Original Research Article

Effect of Phosphorus and Potassium on Growth and Yield of Baby corn *(Zea mays* L.)

Abstract

A field experiment was conducted during *Rabi* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice on the basis of one year experimentation. The treatments which are T_1: 50 kg/ha Phosphorous + 15 kg/ha Potassium, T_2: 50 kg/ha Phosphorous + 20 kg/ha Potassium, T_3: 50 kg/ha Phosphorous + 25 kg/ha Potassium, T_4: 60 kg/ha Phosphorous + 15 kg/ha Potassium, T_5: 60 kg/ha Phosphorous + 20 kg/ha Potassium, T_6: 60 kg/ha Phosphorous + 25 kg/ha Potassium, T_7: 70 kg/ha Phosphorous + 15 kg/ha Potassium, T_8: 70 kg/ha Phosphorous + 20 kg/ha Potassium, T_9: 70 kg/ha Phosphorous + 25 kg/ha Potassium are used. The results showed that application of 70 kg/ha Phosphorous + 25 kg/ha Potassium was recorded significantly Plant height (162.73 cm), No. of leaves/plant (13.26), Plant dry weight (108.06 g/plant), Cobs/Plant (1.34), Length of Cob/plant (19.29 cm), Girth of Cob/plant (7.64 cm), Cob weight with husk (65.09 g), cob weight without husk (23.63 g), cob yield with husk (15.14 t/ha), Cob yield without husk (5.16 t/ha) as compared to other treatments.

Key words: Growth, Phosphorous, Potassium, yield.

INTRODUCTION

Baby corn is the young, finger-length de-husked corn young ear of female inflorescence, harvested within 2-3 days of silk emergence but prior to fertilization and is crisp and sweet in taste**.** We can say the shank with un-pollinated silk is baby corn. Baby corn ears are light yellow color with regular row arrangement, 10-12 cm long and a diameter of 1.0-1.2 cm are preferred in the market. Baby corn is a vegetable crop that can potentially improve the economic status of farmers. It is a profitable crop that allows a diversification of production, aggregation of value, and increased income (**Sadiq *et al*. 2007).** It is highly remunerative and farmers can get a high return in a short period of 45-60 days. Its short duration, adoptability in different cropping systems, suitability to cultivate in all the seasons and ecofriendly cultivation practices made it a special choice for cultivation in non-traditional corn growing areas. The other advantage of growing baby corn is its remaining biomass (green fodder) after harvesting **(Kar 2014).**

These green products can be used as feed for animal and aquaculture raising **(Bindhani Anita *et al*. 2007).** The succulent green fodder of high quality adds enormously to the total returns to the farmers, resulting in higher profit per unit area per unit time compared to grain maize. Another benefit of baby corn consists of utilizing husk, silk, and Stover as green herbage for feeding ruminants and swine; only 13 to 20% of fresh ear weight is for human use (**Raskar *et al.* 2012).** The baby corn is highly nutritious and its nutritive value is comparable with several high priced vegetables like cauliflower, cabbage, French beans, spinach, lady finger, tomato, radish etc. It is a low caloric, low cholesterol and high fibre product which is free from residual effect of pesticides because it is harvested as young cob wrapped up tightly with husk and well protected from disease and insect pest attack. Further nutritious green fodder is the most valuable by-product of baby corn crop.

Phosphorus is the second important key element after nitrogen as a mineral nutrient in terms of quantitative plant requirement. Although abundant in soils, in both organic and inorganic forms, its availability is restricted as it occurs mostly insoluble forms. It is needed for growth, utilization of sugar and starch, photosynthesis, nucleus formation and cell division, fat and albumen formation. Energy from photosynthesis and the metabolism of carbohydrates is stored in phosphate compounds for later use in growth and reproduction **(Arya *et al*. 2001)**. It is readily translocated within the plants, moving from older to younger tissues as the plant forms cells and develops roots, stems and leaves. Adequate P results in rapid growth and earlier maturity and improves the quality of vegetative growth. Phosphorus deficiency is responsible for crooked and missing rows as kernel twist and produce small ears nubbies in maize.

