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Effect of Different Levels of NPK on Growth and Yield Parameters of Sweet Corn*

M. A. ARUN KUMAR, S. K. GALI AND N. S. HEBSUR

Department of Soil Science and Agricultural Chemistry
University of Agricultural Sciences, Dharwad - 580 005, Karnataka, India
E-mail : galisk@rediffmail.com

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Abstract : A field experiment was conducted at Main Agricultural Research Station, Agriculture College, Dharwad, during 2002-03 to study the fertilizer requirement of sweet corn grown on Vertisols of zone-8 of Karnataka. The growth parameters of sweet corn *viz*., leaf area index and total dry matter production were influenced favourably with increasing levels of NPK application. The yield and yield components of sweet corn were also influenced favourably with increasing levels of NPK application. A reduction in N application below 75 per cent of recommended dose of nitrogen (RDN) reduced the yield parameters and fresh cob yield significantly. The fresh cob yield of sweet corn in treatment which received 75 per cent RDN along with 100 per cent recommended dose of phosphorus (RDP) and recommended dose of potassium (RDK) was on par with the highest yield obtained in the treatment which received highest levels of all the three nutrients *i.e.,* 100% RDN + 100% RDP + 125% RDK indicating the possibility of reducing N level by 25 per cent without affecting yield levels of sweet corn.

Keyword : Sweet corn, Nitrogen, Phosphorus, Potash, Productivity

Introduction

Maize is one of the most widely grown cereals in the world and has great significance as human food, animal feed and raw material for large number of industrial products. In India, about 50 to 55 per cent of the total maize production is consumed as food, 30 to 35 per cent goes for poultry, piggery and fish meal industry and 10 to 12 per cent to wet milling industry. The green ears of maize are consumed directly as food in and around cities. Sweet corn is a medium plant type and provides green ears in 65 to 75 days after sowing. These are harvested earlier by 35 to 45 days compared to normal grain maize. The demand for sweet corn as a crunchy bite in the amusement parks, theatres, circus and exhibitions is increasing with increasing urban population. Due to its increasing demand, there is an increasing tendency for commercial production of sweet corn.

Maize has high production potential especially under irrigated condition when compared to any other cereal crop. The productivity of maize largely depends on its nutrient requirement and management particularly that of nitrogen, phosphorus and potassium. Information on fertilizer requirement for sweet corn is scanty. Hence, there is need to work out a suitable fertilizer dosage for sweet corn and there is also a need to study the effect nutrient levels on the growth and yield of sweet corn.

Material and Methods

A field experiment was conducted at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during kharif 2002. It was laid out in Randomized Block Design with three replications consisting of varying levels of N, P and K, to study the effect of N, P and K levels on sweet corn. The nutrient levels were, three levels of N (100%, 75% and 50% RDN of grain maize), two P levels (100% and 75% RDP of grain maize) and three K levels (75%,100% and125% RDK of grain maize) and totally 18 different treatment combinations were laid out. The calculated quantity of N, P_2O_5 and K_2O in the form of urea, single superphosphate and muriate of potash, respectively were applied as per the treatments. Half the dose of N and full dose of P_2O_5 and K_2O were applied in a circular band at about 5 cm away from each plant and the crop was top dressed with the remaining half dose of N, 30 days after sowing (DAS). All other cultural and plant protection measures were followed as recommended.

Five plants per plot were selected randomly in the net plot area and tagged for observations at critical stages (30, 60 DAS and at harvest) for recording growth and yield parameters. Destructive sampling was followed to record dry weights at different stages.

The product of leaf length and breadth was multiplied by a factor 0.75 and leaf area of individual leaf was calculated. The average leaf area per plant was expressed in dm^2. Further, LAI was calculated by the following formula.

$$LAI = \frac{\text{Leaf area plant}^{-1}\ (dm^2)}{\text{Ground area covered by plant}\ (dm^2)}$$

The five randomly collected plants were dried at room temperature for two days and then oven dried at 65^0 C till a constant weight was obtained. The oven dry weight was recorded for estimating the dry matter yield in quintal per ha.

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The number of grains in five cobs was recorded and average number of grains per cob was computed (number of grains per cob). The length of five cobs randomly selected was measured from the base of the lower most primary rachis to the tip of the cob and the average was recorded as cob length in cm and the circumference of cobs from five randomly selected plants was measured at the center of the cob and the average was recorded as cob girth in cm. The number of cobs per plant was recorded from five randomly selected plants and the average was recorded as the number of cobs per plant. When crop attained milky stage, cobs from each net plot were harvested (65-75 DAS) and weighed fresh and expressed in quintals per ha.

