CONTEMPORARY RESEARCH IN INDIA
ISSN 2231 - 2137

EFFECT OF FERTILIZER LEVELS AND PLANT DENSITIES ON GROWTH, PRODUCTIVITY AND ECONOMICS OF SWEET CORN IN SUMMER SEASON

R. A. Kurne[1], Y. R. Jadhav[2] and A. B. Mohite[3]

[1]P.G., Student, [2]and[3] Associate Professor

Agronomy Section, College of Agriculture, Kolhapur (India)

Received: 05/07/2017 | **Edited: 08/07/2017** | **Accepted: 13/07/2017**

Abstract: *A field experiment was conducted to study effect of fertilizer levels and plant densities on growth, productivity and economics of sweet corn during summer season of 2012 at College of Agriculture, Kolhapur on medium black soil. The treatment consisting of three fertilizer levels viz., F_1- 125% RDF (150:75:50 Kg NPK ha^{-1}), F_2- 100% RDF (120:60:40 Kg NPK ha^{-1}) and F_3- 75% RDF (90:45:30 Kg NPK ha^{-1}) with four plant spacing levels viz., S_1 - 60 x 15, S_2 - 60 x 20, S_3 - 75 x 15 and S_4 -75 x 20 cm^{-2}. The results revealed that, fertilizer level of 125% RDF recorded significantly higher growth and yield attributes, which resulted into higher green cob and fodder yields of sweet corn (10.07 and 26.93 t ha^{-1}, respectively) and also higher gross and net monetary returns with benefit cost ratio of 2.64 than 75 and 100% RDF. The plant spacing of 75 x 20 cm^2 recorded significantly higher growth and yield attributes resulting in to higher green cob and fodder yields (9.43 and 26.06 t ha^{-1}, respectively) and also higher gross and net monetary returns with benefit cost ratio of 2.62 over rest of plant spacing levels.*

Key words: *Sweet corn, Plant Spacing, Recommended dose of fertilizers.*

Maize is one of the most versatile crops and can be grown in the diverse environmental conditions due to its wider adaptability and has diversified uses in industries, human food and animal feed. It is a C_4 plant and efficient converter of nutrients resulting into high yield potential among all cereals.

Among all the groups of maize, sweet corn is one of the commercially used types of maize, gaining popularity both in rural and urban areas because of its high sugar (14-20%), low starch and vitamin C and A content. Hence, sweet corn is usually eaten in the immature stage as a fresh vegetable, boiled, steamed or roasted and also used in a wide variety of vegetable mixtures, soups and canning purposes. Similarly, sweet corn fodder is green, succulent which fetches higher price in market and maximum profit to farmers. Therefore, sweet corn is mainly grown by farmers due to short duration, green fodder at harvest and high market price for various sweet corn products. In India, maize is grown on 8.67 million hectares area with production of 21.60 million tones and productivity of 2492 kg ha^{-1} while in Maharashtra; it occupies 0.694 million hectares area with production of 2.01 million tones and productivity of 2902 kg ha^{-1} (Anonymous, 2012).

Productivity of maize is low, mainly due to inadequate nutrient management and lack optimum plant population. Sweet corn grown during summer season results into better utilization of applied nutrients and pest and disease incidence is also less. The information on fertilizer requirement for sweet corn is meager. Similarly, the plant density has unique importance in crop production for obtaining the maximum number of green cobs per unit area for enhancing sweet corn yield. In view of these considerations, the present investigation was undertaken to study the effect of sweet corn to different fertilizers levels and plant densities in summer season.

Materials and Methods

The field experiment was conducted at Post Graduate Research Farm, College of Agriculture, Kolhapur during summer season of 2012 on medium black soil. The 12 treatment combinations consisting of three fertilizer levels *viz.*, F_1- 125% RDF

(150:75:50 Kg NPK ha^{-1}), F_2- 100% RDF (120:60:40 Kg NPK ha^{-1}) and F_3- 75% RDF (90:45:30 Kg NPK ha^{-1}) with four plant spacing levels viz., S_1 - 60 x 15, S_2 - 60 x 20, S_3- 75 x 15 and S_4- 75 x 20 cm^2 was laid out in factorial randomized block design with three replications. The gross plot size was 7.2 m x 6.0 m and net plot size of 6.0 m x 3.0 m. The experimental site was located at 16^0 42' North latitudes and 74^0 14' East longitudes with average annual rainfall of 1057 mm. The soil of experimental field was low in organic carbon content (0.42%), medium in available N (246 kg ha^{-1}), available P_2O_5 (18 kg ha^{-1}) and available K_2O (329 kg ha^{-1}). The electrical conductivity and pH values were 0.34 d S m^{-1} and 7.9, respectively.

