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EVALUATION OF SWEET CORN GENOTYPES FOR GREEN COB AND FODDER YIELD UNDER DIFFERENT LEVELS OF NUTRIENT AND PLANT SPACING

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SUMMARY

A field experiment was conducted at Punjab Agricultural University, Ludhiana during *kharif* season 2014. Three nutrient levels (125:60:30, 150:50:60, 250:80:100, kg $N:P_2O_5:K_2O$/ha) as main plots, two plant spacing (60×20 and 60×15 cm) as sub plots and six genotypes (Bisco Madhu, Bajaura Sweet Corn, FSCH 18, KSCH-333, Madhuri and WOSC) in sub-sub plots were evaluated for their influence on fodder yield and green cob of sweet corn genotypes. The application of nutrients @ 250:80:100 kg $N:P_2O_5:K_2O$/ha resulted in higher green cob yield (117.6q/ha) as compared to the nutrient @ 125:60:30 kg $N:P_2O_5:K_2O$/ha (109.0 q/ha) and it was at par with the nutrients level @ 150:50:60 kg $N:P_2O_5:K_2O$/ha (114.1 q/ha). However, application of 150:50:60 kg $N:P_2O_5:K_2O$/ha recorded higher net return (31073 Rs./ha) and B:C ratio (1.69) than other two treatments. The green fodder yield (134.5 q/ha) was also significantly higher at higher levels of nutrients. Significantly higher green cob and green fodder yield were recorded under the plant spacing 60×15 cm (116.1 and 132.74 q/ha) than 60×20 cm (111.1 and 125.4 q/ha). Similarly net return and B:C ratio was also higher under closer spacing 60×15 cm. KSCH-333 recorded significantly higher green cob and green fodder yield (141.6 and 160.3 qt/ha) as compared to all other genotypes. Similarly net return and B:C ratio was also higher with KSCH-333 genotype than other genotypes and was followed by the genotype Bisco Madhu.

Key words : Sweet corn, fertilizer levels, spacing, genotypes, green cob, fodder yield and economics

India has made an impressive progress in achieving self sufficiency in food grain production by elevating productivity of several crops. Corn (*Zea mays* L.) being a versatile crop, finds a place in the human food, animal feed, fodder and industrial raw material. Recently speciality corns such as baby corn and sweet corn have emerged as alternative food sources, especially for the affluent society. Sweet corn is used as a human food in the soft dough stage with succulent grain. Attention is now being paid to explore its potential in India, for earning foreign exchange besides higher economic returns to the farmers. The agronomic requirement of sweet corn is similar to grain maize except for a suitable variety, plant population density, higher doses of nitrogen and most importantly early harvesting. Yield and quality of sweet corn are affected by cultural management applied to the maize plants especially fertilizer application. The different levels of nutrition greatly affect the maize yield and quality. Farmers are growing these varieties with existing fertilizer recommendations made for composite and hybrids maize. The needs of a sweet corn crop for supplemental nutrients can vary greatly among fields, seasons and crop growing conditions.

The production areas of maize are increasing day by day due to increase in poultry and dairy farms in the country and the farmers are also interested to grow it in their crop diversification programme in India. Maize has been the source of nutrient for human as cereal crop and for animals as fodder, hence its improvement in terms of its protein quality mainly lysine and tryptophan is very important (Sharma *et al.*, 2015). Added advantage of cultivating sweet corn is that after picking the green ears, the crop remains at green stage and it is fit for feeding cattle as green fodder. The crop is highly remunerative as it possesses high total biomass and green cobs Due to its sweet taste and tenderness, cultivation of sweet corn is becoming the first choice of the farmers now a days for green fodder and green cobs. Therefore, development of sweet corn varieties with enhanced sugar content of soft grains is gaining popularity (Suthar *et al.*, 2014). 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 new sweet corn varieties with varying combination of nutrient levels and plant spacing under Punjab conditions.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* 2014 at the Research Farm of Punjab Agricultural University, Ludhiana. The soil of the experimental field was loamy sand in texture, low in available nitrogen, medium in available phosphorus and potash. The experiment was conducted in split plot design with three replications. Three nutrient levels (125:60:30, 150:50:60, 250:80:100, kg $N:P_2O_5:K_2O$/ha) as main plots, two plant spacing (60×20 and 60×15 cm) as sub plots and six genotypes (Bisco Madhu, Bajaura Sweet Corn, FSCH 18, KSCH-333, Madhuri and WOSC) in sub-sub plots. The plant population were altered with variation in plant to plant spacing. Keeping in spacing as 60×20 cm accommodated 83,333 plants /ha while keeping the spacing as 60×15 cm accommodated 1,11,111 plants/ ha. Two seeds per hill were sown for keeping optimum plant population. Thinning was carried out at 15 days after sowing to maintain required plant population. Weeding, irrigation and insecticides spraying were done as per recommended practices and when required to maintain an optimum growth conditions for the crop. Cobs were harvested by observing maturity signs like green cobs of full size with tight husk, dry brown silks, smooth and plumpy kernels which exude milky liquid when punctured with thumb nail. The cobs of border rows of each plot were harvested and separated first and later the cobs from the net plot were harvested. Green fodder was immediately harvested and weight was recorded in the net plots. Full dose of phosphate and potash along with one third nitrogen as per treatment were applied at sowing. Remaining two third N was applied in two equal split doses at knee high and tasseling stage, respectively. The days taken to 50 per cent tasseling and silking were recorded in all the plots. The height of five randomly selected plants was recorded from the ground level to the base of last fully opened leaf at harvesting. The cost of cultivation for each treatment was computed. Similarly gross returns were calculated based on current market price of the produce. The net returns were obtained after deducting the cost of cultivation from gross returns. The data was analyzed using ANOVA and the different treatment means were separated using least significant test.

