THE ASIAN JOURNAL OF HORTICULTURE
Volume **8** | Issue 2 | December, 2013 | 616-619

Research Paper

Article history **:**
Received : 03.08.2013
Revised : 27.09.2013
Accepted : 11.10.2013

Effect of nitrogen, phosphorus and potassium fertilizers on the growth, yield and quality of tomato var. Azad T-6

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ABSTRACT : A field experiment was carried out during the winter season of (2009-2010) to study the effect of nitrogen, phosphorus and potassium fertilizers on the growth, yield and quality of tomato var. Azad T-6 at the Horticultural Research Farm of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow. Three types of fertilizers (nitrogen, phosphorus and potassium) in different combinations were tested in a Randomized Block Design with three replications. Tomato plants were fertilized with different rates of chemical fertilizers *i.e.* two doses of nitrogen fertilizers N_1 and N_2 (120 and 180 kg/ha), single dose of phosphorus P_1 (80 kg/ha) and potassium K_1 (75 kg/ha).The highest plant height, the maximum number of primary and secondary branches, number of flowers and fruits/plant as well as the greatest fruit size, fruit yield/plant and fruit yield/ha were obtained from the application of the recommended dose of nutrients *viz.*, 120 kg N +80 kg P +75 kg K/ha. The results revealed that significantly the highest plant height higher yield and yield attributing characters were recorded with the application of 100% NPK *i.e.* 180 kg N/ha along with 80 kg P/ha and 75 kg K/ha.

KEY WORDS : Nitrogen, Phosphorus, Potassium fertilizers, Yield, Quality, Tomato

HOW TO CITE THIS ARTICLE : Kumar, Manoj, Meena, M.L., Kumar, Sanjay, Maji, Sutanu and Kumar, Devendra (2013). Effect of nitrogen, phosphorus and potassium fertilizers on the growth, yield and quality of tomato var. Azad T-6. *Asian J. Hort.*, **8**(2) : 616-619.

Tomato (*Lycopersicon esculentum* Mill.) is a popular vegetable in many parts of the world. It is one of the most important – "protective foods" because of its special nutritive value and widespread production. Ripe tomato is a good source of minerals and vitamins, especially vitamin 'C' and carotenoids, which are consumed throughout the world in the form of fresh as well as processed products. The green revolution in India promoted the indiscriminate use of chemical fertilizer and pesticides to obtain a better crop yield. recent investigations have shown that N and P and K requirement of tomato are quite high particularly at the letter part of plant life *i.e.* for fruit growth and development the significant role of nitrogen nutrition in plant production is universally accepted N and K fertilizers are considered to be closely associated having well marked cumulative and individual effects on the quality and production of different vegetable crops. Nitrogen promotes vegetative growth providing sufficient photosynthetic area which in turn helps in flowering ad fruit set. Nitrogen compound constitute 40 to 50 per cent of the dry matter of protoplasm. Because of this reason, it is required in large quantities. Adequate supply of nutrient can increase the yield, fruit quality, fruit size, keeping quality, colour and taste of tomato (Shukla and Naik. 1993). The yield response of tomato to the added nitrogen through organics fertilizers is evident to a considerable level. However, the nitrates produced in the soil from the added N fertilizers can react with organic matter of the soil and deplete even the native humus and may result in the fall of the crop production (Dhar, 1962). It several experimented have been studied the effect of nitrogen and potassium application on the growth, yield and quality of spring crop of tomato cv. Punjab Upma. The treatment consisted in four level of nitrogen (100, 140, 180, 220 kg/ha) and four level of potash (40, 60, 80, 100 kg / ha) nitrogen

was applied 100 to 140 kg / ha and k20 40 to 60 kg / ha increased marketable and total yield. A significant improvement in juice content, ascorbic acid leaves. Thus, integrated nutrient management has become an accepted strategy to bring about improvement in soil fertility and protecting the environment. This strategy utilizes a judicious combination of fertilizers. Groot *et al.* (2002) the relative growth rate of tomato increase sharply with increasing plant P concentration when the letter is below the critical level of adequacy. Results from recent research have indicated that foliar application of phosphorus in greenhouse tomato enhances the concentrations of chlorophyll, K, P, Mg and Fe in the leaves, accelerates fruit maturity and increases marketable yield and quality. A balanced nutrient regime is important to support rapid and consistent fruit growth (Snapp and Huang 2004). Hence the investigation was carried out to study the effect of integrated nutrient management on the growth, yield and yield attributes, and quality of tomato.

