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Response of varying nitrogen and phosphorus levels on growth and yield of Anise (*Pimpinella anisum* L.)

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Abstract

A field experiment was conducted during *rabi* season of 2011-12 at NRCSS, Tabiji, Ajmer. The experiment comprising sixteen treatments of different nitrogen and phosphorus levels was laid in randomized block design with three replications. The maximum plant height, fresh weight per plant, dry weight per plant, number of primary branches per plant, secondary branches per plant, number of leaves per plant, number of nodes per plant, number of umbels per plant, number of umbellates per umbel, number of seeds per umbel and umbellate, test weight (g), harvest index (%), seed yield, straw yield, biological yield (q ha^{-1}), were recorded with 45 kg N ha^{-1} (N_3) and 40 kg P ha^{-1} (P_3) followed by 35 kg N ha^{-1} (N_3) and 30 kg P ha^{-1} (P_3) as compared to control (N_0, P_0). The highest net profit Rs (23054.05, 20867.01) was obtained with application of 45 kg N ha^{-1} (N_3) and 40 kg P ha^{-1} (P_3) as compared to control (N_0, P_0), The higher benefit: cost ratio of respectively (1.85, 1.68) was found with application of 45 kg N ha^{-1} (N_3) and 40 kg P ha^{-1} (P_3) respectively.

Key words: Anise, nitrogen, phosphorus, levels

Introduction

Aniseed (*Pimpinella anisum* L.), commonly called anise and also *vilayati saunf*, belongs to the family Apiaceae. Anise is an annual plant that grows up to 100 to 120 cm height. It has feathery leaves; the lower leaves are broad, toothed triangular and upper leaves are smaller, divided and narrow. Anise seed has strong flavour and aroma hydro distillation yields the “oil of anise”, which has now replaced the fruit for medicinal and flavouring purposes. The oil content in the dried fruits is about 2.5%. Anithole is the major component of aniseed oil. Anise seed is commonly used for flavouring food, confectionery, bakery products, chewing gums and tobacco. It is also used in flavouring alcoholic beverages, flavouring soups, mouthwashes and toothpastes. It possesses antibacterial, antispasmodic and soporific properties (Meena *et al*., 6). It is cultivated widely in Bulgaria, Cyprus, Germany, Italy, Mexico, Syria, South America, Turkey, Russia and India. In India, it is grown in smaller areas in Rajasthan, Punjab, U.P., Orissa, M.P. and Delhi as a *Rabi* crop. The growth and seed yield are largely influenced by the nutrient fertility status of the soil apart from genetic potential of the variety. Altering the soil nutrients and fertility status by providing balanced and adequate dose of major nutrients like nitrogen, phosphorus and potassium as per the crop requirement, is one of the easiest way to boost up the productivity of anise. The interception in the supply of major nutrients in early stages of crop growth even for a brief period, decreases crop growth and development result in to fewer yields and it cannot be corrected or altered at later stages of the crop growth even by supplying with heavier doses of major nutrients, poor nutrients (macro and micro) and unfavorable environmental conditions which negatively affect growth and productivity of medicinal and aromatic plants including anise, coriander and sweet fennel plants. Therefore, the study on effect of varying nitrogen and phosphorus levels on growth and yield of anise was conducted within view to find out optimum level of nitrogen and phosphorous for anise.

Materials and methods

The experiment was conducted on sandy loam soil of research farm of NRCSS, Ajmer (Rajasthan) India. The experiment comprising of four levels of nitrogen *viz*., 25 kg/ha (N_1), 35 kg/ha (N_2), 45 kg/ha (N_3), control (N_0) and four levels of phosphours *viz*., 20 kg/ha (P_1), 30 kg/ha (P_2), 40 kg/ha (P_3), control (P_0) was conducted in factorial randomized block design with three replications. The crop was sown during *rabi* season of 2011-12. The soil of the experimental field was sandy loam having low organic matter (0.23 %), available nitrogen (178.65 kg /ha), phosphorus (12.0 kg /ha) and enough available potassium (165 kg /ha), slightly alkaline with pH (8.04)

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and EC (0.076 dS/m). The anise variety Ajmer Anise-1 was sown on 15th October. All standard required cultural practices were followed during whole cropping season. Yield parameter and growth parameter were recorded in five random plants of each plot and average was worked out. Statistical analysis was done through procedure prescribed by (Panse & Sukhatme, 11).