Potassium (K) is substantially an important nutrient for plant growth, and has the capability to maximize plant growth and it influences soil plant interactions as well. As, for acting as an essential nutrient for crop production and its development; it acts as a co-factor for more than 40enzymes that are involved in metabolic pathways directly. The application of potassium activates a number of enzymes, including those involved in the synthesis of carbohydrates and resistance to disease, adverse environmental conditions and also enhances utilization of N and P. It is the most abundantly available cation and found in cytoplasm that regulates osmotic potential of cells and tissues of glycophytic plant species **(Amanullah *et al*. 2016),** Potassium nutrition in maize has positively affected dry matter production as well as plant height.

MATERIALS AND METHODS

A field experiment was conducted during *Rabi* season of 2021, at Crop research farm of Department of Agronomy at Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj which is located at 25^o 24' 42" N latitude, 81^o 50' 56" E longitude and 98 m altitude above the mean sea level (MSL). To assess the effect of Phosphorous and Potassium on growth and yield of Baby Corn. The experiment was laid out in Randomized Block Design comprising of 9 treatments which are replicated thrice. Each treatment net plot size is 3m × 3m. The treatment are categorized as with recommended dose of nitrogen through urea in addition with Phosphorous through DAP and potash through Muriate of Potash, where applied in combinations as follows, T_1: 50 kg/ha Phosphorous + 15 kg/ha Potassium, T_2: 50 kg/ha Phosphorous + 20 kg/ha Potassium, T_3: 50 kg/ha Phosphorous + 25 kg/ha Potassium, T_4: 60 kg/ha Phosphorous + 15 kg/ha Potassium, T_5: 60 kg/ha Phosphorous + 20 kg/ha Potassium, T_6: 60 kg/ha Phosphorous + 25 kg/ha Potassium, T_7: 70 kg/ha Phosphorous + 15 kg/ha Potassium, T_8: 70 kg/ha Phosphorous + 20 kg/ha Potassium, T_9: 70 kg/ha Phosphorous + 25 kg/ha Potassium. The crop was harvested treatment wise at harvesting maturity stage. Growth parameters viz. plant height (cm), no of leaves/plant and dry weight (g/plant) were recorded manually on five randomly selected representative plants from each plot of each replication separately and after harvesting, Length of Cob/plant, Girth of Cob/plant, Cob weight with husk, cob weight without husk, cob yield with husk andCob yield without husk were calculated from each net plot and was computed and expressed in tonnes per hectare. The data was computed and analysed by following statistical method of Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant height (cm)

It is evident from Table-1 that significantly highest plant height (162.73 cm) was observed in the treatment with 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the other treatments. However, the treatments with application of 60 kg/ha Phosphorous + 25 kg/ha Potassium (159.64 cm) and 70 kg/ha Phosphorous + 20 kg/ha Potassium (161.88 cm) which were found to be statistically at par with treatment 70 kg/ha Phosphorous + 25 kg/ha Potassium. Phosphorus encourage formation of new cells, promote plant vigour and hastens leaf development, which help in harvesting more solar energy and better utilization of nitrogen, which help towards higher growth attributes, **Noonari *et al*. (2016)**. The increase in plant height might due to the Potassium in that application plays a crucial role in meristematic growth through its effect on the synthesis of phyto hormones. Among various plant hormones, cytokinin plays an important role in growth of the plant. Beneficial effect of K on growth reported by **Kumar and Bohra (2014)**.

No. of Leaves/plant

Treatment with 70 kg/ha Phosphorous + 25 kg/ha Potassium was recorded with significantly maximum No. of Leaves/plant (13.26) over all the treatments. However, the treatments with 60 kg/ha Phosphorous + 25 kg/ha Potassium (12.90) and 70 kg/ha Phosphorous + 20 kg/ha Potassium (13.13) which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium. The increase in number of leaves due to the application of Potassium 25 kg/ha might be that potassium application plays a crucial role photosynthetic process and formation of chlorophyll in the leaf. Similar, results observed by **Patil *et al.* (2018).**

