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Evolutionary study of nitrogen and phosphorus levels on growth of baby corn

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Abstract
An experiment entitled "Effect of nitrogen and phosphorus levels on yield and quality of baby corn" was carried out in *kharif* season of 2014-15 at the Main Garden, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.). The experiment was laid out in Factorial Randomized Block Design with three replications and twelve treatment combinations with factor A *viz.* nitrogen (N) i.e. 150 kg ha^{-1} (N_1), 175 kg ha^{-1} (N_2), 200 kg ha^{-1} (N_3) and 225 kg ha^{-1} (N_4) factor B phosphorus (P) i.e. 50 kg ha^{-1} (P_1), 75 kg ha^{-1} (P_2) and 100 kg ha^{-1} (P_3). Growth parameters were significantly influenced by nitrogen levels, treatment with application of nitrogen 225 kg ha^{-1} recorded significantly higher plant height, no. of leaves, leaf area index, total dry matter accumulation per plant, chlorophyll content. Minimum days to 50% tasseling, silking and maximum cob emergence were recorded at 225 kg ha^{-1} of nitrogen application. The maximum plant height, number of leaves was recorded in P_3 level of phosphorus application (100kg P_2O_5 kg^{-1}). Among the growth parameters (number of leaves, total dry matter accumulation, leaf chlorophyll content, leaf area) the data in respect of growth was significantly affected by treatment combination N_4P_3 (225kg +100 kg $N{:}P_2O_5ha^{-1}$).

Keywords: babycorn, cultivar, nitrogen, phosphorus, yield

Introduction
Vegetables are rich sources of vitamins, mineral and dietary fiber essential for functioning of human body and very common in human diet that a meal without vegetable is supposed to be incomplete in any part of the world. Maize (*Zea mays* L.) also known as "Queen of Cereals" belongs to family Graminae and is the third most important cereal crop next to rice and wheat and having highest production potential among the cereals. For diversification and value addition of maize as well as growth of food processing industries. For diversification and value addition of maize as well as growth of food processing industries, recent development is of growing maize for vegetable purpose, which is commonly known as 'baby corn' The diploid chromosome number of baby corn is 2n=20. Mexico is considered to be the center of origin of baby corn. It is a small young corn ear harvested at the stage of silk emergence. Young cob corn has been used by Chinese as vegetable for generations and this practice has spread to other Asian countries. This vegetable has a great potential for cooking purposes and for processing as a canned product. Canned corn cobs are exported to Thailand, Japan and Europe and have a good future.

Young cob corn has a short growth thus a farmer can grow four or more crop cycles per year. It has a wide range of adaptation and does not need intensive cultivation. Considering these factors, young cob corn has good potential. Baby corn production, being a recent development has proved an enormously successful venture in countries like Thailand and Taiwan. Attention is now being paid to explore its potential in India, for earning foreign exchange besides higher economic returns to the farmers. Baby corn production being a recent development has proved an enormously successful venture in countries like Thailand and Taiwan.

It is cultivated on nearly 150 million ha in about 160 countries having wider diversity of soil, climate, biodiversity and management practices that contributes 36 % (782 mt) in the global grain production. The United States of America (USA) is the largest producer of maize contributes nearly 35 % of the total production in the world highest productivity (>9.6 t ha^{-1}).Whereas, the average productivity in India is 2.43 t ha^{-1}. It is estimated the maize was cultivated on 8.7 million ha area (2010-11) and mainly during *kharif* season.