RESEARCH METHODS

A field experiment was carried out during the winter season (2009-2010) to study the "Effect of Nitrogen , Phosphorus and Potassium fertilizers on the growth, yield and quality of Tomato var. Azad T-6." at the Horticultural Research Farm of the Department of Applied plant science (Horticulture) Babasaheb Bhimrao Ambedkar University Lucknow. The soil of the experimental farm was saline with soil pH less than 8.2 Three types of fertilizers *i.e.* of nitrogen, phosphorus and potassium in different combinations were tested in comparison with inorganic fertilizer treatment as control in a Randomized Block Design with three replications. Combinations were tested in comparison with inorganic fertilizer treatment as control in randomized block design with three replications. The soil of the experimental field was sandy loam texture with pH 8.2 and organic matter - 0.23 %.The fertilizers were incorporated into the soil at the rate of 120:80:75 kg/ha NPK at the time of planting.

The recommended dose of inorganic fertilizers viz., 120:80:75 kg NPK/ha were applied as per the treatments. P and K each @ 75 kg/ha along with 50 % N The chemical fertilizers were applied to tomato before transplanting. A block without fertilizer treatment was used as the control. The twelve treatments were arranged in 3m x 3m plots and Seedlings were transplanted at a spacing of 60 x 45 cm and thus in a plot a complete randomized block design with three replications. Were applied as basal Remaining 50 % N was applied 30 days after transplanting. Observations on plant height, number of branches/plant, number of fruits/plant, fruit weight and yield were recorded. Total soluble solids were measured using hand refractometer and expressed in 0Brix.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

Growth attributes:

Results presented in Table 1, indicated the significant differences among the kinds of inorganic fertilizers. The plant height, considered to be an important factor to judge the vigor was found increased to a significant level. inoculated plants resulting in accumulation of more dry matter, N, P and K in the stems and leaves (Nanthakumar and Veeraragavathatham, 2001).

Similar to plant height, the branching was increased due to the application of inorganic fertilizers. The number of branches per plant is of considerable importance and it has positive association with yield.

Table 1: Effect of NPK

Treatments	Height of the plant (cm)	Number of primary branches	Number of secondary branches	Days to flowering	Days to fruiting	Days to maturity
T_1 - NPK control	17.73	1.96	3.32	42.48	45.24	65.50
T_2 - No, Po, K (75 kg / ha)	17.94	2.02	4.32	43.62	45.70	68.33
T_3 - No, P (80 kg / ha), Ko	18.76	2.05	4.22	43.47	48.30	67.44
T_4 - No, P (80 kg / ha , K (75 kg /ha)	19.04	2.07	4.46	44.49	50.00	69.33
T_5 - N (120 kg / ha), Po, Ko	19.09	2.15	4.76	46.21	49.66	69.84
T_6 - N (120 kg / ha), Po, K (75 kg /ha)	19.48	2.20	5.60	47.72	48.33	70.11
T_7 - N (120 kg / ha), P (80 kg /ha) Ko	19.64	2.26	4.43	46.65	47.15	70.25
T_8 - N (120 kg / ha), P (80 kg /ha), K (75 kg / ha)	19.78	2.27	5.80	49.20	46.25	72.33
T_9 - N (180 kg / ha), Po, Ko	19.93	2.34	5.85	49.64	55.25	70.55
T_{10} - N (180 kg / ha), Po, K (75 Kg / ha)	20.68	2.34	4.95	48.79	49.55	69.92
T_{11} - N (180 kg / ha), P (80 kg / ha)	20.72	2.50	5.86	48.00	50.88	70.56
T_{12} - N (180 kg / ha), P (80 kg / ha), K (75kg/ha)	21.38	2.53	6.25	48.66	51.66	74.33
S.E. Difference	0.561	0.148	0.096	1.442	1.194	1.613
C. Difference	1.164	0.308	0.199	2.991	2.476	3.347

