Growth and Yield of Baby Corn (Zea mays L.) as affected by Different Crop Geometry and Level of Nitrogen Application

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ABSTRACT *A field experiment with six treatments of crop geometry viz. 40 cm x 15 cm, 40 cm x 20 cm, 50 cm x 15 cm, 50 cm x 20 cm, 60 cm x 15 cm and 60 cm x 20 cm in main plots and four levels of nitrogen (0, 60, 120 and 180 kg/ha) in sub plots was conducted in split plot design with four replications. The present study concluded that planting of baby corn at 50 cm x 15 cm resulted in higher growth and yield attributes and finally yield of baby corn and its fodder.The plant height, Leaf area index, baby corn and green fodder yield were higher in 50 cm x 15 cm crop geometry than all other geometry treatments. Most of the growth attributes as well as cob and baby corn yield increased with increase in the level of N application up to 120 kg N/ha. However, green fodder yield was significantly improved up to 180 kg N/ha.*

INTRODUCTION

India ranks first in livestock population in the world. It supports nearly 20% of the world's livestock population. It is leader in cattle (16%) and buffalo (55%) population. The latest livestock census has placed the total livestock population at 529.7 million (GOI, 2012). Livestock sector contributes approximately 4% to GDP and 27% to agricultural GDP (BIEC, Bengaluru, 2013). The animal productivity in terms of draft, milk, meat and other products depend directly on the availability of good quality green fodder. At present, the country faces a net deficit of 62.76% of green fodder and 23.46% of dry crop residues and 64% feeds and it is expected to be increased in near future (ICAR, 2010). To overcome this problem, there is need to shift from sole food and fodder crops to the dual or multipurpose food cum fodder crops. Under this situation, baby corn can be a good option as a dual purpose food cum fodder crop that can maintain the supply of fodder to burgeoning livestock population of the country. Baby corn (Zea mays L.) refers to the whole, entirely edible cobs of immature corn, harvested just before fertilization at silk emergence stage. It is a dual purpose crop which provides green cobs for human consumption and fodder for livestock within 65-75 days after sowing. It is a low calorie vegetable having higher fibre content without cholesterol, rich in vitamin B and C, potassium, fibres and carotenoids. Among the different agronomic practices, plant density is one of the most important factor determining grain yield and other agronomic attributes of maize. There is an optimum plant density for each crop. Under low plant density, although single-plant production increases, yield per unit area decreases. On the other hand, excessive density can increase the competition and decrease the yield. Regarding nutrient requirement, nitrogen is the most important for the growth and yield of corn. Ideal nitrogen management optimizes grain yield, farm profit and nitrogen use efficiency, while it minimizes the potential for leaching of nitrogen, thus preventing environmental pollution. Keeping all this in view the present experiment was conducted to standardise the planting geometry and nitrogen requirement for maximising growth and yield of baby corn.

MATERIALS AND METHODS

A field experiment was conducted during Kharif, 2012 at the Research Farm of Forage Research and Management Centre, NDRI, Karnal, India (29^0 43' N latitude and 76^0 58' E longitudes). The field experiment was laid out in split plot design with six treatments of planting geometry (40 cm x 15 cm (166,666 plants/ha), 40 cm x 20 cm (125,000 plants/ha), 50 cm x 15 cm (133,333 plants/ha), 50 cm x 20 cm (100,000 plants/ha), 60 cm x 15 cm (111,111 plants/ha) and 60 cm x 20 cm (83,333 plants/ha) in main plots and four levels of nitrogen (0, 60, 120 and 180 kg/ha) in sub plots with four replications. The variety "HM-4" of baby corn was selected as a test crop. The soil of the experimental field was clay loam in texture. Chemical analysis of the soil (top 15 cm) showed a neutral pH (7.3), 0.52% organic carbon, 202.8 kg/ha permanganate extractable nitrogen, 35 kg/ha Olsen's (0.5 M $NaHCO_3$ extractable) phosphorus and 290.5 kg/ha exchangeable potassium. Total rainfall and evaporation received during the crop season was 403.2 mm and 324.1 mm respectively. Nitrogen as per the treatments was applied in three splits. Half dose of nitrogen along with 60 kg P_2O_5 and 40 kg K_2O was applied at the time of sowing. The remaining dose of nitrogen was applied equally in two splits at 30 and 45 DAS. Five pickings of baby corn were taken at an interval of 3-4 days. Ten plants were tagged randomly from each plot for recording of growth and yield attributes. Leaf area index was calculated as per the procedure given by Sestak et al., (1971). The cob and baby corn yield were calculated by adding the yield from all the five pickings and fodder yield was calculated from the weight of plants per plot at the time of harvest and added with tassel and husk yield. Statistical analysis of the recorded data for each character was done using the standard procedures of analysis of variance in split plot design   (P < 0.05) with the help of statistical software IRRISTAT (IRRI, 1999).