The final estimates of 2014-15 have indicated an increase in of maize production over last two years and it has touched 24.35 million tonnes, which is the highest so far in the history of maize production in India. The trends in last three years indicate that area under maize cultivation expanding not only in *rabi* but also *kharif* season. For the major processes of plant development, the presence of nutrient element like nitrogen, phosphorus, potassium, sulphur, magnesium etc in balanced form is essential as given by (Colomb *et al.* 2000) [3], (Randhawa and Arora, 2000) [9]. Maize is an exhaustive crop requires all types of macro and micro nutrients for better growth and yield potential. Among the various nutrients, nitrogen is the principal of better harvest and requires approximately 150 N_2O kg ha^{-1}. Nitrogen is a primary plant nutrient that plays a major role in achieving the maximum economic yields from production. Nitrogen is an essential constituent of proteins, nucleic acids, vitamins and many other organic molecules such as chlorophyII. Nitrogen also forms a constituent of various hormones, coenzymes and ATP. Nitrogen is added to soil through inorganic and organic sources. The chemical fertilizers contain concentrated nitrogen and widely used to meet the demand of high yielding crop varieties. In these fertilizers, N is present as either NH_4^+, NO_3– or both or as amide (NH_2^-). Some of the nitrogen containing fertilizers is ammonium sulphate (20.6% nitrogen). Similarly adequate supply of phosphorus encourages root growth and enhances maturity. Phosphorus promotes healthy root growth and fruit ripening. It makes about 0.2% of the nutrient. No other element can be substituted for it. It is utilized in large quantity by plants.

Materials and Methods

The experiment entitled, "Effect of nitrogen and phosphorus levels on yield and quality of baby corn" was carried out at Main Garden, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* season of 2015.The meteorological data in respect of rainfall, humidity, maximum and minimum temperature for the period of experimentation recorded at Meteorological section Department of Agronomy, Dr. Panjabrao Krishi Vidyapeeth, Akola in 2015. Fairly leveled land was selected for conducting the experiment. The experimental plot was with very loose soil having uniform texture and structure with good drainage. Seeds were dibbled at 3-5 cm depth @ two seeds per hill at recommended spacing. Total plant population/plant was 28 and per hill 2 plants was taken. The experiment was laid out in factorial randomized block design with three replications and treatments were consisting of twelve combinations of four levels of nitrogen four nitrogen levels viz.150 kg N ha-1, 175 kg N ha-1, 200 kg N ha-1,225 kg N ha-1 and three levels of phosphorus viz 50 kg P ha-1, 75kgP ha-1,100 kg P ha-1. The crop was baby corn with variety G-5414 and number of plot thirty six. Statistical analysis of the data was carried out using standard analysis of variance.

Result and Discussion

Growth attribute: babycorn responded well to nitrogen and phosphorus application. Plant height (193.17cm),Number of leaves (12.44 cm),total dry matter(95g),leaf chlorophyll (1.69mg/g), leaf area (480.72cm^2),leaf area index (3.78 cm^2) moisture content (89.74), available nitrogen, phosphorus, potassium (176.80, 24.29, and 127.18 kg/ha) were observed maximum at N_4(225kgNha^{-1}) N promotes the vegetative growth where as P stimulates root development metabolic activity, cell division and expontion leading to taller plants. Similar results were also recorded Kole, G.S(2010) [7], Hooda, S. and A. Kawatra (2013) [5], Lone, A.A., B.A. Allai and F.A. Nehvi (2013) Interaction effect due to different nitrogen and phosphorus levels on plant height was found to be significant at 30 DAS and at harvest. At 30 DAS, significantly maximum plant height (46.83cm) was recorded with treatment N_4P_3 (225kg+ 100 kg N: P_2O_5 ha^{-1}). Whereas minimum plant height (40.04cm) was recorded with treatment N_1P_1 (50 kg +100 kg N: P_2O_5 ha^{-1}) at 45 DAS interaction was non significant. Present findings are in agreement with the result of Kumar *et al.* (2007), Kole (2010) [7], (Rafiq *et al.* (2010) [8].

