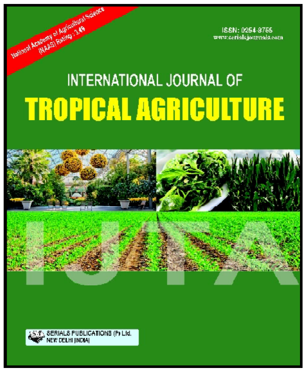

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Effects of phosphorus and potassium on yield attributes and yield of *summer* sweet corn (*Zea mays* L. *var. saccharata* Sturt) under South Gujarat condition

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Abstract: An experiment was carried out during *summer* season of 2013-14 to study the "Response of *summer* sweet corn (*Zea mays* L. *var. saccharata* Sturt) to phosphorus and potassium under South Gujarat condition". Total twelve treatment combinations consisting of four levels of phosphorus *viz.,* P_0 (0 kg P_2O_5/ha), P_1 (30 kg P_2O_5/ha), P_2 (60 kg P_2O_5/ha), and P_3 (90 kg P_2O_5/ha) and three levels of potassium *viz.*, K_0 (0 kg K_2O/ha), K_1 (30 kg K_2O/ha) and K_2 (60 kg K_2O/ha) were evaluated in factorial randomized block design with four replications. Phosphorus applied @ 60 kg P_2O_5/ha was recorded significantly higher plant height at harvest (189.75 cm), number of cobs per plant (1.17), cob length (20.73 cm), cob girth (20.73 cm), cob weight with husk (0.395 g) and without husk (0.318 g), number of kernals per cob (& 506.28), green cob yield (14.40 t/ha) and dry fodder yield (11.89 t/ha) over control. However, application of 60 kg K_2O/ha, recorded significantly the higher cob length (27.31cm) and numbers of kernals per cob (510.10), green cob yield (14.45 t/ha) and dry fodder yield (12.12 t/ha) over control.

Key words: Sweet corn, Phosphorus, Potash, Green cob yield,

INTRODUCTION

Sweet corn is now becoming popular in India and other Asian countries. Sweet corn differs from other corn (field maize, pop corn and ornamental) because the kernels have a high sugar content in the milky or early dough stage. It is consumed in the immature stage of the crop. It contains about 12-20 % sugar. It also contains energy of 90 kcal, carbohydrates 19 g, sugar 3.2 g, dietary fiber 2.7 g, fat 1.2 g, protein 3.2 g, vitamin-A 10 µg, folate (Vit.B9) 46 µg, vitamin-C 7 mg, iron 0.5 mg, magnesium 37 mg and potassium 270 mg nutritional values per 100 g sweet corn seed.

The various agronomic factors determining the crop yield, nutrient management is consider as one of the basic factors. Judicious use of fertilizer is therefore considered to be vital importance to achieve high yield.

Among the primary nutrients, phosphorus is most common important essential macro nutrient for crop growth after nitrogen. Phosphorus requirement is generally low as compare to nitrogen but its application is necessary for promoting root growth and development, early flowering and ripening. It is involved in a wide range of plant processes from permitting cell division to the development of a good root system and for ensuring timely and uniform ripening at the crop. In plants, P is necessary for photosynthesis, respiration, cellular function, gene transfer and reproduction (Rashid and Memon, 2001). Once aware of the critical link between P and life itself, it becomes apparent that "without phosphorus, there is no cell, plant and grain". It shows its deficiency mainly at the seedling stage, though it is needed most after flowering stage.

Potassium plays an important role in improving quality of crops. It is highly mobile within plant vascular system and plays an essential role in a number of metabolic functions. In plant, potassium stimulates about 80 different types of enzymes (Kasana and Khan, 1976). It stimulates in the stomatal functioning and helps plants to grow under drought condition (Hsiao, 1973). Potassium also promotes the translocation of photosynthetic assimilates from leaves to grain through the phloem and demonstrated that both the rate at which grain fills and the period for which it fills can be increased by K fertilization. Application of potash increased vigour and disease resistance in plant, helps in protein production of plants, induced plum development of grain, improved quality of plant, helps in root developments and helps in formation and transformation of starch, sugar and oils. To achieve higher yield of crops it is essential to provide them in optimum level of their nutrient requirements. Therefore, present experiment was conducted to find out the "Response of *summer* sweet corn (*Zea mays* L. *var. saccharata* Sturt) to phosphorus and potassium under South Gujarat condition".

