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SHORT CUMMUNICATION

PERFORMANCE OF SWEET CORN [*ZEA MAYS* (L.) SSP. *SACCHARATA*] VARIETIES AT VARYING FERTILITY LEVELS

S. K. DHAKA, DILIP SINGH*, V. NEPALIA, SULOCHANA AND J. DHEWA

Department of Agronomy
Maharana Pratap University of Agriculture & Technology,
Udaipur-313 001 (Rajasthan), India
**(e-mail : dilipagron@gmail.com)*
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SUMMARY

A field experiment was conducted during **kharif** 2013 to select best sweet corn variety for green cobs, green fodder and to evaluate optimum fertility levels. The treatment consisted combinations of four sweet corn varieties (Madhuri, Hi-Brix-51, Misthi and Sugar-75) and four fertility fertilizer levels (70+30, 90+40, 110+50 and 130+60 kg N+P_2O_5/ha). With highest green cobs (92.9 q/ha), green fodder yield (204.0 q/ha), its total digestible nutrient (90.8%), total soluble solids of grain of green fodder (12.48%), protein (4.91%), green cobs yield (126.9), net returns (Rs. 94081/ha) and B : C ratio (4.9), the sweet corn variety 'Sugar-75' proved economically profitable. The N and P uptake by grain and stover of 'Sugar-75' were significantly higher over rest of the varieties. At harvest, sweet corn varieties failed to influence P status of soil, however, N status significantly decreased in 'Sugar-75' compared to rest of the varieties. Application of 90 kg N+40 kg P_2O_5/ha economically proved optimum profitable dose for green cobs, fodder and its quality. Further increase in fertility level failed to influence these parameters significantly. Phosphorus status of soil did not influence significantly under different fertility levels, however, nitrogen status of soil increased with increasing level of nitrogen.

Key words : Sweet corn, green fodder and cob yield, fertility levels, economics

Maize is an important cereal crop of the world and staple food of tribal people in many parts the of country. Now-a-days, use of sweet corn cobs at immature stages as roasted and boiled ears is a popular practice as the kernels are sweet, creamy, tender, crispy and test almost shell-less. After harvesting green cobs, plant of maize is used as green fresh fodder or dry fodder. Due to sweet taste and tenderness of green cobs as well as quality green fodder, cultivation of sweet corn is the first choice of farmers now-a-days. Therefore, development of sweet corn varieties with enhanced sugar content of soft grains is gaining popularity (Suthar *et al.*, 2014). Identification of such new genotypes having wider adaptability and responsiveness to input is considered essential for gaining more popularity and exploiting higher yield potential of sweet corn. Amongst nutrients, nitrogen plays an important role in synthesis of chlorophyll, amino acids and other organic compounds of physiological significance in plant system (Halvin *et al.*, 2005). Phosphorus plays an important role in energy transfer in living cells by means of high energy phosphate bonds of ATP (Reddy and Reddy, 2002). Our most of the soils are having medium to low status of nitrogen and phosphorus, hence, adequate nitrogen and phosphorus fertilization is considered to be one of the most important pre-requisites for increasing green cob and fodder yield. Considering these facts and paucity of research findings, the trial was conducted to work out optimum combination of nitrogen and phosphorus fertilization for sweet corn varieties under agroclimatic condition of sub-humid southern and Arawali hills of Rajasthan.

A field experiment was conducted during **kharif** 2013 at the Instructional Farm, Rajasthan College of Agriculture, Udaipur which is situated at 23°34′ N latitude, 72°42′ E longitude and 582.17 m above the mean sea level. The soil of the experimental site was clay loam having pH 7.8, organic carbon 0.82, available nitrogen 290.3 kg/ha, phosphorus 18.1 kg/ha and potassium 305.4 kg/ha in the plough layer. The well distributed rainfall of 674.4 mm was recorded during crop growth period. The treatments consisted of four sweet corn varieties (Madhuri, Hi-Brix-51, Misthi and Sugar-75) and four fertility levels (70+30, 90+40, 110+50

and 130+60 kg N+P_2O_5/ha) and were evaluated in randomized block design replicated thrice. The crop was sown manually on 8 July, 2013 by placing two seeds at a depth of 5-6 cm at 60 x 25 cm. The experimental plot size was 3 x 5 m. Thinning was carried out at 15 days after sowing to maintain required plant population. The green cobs were harvested 15 days after silking when grains were in milky stage. Crop was harvested for green fodder after plucking green cobs. Phosphorus as per treatments was applied as basal, whereas nitrogen was applied in three equal splits viz., 1/3 as basal, 1/3 at knee high stage and remaining 1/3 at initiation of tassel. In order to minimize weed competition, pre-emergence application of atrazine at 0.5 kg/ha followed by one hoeing and earthing up at 20 days after sowing was carried out. Net returns and B : C ratio were calculated on basis of prevailing market prices of inputs and produce. Leaf area index (LAI), chlorophyll, protein content, nutrient content and uptake, crop growth rate (CGR) and relative growth rate (RGR) were worked out by using standard methods for analysis and formula. Data of each character collected were statistically analyzed using standard procedure of variance analysis.

