IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 11, Issue 5 Ver. II (May 2018), PP 54-68
www.iosrjournals.org

Growth and Yield of Chilli Influenced By Nitrogen And Phosphorus

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Abstract : *A field experiment was carried out during the period from November 2015 to May 2016 at Horticultural farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh to investigate the influence of nitrogen and phosphorus on growth and yield of chilli. The two factorial experiments were laid out in Randomized Complete Block Design with three replications. Four levels of nitrogen N_0: 0 kg N ha^{-1}, N_1: 100 kg N ha^{-1}, N_2: 120 kg N ha^{-1}, N_3: 140 kg N ha^{-1} and three levels of phosphorous P_0: 0 kg P_2O_5 ha^{-1}, P_1: 30 kg P_2O_5 ha^{-1}, P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1} were used in this experiment. Growth and yield contributing parameters significantly influenced by different doses of nitrogen and phosphorus fertilizers. The dose of N_2 gave the highest plant height (cm) and most of the growth parameters increased with increasing nitrogen levels up to N_3. The dose of P_2gave the highest plant height (cm) and most of the growth parameters increased with increasing phosphorus levels up to P_3.The treatment combinationN_3 and P_3 gave the highest plant canopy(33.25 cm), fruit diameter (0.95 cm), fruit pedicel (2.87 cm), fruit length (5.60 cm), yield of fruits plant^{-1}(235.00 g), average fruit yield plot^{-1} (3.39 kg), individual fruit weight (2.52 g) and average fruit yield (12.32 tha^{-1}). Based on the present results, it can be suggested that the combined use of 140 kg N ha^{-1} with 60 kg P_2O_5 ha^{-1} increased plant growth and fruit yield of chilli.*

Keywords : *Chilli, Growth, Nitrogen, Phosphorus, Yield*

Date of Submission: 20-05-2018 Date of acceptance: 05-06-2018

I. Introduction

Chilli (*Capsicum frutescens*) is an important spice belongs to the family Solanaceae. The genus *Capsicum* contains about 20 species and now five domesticated species *Capsicum annum*, *Capsicum frutescens*, *Capsicum chinense*, *Capsicum baccatum*, *Capsicum pubescens*are only recognized. Pepper cultivars of *Capsicum frutescens* can be annual or short-lived perennial plants. Capsicum has different color-range from green to yellow, red, orange, purple and black. Other capsicum include the red, heart-shaped; the pale green, slender and curved bull's horn which range in color from yellow to red and sweet banana pepper which is yellow and banana shaped (TeshmTadesse Michael *et al*.,1999). The chilli is a plant of tropical and sub-tropical region. Tropical south America especially Brazil is thought to be the original home of pepper (Shoemaker and Teskey, 1995).

The profit from the use of commercial fertilizer has been so often demonstrated by experiment that there is no doubt about the necessity of using the right fertilizer and the economic returns resulting from them. The optimum proportion of fertilizer enhances the growth and development of a crop as well as ensures the availability of other essential nutrients for the plant. Use of inorganic and organic fertilizers has amused a great significance in recent years in vegetables production, for two reasons. Firstly, the need for continued increase production and per hectare yield of chilli requires the increase amount of nutrients. Secondly, the results of a large number of experiments on inorganic and organic fertilizers conducted in several countries reveal that inorganic fertilizer alone cannot sustain the productivity of soils under highly intensive cropping systems (Singh, 2004). Fertilizer rates influenced capsaicin content and colour of powdered pepper (Yodpetch, 1997). The mineral nutrients, N, P and K are known to affect growth and yield of the capsicums. In Bangladesh, urea is mostly used as the source of Nitrogen and split application of this fertilizer is commonly practiced(Hossain, 1990). On the other hand nutrient availability in a soil depends on some factors.Growth, development and yield of chilli depends on various factors among them balanced fertilizer is important one. Many researchers reported that different varieties of crop have different effect for the reducing higher rate of flower/ fruit dropping and fruit setting condition as well as the marketable yield of chilli. Different varieties respond to differential

cultivation practices and prevailing environmental condition during growing season.Generally large amount of nitrogen is required for the production of vegetable (Opena*et al.,* 1988). It is also the most essential element to manage in a fertilization system such that an adequate, but not excessive amount of nitrogen is available during the entire growing season (Anon., 1972).

Nitrogen plays a vital role as a constituent of protein, nucleic acid and chlorophyll (Devlin, 1972). Nitrogen is essential for building up protoplasm and protein, which induce cell division and initial meristematic activity when applied in optimum quantity (Singh and Kumar, 1969). Adequate nitrogen increases the quality, fruit size, keeping quality, color and taste (Shukla and Nair, 1993). Nitrogen influences flower development of several vegetable crops including pepper, tomato and cucumber (Kinet*et al* 1985). According to Bhatnagar and Panditu (1981), increase in nitrogen levels and spacing resulted in the production of quality fruits. Adequate supply of nitrogen is essential for vegetative growth, and desirable yield (Yoshizawa*et al*., 1981). Excessive application of nitrogen on the other hand is not only uneconomical but also induces physiological disorder and pollutes the environment.

Phosphorus is also one of the important macro essential element for normal growth and development of plant Phosphorus requirements vary depending upon the nutrient content of the soil (Bose and Som, 1986). Phosphorus shortage restricted the plant growth and remains immature (Hossain, 1990). The effect of phosphorus on the formation and translocation of carbohydrates, roots development, nodulation, growth and other agronomic characters are well recognized. Phosphorus induces earliness in flowering and fruiting including seed formation (Buckman and Brady, 1980). Again secondary mechanism of interference was the absorption of phosphorus from the soil through luxury consumption, increasing the tissue content without enhancing smooth biomass accumulation (Santos *et al*., 2004).To attain considerable production and quality yield for chilli it is necessary to proper management including ensuring the availability of essential nutrient components in proper doses. Considering the importance of chilli cultivation, the present research work has been undertaken with the objectives: a) to study the effect of nitrogen and phosphorus fertilizers on growth and yield of chilli cv. BARI Morich-1. b) to determine the optimum doses of nitrogen and phosphorus fertilizers on growth and yield of chilli cv. BARI Morich-1.