MATERIALS AND METHODS

Field experiment was conducted in *summer* season of 2013-14 at Navsari, Gujarat. Total twelve treatment combinations comprising of four levels of phosphorus *viz.,* P_0 (0 kg P_2O_5/ha), P_1 (30 kg P_2O_5/ha), P_2 (60 kg P_2O_5/ha), and P_3 (90 kg P_2O_5/ha) and three levels of potassium *viz.*, K_0 (0 kg K_2O/ha), K_1 (30 kg K_2O/ha) and K_2 (60 kg K_2O/ha) were evaluated in factorial randomized block design with four replications. The soil of experimental plot was clayey in texture having EC 0.84 dS/m and soil pH 7.59. The soil was low in organic carbon (0.37 %) and available N (168.34 kg/ha) and medium in available P (39.77 kg/ha) and available K (266.58 kg/ha) were determined by Kjeldahl's method, Olsen's method and Flame photometric method (Jackson, 1979), respectively. The total sugar content in sweetcorn kernals were estimated by the Phenol-sulphuric acid method described by Dey (1990). Sweet corn variety "Sugar-75" seeds were sown at 60 cm x 20 cm spacing. The entire dose of phosphorus and potassium were applied at basal application just before sowing as per the treatments. Urea, single super phosphate and murate of potash were taken as fertilizer sources for N, P and K, respectively. Recommended dose of nitrogen (120 kg/ha) was applied in three equal splits at basal, knee height and tasseling stage.

RESULTS AND DISCUSSION

Effect on phosphorus level

Growth attributes *viz.,* plant height at harvest (Table 1) were significantly influenced due to the application of phosphorus. Significantly the highest plant height (191.92 cm) was found under 90 kg P_2O_5/ha over control, which was at par with 60 and 30 kg P_2O_5/ha. The different levels of phosphorus could not exert remarkable difference on number of leaves per plant at harvest. Increased in plant height might be due to application of phosphorus helps to develop a more extensive root system and thus enables the plant to extract more water and nutrient from soil depth, resulting in better development of plant growth. Similar results are in accordance with the findings of Patel *et al.,* (2000), Sarma *et al.* (2000) and Kumar and Singh (2003).

The variation in the all the yield attributing characters *viz*., number of cobs per plant, cob length, cob girth, cob weight with husk and without husk and number of kernals per cob were significantly differed due to application of phosphorus. Phosphorus applied @ 90 and 60 kg P_2O_5/ha being at par, but recorded significantly higher number of cobs per plant, cob length, cob girth, cob weight with husk and without husk and number of kernals per cob over control. The increased in the number of cobs per plant, cob length, cob girth, cob weight with husk and without husk and number of kernals per cob were up to the tune of 37.65 &51.76, 18.77 & 17.69, 10.0 &7.92, 15.34& 12.22, and 20.51 & 16.48 and 6.45 & 4.28 per cent higher under the application of 90 and 60 kg P_2O_5/ha over control, respectively. The favourable effect of phosphorous fertilizer on yield attributes might be due to the better nutritional environment in soil and plant, positive effect on root formation, proliferation and their functional activities and important role of phosphorus in energy transformation and metabolic processes. The present findings are within the close vicinity of those reported by Maliwal *et al.* (1985), Arya and Singh (2000) and Sarma *et al*., (2000) and Patel *et al.* (2013).

Significantly the highest green cob (14.91t/ha) and dry fodder yield (12.56 t/ha) were produced with the application of 90 kg P_2O_5/ha over control, which was at par with 60 kg P_2O_5/ha. The magnitude of increased in green cob yield of 44.34 and 39.40 per cent and dry fodder yield of 25.72 and 19.02 per cent under the application of 90 and 60 kg P_2O_5/ha over control, respectively. The present findings are in close agreement with the results obtained by Arya and Singh (2000), Sarma *et al*., (2000) and Kokani *et al.* (2015).

The different level of phosphorus application was significantly influenced on protein content of cob. But, sugar content in cob after 1, 2 and 3 days of harvest of sweet corn did not affect significantly by the application of phosphorus. Significantly the highest protein content in cob was recorded due to application of 90 kg P_2O_5/ha over rest of the treatments. This might be due to application of phosphorous helps in development of better environment in soil to produced effective root formation, proliferation and their functional activities and thus plant uptake more nutrients particularly nitrogen from the soil, which directly influenced the protein content of cob. Yogandra *et al.* (2000) found similar type of result of protein content in pop corn.

Effect on potassium levels

Growth parameters *viz*., plant height at different stages and number of leaves per plant at harvest did not affected remarkably by the various levels of potassium. It showed that the original potassium status in experiment field soil was enough to meet the requirement of the crop and hence, potassium failed to show response on growth parameters. The similar type of result was reported by Singh *et al.* (2003).