The data in Table 1 reveal that at harvest of crop 'Sugar-75' attained the highest plant height and dry matter which were significantly higher over rest of the varieties. The relative crop growth rate (RGR) of 'Sugar-75' was significantly higher over rest of the varieties. However, the crop growth rate (CGR) of 'Sugar-75' was at par with 'Madhuri', but proved significantly higher over rest of the varieties. Sweet corn variety 'Hi-Brix-51' took highest days to maturity which was significantly higher over rest of the varieties. Plant population did not differ significantly amongst different varieties. Under present investigation, the better performance of 'Sugar-75' seems to be on account of higher uptake of nitrogen and phosphorus (Table 2) from soil and its reallocation in grain and plant. The higher availability of nitrogen and phosphorus seems to have promoted development of morphological structure by virtue of multiplication of cell division which is well reflected through increased leaf area index, crop growth rate and relative growth rate (Kumar, 2009). Application of 90 kg N+40+P_2O_5/ha significantly enhanced plant height, dry matter, LAI and CGR of sweet corn varieties over 70 kg N+30 kg P_2O_5/ha. Further increase in nutrient level though improved these parameters, however, failed to record statistical significance. Days to 50 per cent silking and plant height did not vary significantly under different fertility levels. The significant response up to 90 kg N+40 kg P_2O_5/ha might be on account of enrichment of soil with these two major nutrients (N and P) to the level of sufficiency which in turn promoted growth of plant right from early stage (Kumar, 2009; Suthar *et al.*, 2014).

The data presented in Table 2 show that highest

TABLE 1
Effect of varieties and fertility levels on growth and yield attributing parameters

Treatment	At harvest			LAI at 50 DAS	50 DAS to harvest		Green fodder		TSS (%)	Days to 50% silking	Cobs/ plant	Grains/ cob	Grain rows/ cob	Cob length (cm)
	Plants/ ha	Plant height (cm)	DM (g/plant)		CGR	RGR	Protein (%)	TDN (%)						
Varieties														
Madhuri	62.0	144.3	112.8	2.33	2.91	1.01	4.73	88.3	11.19	53.7	1.01	144.3	13.00	19.73
Hi-Brix-51	61.9	128.3	110.5	2.24	2.86	1.34	4.39	87.3	12.29	54.8	1.34	128.3	13.08	18.04
Misthi	62.1	129.0	97.4	2.04	2.39	1.20	4.77	89.1	12.28	52.2	1.20	129.0	13.08	17.18
Sugar-75	61.9	219.5	116.7	2.38	2.96	1.28	4.91	90.8	12.48	52.3	1.28	219.5	13.75	21.86
S. Em±	0.20	1.10	0.60	0.03	0.03	0.01	0.02	0.61	0.08	0.20	0.01	1.10	0.03	0.13
C. D. (P=0.05)	NS	3.17	1.73	0.06	0.08	0.02	0.06	1.76	0.24	0.60	0.02	3.17	0.09	0.36
Fertility levels (N+P_2O_5/ha)														
70+30	62.1	143.3	98.5	2.03	2.45	1.21	3.69	84.3	12.00	53.2	1.21	143.3	13.25	18.06
90+40	61.9	157.7	111.3	2.30	2.84	1.21	5.00	89.9	12.15	53.2	1.21	157.7	13.25	19.48
110+50	61.8	159.9	113.5	2.33	2.91	1.20	5.05	90.3	12.02	53.5	1.20	159.9	13.25	19.59
130+60	62.1	160.2	114.1	2.33	2.93	1.20	5.05	90.9	12.08	53.0	1.20	160.2	13.17	19.69
S. Em±	0.20	1.10	0.60	0.03	0.03	0.01	0.02	0.61	0.08	0.20	0.01	1.10	0.03	0.13
C. D. (P=0.05)	NS	3.17	1.73	0.04	0.09	NS	0.06	1.76	NS	NS	NS	3.17	NS	0.36

DM : Dry matter, CGR : Crop growth rate (g $m^{-2}day^{-1}$), RGR : Relative growth rate (g g^{-1} day^{-1}), TDN : Total digestible nutrient, TSS : Total soluble solids. NS–Not Significant.

TABLE 2
Effect of varieties and fertility levels on yield, economics, soil status, nutrient content and uptake

