	22.58	4.25	10.90	3056.04	623.55
N_2	83.92	113.49	61.86	6.19	25.30	5.22	12.01	3810.81	726.19
C.D.	0.87	0.98	1.10	0.56	1.05	0.65	0.62	208.71	47.61
SE(m)	0.49	0.45	0.36	0.18	0.34	0.21	0.20	68.14	15.55
Phosphorous levels									
P_1	83.58	115.83	56.48	5.08	23.18	4.31	10.34	3134.25	626.33
P_2	83.42	111.45	61.98	6.47	24.38	5.077	12.59	3660.85	704.50
P_3	84.75	113.15	61.40	6.31	24.28	4.803	11.86	3552.31	690.14
P_4	84.25	114.50	58.97	5.64	23.92	4.752	11.02	3386.30	678.50
C.D.	2.12	1.94	1.55	0.79	1.25	0.06	0.87	295.164	45.35
SE(m)	0.69	0.63	0.51	0.26	0.48	0.60	0.29	96.378	21.99

Table 4: Interaction effect of different levels of nitrogen and phosphorus on yield and yield attributes of Coriander *cv*. Ajmer coriander-1 (mean data of two years).

Treatments	Days to 50% flowering	Days to seed maturity	No. of umbels plant^{-1}	No. of umbellets umbel^{-1}	No. of seeds umbel^{-1}	No. of seeds umbellet^{-1}	1000 seed weight (g)	No. of seeds plant^{-1}	Seed yield ha^{-1} (kg)
N_1P_1	83.50	116.00	54.00	4.92	21.17	3.62	10.05	2578.90	554.45
N_1P_2	85.00	110.92	57.67	5.27	22.25	4.17	11.52	3008.21	613.15
N_1P_3	83.50	112.83	59.83	6.53	22.57	4.37	10.98	3172.43	643.21
N_1P_4	84.33	116.17	57.75	5.50	24.32	4.84	11.03	3464.64	683.38
N_2P_1	83.67	115.67	58.97	5.23	25.20	5.00	10.63	3689.60	698.22
N_2P_2	81.83	111.98	66.30	7.67	26.50	5.98	13.67	4313.50	795.85
N_2P_3	86.00	113.47	62.83	6.08	26.00	5.24	12.73	3932.19	737.07
N_2P_4	84.17	112.83	59.33	5.78	23.52	4.67	11.01	3307.97	673.63
C.D.	NS	NS	2.19	1.12	2.10	0.89	1.01	417.425	95.23
SE(m)	0.98	0.90	0.71	0.36	0.69	0.42	0.40	136.299	31.09

N_1P_1 :(40 kg Nitrogen/ha + 30 kg P_2O_5/ha), N_1P_2 :40 kg Nitrogen/ha + 40 kg P_2O_5/ha), N_1P_3 : (40 kg Nitrogen/ha + 50 kg P_2O_5/ha), N_1P_4 : (40 kg Nitrogen/ha + 60 kg P_2O_5/ha), N_2P_1 : (60 kg Nitrogen/ha + 30 kg P_2O_5/ha), N_2P_2 : (60 kg Nitrogen/ha + 40 kg P_2O_5/ha), N_2P_3 : (60 kg Nitrogen/ha + 50 kg P_2O_5/ha), N_2P_4 : (60 kg Nitrogen/ha + 60 kg P_2O_5/ha).

1000 seed weight (g), no. of seeds plant^{-1} and seed yield ha^{-1}

The data pertaining to weight of 1000 seeds (g), no. of seeds plant^{-1} and seed yield ha^{-1} of coriander as influenced by application of different levels of nitrogen and phosphorus was presented in Table 3. The maximum 1000 seed weight (12.01 g), no. of seeds plant^{-1} (3810.81) and seed yield ha^{-1} (726.19 kg) was recorded in N_2 (60 kg/ha) treatment, whereas minimum was N_1 treatment. In the same table, P_2 (40 kg/ha) treatment was recorded the maximum 1000 seed weight (12.59 g), no. of seeds plant^{-1} (3660.85) and seed yield ha^{-1} (704.50 kg) followed by P_3 treatment. Whereas the minimum 1000 seed weight (10.34 g), no. of seeds plant^{-1} (3134.25) and seed yield ha^{-1} (626.33 kg) was recorded in P_1 treatment which was followed by P_4 treatment. In Table 4, the interaction effects due to application of different levels of nitrogen and phosphorous was found to be significant for all yield attribute parameters. The maximum 1000 seeds (13.67 g), no. of seeds plant^{-1} (4313.50) and seed yield ha^{-1} (795.85 kg) due to application with 60 kg Nitrogen/ha + 40 kg P_2O_5/ha (N_2P_2) which was followed by N_2P_3 (60 kg Nitrogen/ha + 50 kg P_2O_5/ha) treatment. Whereas the minimum 1000 seeds (10.05 g), no. of seeds plant^{-1} (2578.90) and seed yield ha^{-1} (554.45 kg) due to application with 40 kg Nitrogen/ha + 30 kg P_2O_5/ha (N_1P_1) which was followed by N_1P_2 (40 kg Nitrogen/ha + 60 kg P_2O_5/ha) treatment. This was probably due to the fact that both these nutrients play an important role in plant nutrient uptake and affects various physiological functions such as photosynthesis, cholorophyll synthesis and reduced attack of diseases and pests etc. and ultimately leads to the improvement of seed yield. The results of this experiment support the findings of Bhat and Sulkieri (1992) [1] and Tehlan *et al*. (2008) [13] in coriander crop.