Results and discussion

Effect of Nitrogen levels on growth parameters

Data presented in Table 1 clearly indicates that application of varying levels of nitrogen significantly influenced plant growth parameters at different growth stages. The highest plant height, dry matter accumulation, primary branches, secondary branches, number of nodes, number of leaves per plant and fresh weight per plant at all the growth stages were recorded with application of 45 kg/ha nitrogen (N_3), being at par with 35 kg/ha nitrogen (N_2). The lowest values of all these given parameters were recorded under control (N_0). The lowest value of growth attributes under control could be due to severe nutrient deficiency for the resources which made the crop plant inefficient to take up moisture and nutrients consequently plant height, dry matter accumulation were adversely affected. These results were corroborated with those reported by Vinay et al., (14) and Meena *et al.*, (5) in coriander; Ameen *et al.*, (1) in fennel and Mohamed *et al.*, (9) in nigella.

Effect of Phosphorus levels on growth parameters

Application of varying levels of nitrogen and phosphorus significantly influenced different plant growth parameters at different growth stages. (Table-1) The highest plant height, number of leaves, number of nodes, primary branches, secondary branches, fresh weight and dry matter accumulation per plant at all the growth stages were recorded with application of phosphorus 45 kg/ha, being at par with 40 kg/ha phosphorus (P_2). The lowest values of all these parameters were recorded under control (P_0). Higher value of all these growth parameters under these treatments might be due to favourable agro climatic conditions during the crop growth period which might have resulted due to better availability of moisture and nutrients to the crop resulting more favourable condition for crop consequently crop attained luxuriant due to better availability of nitrogen and phosphors. These results corroborate with those reported by Jage *et al.* (3) in coriander; Ameen *et al.* (1) in fennel; Mehta *et al.*(8) in fenugreek and Mohamed *et al.*(9) in nigella.

Effect of Nitrogen levels on Yield attributes and yield

The highest yield attributes like early 50% flowering, maximum number of umbels/plant (37.55), number of umbellates/umbel (13.43), number of seeds/umbels (219.09), number of seeds/umbellate (16.32), seed yield (7.26 q/ha), straw yield (22.62 q/ha) and biological yield (29.88 q/ha) as well as test weight (24.99 g) were recorded with the application of 45 N kg/ha (N_3), being at par with 35 N kg/ha (N_2). The lowest values of all these parameters were recorded under control (N_0). Application of N affect physiological and biochemical process in plant which favorably enhanced 50% flowering in plants. Thus on one hand profuse branching might have led to formation of maximum number of flowers, while on the other hand increased availability of nitrogen to these developing structures seems to have resulted in greater retention of flowers and then developed to fertile fruits (umbels per plant). Maintaining high soil fertility, which ultimately exhibited higher yield attributes and yield. Similar findings were also reported by Satpal *et al.*(12), Kumar *et al.*(4) and Meena *et al.*(7) in coriander and Azizi (2) in anise.

Effect of Phosphorus levels on Yield attributes and yield

Yield and yield attributes as well as seed and straw yield were significantly influenced with the application of different phosphours levels. The highest yield attributes like early 50% flowering, maximum number of umbels /plant (35.83), number of umbellates/umbel (13.78), number of seeds/umbels (212.38), number of seeds/umbellate (16.60), seed yield (6.82 q/ha), straw yield (21.09 q/ha) and biological yield (27.91 q/ha) as well as test weight (25.46 g) were recorded with the application of 40 kg/ha phosphours (P_3), being at par with 30 kg/ha phosphours (P_2). Thus on one hand profuse branching might have led to formation of maximum number of flowers, while on the other hand increased availability of nutrients and photosynthates to these developing structures seems to have resulted in greater retention of flowers and then developed into fertile fruits (umbels per plant). Maintaining high soil fertility, which ultimately exhibited higher yield attributes and yield. Similar findings were also reported by Satpal *et al.*(12) and Kumar *et al.*, (4) in coriander; (Azizi, 2) in anise.

