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Research Communication

Yield and economic response of baby corn (*Zea mays*) genotypes to crop geometry and fertility levels

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ABSTRACT

An experiment was conducted during rainy (*kharif*) season of 2018 at Varanasi, Uttar Pradesh, to study the effect of crop geometry and fertility levels on baby corn (*Zea mays* L.) hybrids. The experiment was laid out in a split-plot design with main plot comprising of 4 treatment combinations of crop geometry (65 cm × 16 cm, 65 cm × 12 cm) and fertility levels [recommended dose of fertilizer (RDF), 150% RDF] and subplot comprising of 2 baby corn genotypes 'BC 18K-ZIII 1', 'BC 18K-ZIII 2'. The growth attributes, viz. plant height (cm), leaves/plant, leaf-area index (LAI) and dry-matter/plant, were found significantly higher for 'BC 18K-ZIII 2' in comparison to 'BC 18K-ZIII 1' at harvesting stage. The combination of wider spacing, 150% RDF and 'BC 18K-ZIII 2' recorded the maximum baby cob and corn yield in the first picking. The net returns and benefit: cost ratio were significantly higher with 150% RDF and 'BC 18K-ZIII 2' than RDF and 'BC 18K-ZIII 1', respectively. The maximum net returns was recorded with the combination of closer spacing and 150% RDF as compared to all the other treatment combinations. Thus, the sowing of baby corn hybrid at 65 cm × 12 cm spacing with 180, 90 and 60 kg of N, P and K/ha may be used under Varanasi conditions of India.

Key words: Baby corn, Crop geometry, Fertility levels, Genotype, LAI

Maize is an important cereal crop of the world, next to that of rice and wheat. Globally, it is cultivated in an area of 190.76 million ha with a production of 1,076.40 million m tones. In India, it is cultivated in 9.22 million ha area with 28.72 million m tonnes production (USDA, 2019). In Uttar Pradesh, maize is grown in 0.83 million ha area with a production of 1.56 million tonnes (MoA&FW, 2017). Maize produced as baby corn having high demand because of its immense processing and export potential. Baby corn is a young unfertilized ear of maize, eaten as vegetable, harvested 2–3 days after silk emerges from the tip of the ear. The ears are light-yellowish and preferably of 10–12 cm in length with 1–1.5 cm diameter. The baby cobs have a high nutritional value and crispy nature making them a favourable choice for different types of continental and traditional dishes (Singh *et al*., 2010). It has very low fat and low calorie but high in fibre content (3–5%). A baby corn is comparable to that of an egg with respect to mineral composition (Rani *et al*., 2017). Because of its short-duration nature and medium plant type, it can produce marketable yield within 65–75 days (Thavaprakash *et al*., 2006). This enables growers to take the crop 4–5 times in a calendar year and also allows them to utilize short fallow periods of 2 months or less. It is grown round-the-year in the country as one of the most important dual-purpose crops (Singh *et al*., 2015). The full potentiality of the hybrid cultivars could be exploited only when they are grown under optimum crop geometry. Maximum yield could be attained only when plant population exercises optimum pressure on soil and atmospheric resources. Therefore, determination of optimum crop geometry for a given hybrid cultivar reduces the cost of production as well as increases the productivity (Kumari, 2015). Corn is a heavy feeder crop, and it requires quite higher amount of nutrients throughout its entire growth cycle and it is reported that baby corn responds well to fertilizers (FAO, 2005). The scientific combination of both density and fertilization along with the use of hybrid cultivar is important for baby corn. Since sufficient research work has not been done on spatial arrangement, nutrient management and cultivars of baby corn un-

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der Varanasi conditions of Eastern Uttar Pradesh, the present experiment was carried out to study the effect of crop geometry and fertility levels on growth attributes, yield attributes, yield and economics of baby corn.

A field experiment was conducted at Agricultural Research Farm, Banaras Hindu University, Varanasi ($25^{o}18\times$ N, $83^{o}03\times$ E of 75.7 m above mean sea-level), Uttar Pradesh, India located to study the effect of crop geometry and fertility levels on baby corn genotypes during the rainy (*kharif*) season of 2018. The climatic condition under Varanasi district of eastern Uttar Pradesh is subtropical. The total rainfall received during the crop-growing period was 674.5 mm. The weekly maximum and minimum temperature during the experimental period ranged from 28.1°C to 38.1°C and 22.8°C to 25.4°C, respectively. The soil of experimental plot was sandy clay loam, with low organic carbon (0.42%) content, low available nitrogen (185.86 kg/ha), medium available phosphorus (18.70 kg/ha) and potassium (240.92 kg/ha). The soil reaction of the experimental field was nearly neutral (*p*H 7.1) with an electrical conductivity of 0.26 dS/m.