RESULTS AND DISCUSSION

Effect of nutrient levels

The data (Table 1) revealed significant differences in plant and ear height. The application of $N:P_2O_5:K_2O$ @ 250:80:100 kg/ha Significantly increased plant and ear height as compared to 125:60:30 kg/ha however, it was statistically at par with the application of $N:P_2O_5:K_2O$ @ 150:50:50 kg/ ha. The higher plant and ear height, under higher fertilizer level may be due to increase in cell division, assimilation rate and metabolic activities in plant which had also been reported by Massey and Gaur (2006). Moreover, Profound influence of N and P, a component of fertility management, on crop growth seem to be due to maintenance congenial nutritional environment of plant system on account of their greater availability from soil media, which might have resulted in greater synthesis of amino acids, proteins and growth promoting substances, which further have enhanced the meristematic activity and increased cell division and their elongation (Mathukia *et al.*, 2014). The sweet corn fertilized with higher dose of $N:P_2O_5:K_2O$ @ 250:80:100 kg/ha took less number of days to 50 % tasseling and silking but the differences with the other fertilizer levels were non significant. Similar findings were reported by (Kumar and Chawla 2015). The application of $N:P_2O_5:K_2O$ @ 250:80:100 kg/ha produced significantly higher green cob yield (117.6 q/ha) as compared to lowest applied nutrient level of 125:60:30 kg/ha (109.0 q/ha). But, it was statistically at par with the application of $N:P_2O_5:K_2O$ @ 150:50:60 kg/ha (114.1q/ha). Thus greater availability of photosynthates, metabolites and nutrients to develop reproductive structures seems to have resulted in increased productive plants, with these fertility levels. The present findings are within the close vicinity of those reported by Massey and Guar (2006) and Khazaei *et al.* (2010). The highest green fodder yield (134.5 q/ha) was recorded with application of 250:80:100 kg $N:P_2O_5:K_2O$ /ha followed by 150:50:60

TABLE 1
Effect of nutrient levels and plant population on growth, yield and yield attributes of sweet corn genotypes

Nutrient levels (kg/ha)	Plant height (cm)	Ear height (cm)	50% tasseling	50% silking	Cob yield (q/ha)	Green fodder yield (q/ha)
125:60:30	172.7	81.7	49.2	51.1	109.0	122.3
150:50:60	179.8	84.4	48.7	50.8	114.1	130.4
250:80:100	183.4	86.5	48.1	50.1	117.6	134.5
CD (P=0.05)	5.73	3.07	NS	NS	4.2	3.53
Spacing (cm)						
60 × 20	177.9	83.4	48.3	49.9	111.1	125.4
60 × 15	179.3	84.9	49.1	51.4	116.1	132.7
CD (P=0.05)	NS	NS	NS	0.19	3.64	2.56
Genotypes						
Bisco Madhu	178.8	81.0	48.8	50.6	135.0	149.2
Bajaura Sweet corn	175.4	86.0	48.3	50.1	92.2	95.0
FSCH 18	175.3	81.3	45.2	47.2	129.9	134.1
KSCH-333	180.7	78.6	49.7	51.5	141.6	160.3
Madhuri	177.2	86.5	49.8	52.4	84.3	102.8
WOSC	184.4	91.7	50.1	52.2	98.5	132.0
CD (P=0.05)	5.1	3.11	1.32	1.45	5.4	4.6

kg N:P_2O_5:K_2O /ha and 125:60:30 kg N:P_2O_5:K_2O/ha. Application of 250:80:100 kg N:P_2O_5:K_2O /ha increased green fodder yield by 3.1 and 10.0% over nutrient levels @150:50:60 and 125:60:30 kg N:P_2O_5:K_2O/ha. Significant increase in green fodder yield under high fertility levels appears to be on account of their influence on dry matter production and indirectly via increase in plant height, functional leaves, leaf area, stem diameter and possibly a result of higher uptake of nutrients has also been reported by Massey and Gaur (2006).

