Published with Open Access at Journal BiNET
Vol. 02, Issue 01: 33-40
International Journal of Multidisciplinary Perspectives
Journal Home: https://www.journalbinet.com/ijmp-journal.html

Effect of nitrogen and phosphorus on growth, yield and quality of tomato

Nusrat Jahan Nishat[1], Sazib Biswas[1], Md. Nazmul Hasan Mehedi[2], Abdur Rakib[2] and Kazi Tahmina Akter[2]

[1]Department of Horticulture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur-1706, Bangladesh
[2]Horticulture Division, Bangladesh Institute of Nuclear Agriculture, BAU Campus, Mymensingh-2202, Bangladesh

Corresponding author: nazmul02348@gmail.com (Mehedi MNH)
Article Received: 23.06.21; Revised: 19.08.2021; First published online: 15 September, 2021.

ABSTRACT

The experiment was conducted between October 2013 and March 2014 in the Horticulture Research Field and the Laboratories of the Sheik Mujaibur Rahman University of Agriculture, Salna, Gazipur, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur, to identify the optimum dose of nitrogen and phosphoric fertilizer for better growth, yield and quality of tomatoes. There were five levels of nitrogen 0 kg ha^{-1} (N_0), 125 kg ha^{-1} (N_{125}), 250 kg ha^{-1}(N_{250}), 300 kg ha^{-1} (N_{300}), 350 kg ha^{-1} (N_{350}) and five levels of phosphorus 0 kg ha^{-1} (P_0), 50 kg ha^{-1} (P_{50}), 100 kg ha^{-1} (P_{100}), 125 kg ha^{-1} (P_{125}), 150 kg ha^{-1} (P_{150}) which made 25 treatment combinations. The results revealed that nitrogen level 300 kg ha^{-1} (N_{300}) performed the best regarding plant height at final harvest (108.10 cm), weight of fruits per plant (2.50 kg), yield per hectare (76.17 t) and TSS (10.41%). The crop treated with phosphorus 125 kg ha^{-1} (P_{125}) produced the maximum plant height at final harvest (103.89 cm), number of fruits per plant (66.76), weight of fruits per plant (2.20 kg), weight of fruits per plot (32.04 kg), yield per hectare (66.75 t) and TSS (10.42%). The plants treated with nitrogen 300 kg ha^{-1} and phosphorus 125 kg ha^{-1} ($N_{300}P_{125}$) performed the best regarding plant height at final harvest (112.17 cm), number of fruits per plant (88.11), weight of fruits per plant (2.87 kg), yield per hectare (87.85 t) and TSS (10.62%). For tomato growing in the Salna series of shallow Red-Brown Terrace soil, a combined treatment of nitrogen 300 kg ha^{-1} and phosphorus 125 kg ha^{-1} was found to be more lucrative, with a high benefit-cost ratio (8.61).

Key Words: *Nitrogen, Phosphorus, Growth, Yield and Tomato.*

Cite Article: Nishat, N. J., Biswas, S., Mehedi, M. N. H., Rakib, A. and Akter, K. T. (2021). Effect of nitrogen and phosphorus on growth, yield and quality of tomato. International Journal of Multidisciplinary Perspectives, 02(01), 33-40.
Crossref: https://doi.org/10.18801/ijmp.020121.06

I. Introduction

Annual herbal self-pollinated Tomato (*Solanum lycopersicum*), belonging to the Solanaceae family with a diversity center in the Peruvian Highlands (Taylor, 1986). Tomato is ranked third worldly in

Published with open access at journalbinet.com.
EISSN 2710-5067 © 2021 The Authors, Research Paper.

vegetable production and is grown in tropical, subtropical and temperate climates (FAO, 2008). Tomato fruits are of considerable nutritional value, comprising precursors of calcium, iron and other minerals for vitamin A, B and C (Bose and Som, 1986). A hundred grams of red tomato (rough) have 18 kcal of energy, 1.0 g dietary fiber, 0.2 g of fat, 1.6 g of sugar, 1.0 g of protein, 93 g of water, 31 mg of vitamin C (Zhang et al., 2009). Tomato is a well-known crop since it adapts to various soil and temperature and tomatoes are one of the main plants grown in Bangladesh (Ahmed, 1995). Bangladesh has an average tomato output of 14.3 t ha^{-1} (BBS, 2008) and it is 22.5 t ha^{-1} (BBS, 2013) which is lower than in Japan (52.82 t ha^{-1}), USA (65.22 t ha^{-1}), China (30.39 t ha^{-1}), Egypt (34.00 t ha^{-1}) and Turkey (41.77 t ha^{-1}).