Interaction effects of different nitrogen and phosphorus levels on number of leaves at 30 DAS and harvest was found significant. The maximum number of leaves at 30 DAS (9.60) was recorded in treatment combinations N_4P_3 (225 kg+100 kg N: P_2O_5 ha^{-1}) and minimum number of leaves (8.20) was recorded in treatment combinations N_1P_1 (150kg+ 50kg N: P2O5 ha^{-1}) Number of leaves at 45 DAS was recorded maximum (11.30). This finding consistent with the results Bidhani *et al.* (2008), Interaction effects of different nitrogen and phosphorus levels on total dry matter accumulation per plant were found significant. The significantly maximum dry matter accumulation (97.90 g) was recorded in treatment combinations N_4P_3 (225 kg +100kg N: P_2O_5 ha^{-1}). Dadarwal *et al*. (2009) reported the result, which is consistent with result of present findings in baby corn.

Interaction effects of different nitrogen and phosphorus levels on chlorophyll content (mg/g) was found significant. The maximum chlorophyll content (2.33 mg/g) was recorded in treatment combinations N_4P_3 (200kg+100 kg N:P_2O_5 ha^{-1}). The interaction effects between nitrogen and phosphorus levels on leaf area (cm^2) were found to be statistically significant. The maximum leaf area (484.58 cm^2) was recorded in treatment combination N_4P_3 (225 kg+100 kg N:P_2O_5 ha^{-1}). The maximum leaf area index (3.84) was recorded in treatment combination N_4P_3, (225 kg +100 kg N: P_2O_5 ha^{-1}). The similar findings have also been reported by Aravinth *et al*. (2011) [1].

The interaction effects due to nitrogen and phosphorus levels on days to 50% tasseling (days) were found to be statistically significant. Significantly minimum days to 50% tasseling (52.10) were recorded with treatment N_1P_1 (150 kg + 50 kg N: P_2O_5 ha^{-1}). The interaction effects due to nitrogen and phosphorus levels on days to 50% cob emergence (days) was found to be non-significant. Days to 50% cob emergence increase with increasing level of nitrogen. This might be due to the fact that with increase of nitrogen level vegetative growth prolongs and due to phosphorus plant stimulates root development and growth. Hence, crop takes more time to 50% cob emergence. Whereas, minimum days to cob emergence is desirable, which were days to cob emergence (53.08 and 53.40 days) were observed with application of 150 kg N ha^{-1} and 50 kg P_2O_5 ha^{-1} respectively.

Table 1: Effect of different levels and nitrogen and phosphorus on growth of baby corn.

Treatments	Plant height (cm)	No. of leaves	Total dry matter accumulation(g)	Leaf chlorophyll content(mg/gm)	Days to 50 % silking	Days to 50 % cob emergence	Leaf area(cm^2)	Leaf area index
A. Nitrogen (kg ha^1)								
N_1 – 150	176.00	11.53	91.50	1.36	53.26	53.08	442.97	3.33
N_2 – 175	186.90	11.60	92.74	1.63	53.91	53.61	456.77	3.57
N_3 – 200	191.82	12.22	92.72	1.68	54.47	53.69	467.61	3.63
N_4 – 225	193.17	12.44	95.34	1.69	55.15	54.91	480.72	3.78
F Test	Sig.	Sig.	Sig	Sig	Sig.	Sig.	Sig	Sig
SE(m)±	2.20	0.24	0.43	0.07	0.11	0.17	1.50	0.03
CD at 5%	6.44	0.72	1.27	0.22	0.37	0.51	4.41	0.09
B. Phosphorus (kg ha^{-1})								
P_1– 50	181.56	11.32	92.12	1.45	53.98	53.40	456.68	3.50
P_2 – 75	186.43	11.90	93.19	1.45	54.11	53.86	460.08	3.61
P_3 – 100	193.03	12.63	93.92	1.87	54.41	52.68	469.80	3.62
F Test	Sig.	Sig.	Sig.	Sig	Sig.	Sig.	Sig.	Sig.
SE(m)±	1.90	0.21	0.38	0.06	0.11	0.15	1.30	0.03
CD at 5%	5.58	0.62	1.10	0.19	0.32	0.44	3.82	0.08

Table 2: Interaction effect of different levels and nitrogen and phosphorus on growth of baby corn.