Sweet corn certified seed of hybrid Sugar-75 procured from private seed company and was treated with fungicide (Bavistin) and Azotobactor @ 3 g kg^{-1} and 250 g for 10 kg^{-1} of seed, respectively to avoid bacterial diseases and nutrient fixation. The ridges and furrows were opened at 60 and 75 cm distances as per treatments. Sweet corn was sown on 15th January, 2012 by dibbling two seeds manually per hill on one side of ridge by keeping 15 and 20 cm intra row spacing as per treatments. Application of 1/3 rd N and full dose of phosphorus and potash fertilizers applied as basal dose to all plots at sowing on one side of ridge as per treatments. However, organic manure 5 t FYM ha^{-1} was incorporated at last harrowing. The top dressing of 1/3 rd N dose of fertilizer was applied at 30 DAS and remaining 1/3 rd N dose of fertilizer was applied at 45 DAS. The thinning was carried out at 15 DAS by keeping one healthy seedling per hill. The recommended packages of practices were carried out during crop growth period. The green cobs were harvested at milk stage.

Results and Discussion:

Effect on growth parameters:

The effect of different fertilizers levels on the growth characters of sweet corn was found significant (Table-1). Application of 125% RDF (150:75:50 Kg NPK ha^{-1}) recorded significantly higher plant height, number of functional leaves, leaf area and dry matter production per plant over 100% RDF (120:60:40 Kg NPK ha^{-1}) and 75% RDF (90:45:30 Kg NPK ha^{-1}). The higher plant height, number of functional leaves and leaf area per plant under higher fertilizer level may be due to increase in cell division, assimilation rate and metabolic activities in plant. Similar, results were reported by Kumar and Thakur (2004), Jat (2006) and Massey and Gaur (2006). The maximum dry matter accumulation was obtained under higher fertilizer level of 125% RDF, which may be due to more availability of nutrients from inorganic fertilizers. Similar, results were reported by Kumar (2008).

The significant variations in growth parameters of sweet corn were observed due to different plant spacing levels (Table-1). The plant spacing of 75 x 20 cm^2 recorded significantly higher plant height, number of functional leaves per plant, leaf area per plant and dry matter production per plant as compared to 60 x 15, 60 x 20 and 75 x 15 cm^2 spacing levels. The wider plant spacing of 75 x 20 cm^2 recorded higher plant height, which may be due to efficient utilization of growth resources like sunlight, moisture and nutrients. The results are in conformity with the findings of Paygonde *et al.* (2008).

Effect on yield attributes:

The yield attributes of sweet corn significantly influenced due to fertilizers levels (Table 2). The fertilizer level of 125% RDF (150:75:50 Kg NPK ha^{-1}) recorded significantly higher number of green cobs per plant, cob length, cob diameter and number of green cobs per hectare over rest of fertilizer levels of 75 and 100% RDF.

The plant spacing of 75 x 20 cm^2 recorded significantly higher number of green cobs per plant, cob length, cob diameter and number of green cobs per hectare over rest of plant spacing levels of 60 x 15, 60 x 20 and 75 x 15 cm^2.

Effect on yield and economics:

The effect of different fertilizers levels on yield of sweet corn was found significant (Table-3). Application of 125% RDF (150:75:50 Kg NPK ha^{-1}) recorded significantly higher green cob and fodder

yields of sweet corn (10.07 and 26.93 t ha^{-1}, respectively) than fertilizer levels of 75 and 100% RDF. The higher fertilizer level increased nutrients availability to plants, which resulted into higher values of yield attributes and yield under treatment of 125% RDF. The results corroborated with those reported by Kumar and Thakur (2004). Similarly, 125% RDF recorded higher gross and net monetary returns (Rs. 1, 14,165 and 71,651 ha^{-1}, respectively) and benefit cost ratio of 2.64 over fertilizer levels of 75 and 100% RDF. Similar, results were reported by Kumar and Thakur (2004) and Jadhav and Shelke (2012).