The experiment was laid out in a split-plot design, with main plot comprising 4 treatment combinations (S_1F_1, S_1F_2, S_2F_1 and S_2F_2), i.e. 2 crop geometry (S_1, 65 cm × 16 cm; S_2, 65 cm × 12 cm) and 2 fertility levels [F_1, recommended dose of fertilizer RDF (120-60-40 kg N-P-K/ha), F_2, 150% RDF (180-90-60 kg N-P-K/ha)] and subplot comprising 2 baby corn genotypes, viz. G_1 'BC 18K-ZIII 1' and G_2 'BC 18K-ZIII 2'. All these treatment combinations were replicated thrice.

The baby corn seeds were sown in well-prepared soil on the ridges with a seed rate of 28.84 kg/ha (65 cm × 16 cm spacing) and 37.95 kg/ha (65 cm × 12 cm spacing) by dibbling in a net plot area of 1.30 m ×3.04 m. The sources of fertilizers used were urea (46% N), diammonium phosphate (18% N and 46% P_2O_5) and muriate of potash (60% K_2O). The fertilizers were applied as band placement along the crop rows. The amount of seeds and fertilizer varied as per the spacing and fertility treatments. Nitrogen was applied in 3 equal splits-first at the time of sowing, second at 30 days after sowing (DAS) and third 1 week after the previous application. Phosphorus and potassium were applied as basal at the time of sowing. One irrigation was applied to the crop 2 days after sowing. Also, 1 hand-weeding was done to control the emerged weeds at 30 DAS. Hand-weeding was proceeded by earthing-up after the first nitrogen application to check crop lodging. Regular monitoring and detasseling was done to prevent fertilization. Harvesting of baby cobs was done manually by picking the green cobs 2–3 days after emergence of the silk i.e. 55–65 DAS. Four pickings were done from the net plot area of each plot.

The growth attributes, viz. plant height (cm), leaves/plant, leaf-area index (LAI) and dry matter/plant (g), were recorded at 60 DAS. Various yield attributes, viz. baby corn weight (g), baby corn girth (cm), baby corn length (cm) and number of baby corn/ha, were recorded at the time of harvesting of baby cobs. Baby corn yield in the first

Table 1. Effect of crop geometry, fertility levels and genotypes on growth and yield attributes (60 days after sowing DAS), yield and economics of baby corn

Treatment	Plant height (cm)	Leaves/ plants	Leaf-area index (LAI)	Dry matter/ plant (g)	Baby corn weight (g)	Baby corn girth (cm)	Baby corn length (cm)	Baby corn/ ($\times10^3$ ₹/ha)	Baby corn yield (kg/ha)		Net returns ($\times10^3$ ₹/ha)	Benefit: cost ratio
									First picking	Total picking		
Crop geometry												
S_1 (65 cm × 16 cm)	147	7.04	4.52	95.7	4.56	1.19	8.89	138.1	130	837	164.0	2.77
S_2 (65 cm × 12 cm)	137	6.52	3.77	89.1	5.63	1.19	9.00	140.4	120	821	167.9	2.77
SEm±	2.7	0.16	0.09	2.9	0.21	0.02	0.08	4.8	16.5	40.8	6.4	0.10
CD (P=0.05)	9.4	NS	0.33	NS	0.72	NS	NS	NS	NS	NS	NS	NS
Fertility levels												
F_1 (RDF)	138	6.41	4.09	89.6	5.04	1.17	8.82	115.7	124	672	131.2	2.41
F_2 (150% RDF)	145	7.15	4.21	95.1	5.15	1.21	9.07	162.8	125	986	200.7	3.12
SEm±	2.7	0.16	0.10	2.9	0.21	0.02	0.08	4.8	16.5	40.8	6.4	0.10
CD (P=0.05)	NS	0.58	NS	NS	NS	NS	NS	16.7	NS	141.2	22.3	0.37
Genotype												
G_1 ('BC 18K ZIII 1')	135	6.58	3.98	87.5	5.02	1.19	8.89	124.8	103	724	145.9	2.55
G_2 ('BC 18K ZIII 2')	149	6.98	4.31	97.3	5.17	1.18	9.00	153.7	146	934	186.0	2.98
SEm±	2.4	0.03	0.08	1.9	0.14	0.01	0.08	7.2	12.1	25.2	6.2	0.06
CD (P=0.05)	7.96	0.12	0.26	6.2	NS	NS	NS	23.7	39.5	85.1	20.2	0.22

RDF, Recommended dose of fertilizer

picking (kg/ha) and total baby corn yield (kg/ha) were also recorded.

