Forage Res., **38** (2) : pp. 115-118 (2012) **http://forageresearch.in**

GREEN FODDER AND COB YIELD OF SWEET CORN (*ZEA MAYS.* L. *SSP. SACCHARATA*) VARIETIES AT VARYING FERTILITY LEVELS

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(Received : 28 March, 2013, Accepted : 20 July2013

SUMMARY

A field experiment entitled 'Green fodder and cob yield of sweet corn (*Zea mays*. L. *Ssp. saccharata*) varieties at varying fertility levels was conducted at Instructional Farm, Rajasthan College of Agriculture, Udaipur during ***kharif*** 2011, with objective to evaluate production potential of sweet corn varieties under prevailing agro-climatic conditions and to work out optimum fertilizer dose for sweet corn varieties. The treatment consisted of combinations of four sweet corn varieties ('Sugar 75', 'Win orange', 'Madhuri' and 'Bright Jean') and four fertility levels (70 + 30, 90 + 40, 110 + 50 and 130 + 60 kg N + P_2O_5/ ha). With highest green fodder (26.54t/ha) and green cob yield (12.66 t/ha) 'Sugar-75' proved best and economically profitable (Net returns Rs.127817 ha^{-1} and BC ratio 6.0) compared to rest of varieties. Quality of grain of 'Sugar-75' estimated in terms of nutrient uptake, protein content, total soluble solids (TSS), moisture content and total digestive nutrient (TDN) content, and protein content green fodder proved best compared to other varieties. Application of 90 kg N + 40 kg P_2O_5/ha recorded significantly higher green cob (9.97 t/ha) green fodder (19.97 t/ha) yield over 70 kg N + 30 kg P_2O_5/ha and proved economically beneficial compared to its lower level. TSS content of grain and TDN of green fodder did not influenced significantly under fertilizer levels, however, moisture content and protein content of cobs responded significantly up to 90 kg N + 40 kg P_2O_5/ ha.

Key words : Sweet corn, Fertilizer, Green cob & fodder yield, quality and economics

In recent past, India has made an impressive progress in achieving self sufficiency in food grain production by elevating productivity of several crops. However, forage production for livestock is limited and costly due to erratic rainfall especially in Rajasthan. Maize is a versatile product with uses ranging from industrial products to food preparations, as well as direct human consumption at vegetative stage. Off the different types, sweet corn is a hybridized variety of maize specifically breds to increase the sugar content (Wikipedia, 2006). Its consumption at immature stage as roasted and boiled ears is a popular practice as the kernels are sweet, creamy, tender, crispy and tests almost shell-less. The crop is highly remunerative as it possess high total biomass and green cobs Due to its sweet teste and tenderness, cultivation of sweet corn is the first choice of the farmers now a day for green fodder and green cobs. Therefore development of sweet corn varieties with enhanced sugar content is gaining popularity not only in India but in international market as well (Kumar, 2008). This speciality corn with its high market value is very suitable for periurban agriculture. Presently 'Madhuri' is the most preferred sweet corn variety in most part of maize growing area. Recently few new sweet corn varieties have been released by private and public sector which need evaluation under prevailing conditions for exploiting higher yield potential. It is an established fact that green cobs and fodder yield potentials of the sweet corn genotypes are realised to the fullest extent when they are grown under adequate nitrogen and phosphorus mineral fertilization. It also affects quality of green fodder. Therefore there is need to evaluate production performance of sweet corn varieties and to work out optimum combination of nitrogen and phosphorus fertilization for recently released sweet corn varieties under prevailing agroclimatic conditions.

MATERIALS AND METHODS

The field experiment was carried out during ***kharif*** 2011 at the Instructional Farm, Rajasthan College