Dry matter accumulation

Treatment with 70 kg/ha Phosphorous + 25 kg/ha Potassium was recorded with significantly maximum dry weight (108.06 g/plant) over all the treatments. However, the treatments with 60 kg/ha Phosphorous + 25 kg/ha Potassium (104.73 g/plant) and 70 kg/ha. Phosphorous + 20 kg/ha Potassium (106.44 g/plant) which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium. The plants attained more vigour with phosphorus, due to adequate supply and availability of nitrogen, phosphorus, potassium and spacing in balanced combination, resulting in increased dry weight of the plant.The application of Phosphorus 70 kg/ha to baby corn significantly increased dry matter production. The results were in accordance with **Hirpara *et al*. (2017).** Potassium plays a crucial role in meristemtic growth through its effect on the synthesis of phyto hormones. Similar results were reported by **Kumar *et al.* (2007).**

Table 1. Effect of Potassium and Phosphorous on growth parameters of Baby corn.

S.No	Treatments	Plant height (cm)	Leaves/plant	Dry matter (g plant^{-1})
1.	50 kg/ha Phosphorous + 15 kg/ha Potassium	149.24	11.95	94.75
2.	50 kg/ha Phosphorous + 20 kg/ha Potassium	150.79	12.07	96.48
3.	50 kg/ha Phosphorous + 25 kg/ha Potassium	155.39	12.61	100.60
4.	60 kg/ha Phosphorous + 15 kg/ha Potassium	152.46	12.22	97.60
5.	60 kg/ha Phosphorous + 20 kg/ha Potassium	157.48	12.76	102.72
6.	60 kg/ha Phosphorous + 25 kg/ha Potassium	159.64	12.90	104.73
7.	70 kg/ha Phosphorous + 15 kg/ha Potassium	154.34	12.52	99.62
8.	70 kg/ha Phosphorous + 20 kg/ha Potassium	161.88	13.13	106.44
9.	70 kg/ha Phosphorous + 25 kg/ha Potassium	162.73	13.26	108.06
	SEm (±)	1.15	0.14	1.19
	CD (P 0.05)	3.44	0.41	3.57

Yield and Yield Attributes:

Number of Cobs/plant

Significantly Maximum cobs/plant (1.34) was recorded with the treatment of application of 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the treatments. However, the treatments 60 kg/ha Phosphorous + 25 kg/ha Potassium (1.23) and 70 kg/ha Phosphorous + 20 kg/ha Potassium (1.28) which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium. Application of P increased the number of cobs per plant might be due to the enhanced early vegetative growth in terms of higher leaf area, dry matter accumulation and vigorous root system consequently increased the number of cobs significantly. Similar findings were observed by **Masood *et al*. (2011).**

Length of Cob/plant (cm)

Significantly Maximum Length of Cob/plant (19.29 cm) was recorded with the treatment of application of 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the treatments. However, the treatments 60 kg/ha Phosphorous + 25 kg/ha Potassium (18.57 cm) and 70 kg/ha Phosphorous + 20 kg/ha Potassium (18.97 cm) which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium. Potassium application enhances the development of strong cell walls and improves germination of pollen in the florets which leads to high fertility and cob formation. The results were in accordance with **Kalpana and Anbumani (2003)**.

Girth of Cob/plant (cm)

Significantly Maximum Girth of Cob/plant (7.64 cm) was recorded with the treatment of application of 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the treatments. However, the treatments 60 kg/ha Phosphorous + 25 kg/ha Potassium (7.35 cm) and 70 kg/ha Phosphorous + 20 kg/ha Potassium (7.50 cm) which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium. Potassium might be attributed to better filling of grains and thus, an increase in different yield attributing characters. The results were found to be similar with **Singh *et al.* (2010).**

Cob weight (g)

a) With husk

Significantly Maximum Cob weight (65.09 g) was recorded with the treatment of application of 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the treatments. However, the treatments 60 kg/ha Phosphorous + 25 kg/ha Potassium (64.42 g) and 70 kg/ha Phosphorous + 20 kg/ha Potassium (64.85 g) which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium.

b) Without husk

Significantly Maximum Cob weight (23.63 g) was recorded with the treatment of application of 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the treatments. However, the treatments 60 kg/ha Phosphorous + 25 kg/ha Potassium (23.23 g) and 70 kg/ha Phosphorous + 20 kg/ha Potassium (23.45 g) which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium.