The number of primary branches ranged from treatment T_{12} (2.53) where as the secondary branches (6.25) per plant. Both the parameters were boosted correspondingly with the increasing levels of nitrogen application of N, (180kg/ha) which caused 30% increase of branches. The height of tomato plants increased significantly with the increased levels of nitrogen. It ranged from 21.38 to17.73 Under the different treatments. Application of (180 kg. N/ha) produced (21.38 cm.) taller plants than the lowest dose i. e. (120kg/ N ha). The plants under the lowest level remained significantly dwarf when compared with the rest of the treatments. The findings of the present investigation are in conformity with the reports of Baringer *et al.(*1999), Sharma *et al.* (2001) as reported in tomato.T_3 as primary branches (2.05) per plant and the secondary branches (4.22) per plant. Both the parameters were boosted correspondingly with the increasing levels of phosphorus application (80kg/ha) which increased for 20% in these attributes as compared to the lowest level of P fertilizer (Gupta and Sanger (1998), Groot *et al.* (2002) as reported in tomato. The number of primary branches ranged from 2.07 - 2.50 per plant under the different treatment where as the secondary branches ranged from 4.76- 6.25 per plant under the different treatment. Both the parameters were boosted correspondingly with the increasing levels of application of K (75kg/ha). The height of tomato plants increased correspondingly with the increased levels of potassium. It ranged from 19.78 to 20.72 cm under the different treatments.

Floral Parameters:

Flowering under different N treatments varied from T_9 (49.64) days. Nitrogen nutrition at the rate of (180 kg/ ha) delayed the flowering varied significantly under the varying doses of nitrogen increasing. The increasing levels of N took relatively longer duration for these parameters. The maximum duration noted for completing 50 per cent flowering was under N (180 kg/ha) at 49.64 days followed by (180 kg/ha) at 48.79 days noted under (120 kg N/ha). A delay of 5.8 days was, therefore, noted in this regard under the highest doses of nitrogen when compared with the lowest dose. The finding are in agreement with the reports of Mitra *et al.* (1969), Taber (2001).The maximum duration noted for completing 50 per cent flowering was under P (80Kg/ ha) (49.20 days) followed by (80Kg/ha) (48.00 days) noted under (20 kg P/ha). A delay of 5.8 days was, therefore, noted in this regard under the highest doses of phosphorus when compared with the lowest dose. The finding are in agreement with the reports of Poulton *et al.* (2001). Flowering under different K treatments varied from T_{10} (48.79) days. Potassium nutrition at the rate of (75 kg/ ha) delayed the flowering varied significantly under the varying doses of potassium increasing.

Fruit-set and fruit ripening :

The observation also showed that Increasing levels of N delayed the period require for fruit setting and fruit ripening similarly the increasing doses of N delayed the fruit ripening and fruit set. The longest period of T_9 (55.25) days was required when N (180 kg/ha) was given against the shortest period (45.24 days) observed under control, in other words it was delayed by approximately (55.25 days) under the highest level of fertilization when the total period from transplanting to fruit ripening was examined, the highest days (74.33 Days) was required under the treatment (180 kg) N/ ha against the minimum 69.33 days under the treatment 120 kg N/ha. Nitrogen nutrition promotes flowering and fruit set

