http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences, 2 (3): 752-754, 1999 Research Article

Effect of Nitrogen and Phosphorus on Seed Production of Three Onion (*Allium cepa* L.) Cultivars

Muhammad Amjad*, Muhammad Akbar Anjum** and Habib Ullah Malik*
*Department of Horticulture, University of Agriculture, Faisalabad-38040, and
**University College of Agriculture, Bahauddin Zakariya University, Multan-60800, Pakistan

Abstract

N (0, 25, 50 or 75 kg ha^{-1}) and P_2O_5 (0, 15, 30 or 46 kg ha^{-1}) were applied in different combinations to onion cultivars Dark Red, Early Red and Faisal Red. All the P and half of the N were applied at the time of sowing while the rest of N was applied as a top dressing at flowering. Number of flowers per umbel significantly varied among the cultivars and was highest in Faisal Red (667), while the cultivars did not differ significantly in time taken to flowering, number of flower stalks per plant, diameter of umbel and seed yield. Fertilizer doses had significant effect on diameter of umbel, number of flowers pe umbel and seed yield, while time taken to flowering and number of flower stalks per plant have no significant response to these particular doses of fertilizer, Interaction between cultivars and fertilizers doses was only significant for number of flower stalks per plant. Maximum number of flower stalks were produced in cv. Faisal Red at a fertilizer dose of 75 kgN + 45 kg P_20, ha^{-1}.

Introduction

Onion (*Allium cepa* L.) is a biennial crop for the purpose of Seed production. In one season bulbs are produced from seed and in the second season bulbs are replanted to produce seed. Quality seed is one of the basic and most important input for successful onion production. As onion seed is poor in keeping quality and looses its viability within a year (Shinde and Sontakke, 1993), therefore it is essential to produce fresh seed every year and use the same for bulb production. In onions, seed yield and quality is influenced by many factors including cultivars, bulb weight, spacing, date of planting, soil and climate and fertilizer application. In onions, application of N has been found to increase the number of umbels per plant (Cuocolo and Barbieri, 1988; Nehra *et al*., 1988; Bhardwaj *et al*., 1991; Mishra, 1994), number of florets per umbel (Ahmed and Abdalla, 1984), umbel size (Nehra *et al*., 1988; Bhardwaj *et al*., 1991; Pandey *et al*., 1992; Mishra, 1994) and seed yield (Pandey *et al*., 1982; Cuocolo and Barbieri, 1988; Nehra *et al*., 1988; Mishra, 1994; Pandey *et al*., 1992). While, the results reported about the effects of phosphorus are contradictory. According to Chakrabarti *et al*. (1980), phosphorus alone and in combination with nitrogen had no effect on seed production in onions, while Ahmed and Abdalla (1984) reported that P alone had no effect on seed production but when applied in combination with N resulted in significant increase in seed yield. Highest seed yields were obtained with highest dose of N and P fertilizers (Bokshi *et al*., 1989; Patel and Vachhani, 1994). Not only the seed yield, number of umbels and its size were also increased when N was applied in combination with P (Bokshi *et al*., 1989). Response to N and P fertilizers also varies among cultivars. Therefore, the present studies were carried out to ascertain the effects of nitrogen and phosphorus fertilizers on the seed production of three cultivars of onion.

Materials and Methods

Bulbs of the onion (*Allium cepa* L.) cultivars; Dark Red Early Red and Faisal Red were obtained from Directorate of Vegetables, Ayub Agricultural Research Institute, Faisalabad and planted at Vegetable Research Area, Department of Horticulture, University of Agriculture, Faisalabad. The physico-chemical characteristics of the soil used for the experiment are given in Table 1, as determined using the method of U.S. Salinity Laboratory Staff (1954). Th fertilizer treatments included were:

F_0 = Control (no fertilizer)
F_1 = 25 kg N + 15 kg P_2O_5 ha^{-1}
F_2 = 50 kg N + 30 kg P_2O_5, ha^{-1}
F_3 = 75 kg N + 45 kg P_2O_5, ha^{-1}

Table 1: Physico-chemical characteristics of the soil use for the experiment

Characteristic	Unit	Quantity
Sand	%	52.4
Silt	%	20.6
Clay	%	27.0
Textural class	-	Sandy clay loam
pH	-	7.8
TSS	%	0.21
Organic matter	%	0.69
Total nitrogen	%	0.036
Available Phosphorus	ppm	6.3
Available potassium	ppm	187

The experiment was laid out in a split plot design with their replications, randomizing the cultivars in main plots a fertilizers doses in subplots. The bulbs of these cultivar were planted on November 13, 1996. The row to row an plant to plant distance were maintained as 75 and 30 cm respectively. Whole amount of phosphorus and half amount of nitrogen applied at the time of sowing while remaining

nitrogen was applied at the time of flowering to the respective subplots. The first irrigation was given just after the sowing of bulbs, care was taken to avoid flooding. Subsequent irrigations were applied at an interval of 7-14 days, keeping in view the environmental conditions. The crop was kept free from weeds during the entire growth period through hoeing manually.