II. Methods And Materials

The experiment was laid out in Randomized Complete Block Design (RCBD) having two factors with three replications. An area of 25.5 m x 5.5 m was divided into three equal blocks. Each block was consists of 16 plots where 16 treatments were allotted randomly. There were 48 unit plots in the experiment. The size of each plot was 1.2 m x 1.2 m, which accommodated 4 plants at a spacing 0.3 m x 0.3 m. The distance between two blocks and two plots were kept 1.0 m and 0.5 m respectively. Chilli seedlings were raised in different polybags. The soil was well prepared and converted into loose friable and dried mass by spading. All weeds and stubbles were removed and 5 kg well rotten cow dung was mixed with the soil. 3-5 seeds was sown on each polybag on 15th November 2013. After sowing, seeds were covered with light soil. The emergence of the seedlings took place within 5 to 6 days after sowing. Weeding, mulching and irrigation were done as and when required. After 25 days of seed sowing they are ready for transplanting. The experiment was consisted on four levels of nitrogen N_0: 0 kg N ha^{-1}, N_1: 100 kg N ha^{-1}, N_2: 120 kg N ha^{-1}, N_3: 150 kg N ha^{-1} and four levels of phosphorous P_0: 0 kg P_2O_5 ha^{-1}, P_1: 30 kg P_2O_5 ha^{-1}, P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}. There were in total 16 (4×4) treatment combinations such as: N_0P_0, N_0P_1, N_0P_2, N_0P_3, N_1P_0, N_1P_1, N_1P_2, N_1P_3, N_2P_0, N_2P_1, N_2P_2, N_2P_3, N_3P_0, N_3P_1, N_3P_2, N_3P_3. Urea, triple super phosphate (TSP), muriate of potash (MP) and borax were used as source of nitrogen, phosphorus, potassium and boron, respectively. Well decomposed cowdung was also applied to the field before final ploughing. Total amount of TSP, MP, borax and 50% of urea were applied as basal doses during final land preparation. The remaining 50% urea was applied as top dressing at 40 days after transplanting during flowering and fruiting start stage. Healthy and uniform 25 days old seedlings were uprooted separately from the polybag and were transplanted in the experimental plots in 20th December, 2013 maintaining a spacing of 30 cm x 30 cm between the plants and rows respectively. This allowed an accommodation of 16 plants in each plot. The seedlings were watered after transplanting. Seedlings were also planted around the border area of the experimental plots for gap filling. After transplanting the seedlings, different intercultural operations were accomplished for better growth and development of the plants. Five plants were selected randomly from each plot for data collection in such a way that the border effect could be avoided for the highest precision. Data on the following parameters were recorded from the sample plants during the course of experiment. The data on pant height, number of leaves per plant, leaf length of plant, leaf breadth of plant, number of branches per plant, canopy of plant, length of fruit, diameter of fruit, length of pedicel, individual fruit weight, yield of fruits per plant, yield of fruits per plot and yield of fruits per hectare were recorded. The recorded data on various parameters were statistically analyzed using MSTAT-C statistical package programme. The mean for all the treatments was calculated and analysis of variance for all the characters were performed by F- Difference

between treatment means were determined by Duncan`s Multiple Range Test (DMRT) according to Gomez and Gomez, (1984) at 5% level of significance.

III. Results And Discussions

The results obtained with different levels of nitrogen (N) and phosphorus (P) and their combinations are presented and discussed in this chapter. Data about growth parameters, yield contributing characters and yield of chilli have been presented in both Tables and Figures and analyzes of variance and corresponding degrees of freedom have been shown in Appendix.

3.1 Plant height:

The plant height of chilli was statistically significant with various levels (25, 40, 55, 70 and 85 DAT) of nitrogen (Table 1 and Appendix V). The result revealed that at 25 DAT the tallest plant was recorded from N_2 (14.06 cm) which was statistically similar with N_1 (13.53 cm) and N_3 (13.09 cm) whereas the shortest plant height was found from N_0 (11.98). At 40 DAT the highest plant height (20.19 cm) was observed from the N_2 treatment which was statistically similar to N_1 (20.06 cm) whereas, the lowest (17.81 cm) was observed in N_0 treatment. At 55 DAT the highest plant height (25.27 cm) was observed from the N_2 treatment which was statistically similar to N_1 (24.34 cm) whereas, the lowest (22.08 cm) was observed from N_0 treatment which was statistically similar with N_3 (23.29 cm). At 70 DAT the highest plant height (27.35 cm) was observed from the N_2 treatment which was statistically similar with N_1 (27.17 cm), N_3 (27.79 cm) whereas, the lowest (25.21 cm) was observed from N_0 treatment. At 85 DAT the highest plant height (30.96 cm) was observed from the N_1 treatment which was statistically similar with N_2 (30.63 cm) whereas, the lowest (27.45 cm) was observed from N_0 treatment. It was revealed that increased plant height up to a certain level then decreases due to increasing the nitrogen fertilizer. The result was similar with that of Lal and Pundrik (1973), Damke *et. al.* (1990) and Nicola *et. al.(1995).* They observed an improvement on plant height with increasing nitrogen application.

Table 1. The effect of different levels of nitrogen and phosphorous on plant height of chilli

Treatments	Plant height (cm)				
	25 DAT	**40 DAT**	**55 DAT**	**70 DAT**	**85 DAT**
Levels of Nitrogen					
N_0	11.98 b	17.81 c	22.08 c	25.21b	27.45 c
N_1	13.53 a	21.06 a	24.34 ab	27.17 a	30.96 a
N_2	14.06 a	20.19 a	25.27 a	27.35 a	30.63 a
N_3	13.09 a	19.04 b	23.29 bc	27.79 a	28.99 b
Levels of Phosphorus					
P_0	12.09 c	18.42 c	23.61 a	27.10 ab	29.54 ab
P_1	12.50 bc	19.10 bc	23.08 a	26.04 b	28.90 b
P_2	14.69 a	20.89 a	24.04 a	27.75 a	30.63 a
P_3	13.38 b	19.69 b	24.25 a	26.63 ab	28.96 b
$LSD_{(0.05)}$	**0.502**	**0.520**	**0.598**	**0.571**	**0.605**
CV%	**9.34**	**6.53**	**6.17**	**5.20**	**5.02**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P ha^{-1} (control); P_1: 30 kg P ha^{-1}; P_2: 45 kg P ha^{-1} and P_3: 60 kg P ha^{-1}

Plant height of chilli varied significantly for different levels (25, 40, 70 and 85 DAT) of phosphorus but except 55 DAT (Table 1 and Appendix V). At 25 DAT the tallest plant (14.69 cm) was observed from P_2 whereas the shortest plant was observed from P_0 (12.09 cm) which was statistically similar to P_1 (12.50 cm). At 40 DAT the highest plant height (20.89 cm) was observed from P_2 whereas the shortest plant was observed from P_0 (18.42 cm) which was statistically similar to P_1 (19.10 cm). At 70 DAT the highest plant height (27.75 cm) was observed from the P_2 treatment which was statistically similar to P_0 (27.10 cm), P_3 (26.63 cm) whereas the lowest (26.04 cm) was observed from P_1 treatment. At 85 DAT the highest plant height was observed from the P_2 (30.63 cm) treatment which was statistically similar to P_0 (29.54 cm) whereas the lowest was observed from P_1 (28.90 cm) treatment which was statistically similar to P_3 (28.96 cm). It revealed that with the increase of application of phosphorus, plant height showed increasing trend, but after a certain level plant height increases very slowly.