Successful crop production depends on many factors, such as planting time, population density, fertilization, both macro and micronutrients etc. Among them, fertilizer is one of the important factors contributing to the production and yield of any crop. Nutrient management is considered one of the vital factors responsible for increased yields and quality of crops, which varies from region to region (Raskar, 2003). According to the cultivars and soil type in agro-ecological zones, fertilizer requirement for any crop varies. So it is essential to standardize proper dose of fertilizer for each cultivar to improve the crop yield. Proper and judicious use of fertilizer, especially nitrogen and phosphorus, is one way to increase the crop yield of tomatoes in Bangladesh. Nitrogen promotes strong early growth, ensures continued growth, maximizes flower numbers and fruit set of tomatoes. Among the fertilizers, nitrogen has been known as the central element for agricultural improvement (Mukhopadhyay et al., 1986). Although acidity is also increased by excess nitrogen, it has a great impact as it helps increases fruit quality, fruit size, keeping quality, color and taste (Banerjee et al., 1997). Nitrogen significantly increases the growth and yield of tomatoes (Bose and Som, 1986). Phosphorus is an essential nutrient, second major element for crop growth, yield and quality. It ensures continued growth, establishes maximum root development and fruit development. Phosphorus stimulates floral cluster formation, which enhances yield (Zhang et al., 2007; Karim, 2005). Seno claims optimal macronutrient rates, especially phosphorus, boost tomato yield and quality (Seno et al., 1987). Despite some evidence that fertilization is beneficial, relatively little work has been done in Bangladesh on the usage of N and P with tomatoes. Considering all the facts, present observations were carried out to analyze the influence of nitrogen and phosphorus on development, yield and quality of tomatoes and standardize the right nitrogen and phosphorus doses to maximize tomato yield.

II. Materials and Methods

Climate and soil

The trial site has a subtropical climate with substantial rains from April to September and little rain the rest of the year. The experimental field soil was a Shallow Red-brown Terrace soil from the Salna series of Shallow Red-brown Terrace soil. The soil was silty clay loam, acidic and deficient in fertility.

Land preparation and experimental design with layout

Deep plowing was used to prepare the research field for good tilth. During final land preparation, basal doses of fertilizers such as cow dung (10 t ha^{-1}) were applied. The trial was laid out using a Randomized Complete Block Design (RCBD) and divided into three blocks; treatments were assigned at random in each block, representing three replications. The blocks to block and plot to plot distances were 1 m and 0.5 m, respectively, with a unit plot dimension of 2.4 m 2.4 m. Row to row spacing was 60 cm, while plant to plant spacing was 40 cm.

Plant material and treatments

One tomato variety, 'BARI tomato 14', was used as planting material for this experiment. It was an open pollinated variety, 30-35 days to maturity (anthesis to ripening) and tolerant to bacterial wilt. The experiment consisted of two factors (nitrogen and phosphorus fertilizer).

Factor A	Factor B
N_0 =0 kg N ha^{-1}	P_0 =0 kg P ha^{-1}
N_{125} =125 kg N ha^{-1}	P_{50} =50 kg P ha^{-1}
N_{250} =250 kg N ha^{-1}	P_{100} =100 kg P ha^{-1}
N_{300} =300 kg N ha^{-1}	P_{125} =125 kg P ha^{-1}
N_{350} =350 kg N ha^{-1}	P_{150} =150 kg P ha^{-1}

Published with open access at journalbinet.com.
EISSN 2710-5067

Manuring and fertilizer
Urea and triple superphosphate were applied as per treatment as nitrogen and phosphorus fertilizer, respectively. Entire cowdung (10 t ha^{-1}) and TSP were applied during land preparation. In two installments at 15 and 30 days after transplanting, Urea and MoP were applied as top dressing. Urea and TSP were applied as per treatment combination.

Seedling raising and transplanting and intercultural operations
Seedbed was used to raise tomato seedlings. They need fine tilth condition, seed was sown in line on 14 October 2013. Then seedlings (30 days old) were transplanted to the experimental plot on 14 November, 2013. Necessary gap filling was done within a week of transplanting. Weeding was done to break the soil crust and to keep the plots free from weeds. Irrigation was given to the plants as and when needed. Control measures were taken against aphid, bacterial wilt and leaf curl virus. Aphids were controlled by spraying Admire @ 2 ml/10 L of water and bacterial wilt, fungal diseases and leaf curl virus were controlled by Diathene M45 @ 2 g L^{-1} of water and Ridomill gold @ 2 g L^{-1} of water.