Table 2 : Effect of NPK

Treatments	Number of marketable fruit	Number of unmarketable fruit	Number of fruit / plant	Weight of fruit / plant (kg)	Weight of fruit / plot (kg)	Fruit yield (q / ha)	T.S.S. (%)
T_1 - NPK Control	27.08	9.03	37.01	6.03	50.85	321.60	3.32
T_2 - No, Po, K (75 kg / ha)	30.62	11.50	42.12	6.78	62.33	350.31	4.43
T_3 - No, P (80 kg / ha), Ko	34.91	10.33	45.24	7.81	62.55	380.43	4.46
T_4 - No, P (80 kg / ha , K (75 kg /ha)	36.20	13.44	49.64	8.54	54.25	400.66	4.76
T_5 - N (120 kg / ha), Po, Ko	29.92	14.30	44.22	7.32	65.14	425.55	5.60
T_6 - N (120 kg / ha), Po, K (75 kg /ha)	37.90	12.43	50.33	8.43	68.33	433.33	4.32
T_7 - N (120 kg / ha), P (80 kg /ha) Ko	36.65	14.43	51.08	6.99	57.88	418.56	4.95
T_8 - N (120 kg / ha), P (80 kg /ha), K (75 kg / ha)	37.33	15.33	52.66	7.34	50.55	450.68	4.22
T_9 - N (180 kg / ha), Po, Ko	37.43	13.12	50.55	8.53	62.33	480.3	5.80
T_{10} - N (180 kg / ha), Po, K (75 kg / ha)	35.97	13.65	49.62	8.75	63.65	470.93	5.85
T_{11} - N (180 kg / ha), P (80 kg / ha)	37.83	14.02	51.85	8.6	61.50	485.50	5.86
T_{12} - N (180 kg / ha), P (80 kg / ha), K (75k g/ha)	38.54	16.68	55.22	10.11	75.50	510.11	6.25
S.E. Difference	2.106	1.098	1.241	0.827	2.096	21.982	0.096
C. Difference	4.369	2.278	2.573	1.716	4.347	45.588	0.199

but excess of it delayed fruit maturity and decreased fruit size. Ruiz and Romero (1998) also showed the similar result. He stated that fruit ripening was recorded at maximum days (72.33 Days) required when plants were treated with high dose of nitrogen (80 kg N/ha) in comparison to lower fertilizer level which required minimum days (65.50 days) for ripening. Phosphorus nutrition promotes flowering and fruit set but excess of it delays fruit maturity and decreased fruit size. the increasing doses of K delayed the fruit ripening and fruit set. The longest period of T_{12} (51.66) days was requiring when K (75 kg/ha) was given against the shortest period (45.24 days) observer under control. , the highest of T_8 (72.33 days) were required under (75 kg) N/ha against the minimum of (65.50 days) under lowest dose of potassium as reported by Singh (1979).

Yield attributing traits :

Tomato is mainly grown for ripe fruits which are used in vegetable preparation, salad and processing industries. Nitrogen treatment in increasing levels improved the yield and yield attributing characters. In the present investigation application of 180kg N/ha produced the highest number of fruits per plant (55.22). These findings are in line with the reports of Portand Famous *et al*.(1975), and Mishra and Singh (2006). Phosphorus treatment in increasing levels improved the yield and yield attributing characters. Application of 80kg P/ha produced the highest number of fruits per plant (45.24) and maximum number of marketable fruit per plant (34.91). These findings are in line with the reports of Poulton *et al.* (2001). Potassium treatment in increasing levels also improved the yield and yield attributor characters. In the present investigation application of 75 kg K/ha produced the highest number of fruits per plant (42.12) as well as highest number of marketable fruit per plant (30.62).Which is on supported by the reports of Mishra and Singh (2006).

Among the treatments, application of NPK (180 kg / ha + 80 kg / ha + 75 kg / ha) recorded the highest TSS of 6.25 0Brix. This might be due to the presence of better nutrients and phytohormones due to the application of NPK.

Conclusions :

It can be concluded that application of NPK @ 180+80+75 kg / ha improved the growth, yield and quality of tomato under luck now condition.

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