Table 2. Combined effect of different levels of nitrogen and phosphorous on plant height of chilli

Treatments	Plant height (cm)				
	25 DAT	**40 DAT**	**55 DAT**	**70 DAT**	**85 DAT**
N_0P_0	7.92 g	13.00 i	20.33 g	22.33 e	25.00 g
N_0P_1	11.58 f	19.00 efg	21.83 efg	24.25 de	26.97 fg
N_0P_2	14.08 bcde	20.08 cdef	24.17 cde	25.50 cd	27.83 ef

N_0P_3	14.33 bc	19.17 defg	26.17 bc	28.75 ab	30.00 cde
N_1P_0	14.77 ab	23.00 b	26.93 ab	28.50 ab	31.17 bc
N_1P_1	12.25 def	21.17 bcd	24.33 cd	29.00 ab	30.00 cde
N_1P_2	14.25 bcd	20.83 cde	20.83 g	24.33 de	32.50 ab
N_1P_3	12.83bcdef	19.25 defg	25.25 bc	26.83 bc	30.17bcde
N_2P_0	13.58bcdef	20.17 cdef	26.17 bc	28.58 ab	32.00 abc
N_2P_1	12.17 ef	15.42 h	24.50 bcd	26.17 cd	28.17 def
N_2P_2	16.50 a	26.67 a	28.83 a	30.67 a	34.17 a
N_2P_3	14.00 bcde	18.50 fg	21.58 fg	24.00 de	28.17 def
N_3P_0	12.08 ef	17.50 gh	21.00 g	29.00 ab	30.00 cde
N_3P_1	14.00 bcde	20.83 cde	21.67 fg	24.75 cd	30.48 bcd
N_3P_2	13.92 bcde	16.00 h	22.33defg	30.50 a	28.00 ef
N_3P_3	12.35 cdef	21.83 bc	24.00 cdef	26.93 bc	27.50 f
$LSD_{(0.05)}$	**1.004**	**1.041**	**1.197**	**1.142**	**1.211**
CV%	**9.34**	**6.53**	**6.17**	**5.20**	**5.02**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

Combined effect of different levels of nitrogen and phosphorus showed significant variation on plant height of chilli at 25, 40, 55, 70 and 85 DAT (Table 2 and Appendix V). At 25 DAT the tallest plant (16.50 cm) was observed from N_2P_2 which was statistically similar to N_1P_0 (14.77 cm) whereas the shortest plant was recorded from N_0P_0 (7.92cm). At 40 DAT the tallest plant (26.67 cm) was observed from N_2P_2 whereas the shortest plant was recorded from N_0P_0 (13.00 cm). At 55 DAT the tallest plant was observed from N_2P_2 (28.83 cm) which was statistically similar with N_1P_0 (23.00 cm) whereas the shortest plant was recorded from N_3P_0 (20.33 cm) which was statistically similar to N_0P_0 (21.00 cm), N_0P_1 (21.83 cm), N_1P_2 (20.83 cm), N_2P_3 (21.58 cm). At 70 DAT the tallest plant was observed from N_2P_2 (30.67cm) which was statistically similar to N_0P_3 (28.75 cm), N_1P_0 (28.50 cm), N_1P_1 (29.00 cm), N_2P_0 (28.58 cm), N_3P_0 (29.00 cm) whereas the shortest plant was recorded from N_0P_0 (22.33 cm) which was statistically similar to N_0P_1 (24.25 cm), N_1P_2 (24.33 cm), N_2P_3 (24.00 cm). At 85 DAT the tallest plant was observed from N_2P_2 (34.17 cm) which was statistically similar to N_1P_2 (32.50 cm) whereas the shortest plant was recorded from N_0P_0 (25.00 cm) which was statistically similar to N_0P_1 (26.97 cm). Similar results were found by Chauhan *et al.* (2005) They stated that among the various N and P combinations, 120 kg N + 60 kg P ha^{-1} recorded the greatest plant height (64.83 cm). Sarma *et al.* (2004) were also found similar results.

3.2 Number of leaves plant^{-1}

Nitrogen fertilizer doses showed significant effect on number of leaves per plant of chilli at 25, 40, 55, 70 and 85 DAT (Table 3 and Appendix VI). At 25 DAT the highest number of leaves per plant (31.17) was observed from the N_3 treatment which was statistically similar to N_1 (30.54) and N_2 (30.69) whereas the lowest (26.35) was observed from N_0 treatment. At 40 DAT the highest number of leaves per plant (71.52) was observed from the N_3 treatment whereas the lowest (54.81) was observed from N_0 treatment. At 55 DAT the highest number of leaves per plant was observed from the N_3 (143.45) treatment whereas the lowest was observed from N_0 (94.70) treatment. At 70 DAT the highest number of leaves per plant was observed from the N_3 (160.88) treatment which was statistically similar to N_2 (159.58) whereas the lowest was observed from N_0 (140.98) treatment. At 85 DAT the highest number of leaves per plant (200.83) was observed from the N_3 treatment whereas the lowest (173.57) was observed from N_1 treatment. As data shown, N fertilization increased leaf number which were in agreement with findings of Ayodele (2002) and Boroujerdnia and Ansari (2007).

Number of leaves per plant of chilli varied significantly for different levels (25, 40, 55, 70 and 85 DAT) of phosphorus (Table 3 and Appendix VI). At 25 DAT the highest number of leaves (30.73) was recorded in P_1 which was statistically identical (29.96) to P_2 whereas the lowest number of leaves was recorded from P_0 (28.92) which was statistically similar to P_3 (29.15). At 40 DAT the highest number of leaves (71.44) was recorded in P_1 whereas the lowest number of leaves was recorded from P_3 (59.73) which was statistically similar to P_0 (60.02). At 55 DAT the highest number of leaves was recorded in P_1 (143.73) whereas the lowest number of leaves was recorded from P_0 (102.98). At 70 DAT the highest number of leaves was recorded in P_1 (167.93) whereas the lowest number of leaves was recorded from P_0 (125.79). At 85 DAT the highest number of leaves (197.10) was recorded in P_2 whereas the lowest number of leaves was recorded from P_0 (165.73). The results showed significant variation in number of leaves per plant with increasing phosphorus in P_1 treatment up to P_2 treatment.