Higher vigour and growth attained by the plants due to sufficient absorption of nutrients might have resulted in higher cob weight. The results were found to be similar with **Hadiya and Shah (2014).**

Cob yield (t/ha)

a) With husk

Significantly highest Cob yield (15.14 t/ha) was recorded with the treatment application of 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the treatments. However, the treatments with (14.74 t/ha) in 60 kg/ha Phosphorous + 25 kg/ha Potassium and with (15.00 t/ha) in 70 kg/ha Phosphorous + 20 kg/ha Potassium which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium.

b) Without husk

Significantly highest Cob yield (5.16 t/ha) was recorded with the treatment application of 70 kg/ha Phosphorous + 25 kg/ha Potassium over all the treatments. However, the treatments with (4.91 t/ha) in 60 kg/ha Phosphorous + 25 kg/ha Potassium and with (5.06 t/ha) in 70 kg/ha Phosphorous + 20 kg/ha Potassium which were found to be statistically at par with 70 kg/ha Phosphorous + 25 kg/ha Potassium.

The increase in cob yield due to phosphorus application is attributed to source and sink relationship. It appears that greater translocation of photosynthates from source to sink might have increased cob yield. Phosphorus increases yield due to its well-developed root system, increased N fixation and its availability to the plants and favourable environments in the rhizosphere. Similar results were found by **Hirpara *et al*. (2017).** Potassium application stimulates the cumulative effect of improvement in yield attributes viz., number of cobs per plant, cob length and thickness and cob weight and also increased availability, absorption, and translocation of K nutrient **Mastoi *et al.* (2013)**.

Table 2. Effect of Phosphorous and Potassium on Yield attributes and Yield of Baby corn.

Treatments	No. of Cobs/plant	Length of Cob/plant (cm)	Girth of Cob/plant (cm)	Cob weight (g)		Cob yield (t/ha)	
				With Husk	Without Husk	With Husk	Without Husk
1. 50 kg/ha Phosphorous + 15 kg/ha Potassium	1.06	17.18	6.49	62.94	21.94	13.64	3.54
2. 50 kg/ha Phosphorous + 20 kg/ha Potassium	1.08	17.42	6.62	63.24	22.19	13.82	3.76
3. 50 kg/ha Phosphorous + 25 kg/ha Potassium	1.18	18.13	7.08	63.90	22.74	14.27	4.53
4. 60 kg/ha Phosphorous + 15 kg/ha Potassium	1.11	17.64	6.71	63.43	22.43	13.88	4.01
5. 60 kg/ha Phosphorous + 20 kg/ha Potassium	1.20	18.33	7.24	64.26	23.03	14.57	4.73
6. 60 kg/ha Phosphorous + 25 kg/ha Potassium	1.23	18.57	7.35	64.42	23.23	14.74	4.91
7. 70 kg/ha Phosphorous + 15 kg/ha Potassium	1.15	17.92	6.89	63.70	22.52	14.07	4.26
8. 70 kg/ha Phosphorous + 20 kg/ha Potassium	1.28	18.97	7.50	64.85	23.45	15.00	5.06
9. 70 kg/ha Phosphorous + 25 kg/ha Potassium	1.34	19.29	7.64	65.09	23.63	15.14	5.16
S. EM (±)	0.04	0.28	0.10	0.24	0.14	0.15	0.09
CD (P = 0.05)	0.12	0.84	0.31	0.71	0.41	0.45	0.28

CONCLUSION

Based on the findings of the investigation it may be concluded that treatment with 70 kg/ha Phosphorous + 25 kg/ha Potassium performed exceptionally in all growth and yield parameters and in obtaining maximum cob yield of sweet corn. Hence, 70 kg/ha Phosphorous + 25 kg/ha Potassium may be more preferable and can be recommended to the farmers.

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