Among the plant spacing levels, 75 x 20 cm^2 recorded significantly higher green cob and fodder yields of sweet corn (9.43 and 26.06 t ha^{-1}, respectively). The higher values of yield contributing characters and yield of sweet corn were recorded under wider plant spacing of 75 x 20 $cm^{2,}$ which may be due more space available for plant growth and also efficient utilization of natural resources. Similar results are reported by Kar *et al.* (2006) and Massey and Gaur (2006). The plant spacing of 75 x 20 cm^2 also recorded higher gross and net monetary returns (Rs. 1, 07,330 and 66,802 ha^{-1}, respectively) with benefit cost ratio of 2.62 over rest of plant spacing levels. Similar, results were reported by Chougale (2003) and Paygonde *et al.* (2008). It can be concluded that, the application of 125% RDF (150:75:50Kg NPK ha^{-1}) found remunerative for higher productivity of sweet corn. Similarly, plant spacing of 75 x 20 cm^2 found suitable for higher productivity and monetary returns of sweet corn during summer season.

Table 1: Effect of fertilizers and spacing levels on growth parameters of sweet corn at harvest

Treatments	Plant height (cm)	Number of functional leaves plant^{-1}	Leaf area plant^{-1} (dm^2)	Dry matter production plant^{-1} (g)
Fertilizer levels				
F_1 - 125% RDF (150:75:50Kg NPK ha^{-1})	185.83	9.58	59.69	116.17
F_2 - 100% RDF (120:60:40Kg NPK ha^{-1})	182.52	7.92	56.60	114.81
F_3 -75% RDF (90:45:30Kg NPK ha^{-1})	179.34	6.67	54.03	113.41
S.E. ±	0.50	0.24	0.24	0.22
C.D.at 5%	1.48	0.70	0.71	0.65
Spacing levels				
S_1 - 60x15 cm^2 (1,11,111 plants ha^{-1})	181.42	7.44	56.19	114.28
S_2 - 60x20 cm^2 (83,333 plants ha^{-1})	182.08	7.78	56.57	114.69
S_3 - 75x15 cm^2 (88,888 plants ha^{-1})	182.90	8.22	56.94	115.01
S_4 - 75x20 cm^2 (66,6666 plants ha^{-1})	183.84	8.78	57.39	128.33
S.E. ±	0.58	0.27	0.28	0.25
C.D.at 5%	1.71	0.81	0.82	0.75
Interaction effect : Fertilizer levels x Spacing levels				
S.E. ±	1.01	0.48	0.48	0.44
C.D.at 5%	N.S.	N.S.	N.S.	N.S.

Table 2: Effect of fertilizers and spacing levels on yield attributes of sweet corn at harvest

Treatments	Number of cobs plant^{-1}	Cob length (cm)	Cob diameter (cm)	Number of cobs ha^{-1} ('000')
Fertilizer levels				
F_1 - 125% RDF (150:75:50Kg NPK ha^{-1})	2.14	18.83	13.60	180.12
F_2 - 100% RDF (120:60:40Kg NPK ha^{-1})	1.60	17.58	12.73	134.36
F_3 -75% RDF (90:45:30Kg NPK ha^{-1})	1.08	15.94	12.15	90.51
S.E. ±	0.06	0.17	0.10	1.66
C.D.at 5%	0.17	0.51	0.30	3.42
Spacing levels				
S_1 – 60x15 cm^2 (1,11,111 plants ha^{-1})	1.24	16.81	12.48	133.56

S_2 – 60x20 cm² (83,333 plants ha^{-1})	1.49	17.27	12.68	121.89
S_3 – 75x15 cm² (88,888 plants ha^{-1})	1.58	17.69	12.99	135.67
S_4 - 75x20 cm² (66,6666 plants ha^{-1})	2.11	18.03	13.17	138.31
S.E. ±	0.07	0.20	0.12	1.74
C.D.at 5%	0.20	0.59	0.35	3.96
Interaction effect : Fertilizer levels x Spacing levels				
S.E. ±	0.12	0.35	0.21	2.34
C.D.at 5%	N.S.	N.S.	N.S.	N.S.