The wider spacing of 65 cm × 16 cm recorded significantly higher plant height than to the narrower spacing of 65 cm × 12 cm (Table 1). Shweta *et al*. (2017) also found significantly higher plant height under 15 cm × 20 cm spacing over 15 cm × 15 cm which was at par with 20 cm × 20 cm spacing. The wider spacing of 65 cm × 16 cm also recorded significantly higher leaf-area index as compared to the closer spacing of 65 cm × 12 cm (Table 1). On the other hand, closer plant spacing of 65 cm × 12 cm recorded significantly higher baby corn weight than the wider plant spacing of 65 cm × 16 cm (Table 1). These findings might be owing to optimum utilization of resources by the plants under densely populated condition in the case of baby corn which is a short-duration crop. However, yield attributes as well as the net returns and B:C ratio were not significantly influenced by the crop-geometry treatments (Table 1). Lucianetti and Bellettini (2020) also reported that, the yield components of baby corn were not significantly affected either by row spacing or plant density indicating that baby corn can be grown at different spacings without any effect on yield.

The effect of fertility levels on variations in number of leaves/plant was found to be significantly higher with 150% RDF as compared to RDF (Table 1). This might be owing to better availability of nutrients for uptake and utilization of these nutrients in the plant body with higher level of fertilizer application. But the effect of fertility levels on leaf-area index (LAI) was found to be non-significant (Table 1). The total number of baby corn/ha was significantly higher with 150% RDF as compared to RDF (Table 1). This was apparently because of increased nutrient availability owing to higher amount of fertilizers in 150% RDF and high demand of baby corn crop which produced better growth attributes, viz. plant height and leaves/plant, resulting in higher number of baby corn/ha. The total baby corn yield (4 pickings) was significantly higher with 150% RDF than to that of RDF. Manea *et al*. (2015) also reported 55% increase in cob yield and the highest yield with a fertility level of 225, 46.76, 112.06, 60 and 15 kg/ha of N, P, K, S and Zn over the control and over all the other treatments with lower fertility level, respectively, in baby corn under Varanasi condition. This might be attributed to the fact that, higher fertility level provided optimum nutrient supply to baby corn plants and at lower fertility rates, the nutrients could not meet the demand of baby corn crop due to its short growth duration (Singh *et al*., 2010). The net return and BC ratio were also significantly higher with 150% RDF than with RDF (Table 1). This might be owing to higher economic yield in spite of higher cost incurred in 150% RDF application. Kumar *et al.* (2015) also reported higher net return and B:C ratio with the application of 125% RDF than that with 100% RDF.

The variations in plant height, leaves/plant, leaf-area index (LAI) and dry matter/plant were significantly higher with 'BC 18K ZIII 2' in comparison to 'BC 18K ZIII 1' (Table 1). Also, the genotype 'BC-18K-ZIII 2' recorded significantly higher number of baby corn/ha, baby corn yield in the first picking and total baby corn yield as compared to 'BC 18K-ZIII 1'. The genetic potential of hybrid cultivar 'BC 18K-ZIII 2' might have been better than 'BC 18K-ZIII 1'. The net return and the B: C ratio were significantly higher with 'BC 18K-ZIII 2' than 'BC 18K-ZIII 1'. This was simply because of the better growth performance of the genotype 'BC 18K-ZIII 2' resulting in higher yield.

Interaction effect of S × F × G on baby corn yield in the first picking was found to be significant (Table 2). In this case, the combination of $S_1F_2G_2$ (65 cm × 16 cm, 150% RDF, 'BC 18K-ZIII 2') resulted in the maximum baby corn yield in the first picking. This finding might be owing to the influence of higher levels of nutrient availability even with lesser number of plants/ha along with the better genetic potential of the genotype 'BC 18K-ZIII 2' which had consistently shown good performance with respect to growth

Table 3. Interaction effect of crop geometry × fertility level on net return (× 10^3/ha)

Treatment	S_1 (65 cm × 16 cm)	S_2 (65 cm × 12 cm)
F_1 (RDF)	143.4	184.6
F_2 (150% RDF)	119.0	216.7
	SEm±	CD (P=0.05)
	9.1	31.6

Table 2. Interaction effect of crop geometry × fertility levels × genotype on baby corn yield (kg/ha) in first picking

Treatment	F_1 (RDF)		F_2 (150% RDF)	
	G_1 ('BC 18K ZIII 1')	G_2 ('BC 18K ZIII 2')	G_1 ('BC 18K ZIII 1')	G_2 ('BC 18K ZIII 2')
S_1 (65 cm × 16 cm)	38	179	110	193
S_2 (65 cm × 12 m)	179	102	87	111
	SEm±		CD (P=0.05)	
G at same level of S × F	10		33	
S × F at same or different level of G	16		39	