Treatment	Yield (q/ha)		Net returns/ ha	B : C	Nutrient content (%)				Nutrient uptake (kg/ha)				Nutrient status (kg/ha)	
	Green cobs	Green fodder			Nitrogen		Phosphorus		Nitrogen		Phosphorus		N	P_2O_5
					Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover		
Varieties														
Madhuri	68.9	137.9	63445	3.30	1.747	0.757	0.358	0.116	24.61	26.37	4.93	4.00	281.2	20.34
Hi-Brix-51	63.7	133.5	57858	3.01	1.825	0.702	0.360	0.118	23.36	23.71	4.59	3.95	282.4	20.34
Misthi	59.1	126.9	52532	2.73	1.711	0.763	0.354	0.114	20.31	24.50	4.18	3.63	283.2	20.37
Sugar-75	92.9	204.0	94081	4.90	1.897	0.785	0.365	0.119	35.33	40.32	6.79	6.07	257.9	20.48
S. Em±	0.50	1.06	2100	0.11	0.004	0.003	0.001	0.0004	0.23	0.28	0.04	0.04	1.8	0.08
C. D. (P=0.05)	1.45	3.05	6066	0.31	0.013	0.009	0.002	0.0010	0.65	0.80	0.10	0.10	5.2	NS
Fertility levels ($N+P_2O_5$/ha)														
70+30	62.5	132.1	57341	3.12	1.645	0.590	0.347	0.109	20.77	19.64	4.34	3.61	264.0	19.35
90+40	72.4	153.1	68812	3.63	1.843	0.800	0.363	0.119	26.90	30.79	5.26	4.57	274.5	19.95
110+50	74.8	159.0	71247	3.66	1.844	0.808	0.364	0.119	27.78	32.33	5.45	4.74	280.6	20.79
130+60	74.7	158.2	70517	3.52	1.848	0.808	0.364	0.119	27.76	32.14	5.45	4.73	285.7	21.43
S. Em±	0.50	1.06	2100	0.11	0.004	0.003	0.001	0.0004	0.23	0.28	0.04	0.04	1.8	0.08
C. D. (P=0.05)	1.45	3.05	6066	0.31	0.013	0.009	0.002	0.0010	0.65	0.80	0.10	0.10	5.2	NS

NS–Not Significant.

number of cobs/plant was recorded under 'Hi-Brix-51' which was significantly higher over rest of the varieties. However, 'Sugar-75' produced highest grains/cob, grain rows/cob and cob length consequently green cobs and fodder yield over rest of the varieties. The significant increase in yield attributes and yield of 'Sugar-75' might be on account of overall improvement in growth as evinced from higher dry matter, leaf area index, CGR, RGR, N and P uptake of plant compared to rest of the varieties (Kumar, 2009). An application of 90 kg N+40 kg P_2O_5/ha registered significant increase in grains/cob, cob length over 70 kg N+30 kg P_2O_5/ha. Green cobs and green fodder yields responded significantly up to 110 kg N+50 kg P_2O_5/ha. Further increase in nutrient level failed to exert any significant variation. Sufficient availability of major nutrients (N and P) suggested greater availability of metabolites synchronized to demand for growth and development of each reproductive structure consequently enhanced green cob and fodder plant (Suthar *et al.,* 2014).

The maximum nitrogen and phosphorus content and uptake by sweet corn grain and fodder were registered under 'Sugar-75' which were significantly higher over rest of the varieties. The significant increase in N and P content and uptake of plant parts at harvest seems to be on account of capabilities of variety 'Sugar 75' for efficient absorption, translocation and utilization of mineral nutrients (Suthar *et al.,* 2014). An application of 90 kg N+40 kg P_2O_5/ha significantly improved N and P uptake by grain and stover compared to 70 kg N+30 kg P_2O_5/ha. The results are quite self-explanatory in light of the fact that because of medium fertility status of N and P in experimental soils, application of 90 kg N+40 kg P_2O_5/ha appeared to enrich soil with these nutrients (N and P) to the level of sufficiency, thus causing higher extraction of nutrients from soil which in turn improved growth of individual plant consequently uptake of these nutrients (Nath *et al.,* 2009).

Highest total soluble solid content of green grain was recorded under 'Sugar-75' which was statistically equal to 'Misthi' and 'Hi-Brix-51', however, proved significantly higher over 'Madhuri'. The TDN and protein content of green fodder of 'Sugar-75' were significantly higher over rest of the varieties. Under present investigation, all varieties were grown under identical conditions, however, marked variation in quality parameters could be ascribed on account of their genetic capabilities to exploit available resources for their growth and development. The improvement in protein content in green fodder of 'Sugar-75' seemed to be on account of increased nitrogen content (Kumar *et al.,* 2002). Protein and TDN contents of green fodder were significantly increased with 90 kg N+40 kg P_2O_5/ha over 70 kg N+30 kg P_2O_5/ha. Nitrogen is constituent of protein and thus the improvement in protein content in green fodder might be on account of marked increase in N

content of stover under 90 kg N/ha (Nath *et al.,* 2009).

Amongst varieties, 'Sugar-75' was the most efficient in realizing highest net returns (Rs. 94081/ha) and B : C ratio (4.9) which were significantly higher over rest of the varieties. The crop fertilized with 90 kg N+40 kg P_2O_5/ha recorded significantly higher net returns and B : C ratio over 70 kg N+30 kg P_2O_5/ha. Further increase in nutrient level failed to alter net returns and B : C ratio significantly because of higher prices of fertilizer.

CONCLUSION

On the basis of results emanated from the present experiment conducted during **kharif** 2013, it was concluded that under prevailing agro-climatic conditions, sweet corn variety 'Sugar 75' fertilized with 90 kg N+40 kg P_2O_5/ha proved most efficient and economically profitable.

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