of Agriculture, Udaipur, Rajasthan which is situated at 23°34'N latitude and 73°42'E longitude at an altitude of 582.17 meter above the mean sea level. The soil of the experiment site was clay loam having pH 7.5, organic carbon 0.66, available nitrogen 268.4 kg/ha, phosphorus 19.5 kg/ha and potassium 365.5 kg/ha in the plough layer. The well distributed rainfall of 642.0 mm was recorded during crop growth period. The treatment consisted of combinations of four sweet corn varieties ('Sugar 75' 'Win orange', 'Madhuri' and 'Bright Jean') and four fertility levels (70 + 30, 90 + 40, 110 + 50 and 130 + 60 kg N + P_2O_5/ha).These sixteen treatment combinations were evaluated under factorial randomized block design with three replications. Sweet corn varieties 'Sugar-75' and 'Bright Jean' were released by Syngenta India Ltd. and Known-You seed Pvt. Ltd., respectively for commercial cultivation throughout India, whereas 'Madhuri' and 'Win-Orange are popular varieties of public sector. The crop was sown manually on 3rd July, 2011 by placing two seeds per hill a depth of 5-6 cm maintaining rows and plants spacing at 60 x 25 cm. The experimental plot size was 15 m^2. 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. Phosphorus as per treatments was applied as basal, whereas nitrogen was applied in 3 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^{-1} followed by one hoeing and earthing up at 20 days after sowing was carried out. Net returns BC ratio were calculated on basis of prevailing market prices of inputs and produce. LAI, chlorophyll, protein content, nutrient uptake, CGR and 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.

RESULTS AND DESCUSSION

Growth Parameters

At harvest 'Madhuri' attained highest plant height, which was statistically at par with 'Sugar-57' and 'Win-Orange' and all three proved significantly higher over 'Bright Jean'. Whereas, at same time 'Sugar-75' produced highest dry matter which was significantly higher over rest of varieties. 'Sugar-75' took highest days to 50 per cent silking which was at par with 'Bright Jean' and 'Win-Orange', however, proved significantly higher over 'Madhuri'. At 50 days after sowing, highest leaf area index was recorded under 'Sugar-75' which was at par with 'Madhuri', and 'Win-Orange' but proved significantly higher over 'Bright Jean'. From 50 days after sowing to harvest, 'Sugar-75' produced maximum crop growth rate and relative growth rate which were significantly higher over rest of 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, 2008). Application of 90 kg N + 40 + P_2O_5/ha significantly enhanced plant height, dry matter, leaf area index, crop growth rate and relative growth rate 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. 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 and Nath *et al.*, 2009).

Yield Attributes and Yield

'Sugar-75' produced highest cobs/plant, grains/cob cob length consequently green cobs and fodder yield over rest of varieties. The significant increase in yield attributes and yield of 'Sugar-75' was expected. This 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 varieties (Kumar, 2009). An application of 90 kg N + 40 kg P_2O_5/ha registered significant increase in grains/cob, cob length consequently green cobs and green fodder yield over 70 kg N + 30 kg P_2O_5/ha. Further increase in nutrient level failed to exert any significant variation. Sufficient availability of major nutrient (N and P) suggest greater availability of metabolites synchronized to demand for growth and development of each reproductive structure consequently enhanced green cob and fodder plant (Abdullah 2008).

TABLE 1
Effect of fertilizer levels on growth, yield attributes and yield of sweet corn varieties

Treatments	At harvest		Days to 50% silking	LAI at 50 DAS	50 DAS to harvest		Yield attributes			Yield (t/ha)	
	Plant height	Dry matter			CGR*	RGR*	Cobs/ plant	Grains/ cob	Cob (cm)	Green cob	Green fodder
Varieties											
Bright Jean	181.6	97.4	53.7	2.04	2.39	0.254	1.0	125	17.1	8.24	15.91
Sugar-75	202.2	158.1	53.8	2.34	4.68	0.360	1.4	219	21.7	12.66	26.54
Madhuri	211.8	104.1	50.4	2.25	2.53	0.245	1.2	126	18.0	8.64	17.28
Win-Orange	201.8	112.8	52.4	2.29	2.85	0.266	1.2	140	19.7	9.65	18.31
S. Em±	4.12	2.02	0.51	0.05	0.08	0.008	0.02	3.80	0.43	0.28	0.39
C. D. (P=0.05)	11.90	5.85	1.47	0.15	0.25	0.022	0.07	10.9	1.25	0.81	1.12
Fertility levels (kg N + P_2O_5/ha)											
70+30	187.5	107.3	52.8	2.00	2.78	0.274	1.2	140	18.0	8.99	17.63
90+40	202.5	120.7	53.0	2.28	3.20	0.284	1.2	155	19.4	9.97	19.97
110+50	203.9	122.1	52.8	2.30	3.23	0.284	1.2	157	19.5	10.09	20.19
130+60	203.4	122.5	51.7	2.32	3.24	0.285	1.2	158	19.6	10.13	20.26
S. Em±	4.12	2.02	0.51	0.05	0.08	0.008	0.02	3.80	0.43	0.28	0.39
C. D. (P=0.05)	11.90	5.85	NS	0.15	0.25	0.022	NS	10.9	1.25	0.81	1.12

*CGR-Crop growth rate, RGR- Relative growth rate, DAS- Days after sowing.