Collection of data
The data collected on plant height (cm) at first flowering, plant height (cm) at last harvest, days to maturity (from seed sowing to first harvest), number of fruits per plant, fruit diameter, fruit length, weight of fruits per plant, weight of fruits per plot, yield per hectare, total soluble solid (tss) content (%), estimation of ascorbic acid and estimation of β-carotene. The ascorbic acid was determined and free ascorbic acid content was quantified (Ranganna, 1979). The estimation of β-carotene was done by the following formula (Nagata and Yamashita, 1992). The optimum doses of nitrogen and phosphorus for maximum crop yield were calculated from a simple ploynomical regression equation.

$$y = \alpha + \beta_1 x + \beta_2 x^2$$

Where, x is the independent variable (fertilizer dose). The optimum dose of fertilizer for maximum yield was $x = -\beta_1 / 2\beta_2$.

Statistical analysis and economic analysis
MSTAT-C program was used to find out the significance of the experimental result. The mean for all the treatments was calculated. By F-variance ratio, the analysis of variance for each of the characters was performed. The DMRT did the mean separation at 1 or 5% level of probability. The total cost of production, gross income, net return and cost-benefit ratio of tomatoes were calculated.

III. Results and Discussion

Plant height at last harvest
Effect of nitrogen on plant height at the last harvest was significantly differed (Table 01). The longest plant was observed in treatment 300 kg N ha^{-1} (N_{300}) (108.10 cm), which was statistically alike to 250 kg N ha^{-1} (107.30 cm), 350 kg N ha^{-1} (106.50 cm) and 125 kg N ha^{-1} (105.50 cm). With increase of nitrogen level up to 300 kg/ha, the plant height increased and then decreased. Wahle and Masiunas (2003) reported that tomato growth was improved with high levels of N. Phosphorus had no significant influence on plant height at harvesting (Table 01). The tallest plant was found in treatment 125 kg p ha^{-1} (P_{125}) (103.89 cm) and the shortest was found in 0 kg p (100.52 cm). The interaction effects of nitrogen and phosphorus also had no significant difference (Table 02). Numerically, the tallest plant was found in $N_{300}P_{125}$ (112.17 cm) and the shortest was found in N_0P_0 (81.17 cm).

Days to maturity (from seed sowing to the last harvest)
Nitrogen had a significant effect on days to maturity (Table 01). The minimum days required to maturity were observed in N_{125} (142.10 days) and the maximum days (144.40 days) were observed in N_0 and N_{350}. The observation showed that increasing levels of N delayed the period required for fruit ripening. Nitrogen nutrition promotes flowering and fruit set but excess of it delayed the period of fruit maturity. The findings were in line with Kumar et al. (2013). Phosphorus also had a significant effect on days to maturity (Table 01). But among the treatments, the minimum number of days was required in P_{125} (142.80 days). The maximum days required in control treatment P_0 (144.60 days). The findings revealed that an increased phosphorus level promoted early maturity, but excess of it delayed

Published with open access at journalbinet.com.
EISSN 2710-5067

the period of fruit maturity. These results were also in line with Kumar et al. (2013). To evaluate the interaction effect treatment combination $N_{125}P_{125}$ (138.10 days), the maximum days were recorded in N_0P_0 (146.40 days).

Fruits per plant

The number of fruits per plant was observed highest in N_{250} (70.63), which was statistically alike to N_{300} (70.17) and N_{350} (68.67) (Table 01) while, lowest number of fruit in control treatment (N_0). These findings were in line with the reports of Mishra and Singh (2006). For phosphorus, the highest number was found in P_{125} (66.76), which was statistically identical to P_{50} (63.76) and P_{150} (59.68), where the lowest was found in P_0 (56. 46). These findings were more or less (80 kg P/ha produced the highest number of fruits per plant) in line with Kumar et al. (2013) report. The maximum number of fruit per plant, in interaction, was observed in $N_{300}P_{125}$ (88.11) and the minimum number was observed in control treatment N_0P_0 (31.89).