Economics

Nitrogen levels

Varying levels of nitrogen significantly influenced gross return, net return and B: C ratio. The highest gross return of (Rs. 35504.05/ha), net return of (Rs. 23054.05/ha)

Table 1: Effect of varying levels of nitrogen and phosphorus on growth parameters of anise

Treatments	Plant Height (cm)	Dry matter accumulation (g)	Number of primary branches	Number of secondary branches	Number of nodes on	Number of green leaves main shoots	Fresh weight of leaves(gm)
Nitrogen levels							
N0 = Control	47.37	13.76	10.80	19.23	11.72	43.69	82.65
N1 = 25 kg/ha	50.55	17.32	12.07	22.51	12.13	45.46	88.70
N2 = 35 kg/ha	50.88	17.83	13.02	24.03	12.63	48.48	91.55
N3 = 45 kg/ha	52.68	20.29	13.86	26.06	13.83	53.06	96.96
SEm+	0.932	0.470	0.229	0.616	0.277	1.233	1.617
CD (P=0.05)	2.693	1.357	0.662	1.778	0.800	3.562	4.670
Phosphorus levels							
P0 = Control	47.23	13.78	11.35	20.50	12.02	42.98	82.47
P1 = 20 kg/ha	49.66	17.26	12.38	22.07	12.40	46.35	87.91
P2 = 30 kg/ha	50.91	18.24	12.65	23.84	12.67	49.63	92.38
P3 = 40 kg/ha	53.68	19.93	13.38	25.40	13.23	51.72	97.09
SEm+	0.932	0.470	0.229	0.616	0.277	1.233	1.617
CD (P=0.05)	2.693	1.357	0.662	1.778	0.800	3.562	4.670

Table 2: Effect of varying levels of nitrogen and phosphorus on yield attributes and yields of anise

Treatments	Days to 50% Flowering	No of umbells per plant	No of umbellates per umbells	No of seeds per umbells	No of seeds per umbellates	Seed yield q/ha	Straw yield q/ha	Biological q/ha	Test weight (g)
Nitrogen levels									
N0 = Control	84.42	24.37	10.92	185.54	13.75	5.45	13.26	18.71	29.03
N1 = 25 kg/ha	84.42	28.99	12.95	190.77	15.43	6.19	14.92	21.11	29.37
N2 = 35 kg/ha	83.92	32.77	12.43	199.12	16.50	6.71	21.48	28.19	24.55
N3 = 45 kg/ha	81.42	37.55	13.43	219.09	16.32	7.26	22.62	29.88	24.99
SEm+	0.280	1.021	0.336	2.903	0.185	0.183	0.509	0.525	0.885
CD (P=0.05)	0.810	2.948	0.970	8.385	0.534	0.527	1.471	1.517	2.555
Phosporus levels									
P0 = Control	83.75	26.32	10.88	183.14	14.57	5.91	13.74	19.65	30.02
P1 = 20 kg/ha	83.75	28.80	11.95	194.01	15.35	6.25	17.94	24.19	26.27
P2 = 30 kg/ha	83.92	32.72	13.12	204.98	15.48	6.64	19.50	26.14	26.19
P3 = 40 kg/ha	82.75	35.83	13.78	212.38	16.60	6.82	21.09	27.91	25.46
SEm+	0.280	1.021	0.336	2.903	0.185	0.183	0.509	0.525	0.885
CD (P=0.05)	0.810	2.948	0.970	8.385	0.534	0.527	1.471	1.517	2.555

Table 3: Effect of varying levels of nitrogen and phosphorus on Benefit- cost ratio of anise

Treatments	Harvest index (%)	Gross return (Rs ha -1)	Net profit (Rs ha -1)	B:C ratio
Nitrogen levels				
N0 = Control	29.03	26197.20	13747.20	1.10
N1 = 25 kg/ha	29.37	29737.67	17287.67	1.39
N2 = 35 kg/ha	24.55	32877.10	20427.10	1.64
N3 = 45 kg/ha	24.99	35504.05	23054.05	1.85
SEm+ 0.885	817.995	817.995	0.066	
CD (P=0.05)	2.555	2362.541	2362.541	0.190
Phosporus levels				
P0 = Control	30.02	28314.89	15864.89	1.27
P1 = 20 kg/ha	26.27	30383.19	17933.19	1.44
P2 = 30 kg/ha	26.19	32300.92	19850.92	1.59
P3 = 40 kg/ha	25.46	33317.01	20867.01	1.68
SEm+ 0.885	817.995	817.995	0.066	
CD (P=0.05)	2.555	2362.541	2362.541	0.190

and BCR (1.85) was recorded with the application of 45 kg N/ha followed by 35 kg N/ha (Table-3). The lowest gross return, net return and BCR was obtained in control. Similar findings were also reported by Naghera *et al.* (10) and Thakral *et al.* (13) in coriander.