Table 3. The effect of different levels of nitrogen and phosphorous on number of leaves plant^{-1} of chilli

Treatments	**Number of leaves plant^{-1}**				
	25 DAT	**40 DAT**	**55 DAT**	**70 DAT**	**85 DAT**

Levels of Nitrogen					
N_0	26.35 b	54.81 d	94.70 d	140.98 c	181.00 c
N_1	30.54 a	67.69 b	131.15 c	149.85 b	173.57 d
N_2	30.69 a	66.00 c	139.79 b	159.58 a	186.83 b
N_3	31.17 a	71.52 a	143.45 a	160.88 a	200.83 a
Levels of Phosphorus					
P_0	28.92 b	59.73 c	102.98 d	125.79 d	165.73 d
P_1	30.73 a	71.44 a	143.73 a	167.93 a	194.45 b
P_2	29.96 ab	68.83 b	128.12 c	166.08 b	197.10 a
P_3	29.15 b	60.02 c	134.27 b	151.48 c	184.96 c
$LSD_{(0.05)}$	**0.650**	**0.639**	**0.585**	**0.900**	**0.810**
CV%	**5.37**	**2.41**	**1.13**	**1.44**	**1.07**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

Table 4. Combined effect of different levels of nitrogen and phosphorous on number of leaves $plant^{-1}$ of chilli

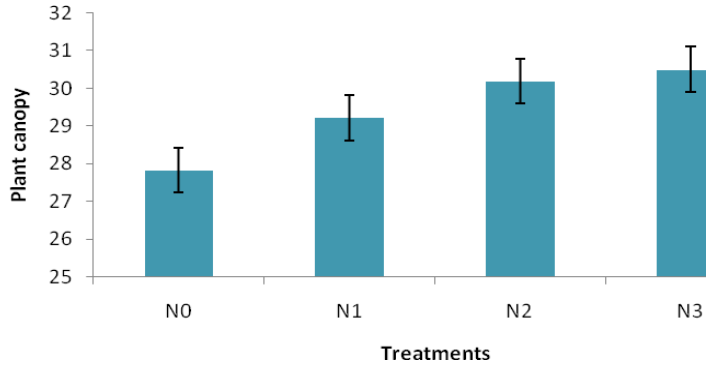
Treatments	**Number of leaves $plant^{-1}$**				
	25 DAT	**40 DAT**	**55 DAT**	**70 DAT**	**85 DAT**
N_0P_0	22.00 g	40.58 j	83.83 l	122.50 i	160.00 i
N_0P_1	29.08 de	74.17 c	106.33 i	148.17 f	183.83 f
N_0P_2	30.08 de	64.25 g	91.90 k	153.50 e	196.50 d
N_0P_3	24.25 fg	40.25 j	96.75 j	139.75 g	183.67 f
N_1P_0	34.00 ab	64.83 g	66.17 m	120.00 i	150.25 j
N_1P_1	33.58 ab	83.42 b	156.08 d	145.42 f	172.25 h
N_1P_2	25.17 f	52.17 i	142.17 e	170.17 c	188.30 e
N_1P_3	29.42 de	70.33 e	160.17 c	163.83 d	183.50 f
N_2P_0	28.25 e	66.42 fg	130.33 f	140.42 g	180.17 g
N_2P_1	30.08 de	54.08 hi	123.83 g	170.23 c	186.65 ef
N_2P_2	34.25 a	88.27 a	164.83 b	195.50 b	208.33 b
N_2P_3	30.17 cde	55.25 h	140.17 e	132.17 h	172.17 h
N_3P_0	31.42 bcd	68.25 ef	131.57 f	120.25 i	172.50 h
N_3P_1	30.17 cde	74.08 c	188.67 a	207.92 a	235.08 a
N_3P_2	30.33 cde	70.65 de	113.58 h	145.17 f	195.25 d
N_3P_3	32.75 abc	73.08 cd	140.00 e	170.17 c	200.50 c
$LSD_{(0.05)}$	**1.301**	**1.278**	**1.169**	**1.800**	**1.621**
CV%	**5.37**	**2.41**	**1.13**	**1.44**	**1.07**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

Significant combined effect between nitrogen and phosphorus on number of leaves was observed of chilli at 25, 40, 55, 70 and 85 DAT (Table 4 and appendix VI). At 25 DAT N_2P_2 showed the maximum (34.25) number of leaves which was statistically similar to N_1P_0 (34.00), N_1P_1 (33.58), N_3P_3 (32.75) while N_0P_0 condition showed the minimum (22.00) number of leaves which was statistically similar to N_0P_3 (24.25). At 40 DAT N_2P_2 showed the maximum (88.27) number of leaves while N_0P_3 condition showed the minimum (40.25) number of leaves which was statistically similar to N_0P_0 (40.58). At 55 DAT the maximum (186.67) number of leaves observed in N_3P_1 while N_1P_0 condition showed the minimum (66.17) number of leaves. At 70 DAT N_3P_1 showed the maximum (207.92) number of leaves while N_1P_0 condition showed the minimum (120.0) number of leaves which was statistically similar to N_0P_0 (122.50) and N_3P_0 (120.25). At 85 DAT the maximum (235.08) number of leaves observed in N_3P_1 while N_1P_0 showed the minimum (150.25) number of leaves. The results showed significant variation in interaction of nitrogen and phosphorus treatments. These results agree with Manchanda and Singh (1988). They concluded that number of leaf per plant increased with increase fertilizer dose of NP.

3.3 Plant canopy

Nitrogen fertilizers doses had significant effect on plant canopy of chilli (Figure 1 and Appendix VII). The highest plant canopy (30.50 cm) was attained from N_3 treatment which was statistically similar to N_2 (30.19 cm) while the lowest (27.83 cm) was observed from N_0 treatment. The results showed that increased in nitrogen treatment with increase in plant canopy but (Grindlay, 1997) reported that the nitrogen distribution between the leaves of a canopy is not uniform.



N_0: 0 kg N ha^{-1} (control), N_1: 100 kg N ha^{-1}, N_2: 120 kg N ha^{-1}, N_3: 140 kg N ha^{-1}

Fig 1. Effect of different nitrogen levels on plant canopy of chilli

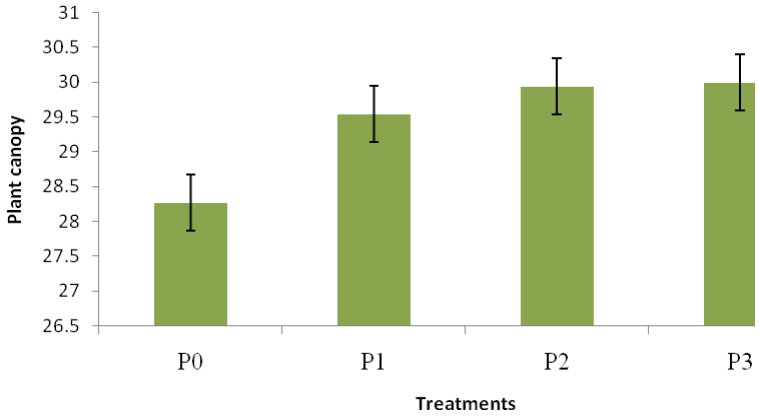
Doses of phosphorus had significant effect on plant canopy of chilli (Figure 2 and Appendix VII). The highest plant canopy (30.00 cm) was attained from P_3 treatment which was statistically similar to P_1 (29.54 cm) and P_2 (29.54 cm) whereas the lowest plant canopy (28.27 cm) was observed from P_0 treatment. Results showed plant canopy increased with increase in phosphorus level.