Table 01. Effect of nitrogen and phosphorus on plant height, days to maturity, no. of fruit per plant, weight of fruits per plant, yield, TSS, Beta carotene and Ascorbic acid

Levels of nitrogen	Plant height at last harvest (cm)	Days to maturity	No. of fruits/plant	Weight of fruits per plant (kg)	Yield per ha (ton)	TSS (%)	Beta carotene (mg/100 g)	Ascorbic acid (mg/100 g)
N_0	86.39 b	144.40 a	35.16 c	1.51 c	38.79 c	10.16 c	0.0478 c	7.36 a
N_{125}	105.5 a	142.10 b	58.54 b	2.02 b	64.46 b	10.31 b	0.0595 b	6.97 a
N_{250}	107.3 a	143.90 a	70.63 a	2.39 ab	71.94 a	10.41 ab	0.0530 b	6.88 a
N_{300}	108.1 a	144.30 a	70.17 a	2.50 a	76.17 a	10.42 a	0.0751 a	6.46 ab
N_{350}	106.5 a	144.40 a	68.67 a	2.27 ab	66.67 b	10.38 ab	0.0814 a	5.96 b
Level of sig.	**	*	**	**	**	**	**	**
CV (%)	7.22	1.50	15.25	19.59	12.42	0.97	6.72	6.91
Levels of phosphorus								
P_0	100.52	144.60 a	56.46 b	1.99 b	61.56 b	10.21 c	0.1031 a	5.68 d
P_{50}	102.72	143.50 ab	63.76 ab	2.09 ab	63.67 a	10.31 bc	0.0392 c	6.34 c
P_{100}	103.6	143.70 ab	56.50 b	2.18 a	64.21 a	10.36 ab	0.0819 b	6.60 c
P_{125}	103.89	142.80 b	66.76 a	2.20 a	66.75 a	10.44 a	0.0461 c	7.40 b
P_{150}	103.12	144.30 ab	59.68 ab	2.12 ab	61.83 b	10.34 b	0.0265 d	8.15 a
Level of sig.	*	*	**	*	*	**	**	**
CV (%)	2.80	1.50	15.25	19.59	6.38	0.97	6.72	6.91

Means bearing same letter (s) in a column do not differ significantly at 1% and 5% level of probability; *=Significant at 5% level of probability, **= Significant at 1% level of probability

Weight of fruits per plant

There were significant differences in weight of fruits per plant due to different levels of nitrogen fertilizer (Table 01). The maximum fruits weight was observed in N_{300} (2.50 kg), which was statistically alike to N_{250} (2.39 kg) and N_{350} (2.27 kg). The minimum fruit weight was found in N_0 (1.51 kg). The plants under the treatment of P_{125} produced the maximum fruit weight (2.20 kg) followed by P_{100} (2.18 kg), P_{150} (2.12 kg) and P_{50} (2.09 kg), which were statistically identical. The plants treated with P_{125} produced the maximum number of fruits per plant, which might cause the maximum fruit weight per plant at the same treatment. Hasan et al. (2012) found similar results in case of brinjal. Besides, the treatment P_{125} produced the maximum fruit per cluster. This also might be another cause behind the result.

The maximum fruit weight was observed in $N_{300}P_{125}$ (2.87 kg), which was statistically similar to all treatment combinations except N_0P_0, N_0P_{50}, N_0P_{100}, N_0P_{150} and $N_{350}P_{125}$, where the minimum fruit weight was found in N_0 P_0 (1.10 kg) (Table 02). The maximum fruit weight per plant was found in this combination might be due to positive role of nitrogen and phosphorus at higher doses in increasing fruit yield.

Published with open access at journalbinet.com.
EISSN 2710-5067

Yield per hectare

In terms of fruit output per hectare, differing nitrogen fertilizer doses produced a substantial result (Table 01). The highest yield was recorded in treatment N_{300} (76.17 t), which was statistically identical to N_{250} (71.94 t). The lowest fruit yield was found in N_0 (38.79 t). Warner et al. (2004) reported that fruit yield increased with N up to 250 kg N ha^{-1} which was agreed with the present result. Phosphorus fertilizer significantly influences the fruit yield (Table 01) as results revealed that fruit yield increased with the increasing level of phosphorus up to 125 kg ha^{-1}. The maximum yield per hectare was found in P_{125} (66.75 t), which was statistically identical to P_{100} (64.21 t) and P_{50} (63.67 t), while the minimum was found in P_0 (61.56 t).