Results and Discussion

Leaf area index of the sweet corn increased with increasing levels of NPK at all growth stages of crop (Table 1). Irrespective of the growth stages, the treatments which received 75% RDN or more (T_1, T_2, T_4, T_7, T_{10}, T_{13}, T_{14} and T_{16}) recorded higher leaf area index than other treatments. The highest leaf area index was recorded in treatment T_{13}, which received 100% RDN + 100% RDP + 125% RDK (0.63, 3.35 and 3.05 at 30, 60 DAS and at harvest, respectively). The lowest leaf area index was recorded in treatment T_{12} which received 50% RDN + 75% RDP + 75% RDK.

The increase in LAI, due to increased leaf area with increasing fertilizer levels was because of increased amount of cellular constituents, mainly protoplasm (Sheshagiri, 1998) and also due to the influence of phytochroms in promotion of cell division, cell enlargement, cell differentiation and cell multiplication resulting in consistent and statistically significant increase in total leaf area per plant and leaf area index (Rao and Padmaja, 1994).

Total dry matter production of sweet corn increased with increasing levels of NPK at all growth stages of crop (Table 1). The treatments which received 100% RDN (T_1, T_4, T_7, T_{10}, T_{13} and T_{16}) accounted for higher dry matter production than other treatments, the highest being in case of T_{13} (12.70, 71.04 and 81.40 q/ha at 30, 60 DAS and at harvest, respectively). The treatment which received only 50% RDN + 75% RDP + 75% RDK recorded the lowest dry matter (10.22, 58.06 and 68.33 q/ha at 30, 60 DAS and at harvest, respectively). Increased dry matter production with increased fertilizer application was due to role of NPK in determining the use efficiency of sunshine by the increased biomass and any inadequacy of nitrogen reduces the sunshine use efficiency or ability to photosynthesise as reported by Wadsworth (2002).

The yield components were significantly influenced by the different fertilizer levels (Table 2). Number of cobs per plant and number of grains per cob varied with different levels of fertilizer. The treatment which received 25% more K along with RDN and RDP (T_{13}) recorded highest number of cobs per

Table 1. Effect of varied levels of NPK on growth parameters at different stages of sweet corn

Treatments	Leaf area index			Dry matter yield (q/ha)		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
T_1 : RDF of grain maize (150:75:37.5) kg NPK per ha	0.63	3.27	3.01	12.51	70.90	80.67
T_2 : 75% RDN + 100% RDP + 100% RDK	0.52	2.99	2.85	11.69	64.63	75.40
T_3 : 50% RDN + 100% RDP + 100% RDK	0.41	2.77	2.62	11.33	60.63	71.36
T_4 : 100% RDN + 75% RDP + 100% RDK	0.57	3.14	2.95	11.91	66.93	75.66
T_5 : 75% RDN + 75% RDP + 100% RDK	0.47	2.89	2.62	11.26	62.70	72.50
T_6 : 50% RDN + 75% RDP + 100% RDK	0.38	2.82	2.68	10.94	59.20	68.50
T_7 : 100% RDN + 100% RDP + 75% RDK	0.60	3.25	2.99	12.52	69.03	79.63
T_8 : 75% RDN + 100% RDP + 75% RDK	0.48	2.95	2.62	11.50	64.23	74.66
T_9 : 50% RDN + 100% RDP + 75% RDK	0.40	2.71	2.58	11.00	60.36	70.10
T_{10} : 100% RDN + 75% RDP + 75% RDK	0.55	3.10	2.91	11.93	66.46	77.83
T_{11} : 75% RDN + 75% RDP + 75% RDK	0.43	2.70	2.55	11.04	63.36	72.33
T_{12} : 50% RDN + 75% RDP + 75% RDK	0.35	2.67	2.50	10.22	58.06	68.33
T_{13} : 100% RDN + 100% RDP + 125% RDK	0.63	3.35	3.05	12.70	71.04	81.40
T_{14} : 75% RDN + 100% RDP + 125% RDK	0.53	3.06	2.88	12.12	65.43	76.53
T_{15} : 50% RDN + 100% RDP + 125% RDK	0.43	2.79	2.66	11.35	61.60	72.70
T_{16} : 100% RDN + 75% RDP + 125% RDK	0.59	3.22	2.95	12.06	68.43	78.63
T_{17} : 75% RDN + 75% RDP + 125% RDK	0.47	2.90	2.65	11.44	63.76	74.16
T_{18} : 50% RDN + 75% RDP + 125% RDK	0.38	2.67	2.57	11.21	60.33	70.13
Mean	0.49	2.96	2.76	11.60	64.28	74.47
SEm+	0.037	0.133	0.128	0.370	2.090	2.270
CD at 5%	0.142	0.383	0.368	1.080	6.390	6.540

