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Effect of crop geometry and nitrogen levels on growth, productivity of baby corn (*Zea mays* L.)

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Abstract
This paper documents the effects of crop geometry and nitrogen levels on baby corn maize crop. In this view, a field experiment was carried out during winter(*rabi*) season of 2019 at Instructional cum Research Farm, IGKV, Raipur,in split plot design with three replications.It was conducted to study the effect of crop geometry and nitrogen levels on growth, yield attributes of baby corn G5414.The treatments involve four crop geometries and three nitrogen levels. Crop geometries are 30 x 20cm, 40 x 20cm, 50 x 20 cm, 60 x 20cm and nitrogen levels are 75,100,125 kg N ha^{-1}.Result illustrated that number of young cobs $plant^{-1}$, length of cob with and with out husk, diameter of cob with and with out husk N content in cob and fodder was found significantly higher in planting geometry of 60 x 20 cm and all these characters were also found superior under treatments receiving 125 kg N ha^{-1}.Cob yield and harvest index was observed maximum in planting geometry of 50 x 20 cm and at the application of 125 kg N ha^{-1}. Planting geometry of 50 x 20 cm (1,00,000 plants $ha^{-1)}$ with 125 kg N ha^{-1} gives highest gross returns (Rs. 198576 ha^{-1}), net returns (Rs. 154337 ha^{-1}) and B:C ratio(2.5). Further, the spacing of 50 x 20cm application of nitrogen *i.e* 125 N kg ha^{-1} was found to be economical as it gave highest monetary benefits and B:C ratio.

Keywords: Baby corn, crop geometry, nitrogen levels and cob yield

Introduction
Maize (*Zea mays* L.) is popularly known as *Makka* or *Makai* in hindi, is one of the most important cereal crops in the world's agricultural economy, both as man-made food and as animal feed. This crop is miracle crop as it has very high yield potential, there is no cereal on earth that has such immense potential, and that's why it's called "Cereals Queen." Maize is grown in almost all the states of India. It is grown in 9380 thousand hectare area and its production is 28753 thousand tonne with a productivity of 3065 kg per hectare in India (Anonymous 2018). It is cultivated in 133.41 thousand hectare area and production is 317.52 thousand tonne with an average productivity of 2380 kg per hectare (Anonymous 2018)

Baby corn is not a specific type of corn like sweet corn or pop corn, it can be any type of corn which is used after harvesting when the silk get emerged or just going to be emerged and fertilization has not taken place. we can also say baby corn is un- pollinated silk. A baby corn might be compared with an"egg" in terms of minerals. It is best for fodder crop because of high succulent, digestibility and palatability. It contains protein (15-18%), sugar (0.016-0.020%), phosphorus (0.6-0.9%), potassium (2-3%), fibre (3-5%), calcium (0.3-0.5%), ascorbic acid (75-80 mg/100 g).The baby corn is extremely nutritious and has a comparable nutritional value with other high-priced vegetables such as cauliflower, cabbage, French beans, spinach, lady finger, tomato, radish *etc*. Whole miniature cob of baby corn is consumed. Baby corn plant can be used as feed for animals as it is very nutritious.

Optimum crop geometry is one of the main factors for higher productivity, whereby underground resources are used efficiently and maximum solar radiation is collected which in effect contributes to better photosynthesis (Monneveux *et al*., 2005). Yield increases with N levels up to a certain point but the optimum economic N dose is independent of the plant density

Material and Method
The present experiment was outlaid in the Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur.

Geographically, Raipur is the central part of Chhattisgarh and lies at $21^0$15' N latitude and $81^0$37'E longitude at an altitude of 296 meters above mean sea level (MSL) and located in the Chhatisgarh plain zone of Chhattisgarh. It was conducted during *rabi* season (2019-20).Soil having pH (7.5), EC (0.21 dsm^{-1}) and OC (0.58%), available N, P, K were 120, 16.34 and 272.02 kg ha^{-1}, respectively. Sowing date was 27 November, 2019 and harvested on 13 March, 2020. Experiment was laid out in split plot designs with three replications.

Result and Discussion

Observations

Number of young cobs plant^{-1}

Highest number of young cobs $plant^{-1}$ was found in planting geometry of 60 x 20cm (S4) and maximum number of cobs $plant^{-1}$ was found in plot receiving 125kg N ha^{-1}(N3).

Length of cob

Highest length of young cob with husk was found in planting geometry of 60 x 20cm (S4) and maximum length was found in plot receiving 125kg N ha^{-1} (N3).Maximum young cob length without husk was found in planting geometry of 60 x 20cm (S4) and maximum cob length with out husk was found in the plot receiving 125 kg N ha^{-1}(N3).

Diameter of cob

Young cob diameter (with husk)obtained maximum value in planting geometry of 60 x 20cm(S4) and in nitrogen level of 125kg N ha^{-1}(N3).Planting geometry and nitrogen levels showed significant effect on young cob diameter (with out husk).maximum diameter was obtained under 60 x 20cm (S4). Amongst varying nitrogen levels, maximum diameter was recorded under the treatments where high nitrogen rate of 125 kg N ha^{-1} (N3) were used.

N content in cob and fodder

Data illustrate that nitrogen content in cob and fodder was found maximum in planting geometry of 60 x 20 cm (S4) and nitrogen level of 125 kg N ha^{-1} as compare to other treatments

Cob yield

Planting geometry of 50 x 20 cm(1,00,000 plants $ha^{-1)}$ along with the application of 125 kg N ha^{-1}, produce maximum cob yield with out husk of (31.93 q ha^{-1}) and with husk(159.9 q ha^{-1}) as compared to other treatments. Thavaprakash and Velayudham (2007) reported the geometry of the crops. Green cob yield and nutrient uptake of infant corn significantly influenced.It was also found that plant spacing of 45 x 25 cm had the highest green cob yield and biological equivalent yield of 60 x 19 cm while nutrient uptake was the highest in 60 x 19 cm compared to 45 x 25 cm.