The interaction effect of different levels of nitrogen and phosphorus was found significant on fruit yield per hectare (Table 02). The maximum yield was recorded in $N_{300}P_{125}$ (87.85 t) followed by $N_{250}P_{125}$ (83.58 t) and $N_{250}P_{100}$ (76.58 t), which were statistically similar. The minimum yield was recorded in N_0P_0 (14.79 t).

Table 02. Interaction effect of nitrogen and phosphorus on plant height, days to maturity, no. of fruit per plant, weight of fruits per plant, yield, TSS, Beta carotene and Ascorbic acid

Treatment combination	Plant height at last harvest (cm)	Day to maturity	No. of fruits/plant	Weight of fruits per plant (kg)	Yield per ha (ton)	TSS (%)	Beta carotene (mg/100 g)	Ascorbic acid (mg/100 g)
N_0P_0	81.17	146.40 a	31.89 i	1.10 f	14.79 i	10.06 g	0.1682 b	4.88 g
N_0P_{50}	82.72	143.30 abc	33.72 hi	1.35 def	36.73 h	10.30 defg	0.0630 cd	7.14 bcd
N_0P_{100}	83.79	145.10 abc	34.22 ghi	1.43 cdef	41.13 h	10.18 fg	0.0643 cd	6.33 cdef
N_0P_{125}	93.79	145.30 ab	40.32 efghi	2.35 abcde	61.54 g	10.18 fg	0.0309 efg	7.91 b
N_0P_{150}	89.56	141.80 bcd	35.64 fghi	1.30 ef	39.77 h	10.07 g	0.0493 def	10.20 a
$N_{125}P_0$	105.90	144.40 abc	58.32 bcdef	2.17 abcde	73.58 bcd	10.27 defg	0.2366 a	5.48 efg
$N_{125}P_{50}$	106.45	143.30 abc	71.83 abcd	2.02 abcdef	67.19 cef	10.39 abcdef	0.0239 ghi	7.55 b
$N_{125}P_{100}$	107.11	145.50 ab	55.11 cdefgh	2.03 abcdef	63.19 def	10.28 defg	0.0294 fgh	7.91 b
$N_{125}P_{125}$	103.22	138.10 d	52.67 defghi	1.92 abcdef	59.81 efg	10.25 defg	0.0015 i	5.78 efg
$N_{125}P_{150}$	105.06	145.40 ab	54.78 cdefgh	1.94 abcdef	58.52 fg	10.35 cdef	0.0058 ghi	8.11 b
$N_{250}P_0$	104.94	143.90 abc	69.11 abcd	2.46 abc	71.27bcdef	10.26 defg	0.0065 ghi	7.10 bcd
$N_{250}P_{50}$	107.45	142.50 abc	77.33 abc	2.32 abcde	73.44 bcd	10.48 abcd	0.0231 ghi	8.13 b
$N_{250}P_{100}$	108.72	145.00 abc	65.94 abcd	2.78 ab	76.58 abc	10.27 defg	0.0158 ghi	7.99 b
$N_{250}P_{125}$	108.90	143.90 abc	80.34 ab	2.68 ab	83.58 ab	10.57 abc	0.0609 cd	6.41 cde
$N_{250}P_{150}$	106.67	144.10 abc	78.22 abc	2.43 abcd	72.83 bcd	10.45 abcde	0.0088 ghi	4.75 g
$N_{300}P_0$	100.94	142.80 abc	67.55 abcd	2.05 abcdef	65.60cdef	10.27 defg	0.0535 cde	5.62 efg
$N_{300}P_{50}$	110.33	143.90 abc	70.56 abcd	2.25 abcde	71.25 bcdef	10.27 defg	0.0293 efgh	6.05 def
$N_{300}P_{100}$	109.11	140.80 cd	67.50 abcd	2.47 abc	67.63cdef	10.36 bcdef	0.0759 c	4.73 g
$N_{300}P_{125}$	112.17	143.40 abc	88.11 a	2.87 a	87.85 a	10.62 a	0.0662 cd	6.18 def
$N_{300}P_{150}$	107.89	144.80 abc	57.11 bcdefg	2.13 abcdef	68.54cdef	10.56 abc	0.0638 cd	7.39 bc
$N_{350}P_0$	106.67	145.80 ab	55.43 cdefgh	2.19 abcde	65.98cdef	10.20 efg	0.0508 cdef	5.20 fg
$N_{350}P_{50}$	108.72	144.50 abc	62.56 bcde	2.47 abc	67.73 cdef	10.48 abcd	0.0567 cd	8.15 b
$N_{350}P_{100}$	107.94	145.30 ab	59.72 bcde	2.27 abcde	72.52 bcde	10.33 cdef	0.2240 a	6.06 def
$N_{350}P_{125}$	102.78	143.30 abc	75.17 abcd	1.75 bcdef	58.94 fg	10.60 ab	0.0708 cd	5.41 efg
$N_{350}P_{150}$	106.45	142.50 abc	72.67 abcd	2.67 ab	68.17cdef	10.27 defg	0.0046 hi	10.01 ab
Level of sig.	NS	*	**	**	**	**	**	**
CV (%)	6.38	1.50	15.25	19.59	7.93	0.97	6.72	6.91