The yield attributes *viz*., cob length and number of kernals per cob was significantly influenced due to potassium application. An application of 60 and 30 kg K_2O/ha being at par, but recorded significantly highest cob length and number of kernals per cob over control. Non-significantly but numerically higher value of number of cobs per plant, cob girth,

Table 1

Effects of various levels of phosphorus and potassium on growth and yield attributes of sweet corn

Treatments	*Plant height at harvest (cm)*	*Number of leaves per plant at harvest*	*Number of cobs per plant*	*Cob length (cm)*	*Cob girth (cm)*	*Cob weight (g) With husk*	*Cob weight (g) Without husk*	*Number of rows per cob*	*Number of kernals per cob*
A. Phosphorus level (P) (kg/ha)									
P_0 = 00	179.67	12.50	0.85	23.01	19.20	0.352	0.273	12.86	422.14
P_1 = 30	185.28	12.58	0.99	24.78	19.77	0.385	0.308	13.22	452.04
P_2 = 60	189.75	13.08	1.17	27.08	20.72	0.395	0.318	13.41	506.28
P_3 = 90	191.92	12.92	1.29	27.33	21.12	0.406	0.329	13.69	525.76
S. Em. ±	3.06	0.24	0.05	0.91	0.45	0.009	0.009	0.30	19.57
C.D. (P=0.05)	8.99	NS	0.13	2.67	1.31	0.027	0.026	NS	57.40
B. Potassium level (K) (kg/ha)									
K_0 = 00	182.10	12.56	0.99	23.51	19.51	0.370	0.292	13.09	438.17
K_1 = 30	187.95	12.81	1.04	25.84	20.22	0.391	0.313	13.35	481.39
K_2 = 60	189.91	12.94	1.13	27.31	20.88	0.392	0.315	13.45	510.10
S. Em. ±	2.65	0.21	0.04	0.79	0.39	0.008	0.008	0.26	16.95
C.D. (P=0.05)	NS	NS	NS	2.31	NS	NS	NS	NS	49.71
C.V. %	5.69	6.54	14.94	12.34	7.68	8.39	10.09	7.72	14.22
Interaction									
P X K	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2

Green cob and dry fodder yield as well as quality parameter of sweet corn affected by various levels of phosphorus and potassium

Treatments	*Green cob yield (t/ha)*	*Dry fodder yield (t/ha)*	*Protein content of cob (%)*	*Sugar content (%) of cob after 1 days harvest*	*2 days harvest*	*3 days harvest*
A. Phosphorus level (P) (kg/ha)						
P_0 = 00	10.33	9.99	8.68	16.02	13.91	13.40
P_1 = 30	13.06	10.72	9.35	16.55	13.96	13.52
P_2 = 60	14.40	11.89	10.21	16.64	14.12	13.56
P_3 = 90	14.91	12.56	11.30	16.82	14.51	13.63
S. Em. ±	0.41	0.38	0.33	0.43	0.41	0.39
C.D. (P=0.05)	1.20	1.10	0.97	NS	NS	NS
B. Potassium level (K) (kg/ha)						
K_0 = 00	11.75	10.34	9.65	16.31	13.93	13.35
K_1 = 30	13.32	11.41	9.81	16.45	14.19	13.54
K_2 = 60	14.45	12.12	10.20	16.76	14.25	13.69
S. Em. ±	0.35	0.33	0.29	0.38	0.36	0.34
C.D. (P=0.05)	1.04	0.96	NS	NS	NS	NS
C.V. %	10.75	11.57	11.54	9.07	10.12	10.08
Interaction						
P X K	NS	NS	NS	NS	NS	NS

cob weight with husk and without husk and number of rows per cob were observed under the same treatments. The percentage increased in the number of cobs per plant, cob length, cob girth, cob weight with husk and without husk, number of rows per cob and number of kernals per cob were observed up to the tune of 14.14, 16.16, 7.02, 5.95 &7.88, 2.75 and 14.42 per cent over control. The yield attributes was increased due to the potassium application which might have been held mostly in available form, might have synergistic effect on increased the availability of potassium and other nutrients near the root zone and resulted in the faster growth of plant. The improvement in yield parameter with potassium was also reported by Sarma and Subramanian (1991).

Potassium applied @ 60 kg/ha produced significantly the highest green cob and dry fodder yield of 14.45 and 12.12 t/ha over rest of treatments, except the dry fodder yield (11.41 t/ha) under the 30 kg K_20/ha. The improvement in yield with application of potassium might have resulted due to cumulative effect of overall improvements in growth and yield attributing characters because of better and timely availability of K to plant for their utilization. The present findings are within the close vicinity of those reported by Singh *et al.* (2003). Protein and sugar content of cob after 1, 2 and 3 days of harvest of sweet corn did not influenced significantly due to potassium application. Similar type of result was also obtained by Lal (1979) in case of protein content in pearl millet grain.

Interaction effects

None of the interaction effect of phosphorus and potassium levels was manifest their significant effect on growth attributes, yield attributes and quality parameters of sweet corn.

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