Twelve plants were tagged randomly in each block and data were recorded on; a) time taken to flowering, b) number of flower stalks per plant, c) number of flowers per umbel, d) Diameter of an umbel and e) seed yield per hectare. The data were analyzed statistically by constructing the analysis of variance tables. The treatments showing significant differences were subjected to Least Significant Difference. test for comparing their means (Steel and Torrie, 1984). Economic analysis of the fertilizer treatments was worked out on the basis of cost of production using prevailing market prices (CIMMYT, 1988).

Results and Discussion

Statistical analysis of the data related to the time required for flowering indicated that,no significant differences were found among the cultivars, different fertilizer doses and their interaction. It means that the time required to reach flowering is almost equal for all these cultivars and this was independent of fertilizer doses (Table 2 and 3).

No significant differences were observed among the cultivars as well as the fertilizer doses for number of flower stalks per plant, while these two interact with each other significantly. Individual comparison of treatments shows that the interaction between Faisal Red and F_3 significantly differed from Early Red x F_3, Dark Red x F_2, Dark Red x F_1, and Faisal Red x F, but stood at par with all other treatment means (Table 4). As the response of cultivars to the fertilizer doses had been found non-significant, this is why the interaction between the two is much overlapping. So it is difficult to draw any confirm results about the interaction between cultivars and fertilizer doses except for this that these' cultivars seem to be sensitive to different fertilizer doses (Cuocolo and Barbieri, 1988; Nehra *et al*., 1988; Bhardwaj *et al*., 1991; Mishra, 1994).

Results for the number of flowers per umbel demonstrated that both cultivars and fertilizer doses differed significantly with each other but no interaction has been observed between these two factors. Faisal Red produced the maximum flowers per umbel followed by Early Red, while Dark Red have the minimum number of flowers per umbel. All the fertilizer doses did not differ much from each other except F_0 (control) which differed significantly from all other fertilizer doses and resulted in minimum number of flowers per umbel. While other three fertilizer doses behaved significantly alike and stood at par with each other. This

Table 2: Effect of different cultivars of onion on seed production

Cultivars	Dark Red	Early Red	Faisal Red
Time taken to flowering (days)	63.89 ± 1.30a*	63.92 ± 1.37a	63.74 ± 1.02a
No. of flower stalks per plant	4.11 ± 1.06a	5.01 ± 1.66a	5.70 ± 0.94a
No of flowers per umbel	509.90 ± 66.1c	578.80 ± 41.3b	667.10 ± 47.7a
Diameter of an umbel (cm)	4.48 ± F 1.10a	4.52 ± 1.26a	4.53 ± 1.19a
Seed yield per hectare (kg)	134.40 ± 31.8a	128.00 ± 32.4a	145.50 ± 40.0a

Means ± SD with different letters in a row are statistically significant at 5% probability

Table 3: Effect of different levels of N and P fertilizers on seed production of onion

Fertilizers treatments	F_o	F_1	F_2	F_3
Time taken to flowering (days)	64.17 ± 0.97a*	63.03 ± 1.41a	64.23 ± 1.26a	63.97 ± 1.26a
No. of flower stalks per plant	5.22 ± 1.08a	4.63 ± 1.53a	5.01 ± 1.26a	4.89 ± 1.78a
No. of flowers per umbel	523.80 ± 76.7b	621.70 ± 64.2a	577.7 ± 62.0a	618.0 ± 61.0a
Diameter of an umbel (cm)	3.02 ± 0.20d	4.01 ± 0.32c	4.95 ± 0.36b	5.91 ± 0.19a
Seed yield per hectare (kg)	88.20 ± 20.3c	138.7 ± 21.7b	175.7 ± 14.8a	147.2 ± 18.6b

Means ± SD with different letters in a row are statistically significant at 5% probability

Table 4: Effect of different levels of N and P fertilizers X cultivars (interaction) on number of flower stalks per plant in onion

	Fertilizer treatments			
Cultivars	F_0	F_1	F_2	F_3
Dark Red	5.67 ± 1.19abc	3.00 ± 0.78c*	4.33 ± -0.40be	5.00 ± 1.20abc
Early Red	5.00 ± 1.03abc	6.67 ± 1.20ab	5.33 ± 0.85abc	3.00 ± 0.72c
Faisal Red	6.67 ± 1.20ab	4.33 ± 0.51be	7.00 ± 0.58ab	7.33 ± 1.25a

Means ± SD with different letters in rows and columns are significant at 5% probability

Table 5: Economic analysis of various fertilizer treatments

Fertilizer treatments	Costs that vary (Rs./ha)	Marginal costs (Rs./ha)	Net benefits (Rs./ha)	Marginal net benefits (Rs./ha)	Marginal rate of return (%)
F_0			13224.00		
F_1	704.13	704.13	20100.87	6876.87	976.65
F_2	1383.26	679.13	24971.74	4870.87	717.23
F_3	2062.39	679:13	20017.61D	-	-

Urea at Rs. 340 and TSP at Rs. 421 per bag of 50 kg

1. Transportation, loading and unloading of fertilizer = Rs. 20 per bag
2. Spreading of fertilizer Rs. 25 per hectare
3. Value of the onion seed yield at Rs. 150 per kg
4. Marginal rate of return = Marginal net benefit x 100/Marginal cost
5. D = Dominated (any treatment having net benefit less than or equal to that of a treatment with lower costs that vary is dominated)

indicates that this stage of seed production is very sensitive to particular dose of fertilizer, which have a great influence on number of flowers per umbel (Ahmed and Abdalla, 1984).