Means bearing same letter (s) in a column do not differ significantly at 1% and 5% level of probability; *= Significant at 5% level of probability **= Significant at 1% level of probability

Total soluble solids (TSS) content (%)

The highest TSS content was found in treatment N_{300} (10.42%), which was statistically similar to N_{250} (10.41%) and N_{350} (10.38%). For phosphorus, the maximum TSS was observed in P_{125} (10.44%), which was statistically alike to P_{100} (10.36%) and the minimum was found in P_0 (10.21%). The interaction effects of nitrogen and phosphorus on total soluble solids (TSS) were significant (Table 02). The maximum TSS was found in $N_{300}P_{125}$ (10.62%).

Published with open access at journalbinet.com.
EISSN 2710-5067

β- carotene (mg/100g)

Here β-carotene increased with the increase of nitrogen. The highest β- carotene (0.0814 mg/100 g) was recorded in treatment N_{350}, which was statistically identical to N_{300}. Kobryn and Hallmann (2005) represented an opinion that the higher nitrogen fertilization increased β-carotene content. The highest β- carotene content was found in P_0 (0.1031 mg/100 g), whereas the lowest in treatment P_{150} (0.0265 mg/100 g). Due to interaction effect, the maximum β- carotene was observed in N_{125} P_0 (0.2366 mg/100 g) followed by N_{350} P_{100} (0.2240 mg/100 g) and the minimum β- carotene content was recorded in treatment $N_{125}P_{125}$ (0.0015 mg/100 g).

Ascorbic acid (mg/100g)

The maximum Ascorbic acid was recorded in treatment N_0 (7.36 mg/100 g), which was statistically identical to N_{125} (6.97 mg/100 g) and N_{250} (6.88 mg/100 g), whereas the minimum was recorded in treatment N_{350} (5.96 mg/100 g). Here it was observed that ascorbic acid decreased with the increase of nitrogen fertilizer. Kobryn and Hallmann (2005) believed that higher nitrogen fertilization decreased the vitamin C content, which supported the present findings. The result was also agreed with Roni (2012). The maximum ascorbic acid content was observed in P_{150} (8.15 mg/100 g) and the minimum was found in P_0 (5.68 mg/100 g).

The maximum ascorbic acid content was found in N_0P_{150} (10.20 mg/100 g), which was statistically similar to $N_{350}P_{150}$ (10.01 mg/100g) (Table 02) where the minimum was observed in treatment $N_{300}P_{100}$ (4.73 mg/100 g).

Economics

The maximum gross return (Tk. 1317750/ha) was obtained from $N_{300}P_{125}$ followed by $N_{250}P_{125}$ (Tk. 1253700/ha) and its lowest value was recorded from N_0P_0 (Tk. 221850/ha) (Table 03). The treatment combination $N_{300}P_{125}$ gave the highest net return (Tk. 1180557.42/ha), followed by $N_{250}P_{125}$ (Tk. 1117588.62/ha). The maximum benefit-cost ratio (BCR) was obtained from $N_{300}P_{125}$ (8.61) followed by $N_{250}P_{125}$ (8.21). The lowest BCR was found in N_0P_0 (0.93) treatment.