Treatment combination	Plant height (cm)	No. of leaves	Total dry matter accumulation	Leaf chlorophyll content	Days to 50 % silking	Days to 50 % cob emergence	Leaf area	Leaf area index
$N_1 \times P_1$	173.90	9.60	90.20	1.22	53.46	52.47	436.30	3.25
$N_1 \times P_2$	179.15	12.93	91.40	1.29	53.10	53.52	445.14	3.50
$N_1 \times P_3$	179.70	12.26	92.90	1.58	53.23	53.26	447.47	3.26
$N_2 \times P_1$	190.81	12.00	92.11	1.55	53.53	53.45	447.37	3.50
$N_2 \times P_2$	191.56	10.33	92.96	1.56	53.66	53.76	452.81	3.53
$N_2 \times P_3$	178.33	12.26	92.16	1.77	54.55	53.63	466.36	3.78
$N_3 \times P_1$	176.59	11.66	92.27	1.66	54.13	53.36	465.51	3.55
$N_3 \times P_2$	191.99	11.33	93.16	1.57	54.56	53.29	462.32	3.63
$N_3 \times P_3$	206.86	12.66	92.73	1.80	54.73	54.23	475.00	3.72
$N_4 \times P_1$	183.26	12.00	92.89	1.38	54.80	54.36	477.56	3.71
$N_4 \times P_2$	189.00	12.84	95.23	2.38	55.13	54.89	480.39	3.78
$N_4 \times P_3$	208.66	13.00	97.90	2.33	55.53	55.49	484.58	3.84
'F' test	Sig.	Sig.	Sig.	Sig.	NS	NS	Sig.	Sig.
SE(m)±	3.81	0.42	0.75	0.13	0.22	0.30	2.61	0.05
CD at 5%	11.16	1.24	2.20	0.37	-	-	7.64	0.16

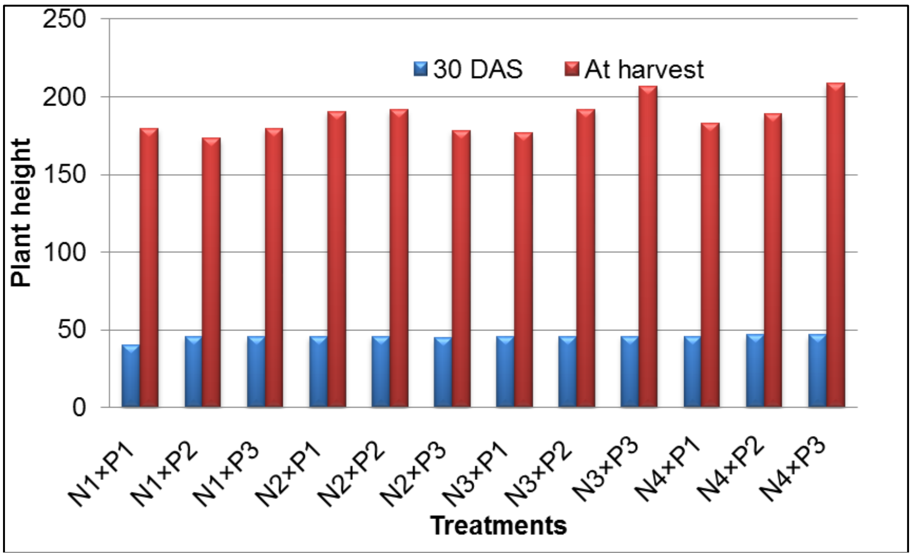

Fig 1: Interaction effect of nitrogen and phosphorus levels on plant height at 30 days and harvest of baby corn

Plate 2: Treatment wise size and quality of baby corn

Conclusion

Among all the treatment combination N_4P_3 (225kg +100 kg N: P2O5 ha^{-1}) was found superior for growth parameters (plant height, number of leaves, total dry matter accumulation, leaf chlorophyll content, leaf area).

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