Combined effect of nitrogen and phosphorus doses showed significant variation on plant canopy of chilli (Table 6 and Appendix VII). The highest plant canopy (33.25 cm) was recorded from N_3P_3 which was statistically similar to N_2P_2 (33.00 cm) while the lowest plant canopy (25.00 cm) was observed in N_0P_0 or control treatment.

3.4 Leaf length

Leaf length of chilli was statistically influenced by different levels of nitrogen (Table 5 and Appendix VII). The longest length of leaf (9.18 cm) was observed from N_3 while the shortest length of leaf (7.96 cm) was found from N_0 or control treatment. The increase in leaf area brought by the N supply causing expansion of individual leaves has also been reported by (Taylor *et al.*, 1993), (Gastal, 2002) because N stimulated the cell division and cell expansion (Lemaire, 2001).

Length of leaf of chilli varied significantly for different levels of phosphorus (Table 5 and Appendix VII). The longest length of leaf (9.03 cm) was observed from P_1 which was statistically identical to P_3 (8.77 cm) whereas the shortest length of leaf was recorded from P_0 (8.08 cm) or control condition. The beneficial effect of phosphorus on the leaf length has been reported by (Rao, 1990) in cowpea (Reddy *et al*., 1991) in groundnut.



P_0: 0 kg P_2O_5 ha^{-1} (control), P_1: 30 kg P_2O_5 ha^{-1}, P_2: 45 kg P_2O_5 ha^{-1} , P_3: 60 kg P_2O_5 ha^{-1}

Fig 2. Effect of different phosphorus levels on plant canopy of chilli

Table 5. The effect of different levels of nitrogen and phosphorous on morphological parameters of chilli

Treatments	Leaf length (cm)	Leaf breadth (cm)	Number of branches $plant^{-1}$ (cm)
Levels of Nitrogen			
N_0	7.96 c	2.06 c	9.42 c
N_1	8.584 b	2.59 b	11.46 b
N_2	8.79 b	2.74 ab	11.89 b

N_3	9.18 a	2.88 a	13.73 a
Levels of Phosphorus			
P_0	8.08 c	2.36 b	11.00 b
P_1	9.03 a	2.66 a	11.78 ab
P_2	8.64 b	2.58 a	11.42 ab
P_3	8.77 ab	2.67 a	12.29 a
$LSD_{(0.05)}$	**0.171**	**0.104**	**0.466**
CV%	**4.85**	**9.96**	**9.82**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

Significant influence was observed on leaf length of chilli due to the different doses of nitrogen and phosphorus (Table 6 and Appendix VII). The longest leaf length (10.91 cm) was obtained from N_3P_1. In contrast to the lowest leaf length (6.85 cm) was observed from N_0P_0 or control condition**.**

3.5 Leaf breadth

Leaf breadth of chilli was statistically influenced by different doses of nitrogen (Table 5 and Appendix VII). The highest leaf breadth (2.88 cm) was observed from N_3 which was statistically identical to N_2 (2.74 cm) while the shortest leaf breadth (2.06 cm) was found from N_0 or control condition. A critical observation of the data indicated that leaf breadth increased with increasing levels of nitrogen up to 120 kg/ha and then a decrease trend was observed with increase in nitrogen levels (Gupta and Sangar, 2000).

Breadth of leaf of chilli varied significantly for different levels of phosphorous (Table 5 and Appendix VII). The highest leaf breadth (2.67 cm) was observed from P_3 which was statistically identical to P_1 (2.66 cm) & P_2 (2.58 cm) whereas the shortest length of leaf was recorded from P_0 (2.36 cm) or control condition. The report was supported by Chauhan *et al.*2005. They reported that a linear increase was observed on leaf breadth with the increasing application of phosphorus up to 180 kg/ha.

Significant influence was observed on leaf length of chilli due to the different doses of nitrogen and phosphorus (Table 6 and Appendix VII). The longest leaf length (3.40 cm) was obtained from N_3P_3 which was statistically identical to N_2P_2 (3.00 cm) & N_3P_3 (3.03 cm). In contrast to the lowest leaf length (1.54 cm) was observed from N_0P_0 or control condition.

3.6 Number of branches $plant^{-1}$

Number of branches of chilli varied significantly for different levels of nitrogen (Table 5 and Appendix VII). The maximum number of branches (13.73) was observed from N_3 and the minimum number of branches was recorded from N_0 (9.42) or control condition. Nitrogen has a significant effect on number of branches per plant as it activates vegetative growth. These results agree with the findings of Manchanda and Singh (1988). They concluded that branches per plant increase with the increasing nitrogen rate.

Table 6. Combined effect of different levels of nitrogen and phosphorous on morphological parameters of chilli

Treatments	Plant canopy (cm)	Leaf length (cm)	Leaf breadth (cm)	Number of branches $plant^{-1}$ (cm)
N_0P_0	25.00 e	6.85 e	1.54 g	7.67 h
N_0P_1	29.08 bcd	8.20 d	2.03 f	8.50 gh
N_0P_2	29.25 bcd	8.56 bcd	2.2 ef	10.33 efg
N_0P_3	28.00 d	8.23 d	2.43 cdef	11.17 def
N_1P_0	29.00 bcd	8.57 bcd	2.79 bc	11.83 cde
N_1P_1	30.00 b	8.56 bcd	2.56 cde	9.83 fg
N_1P_2	28.08 cd	8.21 d	2.33 def	11.83 cde
N_1P_3	29.83 bc	9.00 bc	2.68bcd	12.33 cd
N_2P_0	29.58 bcd	8.71 bcd	2.77 bc	12.83 bcd
N_2P_1	28.75 bcd	8.46 cd	2.66 bcd	13.40 bc
N_2P_2	33.00 a	9.20 b	3.00 ab	10.33 efg
N_2P_3	29.17 bcd	8.79 bcd	2.53 cde	11.00 def
N_3P_0	29.50 bcd	8.18 d	2.32 def	11.67 cdef
N_3P_1	30.33 b	10.91 a	3.03 ab	14.67 ab
N_3P_2	29.17 bcd	8.60 bcd	2.77 bc	13.17 bc
N_3P_3	33.25 a	9.04 bc	3.40 a	15.40 a
$LSD_{(0.05)}$	**0.863**	**0.342**	**0.209**	**0.931**
CV%	**3.59**	**4.85**	**9.96**	**9.82**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

Number of branches of chilli was statistically influenced by different doses of phosphorous (Table 5 and Appendix VII). The maximum number of branches (12.68) was observed from P_2 which was statistically identical to P_3 (12.29) while the minimum number of branches (11.00) was found from P_0 (11.00) or control condition. Phosphorus had a significant effect on number of branches per plant and increased with the increasing of phosphorus rate.