Table 03. Cost benefit ratio of tomato cultivation

Treatment combination	Yield (t ha^{-1})	Total cost of production (BDT)	Gross income (BDT)	Net return (BDT)	BCR
N_0P_0	14.79	115157.30	221850	106692.70	0.93
N_0P_{50}	36.73	120754.10	550950	430195.90	3.56
N_0P_{100}	41.13	126050.90	616950	490899.10	3.89
N_0P_{125}	61.54	129242.58	923100	793857.42	6.14
N_0P_{150}	39.77	131901.06	596550	464648.94	3.52
$N_{125}P_0$	73.58	118591.70	1103700	985108.30	8.31
$N_{125}P_{50}$	67.19	124188.50	1007850	883661.50	7.12
$N_{125}P_{100}$	63.19	129785.30	947850	818064.70	6.3
$N_{125}P_{125}$	59.81	132676.98	897150	764473.02	5.76
$N_{125}P_{150}$	58.52	135335.46	877800	742464.54	5.49
$N_{250}P_0$	71.27	122026.10	1069050	947023.90	7.76
$N_{250}P_{50}$	73.44	127617.60	1101600	973982.40	7.63
$N_{250}P_{100}$	76.58	133219.70	1148700	1015480.30	7.62
$N_{250}P_{125}$	83.58	136111.38	1253700	1117588.62	8.21
$N_{250}P_{150}$	72.83	138769.86	1092450	953680.14	6.87
$N_{300}P_0$	65.60	123107.30	984000	860892.70	6.99
$N_{300}P_{50}$	73.21	128704.10	1098150	969445.90	7.53
$N_{300}P_{100}$	67.63	134300.90	1014450	880149.10	6.55
$N_{300}P_{125}$	87.85	137192.58	1317750	1180557.42	8.61
$N_{300}P_{150}$	68.54	139851.06	1028100	888248.94	6.35
$N_{350}P_0$	65.98	124824.50	989700	864875.50	6.93
$N_{350}P_{50}$	67.73	130421.30	1015950	885528.70	6.79
$N_{350}P_{100}$	72.52	136018.10	1087800	951781.90	6.99
$N_{350}P_{125}$	58.94	138909.78	884100	745190.22	5.36
$N_{350}P_{150}$	68.17	141567.20	1022550	880982.80	6.22

Published with open access at journalbinet.com.
EISSN 2710-5067

IV. Conclusion

With 300 kg N ha^{-1} and 150 kg P ha^{-1} ($N_{300}P_{150}$), the production of tomato was best, but TSS was the highest in P_{125} while ascorbic acid content was found the highest in and beta carotene content was recorded the highest in P_0. The plants treated with $N_{300}P_{125}$ performed the best in all the experimental parameters. So nitrogen @ 300 kg ha^{-1} and phosphorus @ 125 kg ha^{-1} is recommended for better yield, quality and economic benefit of tomato cultivation in this region

References

[1]. Ahmed, K. U. (1995). PhulPhal O ShakSabji (in Bangla). 2nd Edition, Banglow No. 2, Farm Gate, Dhaka, Bangladesh. p. 470.
[2]. Banerjee, M. K., Balyan, D. S., Kalloo, G., Sing, A. and Saini, P. S. (1997). Effect of nitrogen fertilization and planting pattern on fruit yield of tomato cv. Hisal Lalima. Crop Research. 14(3), 441-446.
[3]. Bangladesh Bureau of Statistics (BBS) (2013). Yearbook of Agricultural Statistics of Bangladesh. Planning Division, Ministry of Planning, Govt. of the People's Republic of Bangladesh, Dhaka.
[4]. Bangladesh Bureau of Statistics (BBS). (2008). Year Book of Agricultural Statistics of Bangladesh, Statistics Division, Ministry of Planning, Govt. of the People's Republic of Bangladesh. p. 112.
[5]. Bose, T. K. and Som, M. G. (1986). Vegetable crops in India. B. Mitra Naya Prokash, Bidhan Sarani, Calcutta, India.
[6]. Food and Agriculture Organization (FAO). (2008). FAO Production Year Book. Basic data unit, Statistics Division, FAO, Rome, Italy. 57: 140-143.
[7]. Hasan, M. M., Chowdhury, M. A. H., Saha B. K. and Islam, M. R. (2012). Influence of phosphorus and sulphur on yield, yield attributes and biochemical composition of brinjal. Journal of Agroforestry Environment, 6(2), 109-114.
[8]. Karim, M. R. (2005). Study of growth and yield performance of late transplanted summer tomato genotypes. Bangladesh Agricultural University.
[9]. Kobryn, J. and Hallmann, E. (2005). The effect of nitrogen fertilization on the quality of three tomato types cultivated on Rockwool. Acta Horticulture, 6(1), 341-348. https://doi.org/10.17660/ActaHortic.2005.691.40
[10]. Kumar, M., Meena, M. L., Kumar, S., Maji, S. and Kumar, D. (2013). Effect of nitrogen, phosphorus and potassium fertilizers on growth, yield and quality of tomato var. Azad T-6. The Asian Journal of Horticulture. 8(2), 616-619.
[11]. Mishra, D. N. and Singh, I. R. (2006). Effect of N, P fertilization on the performance and production economics of rainfed okra intercropped with tomato under mid-hill condition of Uttaranchal. Environmental and Ecological, 24S (Special 3), 546-550.
[12]. Mukhopadhyay, D., Eunus, M. and Haque, M. M. (1986). Response of major crop to balanced fertilizer application. DAE and FAO, Field Document No. 5. p-1.
[13]. Nagata, M. and Yamashita, I. (1992). Simple Method for Simultaneous Determinations of Chlorophyll and Carotenoids in Tomato Fruit. Nippon Shokuhin Kogyo Gakkaish, 39, 925-928. (C.F., Food Chemistry, 2006, 103, 413-419).
[14]. Ranganna, S. (1979). Manual of analysis of fruit and vegetable products. Tata Mc Graw Hill publishing company Ltd., New Delhi. p. 634.
[15]. Raskar, B. S. (2003). Increasing yield potential of potato (*Solanum tuberosum*) by using irrigation method and fertilizer levels. Indian Journal of Agronomy, 48(3), 229-231.
[16]. Roni, M. S. (2012). Effect of plant spacing and nitrogen levels on growth, yield and quality of broccoli. Bangabandhu Sheikh Mujibur Rahman Agricultural University.
[17]. Seno, S., Nakagawa, J., Zanin, A. C. W. and Mischan, M. M. (1987). Effects of phosphorus and potassium levels on fruit characteristics and quality of tomato seeds. Horticulture Brasilsirare, 5(2), 25-28.
[18]. Taylor, I. B. (1986). Biosystematics of the tomato. In: The Tomato crop. A scientific basic for improvement, Atherton, J. and Rudich, G. (eds.) Chapman and Hall, New York. P. 1-34. https://doi.org/10.1007/978-94-009-3137-4_1