TABLE 2
Effect of fertilizer levels on economics, nutrient uptake and quality of green cob and fodder of sweet corn varieties

Treatments	Economics		Nutrient uptake (kg/ha)				Content in green grain (%)			Content in green fodder (%)	
	Net returns (Rs./ha)	B : C ratio	Nitrogen Grain	Nitrogen Fodder	Phosphorus Grain	Phosphorus Fodder	Protein	Moisture	TSS	Protein	TDN*
Varieties											
Bright Jean	081792	3.5	28.5	30.3	2.8	4.5	10.09	76.7	11.19	4.73	87.9
Sugar-75	127817	6.0	46.9	53.1	9.2	7.8	11.55	78.1	13.28	4.97	90.8
Madhuri	086359	3.8	29.9	33.1	6.1	4.9	10.77	71.0	10.18	4.73	88.6
Win-Orange	095525	4.3	35.4	35.0	6.9	5.3	11.43	75.4	12.48	4.76	89.0
S. Em±	2334	0.12	1.10	1.01	0.22	0.13	0.078	1.05	0.283	0.066	0.69
C. D. (P=0.05)	6742	0.37	3.19	2.91	0.65	0.38	0.244	3.04	0.817	0.191	2.00
Fertility levels (kg N+P_2O_5/ha)											
70+30	089571	4.1	29.2	27.1	6.2	4.7	10.09	71.9	11.65	3.83	88.6
90+40	099700	4.5	36.4	40.8	7.2	5.9	11.37	75.4	11.99	5.09	89.3
110+50	100925	4.5	37.4	41.7	7.3	6.0	11.53	76.9	11.73	5.14	89.3
130+60	101298	4.5	37.6	41.8	7.3	6.0	11.54	77.0	11.75	5.14	89.6
S. Em±	2334	4.4	1.10	1.01	0.22	0.13	0.078	1.05	0.283	0.066	0.69
C. D. (P=0.05)	6742	0.12	3.19	2.91	0.65	0.38	0.224	3.04	NS	0.191	NS

TSS-Total soluble solids, TDN-Total digestible nutrients.

Nutrient Uptake

The maximum nitrogen and phosphorus uptake by sweet corn grain and fodder were registered under 'Sugar-75' which were significantly higher over rest of the varieties. 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 P_2O_5/ha. This might be on account of higher extraction of nutrient from soil which in turn improved growth of individual plant consequently uptake of theses nutrients (Nath *et al.*, 2009).

Quality of Green Cob and Fodder

The grains of 'Sugar-75' recorded highest protein content which was at par with 'Win-Orange' and both of these proved significantly higher over rest two varieties. However, protein content of green fodder of 'Sugar-75' was significantly higher over rest of varieties. Moisture content of grain of 'Sugar-75', 'Win-Orange' and 'Bright Jean' were statistically equal and significantly higher over 'Madhuri'. Highest total soluble sugar content was recorded under grains of 'Sugar-75' which was statistically equal to 'Win-Orange' and 'Bright Jean', however, proved significantly higher over 'Madhuri'. The total digestible nutrient of green fodder of 'Sugar-75' was significantly higher over rest of the varieties. Under present investigation all varieties were grown under identical conditions, however, marked variation in quality parameter could be ascribed on account of their genetic capabilities to exploit available resources for their growth and developments. The improvement in protein content in grain and fodder of 'Sugar-75' seems to be on account to increased nitrogen content (Kumar *et.al.,* 2002).There were no significant effect of increasing nutrient levels on total soluble sugar of green grain and total digestible nutrients of green fodder. However, protein content of green fodder, grain and moisture content of grain 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 grain and green fodder under 90 kg N/ha over 70 kg N/ha is as per expectation (Nath *et al.,* 2009).

ECONOMICS

Amongst varieties, 'Sugar-75' was most efficient in realizing highest net returns (Rs.127817/ha) and BC ratio (6.0) which were significantly higher over rest of varieties.The crop fertilized with 90 kg N + 40 kg P_2O_5/ha recorded significantly higher net returns and BC ratio over 70 Kg N + 30 kg P_2O_5/ha. This might be on account of significant jump in yield of green cobs and green fodder. Further increase in nutrient level though increased green cobs and fodder yield but marginal increase in green cob and fodder yield unable to compensate higher prices of fertilizer.

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