RDF - Recommended dose of fertilizer (150:75:37.5 kg NPK/ha)

RDN - Recommended dose of nitrogen RDP - Recommended dose of phosphorus

RDK - Recommended dose of potassium DAS – Days after sowing

Table 2. Effect of varied levels of NPK on yield and yield parameters of sweet corn

Treatments	Cobs/plant	No. of grains/cob	Cob length (cm)	Cob girth (cm)	Fresh cob yield (t/ha)
T_1 : RDF of grain maize (150:75:37.5) kg NPK per ha	2.20	576.00	16.80	16.36	13.70
T_2 : 75% RDN + 100% RDP + 100% RDK	1.93	535.33	15.26	14.36	13.54
T_3 : 50% RDN + 100% RDP + 100% RDK	1.66	438.66	13.36	11.63	10.38
T_4 : 100% RDN + 75% RDP + 100% RDK	1.80	541.66	16.16	15.80	12.20
T_5 : 75% RDN + 75% RDP + 100% RDK	1.73	508.33	13.93	13.16	11.50
T_6 : 50% RDN + 75% RDP + 100% RDK	1.60	422.66	12.46	11.36	9.61
T_7 : 100% RDN + 100% RDP + 75% RDK	2.00	570.00	16.20	16.36	13.30
T_8 : 75% RDN + 100% RDP + 75% RDK	1.80	520.00	13.86	13.36	11.94
T_9 : 50% RDN + 100% RDP + 75% RDK	1.63	432.00	12.83	11.76	10.18
T_{10} : 100% RDN + 75% RDP + 75% RDK	1.96	532.00	15.46	15.40	12.32
T_{11} : 75% RDN + 75% RDP + 75% RDK	1.70	483.66	13.60	13.46	11.30
T_{12} : 50% RDN + 75% RDP + 75% RDK	1.53	420.66	11.73	10.66	9.48
T_{13} : 100% RDN + 100% RDP + 125% RDK	2.26	583.00	17.50	17.13	13.72
T_{14} : 75% RDN + 100% RDP + 125% RDK	1.96	544.33	15.46	14.86	12.22
T_{15} : 50% RDN + 100% RDP + 125% RDK	1.66	445.33	13.13	12.60	10.68
T_{16} : 100% RDN + 75% RDP + 125% RDK	1.96	541.33	15.50	16.03	12.58
T_{17} : 75% RDN + 75% RDP + 125% RDK	1.73	510.00	16.70	13.63	11.58
T_{18} : 50% RDN + 75% RDP + 125% RDK	1.66	435.00	12.80	12.56	9.90
Mean	1.82	502.22	14.60	13.92	11.67
SEm+	0.090	20.010	1.106	1.260	0.559
CD at 5%	0.342	57.500	3.179	3.620	1.607

RDF - Recommended dose of fertilizer (150:75:37.5 kg NPK/ha)

RDN - Recommended dose of nitrogen RDP - Recommended dose of phosphorus

RDK - Recommended dose of potassium

plant (2.26). The lowest number of cobs per plant (1.53) was recorded in T_{12} (50% RDN + 75% RDP + 75% RDK). The effect of varying level of NPK on number of grains per cob was similar to effect on cobs per plant i.e., the treatment receiving 100% RDN irrespective of levels of P and K (T_1, T_4, T_7, T_{10}, T_{13} and T_{16}) recorded higher number of grains per cob and were on par with each other. The highest number of grains per cob was observed in T_{13} (583.00), which was significantly higher than T_{12} (420.66). The increase in number of grains per cob with increased fertilizer application could be attributed to the increased physiological processes in crop plants leading to higher growth and increased photosynthates to silks. This might be due to better utilization of NPK supply (Selvaraju and Iruthayaraj, 1994).

Cob length per plant differed with different levels of fertilizer application. The treatment which received 100% RDN + 100% RDP + 125% RDK (T_{13}) recorded the highest cob length (17.50 cm). The treatment T_{12} which received the lowest dose of nutrients recorded lowest cob length (11.73). The effect of varying levels of NPK on cob girth was similar to their effect on cob length. The results of fresh cob yield revealed that cob yield of sweet corn varied with varying fertilizer levels. The treatments which received 100% RDN, irrespective of P and K levels (T_1, T_4, T_7, T_{10}, T_{13} and T_{16}) recorded higher yields of fresh cob than other treatments, the highest being in T_{13} (13.72 t/ha). The higher cob yield with increase in fertilizer levels could be attributed to adequate nutrient supply, which in turn improved all growth and yield influencing characters as already quoted.

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