Published with open access at journalbinet.com.
EISSN 2710-5067

[19]. Wahle, E. A. and Masiunas, J. B. (2003). Population Density and Nitrogen Fertility Effects on Tomato Growth and Yield. HortScience. 38(3), 367-372. https://doi.org/10.21273/HORTSCI.38.3.367
[20]. Warner, J., Zhang, T. Q. and Hao, X. (2004). Effects of nitrogen fertilization on fruit yield and quality of processing tomatoes. Canadian Journal of Plant Science, 84, 865-871. https://doi.org/10.4141/P03-099
[21]. Zhang, C. X., Chen, Y. M., Fu, J. H., Cheng S. Z. and Lin, F. Y. (2009). Greater vegetable and fruit intake is associated with a lower risk of breast cancer among Chinese women. International Journal of Cancer, 125(1), 8-18. https://doi.org/10.1002/ijc.24358
[22]. Zhang, X. S., Liao, H., Chen, Q., Christie, P., Li, X. L. and Zhang, F. S. (2007). Response of tomato on calcareous soils to different seedbed phosphorus application rates. Pedosphere. 17(1), 70-76. https://doi.org/10.1016/S1002-0160(07)60009-5

HOW TO CITE THIS ARTICLE?

MLA
Nishat, N. J. et al. "Effect of nitrogen and phosphorus on growth, yield and quality of tomato." International Journal of Multidisciplinary Perspectives 02(01) (2021): 33-40.

APA
Nishat, N. J., Biswas, S., Mehedi, M. N. H., Rakib, A. and Akter, K. T. (2021). Effect of nitrogen and phosphorus on growth, yield and quality of tomato. International Journal of Multidisciplinary Perspectives, 02(01), 33-40.

Chicago
Nishat, N. J., Biswas, S., Mehedi, M. N. H., Rakib, A. and Akter, K. T. "Effect of nitrogen and phosphorus on growth, yield and quality of tomato". International Journal of Multidisciplinary Perspectives 02 (01) (2021): 33-40.

Harvard
Nishat, N. J., Biswas, S., Mehedi, M. N. H., Rakib, A. and Akter, K. T. 2021. Effect of nitrogen and phosphorus on growth, yield and quality of tomato. International Journal of Multidisciplinary Perspectives, 02(01), pp. 33-40.

Vancouver
Nishat, NJ, Biswas, S, Mehedi, MNH, Rakib, A and Akter, KT. Effect of nitrogen and phosphorus on growth, yield and quality of tomato. International Journal of Multidisciplinary Perspectives. 2021 September 02(01): 33-40.