Essential oil

The perusal data from Fig 1, revealed that the significant difference in essential oil content by application of different levels of N and P. Significantly the maximum essential oil content (2.40%) was observed in N_2P_2 (60 kg Nitrogen/ha + 40 kg P_2O_5/ha) followed by N_2P_2 (60 kg nitrogen + 50 kg P2O5/ha) where as minimum essential oil content (1.46%) was observed in N_1P_1 :(40 kg Nitrogen/ha + 30 kg P2O5/ha) followed by 1.78% in N_1P_2 (40 kg Nitrogen/ha + 40 kg P2O5/ha) treatment. This might be due to the increased vigour of plants at flowering stage and increased ability of the plant to produce more number of seeds per umbel resulted in increased seed yield and essential oil. Similar results have been reported by Ravindra Kumar *et al.*, (2016) [9].

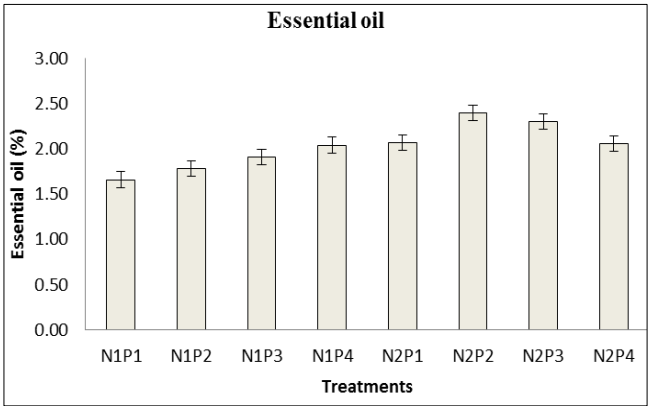

Fig 1: effect of different levels of nitrogen and phosphorus on essential oil of coriander *cv*. Ajmer coriander-1 (mean data of two years).

Conclusion

Coriander crop has been used for different industrial purposes and successful seed production mainly depends on use of healthy crop, more productive, higher quality and resistant to diseases and pests. Nitrogen and phosphorus are the two major nutrient required for the good production or yield of coriander. The increase seed yield ultimately depends on good yield contributing characters, which results from adequate dose of fertilizers. To standardize the rate of two major nutrients nitrogen and phosphorus, the study was conducted, and from the result of the study it could be concluded that treatment N_2P_2 i.e. (N 60 + P 40 kg/ha) was found to be best for obtaining higher seed yield and yield attribute characters.

Acknowledgement

Authors are very thankful to the Department of Plantation spices medicinal and aromatic crops, Faculty of Horticulture, B.C.K.V, Mohanpur, for providing all the necessary facilities for successful conducted of the experiment.

References

1. Bhat VR, Sulikeri GS. Effect of nitrogen, phosphorus, potassium on seed yield and yield attributes of coriander (*Coriandrum sativum*). Karnataka J of Agric Sci. 1992; 5(1):26-30.

2. Ghosh DK. Performance of coriander at different doses of nitrogen fertilizer under coconut based cropping system. Indian Coconut Journal. 2009; 51(9):6-10.
3. Lokhande SN, Jogdande ND, Thakare SS. Effect of varying levels of nitrogen and phosphorus on growth and seed yield of coriander (*Coriandrum sativum*). Plant Archives. 2015; 15(1):57-59.
4. Malav, Yadav. Effect of row spacing and levels of nitrogen on growth and seed yield of coriander. Indian Cocoa, Arecanut and Spices Journal. 1997; 21(2):37-41.
5. Mhemdi H, Rodier E, Kechaou N, Fages J. A supercritical tunable process for the selective extraction of fats and essential oil from coriander seeds. J Food Engg. 2011; 105(4):609-616.
6. Mohammad Ayub, Naeem Muhammad, Nadeem Muhammad Ather, Tanveer Asif, Tahir Muhammad Alam Rehan. Effect of nitrogen application on growth, yield and oil contents of Fennel (*Foenoculum vulgare* Mill.). J of Medicinal Plants Res. 2011; 5(11):2274-2277.
7. Panse VG, Sukatme TJ. Stastical method for agriculture workers ICAR New Delhi, 1979.
8. Ramdan FM, Morsel JT. Oil composition of coriander (*Coriandrum sativum* L.) fruit-seeds. Eur. Food Res. Technol. 2002; 215:204-209.
9. Ravindra Kumar; Sanjay Sahay, Mishra PK, Kumari Rashmi. Effect of nitrogen, phosphorus and potash on coriander yield. Environment and Ecology. 2016; 34(1):360-364.
10. Sahu RL, Hansa Sahu, Sachin Kumar. Effect of application of inorganic fertilizers and biofertilizers on growth components and yield traits of coriander (*Coriandrum sativum* L.). International Journal of Agricultural Sciences. 2014; 10(1):433-436.
11. Salarazai aman ullah, Bajoi AH, Shahwani Naeem. Impact of varying nitrogen levels on growth and yield of fennel (*Foeniculum vulgare*). J App. Em. Sc. 2005; 1(2):36-38.
12. Subbaiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soil. Current Sci. 1956; 25:258-260.
13. Tehlan SK, Thakral KK. Effect of different levels of nitrogen and leaf cutting on leaf and seed yield of coriander (*Coriandrum sativum*). J of Spices and Aromatic Crops. 2008; 17(2):180-182.
14. Usuda H, Shimogawara K. Phosphate deficiency in maize, Leaf phosphate status, growth, photosynthesis and carbon partitioning. Plant Cell Physiol. 1991; 32:497-504.