Significant influence was observed on number of branches of chilli due to the different doses of nitrogen and phosphorus (Table 6 and Appendix VII). The maximum number of branches (15.40) was obtained from N_3P_3 which was statistically identical to N_3P_1 (14.67). In contrast to the minimum number of branches (7.67) was observed from N_0P_0 or control condition which was statistically identical to N_0P_1 (8.50). These results showed that higher dose of nitrogen and phosphorus was influential nutrients for number of branches per plant at final harvesting stage. Similar result was found by Tumbare and Bhoite, (2002).

3.7 Fruit length

Significant variation was observed among the different treatments due to different doses of nitrogen in respect of average fruit length of chilli (Table 7 and Appendix VIII). Fruit length was recorded 4.74 cm, 4.89 cm, 5.16 cm and 5.10 cm in N_0, N_1, N_3 and N_2 treatments respectively. Maximum (5.16 cm) fruit length was found in N_3 treatment which was statistically similar to N_2 (5.10 cm) treatment whereas minimum fruit length was recorded from N_0 (4.74 cm) or control treatment. The results are to some extent in agreement with Lal and Pundrik (1971) who observed an improvement in fruit size with increasing nitrogen application.

Significant variation was found among the different treatments due to different doses of phosphorus in respect of fruit length of chilli (Table 7 and Appendix VIII). Average fruit length was recorded 4.90 cm, 4.93 cm, 5.25 cm and 4.81 cm in P_2, P_1, P_3 and P_0 treatments respectively. However, maximum (5.25 cm) fruit length was found in P_3 treatment whereas minimum fruit length was recorded in P_0 (4.81 cm) which was statistically similar to P_2 (4.90 cm).

Combined effect of nitrogen and phosphorus doses showed significant variation on fruit diameter of chilli (Table 8 and Appendix VIII). Maximum (5.60 cm) fruit length was recorded in N_3P_3 treatment whereas minimum (4.27 cm) fruit length was recorded in N_0P_0 or control treatment. These results are are similar to that of Lal and Pundrik (1971) and Ludilov and Ludilova (1977). Lal and Pundrik (1971) obtained highest yield due to an improvement in fruit size in response to 80 kg N and 90 kg P.

3.8 Fruit pedicel

The effect of different doses of nitrogen application had significant influence on fruit pedicel in chilli (Table 7 and Appendix VIII). However, result revealed that the longest fruit pedicel was recorded in N_3 (2.42 cm) which was statistically similar to N_2 (2.37 cm) whereas the shortest fruit pedicel was recorded in N_0 (2.09 cm) which was statistically similar to N_1 (2.18 cm).

The effect of different levels of phosphorus application had significant influence on fruit pedicel in chilli (Table 7 and appendix VIII). However, result showed that the longest fruit pedicel was found in P_3 (2.43 cm) which was statistically similar to P_1 (2.33 cm) whereas the shortest fruit pedicel was found in P_0 (2.05 cm).

Combined effect of nitrogen and phosphorus doses showed significant variation on fruit pedicel of chilli (Table 8 and Appendix VIII). Longest (2.87 cm) fruit pedicel was recorded in N_3P_3 treatment whereas the shortest (1.77 cm) fruit pedicel was recorded in N_0P_0 which was statistically similar to N_1P_3 (2.00 cm).

3.9 Fruit diameter

Significant variation was observed among the different treatments due to different doses of nitrogen in respect of average fruit diameter of chilli (Table 7 and Appendix VIII). Fruit diameter was recorded 0.68, 0.79, 0.82 and 0.79 cm in N_0, N_1, N_3 and N_2 treatments respectively. Maximum (0.82 cm) fruit diameter was found in N_3 treatment which was statistically similar to N_1 (0.79 cm) treatment whereas minimum fruit diameter was recorded in N_0 (0.68 cm) or control treatment. Roy *et. al.* (2011) documented the similar report on fruit diameter of chilli. According to them length and diameter of fruits and nos. fruits per plant increased significantly with increasing nitrogen dose at N_2 treatment (100 kg N ha^{-1}).

Significant variation was found on fruit diameter due to the effect of different levels of phosphorus in chilli (Table 7 and Appendix VIII). Fruit diameter was recorded 0.75, 0.76, 0.79 and 0.78 cm in P_0, P_1, P_3 and P_2 treatments respectively. Maximum (0.79 cm) fruit diameter was found in P_3 treatment which was statistically similar to P_1 (0.76 cm) and P_2 (0.78 cm) treatments whereas minimum fruit diameter was recorded in P_0 (0.75 cm) or control treatment.

Table 7. The effect of different levels of nitrogen and phosphorous on yield contributing parameters of chilli

Treatments	Fruit length (cm)	Fruit pedicel(cm)	Fruit diameter(cm)
Levels of Nitrogen			
N_0	4.74 c	2.09 b	0.68 c

N_1	4.89 b	2.18 b	0.79 ab
N_2	5.10 a	2.37 a	0.79 b
N_3	5.16 a	2.42 a	0.82 a
Levels of Phosphorus			
P_0	4.81 c	2.05 c	0.75 b
P_1	4.93 b	2.33 ab	0.76 ab
P_2	4.90 bc	2.24 b	0.78 ab
P_3	5.25 a	2.43 a	0.79 a
$LSD_{(0.05)}$	**0.056**	**0.069**	**0.014**
CV%	**2.76**	**7.49**	**4.48**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

Combined effect of nitrogen and phosphorus doses showed significant variation on fruit diameter of chilli (Table 8 and Appendix VIII). Maximum (0.95 cm) fruit diameter was recorded in N_3P_3 treatment whereas minimum (0.57 cm) fruit diameter was recorded in N_0P_0.