It is evident from data presented in Table 2 that the application of N:P_2O_5:K_2O 250:80:100 kg/ha recorded highest gross returns of Rs. 84,003/ha. The lowest gross returns of Rs. 77,606/ha was obtained with 125:60:30 kg N:P_2O_5:K_2O/ha. The crop fertilized with 150:50:60 kg of N:P_2O_5:K_2O/ha recorded highest net returns (Rs. 31,073 /ha) and B:C ratio of 1.69 over its preceding level 125:60:30 kg N:P_2O_5:K_2O/ha with Rs. 28,690 /ha net returns and 1.59 B:C ratio and succeeding level 250:80:100 kg N:P_2O_5:K_2O/ha with Rs. 29,090 /ha net returns and 1.53 B:C ratio, respectively.

Effect of plant spacing

Data in table 1 indicated that the plant and ear height were higher with the closer spacing 60×15 cm than that obtained under 60×20 cm spacing but the differences were non significant. This clearly indicated that increase in number of plants per unit area beyond optimum level certainly reduced the amount of light availability to the individual plant, especially to lower

TABLE 2
Effect of nutrient levels and plant population on economics of sweet corn genotypes

Nutrient levels (kg/ha)	Gross Return (Rs./ha)	Cost of cultivation (Rs./ha)	Net Return (Rs./ha)	B : C
125:60:30	77606	48916	28690	1.59
150:50:60	81507	50433	31073	1.69
250:80:100	84003	54913	29090	1.53
Spacing (cm)				
60 × 20	79178	50747	28431	1.56
60 × 15	82899	52095	30804	1.59
Genotypes				
Bisco Madhu	95889	51421	44468	1.86
Bajaura Sweet corn	64927	51421	13506	1.26
FSCH 18	91327	51421	39906	1.78
KSCH-333	100958	51421	49537	1.97
Madhuri	60833	51421	9411	1.19
WOSC	72298	51421	20877	1.40

leaves due to shading. As the intensity of shading increased due to high population densities, the plants attained higher height to compete for sunlight. Such increase in height of the plants at high population densities was reported by Rafiq *et al*. (2010) and Lakshmi *et al.* (2014). The less number of days taken to 50 per cent tassel and silk emergence were recorded with wider spacing 60×20 cm as compared to closer spacing 60×15 cm but differences were non significant for tasseling emergence. The closer spacing 60×15 cm resulted in significantly higher green cob yield (116.1 q/ha) and green fodder yield (132.7 q/ha) as compared to wider spacing 60×20 cm (111.1 and 125.4 q/ha), respectively. This seems to have compensated more than the improvement in performance of individual plant with regard to various growth and yield components suggesting that at this level inter and intra-plant competition was to such an extent which could be compensated by increased number of plants as reported by Massey and Gaur (2013). The closer spacing of 60×15 cm also recorded higher gross and net returns 82,899 and 30,804 Rs./ha, respectively with benefit cost ratio of 1.59 over wider spacing of 60×20 cm (Table 2).

Effect of Genotypes

The data in Table 1 revealed that the genotype WOSC attained the highest plant (184.4 cm) which being at par to KSCH -333 were significantly higher over rest of the genotypes. Similar trend was obtained for ear height and it was significantly higher than all the genotypes. Sweet corn variety FSCH 18 took lesser days to 50% tasseling (45.2 days) and silking (47.2 days) which were significantly lesser than rest of the genotypes. KSCH-333 exhibited significantly highest yield potential (141.6 q/ha) followed by Bisco Madhu (135.0 q/ha), FSCH 18 (129.9 q/ha), WOSC (98.5 q/ha), Bajaura Sweet corn (92.2 q/ha) and Madhuri (84.3 q/ha). However, the comparison of later varieties indicated that Bisco Madhu (135.0 q/ha), FSCH 18 (129.9 q/ha), were higher yielder as compared to WOSC (98.5 q/ha), Bajaura Sweet corn (92.2 q/ha) and Madhuri (84.3 q/ha). Further, WOSC (98.5 q/ha), Bajaura Sweet corn (92.2 q/ha) were also significantly higher over Madhuri (84.3 q/ha). The green cob yield in case of KSCH-333 might be due to more growth and genetic potential of the variety which contribute towards the green cob yield. Data on green fodder yield of different varieties presented in Table 1 exhibited almost similar trend as observed in green cob yield. Amongst varieties, KSCH-333 (160.3 q/ha) was significantly higher over Bisco Madhu (149.2 q/ha), FSCH 18 (134.1 q/ha), WOSC (132.0 q/ha), Madhuri (102.8 q/ha) and Bajaura Sweet corn (95.8 q/ha-1). Maximum gross realization of Rs.1,00,958 /ha was obtained with sweet corn variety KSCH-333 followed by Bisco Madhu Rs. 95,889 /ha and the lowest gross return from Madhuri with Rs. 60,833 /ha. The data revealed KSCH-333 has maximum realization of net returns (Rs. 49,537 /ha) and B:C ratio (1.97) followed by Bisco Madhu net returns of Rs. 44,468 /ha with B:C ratio of 1.86, FSCH 18 net returns of Rs. 39,906 /ha with B:C ratio of 1.78, whereas Madhuri achieved lowest net returns (Rs. 9,411 /ha) and B:C ratio (1.19).

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