Table 3: Effect of fertilizers and spacing levels on yield and economics of sweet corn at harvest

Treatments	Green cob yield (t ha^{-1})	Green fodder yield (t ha^{-1})	Cost of cultivation (Rs ha^{-1})	Gross monetary Returns (Rs ha^{-1})	Net monetary Returns (Rs ha^{-1})	Benefit Cost ratio
Fertilizer levels						
F_1 -125% RDF (150:75:50Kg NPK ha^{-1})	10.07	26.93	42,514	1,14,165	71,651	2.64
F_2 -100% RDF (120:60:40Kg NPK ha^{-1})	9.01	25.48	41,357	1,02,840	61,483	2.45
F_3 -75% RDF (90:45:30Kg NPK ha^{-1})	7.90	23.65	39,958	90,825	50,867	2.27
S.E. ±	0.06	0.26	-	-	-	-
C.D.at 5%	0.17	0.78	-	-	-	-
Spacing levels						
S_1 – 60x15 cm² (1,11,111 plants ha^{-1})	8.51	24.70	42,296	97,450	55,154	2.32
S_2 – 60x20 cm² (83,333 plants ha^{-1})	8.83	25.10	41,076	1,00,850	59,774	2.47
S_3 – 75x15 cm² (88,888 plants ha^{-1})	9.19	25.54	41,206	1,04,670	63,464	2.54
S_4 - 75x20 cm² (66,6666 plants ha^{-1})	9.43	26.06	40,528	1,07,330	66,802	2.62
S.E. ±	0.07	0.30	-	-	-	-
C.D.at 5%	0.20	0.90	-	-	-	-
Interaction effect : Fertilizer levels x Spacing levels						
S.E. ±	0.12	0.53	-	-	-	-
C.D.at 5%	N.S.	N.S.	-	-	-	-

References:

Anonymous, (2012). Annual Report of Directorate of Maize research, ICAR, New Delhi, 2011-12.

Chougale, S. M. (2003). Effects of spacing and integrated nutrient management on growth and yield of sweet corn (*Zea mays saccharata*). M.Sc. (Agri.) thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M. S.).

Jadhav, V. T. and Shelke, D. K. (2012). Effect of planting methods and fertilizer levels on growth, yield and economics of maize (*Zea mays* L.) *Agril. Res. Tech.* 37(1): 11-14.

Jat, V. 2006. Effect of fertilizer levels with different dates of sowing on growth, yield and quality of sweet corn (*Zea mays saccharata*) for table purpose. M. Sc. (Agri.) thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.).

Kar, P. P., Barik, K. C., Mahapatra, P. K. and Garnayak, L. M. (2006). Effect of planting geometry and nitrogen on yield, economics nitrogen uptake of sweet corn (*Zea mays saccharata*). *Indian J. of Agron.*, 51(1): 43-45.

Kumar, A. (2008). Productivity, economics and nitrogen use efficiency of specialty corn as influenced by planting density and nitrogen fertilization. *Indian J. of Agron.*, 53(4):306-309.

Kumar, A. and Thakur, K. S. (2004). Effect of integrated nutrient management on promising composite maize (*Zea mays* L.) varieties under rainfed mid-hill conditions of Himachal Pradesh. *Indian J. of Agric. Sci.*, 74 (1) 40-42.

Massey, J. X. and Gaur, B. L. (2006). Effect of plant population and fertility levels on growth and NPK uptake by sweet corn (*Zea mays saccharata*) cultivars. *Ann. of Agric. Res.* 27(4): 365-368.

Paygonde, C. D., Sawant, P. K., and Thorat, D. R. (2008). Influence of different weed control methods and planting patterns on cob yield and yield contributing characters of sweet corn. *J. of Maharashtra* Agric. Univ., 33(3): 298-300.