Economics

Planting geometry of 50 x 20cm (1,00,000 plants $ha^{-1)}$ with 125 kg N ha^{-1} gives highest gross returns (Rs. 198576 ha^{-1}), net returns (Rs. 154337 ha^{-1}) and B:C ratio(2.5). Further, the spacing of 50 x 20cm application of nitrogen *i.e* 125 N kg ha^{-1} was found to be economical as it gave highest monetary benefits and B:C ratio.

Table 1: Post harvest observations of baby corn maize as influenced due to crop geometry and nitrogen levels

Treatments Main plot: Crop geometry (cm)	No. of young cobs $plant^{-1}$	Young cob length(cm)		Young cob diameter(cm)		Nitrogen content (%)		Young cob yield (q ha^{-1}) without husk	Harvest index (HI)
		With husk	Without husk	With husk	Without husk	Cob	Fodder		
S_1 : 30 x 20	1.37	22.8	9.0	3.5	1.6	1.55	1.32	21.23	22.4
S_2 : 40 x 20	1.74	23.7	9.6	3.9	1.8	1.59	1.38	22.28	26.3
S_3 : 50 x 20	2.19	23.8	10.1	4.3	2.0	1.60	1.42	27.04	33.1
S_4 : 60 x 20	2.89	25.7	10.5	4.4	2.2	1.60	1.48	25.86	32.8
S.E(m) ±	0.06	0.54	0.19	0.08	0.06	0.04	0.03	0.33	0.31
CD (0.05%)	0.20	1.87	0.65	0.28	0.20	NS	NS	1.14	1.09
Sub plot: Nitrogen levels (kg ha^{-1})									
N_1 : 75	1.88	23.3	9.1	3.8	1.7	1.53	1.36	20.98	27.2
N_2 : 100	1.97	24.0	9.9	3.9	1.9	1.58	1.40	23.51	28.0
N_3 : 125	2.28	24.8	10.4	4.4	2.1	1.64	1.43	27.81	30.8
S.E(m) ±	0.03	0.31	0.14	0.05	0.02	0.02	0.04	0.25	0.29
CD (0.05%)	0.10	0.93	0.41	0.15	0.07	0.07	NS	0.76	0.88
Interaction (SXN)	S	NS	NS	S	S	S	NS	S	S

Table 2: Economics of baby corn maize as influenced due to crop geometry and nitrogen levels

Treatment	Cost of cultivation (Rs ha^{-1})	Gross Monitory Return (Rs ha^{-1})	Net Monitory Return (Rs ha^{-1})	B:C Net
Main plot: Crop geometry (cm)				
S_1 : 30 x 20	69403	154491	103149	2.2
S_2 : 40 x 20	63763	154570	108215	2.4
S_3 : 50 x 20	62203	173166	129811	2.8
S_4 : 60 x 20	60403	165457	124689	2.7
S.E(m) ±	--	2046	2046	0.03
CD (0.05 %)	--	7081	7081	0.11
Sub plot: Nitrogen levels (kg ha^{-1})				
N_1 : 75	63616	143418	98290	2.3
N_2 : 100	63945	159627	114170	2.5
N_3 : 125	64267	182718	136939	2.9
S.E(m) ±	--	1347	1347	0.02
CD (0.05 %)	--	4037	4037	0.06
Interaction (SXN)	NS	S	S	S

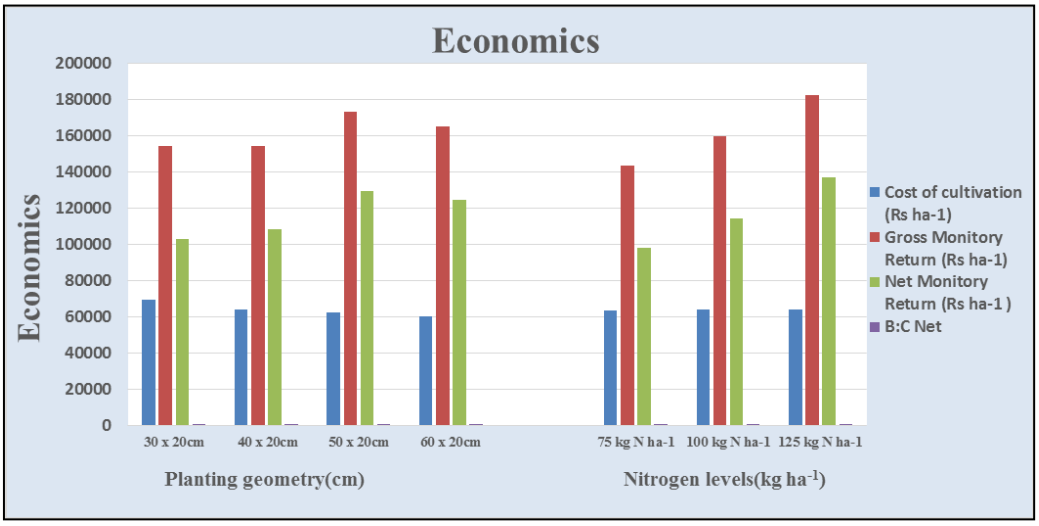

Fig 1: Economics of baby corn as influenced by planting geometry and nitrogen levels

Conclusion

Planting geometry of 50 x 20 cm(1,00,000 plants $ha^{-1)}$ along with the application of 125 kg N ha^{-1},produce maximum cob yield with out husk of (31.93 q ha^{-1}) and with husk(159.9 q ha^{-1})as compared to other treatments.

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