The data procured on the diameter of an umbel, when subjected to statistical analysis, exhibited highly significant differences among the fertilizer doses and non-significant among the cultivars and their interaction with fertilizer doses. An increase in the diameter of umbel was recorded with the increase in the fertilizer dose ultimately contributing to the seed yield. This suggests that the fertilizer doses have a significant influence on diameter of the umbel (Nehra *et al*., 1988; Bhardwaj *et al*., 1991; Mishra, 1994; Pandey *et al*., 1992).

Data on seed yield demonstrated highly significant results for the fertilizer doses and non-significant for the cultivars and their interaction with fertilizer doses. F_2 (50 kg N + 30 kg P_2O_5 ha^{-1}) proved an optimum fertilizer dose in the present work resulting in maximum seed yield. This was followed by F_3 (75 kg N + 45 kg P205 ha^{-1}) and F_1 (25 kg N + 15 kg P_2O_5 ha^{-1}), both behaved alike and stood at par with each other. While F_0 (control) resulted in the minimum seed yield. This indicates that although fertilizer application increased the seed yield but specific fertilizer dose is more important than the amount of fertilizer for the seed production of onion (Nehra, *et al*., 1988; Bokshi *et al*., 1989; Bhardwaj *at al*., 1991; Patel and Vachhani, 1994). Economic analysis of the treatments indicated that the treatment F_1 was the most economical one with maximum marginal rate of return. Although the treatment F_2 gave the maximum net benefit but marginal rate of return was lower because of higher costs that vary (Table 5).

References

Ahmed, I.H. and A.A. Abdalla, 1984. Nitrogen and phosphorus fertilization in relation to seed production in onion *Allium cepa* L. Acta Hortic., 143: 119-126.

Bhardwaj, M.L., R.S. Rattan and U.K. Kohu, 1991. Effect of nitrogen, phosphorus and depth of bulb planting on seed production in onion. Indian J. Hortic., 48: 264-268.

Bokshi, A.I., M.F. Mondal and M.H.R. Pramanik, 1989. Effect of nitrogen and phosphorus nutrition on the yield and quality of onion seeds. Bangladesh Hortic., 17: 30-35.

CIMMYT., 1988. From Agronomic Data to Farmer Recommendations: An Economics Training Manual. CIMMYT., USA., ISBN: 9789686127188, pp: 30-34.

Chakrabarti, A.K., B. Choudhury and C. Singh, 1980. Effect of nitrogen and phosphorus on seed production of onion (*Allium cepa* L.). Seed Res., 8: 1-4.

Cuocolo, L. and G. Barbieri, 1988. Effects of nitrogen fertilization and plant density on seed yield of onion (*Allium cepa* L.). Bangladesh Hortic., 16: 30-35.

Mishra, H.P., 1994. Effect of nitrogen and potassium on onion seeds production in calcareous soil. J. Potassium Res., 10: 236-249.

Nehra, B.K., M.L. Pandita and K. Singh, 1988. Cultural and nutritional studies in relation to seed production in onion (*Allium cepa* L.). II: Effects of bulb size, spacing and nitrogen on plant growth and seed yield. Hariana J. Hortic. Sci., 17: 106-110.

Pandey, U.B., D.S. Panwar and V.P. Sharma, 1992. Effect of spacings and levels of nitrogen on growth and seed yield of kharif onion. Seed Res., 20: 147-148.

Pandey, U.C., R.P. Dhingra, K. Singh and J.L. Mangal, 1982. Effect of nitrogen fertilization, spacing and their interaction on seed yield of onion (*Allium cepa*) var. Hissar-II. Progr. Hortic., 14: 75-77.

Patel, Z.G. and M.U. Vachhani, 1994. Effect of NPK fertilization on the yield and quality of onion. Hortic. J., 7: 75-77.

Salinity Laboratory Staff, 1954. Diagnosis Improvement of Saline and Alkali Soils. United States Department of Agriculture, Washington, DC., USA., Pages: 160.

Shinde, N.N. and M.B. Sontakke, 1993. Bulb Crops-Onio. In: Vegeta Crops, Bose, T.K., M.G. Som and J. Kabir (Eds.). Naya Prokash, Calcutta, pp: 711-729.

Steel, R.G.D. and J.H. Torrie, 1984. Principles a Procedures of Statistics. McGraw Hill Book Co. Inc., Singapore pp: 172-177.