Table 8. Combined effect of different levels of nitrogen and phosphorous on yield contributing parameters of chilli

Treatments	Fruit diameter (cm)	Fruit pedicel (cm)	Fruit length (cm)
N_0P_0	0.57 h	1.77 f	4.27 i
N_0P_1	0.72 fg	2.20 cde	4.67 gh
N_0P_2	0.69 g	2.23 bcde	5.00 cde
N_0P_3	0.74 efg	2.17 cde	5.03 cde
N_1P_0	0.82 bc	2.10 de	5.00 cde
N_1P_1	0.78 cdef	2.40 bc	4.87 efg
N_1P_2	0.74 efg	2.20 cde	5.13 bc
N_1P_3	0.85 b	2.00 ef	4.57 h
N_2P_0	0.80 bcd	2.16 cde	5.20 bc
N_2P_1	0.74 efg	2.33 bcd	5.10 bcd
N_2P_2	0.75 defg	2.50 b	4.90 def
N_2P_3	0.79 cde	2.30 bcd	4.73fgh
N_3P_0	0.82 bc	2.17 cde	5.13 bc
N_3P_1	0.80 bcd	2.40 bc	5.10 bcd
N_3P_2	0.77 cdef	2.40 bc	5.27 b
N_3P_3	0.95 a	2.87 a	5.60 a
$LSD_{(0.05)}$	**0.028**	**0.138**	**0.112**
CV%	**4.48**	**7.49**	**2.76**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

3.10 Individual fruit weight

There was a significant variation in single fruit weight among different doses of nitrogen treatments (Table 9 and Appendix VIII). Individual fruit weight was recorded 1.54, 2.00, 2.12 and 2.50 gm in N_0, N_1, N_2 and N_3 treatments respectively. Highest individual fruit weight (2.50) was found in N_3 treatment whereas the lowest individual fruit weight was found in N_0 (1.54) or control treatment. The result showed increase in nitrogen levels increases the fruit weight. The results also similar with Akanbi *et al*. (2007) who also reported that increasing the rate of nitrogen fertilizers increases the average fruit weight and volume of pepper. This result is also in agreement with Ahmed *et al.* (2007).

There was a significant variation in single fruit weight among different doses of phosphorus treatments (Table 9 and Appendix VIII). Individual fruit weight was recorded 1.30, 1.82, 2.02 and 2.42 gm in P_0, P_1, P_2 and P_3 treatments respectively. Highest individual fruit weight (2.42) was found in P_3 treatment whereas the lowest single fruit weight was found in P_0 (1.30) or control treatment.

Table 9. The effect of different levels of nitrogen and phosphorous on yield contributing parameters of chilli

Treatments	Individual fruit weight (g)	Yield $plant^{-1}$ (g)	Yield $plot^{-1}$ (kg)	Yield ha^{-1} (ton)
Levels of Nitrogen				
N_0	1.54 d	162.20 d	2.59 d	8.88 d
N_1	2.00 c	200.00 c	3.20 c	10.95 c
N_2	2.12 b	212.00 b	3.39 b	11.60 b

N_3	2.50 a	235.00 a	3.75 a	12.83 a
Levels of Phosphorus				
P_0	1.30 d	145.25 d	2.24 d	7.68 d
P_1	1.82 c	170.55 c	2.72 c	9.33 c
P_2	2.02 b	190.81 b	3.05 b	10.44 b
.P_3	2.42 a	220.25 a	3.52 a	12.06 a
$LSD_{0.05}$	**0.016**	**1.297**	**0.021**	**0.0711**
CV%	**3.10**	**2.24**	**2.24**	**2.24**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

Combined effect of nitrogen and phosphorus doses showed significant variation on single fruit weight (Table 10 and Appendix VIII). Highest single fruit weight (2.52) was found in N_3P_3 treatment whereas the lowest single fruit weight was found in N_0P_0 (1.56) or control treatment.

3.11 Yield of fruits $plant^{-1}$

There was a significant variation on number of fruits per plant among different treatments (Table 9 and Appendix IX). Highest number of fruits per plant was found in N_3 (235.00) treatment whereas lowest number of fruits per plant was found in N_0 (162.20) or control treatment. It was revealed that at optimum level nitrogen fertilizer gave highest yield $plant^{-1}$ and increase nitrogen fertilization delayed flowering. Guohua *et al.* (2001) found that flowering was delayed with increase in nitrogen fertilization due to diversion of photosynthates for vegetative growth of plant. Shrivastava (2003) also found similar results.

Significant variation was found among the different treatments due to different doses of phosphorus in respect of number of fruits per plant (Table 9 and Appendix IX). Highest number of fruits per plant was found in P_3 (220.25) treatment whereas lowest number of fruits per plant was found in P_0 (145.25) or control treatment. Bahuguna *et al.*, (2014) also found an increase in fruits increasing per plant with the increasing levels of phosphorus and the maximum number being at P_2 levels in pea.

Combined effect of nitrogen and phosphorus doses showed significant variation on number of fruits per plant (Table 10 and Appendix IX). Highest number of fruits per plant (235.00) was found in N_3P_3 treatment whereas whereas lowest (160.73) number of fruit per plant was found in N_0P_0. The high yield will obtain due to high nitrogen and phosphorus rate. These results agree with the findings of Manchanda and Singh (1988) and Nicola *et. al.* (1995) who obtained the maximum fruits per plant at higher rate of nitrogen and phosphorus.

3.12 Fruit yield $plot^{-1}$

Yield of green fresh fruit of chilli was recorded 2.59, 3.20, 3.39 and 3.75 kg/plot in N_0, N_1, N_2 and N_3 treatments respectively (Table 9 and Appendix IX). Maximum (3.75 kg/plot) yield was obtained in N_3 treatment and minimum (2.59 kg/plot) was found in N_0 treatment or control treatment. N fertilization significantly increased fruit number, yield per plant and total yield comparing to control, that were in agreement with Tumbare and Niikam (2004), Law-Ogbomo and Egharevba (2009). Jilani *et al.* (2008) reported that nitrogen application @ 100 kg ha^{-1} significantly increased brinjal yield. Likewise, Bahuguna *et al.* (2014) also observed the same results in pea.

Yield of fruits of chilli was recorded 2.24, 2.72, 3.05 and 3.52 kg/plot in P_0, P_1, P_2 and P_3 treatments respectively (Table 9 and Appendix IX). Maximum (3.52 kg/plot) yield was obtained in P_3 treatment and minimum (2.24 kg/plot) was found in P_0 treatment or control treatment.

Significant influence was observed on yield of chilli per plot due to the different doses of nitrogen and phosphorus (Table 10 and Appendix IX). The maximum yield 3.39 kg/plot was obtained from N_3P_3. In contrast to the minimum (2.22 kg/plot) was observed from N_0P_0 or control condition. The result were similar with that of Lal and Pundrik (1973) and Ludilov and Ludilova (1977). Lal and Pundrik (1971) obtained highest yield due to an improvement in fruit size in response to 80 kg N, 90 kg P (N_2P_2). It means that recommended fertilization will may affect the fruit size and other growth parameter as well.