RESULTS AND DISCUSSION

Plant density is of particular importance in corn, because it does not have tillering capacity to adjust to variation in plant stand. Optimum plant density leads to proper utilization of solar radiation, which influences leaf area, interception and utilization of solar radiation, and consequently corn dry matter accumulation and biomass production (Moosavi et al., 2012). Cultivation of plants with desirable density has positive effect on crop yield components, so higher yield will be achieved by optimum plant density (Widdicombe and Thelen, 2002). Our research data also showed that closer planting geometry of 50 cm x 15 cm recorded higher plant height and leaf area index as compared to other planting geometry, however highest plant girth was recorded in 60 cm x 20 cm planting geometry (Table I). The increase in plant height may be attributed to increase in the inter-plant competition over light, whereas, higher leaf area index in closer spacing may be

the reflection of proper exploitation of ground area. The reduction in stem diameter with increased plant density could be due to the intensified inter-plant competition for environmental parameters (light, water, space) (Moosavi et al., 2012). Ideal nitrogen management optimizes grain yield, farm profit and nitrogen use efficiency, while it minimizes the potential for leaching of nitrogen, thus preventing environmental pollution. Nitrogen application has been found to have significant effect on growth parameters of baby corn viz., plant height and LAI (Thavaprakaash and Velayudham, 2009), number of cobs and green forage yield (Kar et al., 2006). Our research data also found the highest plant height, plant girth, as well as leaf area index with application of 180 kg N/ha. Higher plant height and girth may be attributed to better availability of nitrogen at higher levels of its application, while as, increase in LAI might be due to more number of leaves and leaf area per plant.

Cob as well as baby corn and fodder yield (Table II) increased with increase in plant density. In the present research also, the highest cob and baby corn yield as well as total green fodder yield was found in closer planting geometry of 50 cm x 15

cm. The higher plant population resulted in better physiological growth indices (Valadabadi and Farahani, 2010), in addition to more number of cobs and plants per hectare, resulting in higher cob and fodder yield. All the growth and yield attributes and finally cob as well as baby corn and fodder yield increased with increase in level of nitrogen application. However the response to nitrogen application varied among different attributes. The data showed that both cob and baby corn yield increased significantly with increase in level of nitrogen application up to 120 kg N/ha, however, total green fodder yield increased significantly up to 180 kg N/ha. This may be attributed to better availability of nitrogen at higher levels of its application, resulting in higher plant height, weight/plant and ultimately higher yield (Singh et al., 2012).

The findings of the present study elucidates that planting of baby corn at 50 cm x 15 cm resulted in higher growth and yield attributes and finally yield of baby corn. Most of the growth attributes as well as cob and baby corn yield increased with increase in the level of N application up to 120 kg N/ha. However, green fodder yield was significantly improved up to 180 kg N/ha.

Table: 1 Effect of crop geometry and nitrogen levels on growth attributes of baby corn

Treatment	Plant height (cm)			Plant girth (cm)			Leaf area index		
	30DAS	45DAS	At Harvest	30DAS	45DAS	At Harvest	30DAS	45DAS	At Harvest
Crop geometry									
40 cm x 15 cm	44.12	91.71	141.68	4.42	5.71	6.39	3.45	5.41	6.78
40 cm x 20 cm	46.13	94.02	144.49	4.71	6.07	6.72	3.30	5.37	5.88
50 cm x 15 cm	48.38	97.04	147.08	4.56	5.80	6.52	3.79	6.54	7.67
50 cm x 20 cm	41.41	87.96	137.84	5.42	6.47	7.28	2.84	4.96	5.32
60 cm x 15 cm	43.49	90.17	145.78	5.12	6.17	7.05	2.90	5.25	5.67
60 cm x 20 cm	40.01	85.01	135.34	5.55	6.69	7.50	2.27	4.05	4.70
SEm ±	1.87	1.34	1.42	0.10	0.14	0.12	0.11	0.08	0.09
CD (p= 0.05)	5.60	4.03	4.25	0.31	0.41	0.35	0.33	0.24	0.26
Nitrogen (kg N/ha)									
0	32.84	68.45	108.34	3.53	4.30	4.61	2.88	4.84	5.74
60	44.61	88.32	138.15	4.94	6.08	7.36	3.04	5.16	5.86
120	47.90	102.43	158.60	5.61	7.06	7.76	3.20	5.45	6.16
180	50.33	104.74	163.05	5.78	7.17	7.91	3.25	5.60	6.25
SEm ±	0.90	0.87	1.21	0.10	0.08	0.08	0.05	0.08	0.08
CD (p= 0.05)	2.69	2.60	3.64	0.29	0.23	0.23	0.15	0.24	0.25

Table: II Green fodder, cob and baby corn yield (q ha-1) as affected by crop geometry and nitrogen levels

Treatment	Green fodder yield (q ha^{-1})	Cob yield (q ha^{-1})	Baby corn yield (q ha^{-1})
Crop geometry			
40 cm x 15 cm	288.25	67.02	14.47
40 cm x 20 cm	296.06	69.94	16.26
50 cm x 15 cm	308.32	73.57	18.81
50 cm x 20 cm	276.55	62.77	12.15
60 cm x 15 cm	272.66	65.56	13.35
60 cm x 20 cm	262.80	59.48	10.84
SEm ±	7.01	1.80	0.49
CD (p= 0.05)	21.03	5.39	1.48
Nitrogen level (kg N/ha)			
0	191.40	48.61	8.96
60	281.64	68.40	13.85
120	322.75	73.31	16.73
180	340.64	75.23	17.72
SEm ±	113.55	1.01	0.42
CD (p= 0.05)	6.63	3.02	1.25

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