Phosphorus levels

Gross return, net return and BCR were significant influenced with application of varying level of phosphorus. The highest gross return of (Rs. 33317.01), net return of (Rs. 20867.04/ha), and BCR (1.68) was obtained with application of 40 kg P_2O_5/ha. The lowest gross return, net return, and BCR were recorded in control. The results Corroborate with those reported by Naghera *et al.* (10) and Thakral *et al.* (13) in coriander.

References

1. Ameen, A. A., Forooqi, A. A. and Bojappa, K. M., 1988. Effect of nutrients and spacings on growth, yield and essential oil content in fennel (*Foeniculum vulgare* Mill.). *Indian Perfumer*, 32: 301-305.
2. Azizi, S. 2000. Effect of N-fertilizer and sowing date on the growth, seed yield and essential oil of anise. *J.-of-Agricultural-Sciences* -Islamic-Azad-University. 6: 79-88.
3. Jage, Singh, Malik, Y. S., Thakral, K. K., Mehla, C. P. and Singh, J. 2000. Effect of sowing time, nitrogen levels and leaf cuttings on green and seed yield of Coriander. *Haryana J. Hort.Sci.* 29: 225-228.
4. Kumar, M., Sinha, K. K. and Roysherma, R. P. 2002. Effect of organic manure, NPK and boron application on the productivity of french bean in sandy loam soil of North Bihar. *Indian J. Pulse Res.* 17: 42-44.
5. Meena, S. S. and Malhotra, S. K. 2006. Effect of sowing time, nitrogen and plant growth regulators on green leaf yield of coriander. *Haryana J. Horti. Sci.*,35(3&4):310-311
6. Meena, S. S., Lal, G., Mehta, R. S., Kant, K. and Anwer, M.M. 2010. Seed spices for home remedies. *Indian Hort*. (July-Aug.):6-8.
7. Meena, S. S., Sen, N. L. and Malhotra, S. K. 2006. Influence of sowing date, nitrogen and plant growth regulators on growth and yield of coriander (Coriandrum sativum L.) *J. Spices and Aromatic Crops*,15 (2): 88-92
8. Mehta, R. S., Patel, B. S., Meena, S. S. and Meena, R. S. 2010. Influence of nitrogen, phosphorus and bio-fertilizers on growth characters and yield of fenugreek (*Trigonella foenum-graecum* L.) *J. Spices and Aromatic Crops*, 19(1&2): 23-28
9. Mohamed, S. A., Medani, R. A., Khafaga, E R., E. I. Sawy M., Francis, R. R., E I Borollosy, M. A. and Hosni, A. M. 2000. Effect of nitrogen and phosphorus applications with or without micronutrients on black cumin (*Nigella sativa* L.) plants. *Annals Agri. Sci. Cairo.* 3: Special, 1323-1338.

10. Naghera, R. P., Sukhadia, N. M. and Ramani, B. B. 2002. Effect of sowing dates and varying levels of nitrogen and phosphorus on Coriander (*Coriandrum sativum* L.). *Gujarat Agricultural University Research Journal.* 26: 52-54.
11. Panse, V. G. and Sukhatme, P. V. 1985. Statistical methods for Agricultural workers, *Fourth Enlarged Edition*, ICAR Pub. New Delhi
12. Satpal, Singh., Jat, N. L. and Singh, S, 2002. Effect of phosphorus and zinc fertilization on growth and yield of coriander (*Coriandrum sativum* L.). *Annals Agri. Res.* 23: 734-736.
13. Thakral, K. K., Singh, G. R., Pandey, U. C. and Srivastava, V. K. 1991. Effect of nitrogen levels and cuttings on the production of green leaves and seed yield of coriander Cv. Natural selection. *Haryana Agril. Univ. J. Res.* 22: 35-39.
14. Vinay, Singh, Bisen, R. K. and Singh, V. 1999. Response of nitrogen and phosphorus on seed crop of coriander. *Environment and Ecology. 17: 238-239.*

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