Table 10. Combined effect of different levels of nitrogen and phosphorous on yield contributing parameters of chilli

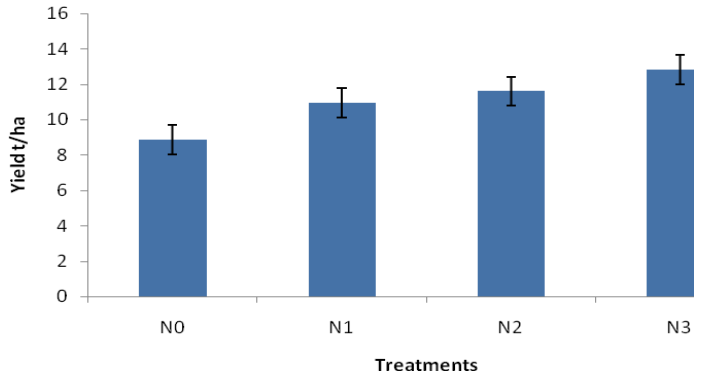
Treatments	Individual fruit weight (g)	Yield $plant^{-1}$ (g)	Yield $plot^{-1}$ (kg)	Yield ha^{-1} (ton)
N_0P_0	1.56 j	160.73 i	2.22 i	7.20 i
N_0P_1	1.72 hi	170.83 h	2.35 h	8.00 h
N_0P_2	1.66 i	206.67 def	2.78 def	9.04 def
N_0P_3	1.80 h	208.03 de	2.95 de	9.44 de
N_1P_0	1.88 g	209.33 d	3.06 d	9.74 d
N_1P_1	2.02 fg	188.17 gh	2.50 gh	8.13 gh

N_1P_2	2.10 e	208.73 d	3.07 d	9.40 d
N_1P_3	1.89 g	189.40 fgh	2.42 fgh	8.25 fgh
N_2P_0	2.05 ef	215.80 c	3.15 c	10.26 c
N_2P_1	2.37 c	219.07 b	3.25 b	10.85 b
N_2P_2	2.40 b	218.17 b	3.22 b	10.82 b
N_2P_3	2.08 e	191.17 efg	2.65 efg	9.41 efg
N_3P_0	2.25 d	190.93 gh	2.58 gh	9.12 gh
N_3P_1	2.38 c	215.67 c	3.18 c	10.22 c
N_3P_2	2.36 c	216.33 c	3.17 c	10.45 c
N_3P_3	2.52 a	235.00 a	3.39 a	12.32 a
$LSD_{(0.05)}$	**0.033**	**2.594**	**0.042**	**0.1421**
CV%	**3.10**	**2.24**	**2.24**	**2.24**

N_0: 0 kg N ha^{-1} (control); N_1: 100 kg N ha^{-1}; N_2: 120 kg N ha^{-1}; N_3: 140 kg N ha^{-1} and P_0: 0 kg P_2O_5 ha^{-1} (control); P_1: 30 kg P_2O_5 ha^{-1}; P_2: 45 kg P_2O_5 ha^{-1} and P_3: 60 kg P_2O_5 ha^{-1}

3.13 Fruit yield ha^{-1}

Yield of green fresh fruit of chilli was recorded 8.88, 10.95, 11.60 and 12.83 ton/ha in N_0, N_1, N_2 and N_3 treatments respectively (Figure 3 and Appendix IX). Maximum (12.83 ton/ha) yield was obtained in N_3 treatment and minimum (8.88 ton/ha) was found in N_0 treatment or control treatment. Nitrogen fertilization improved plant growth, but did not influence fruiting time. Jilani *et al.* (2008) reported that nitrogen application @ 100 kg ha^{-1} significantly increased brinjal yield. In pea, Bahuguna *et al.* (2013) also found the same results.

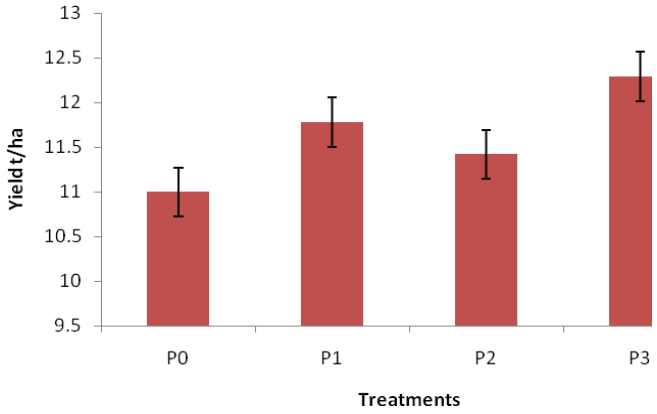


N_0: 0 kg N ha^{-1} (control), N_1: 100 kg N ha^{-1}, N_2: 120 kg N ha^{-1}, N_3: 140 kg N ha^{-1}

Fig 3. Effect of nitrogen on fruit yield ton ha^{-1} of chilli

Yield of fruits of chilli was recorded 7.68, 9.33, 10.44 and 12.06 ton/ha in P_0, P_1, P_2 and P_3 treatments respectively (Figure 4 and Appendix IX). Maximum (12.06 ton/ha) yield was obtained in P_3 treatment and minimum (7.68 ton/ha) was found in P_0 treatment or control treatment.

Significant influence was observed on yield of chilli per plot due to the different doses of nitrogen and phosphorus (Figure 5 and Appendix IX). The maximum yield 12.32 ton/ha was obtained from N_3P_3. In contrast to the minimum (7.20 ton/ha) was observed from N_0P_0 or control condition. These results are in accordance with the findings of Tesfaw (2013) who assessed the growth and yield performance of hot pepper varieties to various doses of nitrogen and phosphorous. Naeem *et al.* (2002) reported that different dozes of nitrogen and phosphorus behaved significantly different for total yield.



P_0: 0 kg P_2O_5 ha^{-1} (control), P_1: 30 kg P_2O_5 ha^{-1}, P_2: 45 kg P_2O_5 ha^{-1} , P_3: 60 kg P_2O_5 ha^{-1}

Fig 4. Effect of phosphorus on average fruit yield ton ha^{-1} of chilli

IV. Conclusion

Considering the above mentioned results, it may be concluded that, different doses of nitrogen and phosphorus varied significantly for growth and yield of chilli. The effect ofN @ 140 kg $ha^{-1}$with application ofP_2O_5@ 60 kg ha^{-1}on chilliyield was statistically highest. It was revealed that application of 140 kg N ha^{-1} along with 60 kg P_2O_5 ha^{-1}(N_3P_3) produce maximum yield and yield contributing characters of chilli.

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Tania Sultana. “Growth And Yield of Chilli Influenced By Nitrogen And Phosphorus." IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 11.5 (2018): 54-68.