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# EFFECT OF CROP GEOMETRY AND NITROGEN LEVELS ON GROWTH OF BABY CORN (*ZEA MAYS* L.)

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**SUMMARY**

This paper documents the effects of crop geometry and nitrogen levels on baby corn maize crop. 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. Result illustrated that number of leaves, leaf area index, stem girth , crop growth rate , 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. Plant height and fodder yield was found significantly higher in 30 x 20cm. cob yield and harvest index was observed in planting geometry of 50 x 20 cm and at the application of 125 kg N/ha. Planting geometry of 50 x 20 cm (1,00,000 plants/ha) with 125 kg N/ha gives highest gross returns (Rs. 198576/ha), net returns (Rs. 154337/ha) 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.

**Key words:** Baby corn, crop geometry, nitrogen levels and fodder yield

One of the most significant cereal crops in the global agricultural economy is maize ( *Zea mays* L.), also known as Makka or Makai in Hindi. It is used as both human food and animal feed. There is no cereal on earth with such enormous potential, which is why it is known as the "Cereals Queen." This crop is a miracle crop because of its extremely high yield potential. Almost all of India's states grow maize. In India, it is farmed on an area of 9380 thousand hectares, producing 28753 thousand tonnes with a productivity of 3065 kilogrammes per hectare (Anonymous 2018). With an average productivity of 2380 kg per hectare, it is grown over an area of 133.41 thousand hectares and produces 317.52 thousand tonnes (Anonymous 2018).

For several kinds of cattle, maize is utilised as both green and conserved feed (silage). When fodder maize is collected during the milk to early dough stage, it contains cellulose 28–30% and hemicellulose 23-25% in the dry matter. These nutrients are essential for animal growth, reproduction, and milk production. In terms of mineral content, infant corn could be compared to a 'egg'. Due to its high succulent, digestibility, and palatability, it is the ideal fodder crop. It includes ascorbic acid (75-80 mg/100 g), protein (15–18%), sugar (0.016–0.020%), phosphorus (0.6–0.9%), potassium (2–3%), fibre (3-5%), calcium (0.3-0.5%), and sugar (0.016–0.020%).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.

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). Optimum plant population for maximum economic yield exists for all crop species and varies with cultivar and climate (Bruns and Abbas, 2005). Yield increases with rising plant density to a limit for a corn genotype grown under a collection of different environmental

and management conditions, and decreases with further increase in plant density (Gozobenli *et al*., 2004).

Yield increases with N levels up to a certain point but the optimum economic N dose is independent of the plant density. There are two key factors in the concentration and timing of urea foliar spray to achieve the desired gain. To offer farmers greater flexibility, the potential for harvesting a combined product (baby corn + green / mature cob) and its interaction with N may be explored.

## MATERIALS AND METHODS

The current study was conducted at Raipur's Indira Gandhi Krishi Vishwavidyalaya's Instructional Cumulative Research Farm. Geographically speaking, Raipur is the centre of Chhattisgarh. It is situated in the Chhattisgarh plain zone, at latitude 21015' N and longitude 81037' E, and at an elevation of 296 metres above mean sea level (MSL). It took place in the rabi season (2019–20). Date of sowing was November 27, 2019, and date of harvest was March 13, 2020. Split plot designs with three replications were used for the experiment's layout.

## RESULTS AND DISCUSSION

### Pre- harvest observations

### Plant height (cm)

Data revealed that significantly highest plant height was obtained at all growth stages where planting geometry was 30 cm x 20 cm (S1). With respect to nitrogen levels, taller plants were observed under nitrogen level of 125 kg/ha (N3) at 20, 40, 60, 80 DAS and at harvest. Kashinath, *et al*. ( 2014) recorded that with the advance of crop age up to harvest, the plant height of fodder maize increased gradually. The crop geometry of 30 cm x 10 cm and the dose of nitrogen of 220 kg/ha resulted in the highest plant stature, whereas the shortest one was reported with 45 cm x 20 cm and 140 kg N/ha.

### Number of leaves

Number of leaves plant$^{-1}$ was found non-significant at harvest planting geometry of 60 x 20cm (S4) gave significantly higher number of leaves plant$^{-1}$as compare to other planting geometries. whereas Significantly maximum number of leaves found at 20,40,60,80 DAS and at harvest in the plot receiving nitrogen level of 125 kg N ha$^{-1.}$ Patel *et al.* (2006) reported that with increase in nitrogen levels from 75 to 175 kg ha$^{-1}$ , there was a significant 9 improvement in the periodical plant height, number of leaves plant$^{-1}$ , stem girth at 60 DAS, leaf area index, dry matter accumulation plant$^{-1}$ and crop growth rate between 30-60 and 60-90 DAS.

### Leaf area index (LAI)

Leaf area index (LAI) was recorded at 20,40,60,80 DAS and at harvest. Planting geometry of 60 x 20cm (S4) gave significantly higher LAI than rest of the treatments at 20 and 40 DAS .At 60,80 DAS and at harvest higher LAI was found in the planting geometry of 30 x 20cm. Nitrogen level of 125 kg N ha$^{-1}$ (N3) recorded higher values which was comparatively higher than other nitrogen levels.

### Stem girth

Data revealed that stem girth was found significantly higher at planting geometry of 60 x 20cm (S4) at harvest .On the other hand, highest stem girth was found in the plot receiving nitrogen level of 125 kg N/ha (N3). Oad *et al*. (2004) reported that all maize plant parameters were significantly affected with the incorporation of nitrogen and FYM levels. Among the plant characters, tall plants, maximum stem girth, more green leaves and highest maize fodder yield was obtained with application of 120 kg N ha$^{-1}$ in combination with 3000 kg FYM ha$^{-1}$.

### Crop growth rate (CGR)

Crop growth rate (CGR) was significantly higher with 20- 40 DAS the maximum crop growth rate was reported under treatment with 50 x 20 cm(S3)planting geometry which was at par with planting geometry of 60 x 20 cm(S4) and 40 x 20cm(S2). During 40- 60 DAS, 60- 80 DAS and 80 DAS- harvest maximum crop growth rate was recorded with 60 cm x 20 cm (S4) planting geometry,which was noted superior over other planting geometries.Among nitrogen levels 0- 20 DAS the crop growth rate was not significant. Higher crop growth rate during 20- 40 DAS was recorded at 125 kg N ha$^{-1}$ (N3) During 40- 60 DAS and 60- 80 DAS crop growth rate was recorded highest at 125 kg N/ha (N3)

TABLE 1.1
Pre - harvest observations of baby corn maize as influenced due to crop geometry and nitrogen levels

| Treatments | Plant height (cm) | Number of leaves/ plant | Stem girth (cm) | Leaf area index (LAI) | | | | | Crop growth rate(CGR) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 20 | 40 | 60 | 80 | At harvest | 0-20 | 20- 40 | 40-60 | 60-80 | 80- harvest |
| **Main plot: Crop geometry (cm)** | | | | | | | | | | | | | |
| $S_1$: 30 x 20 | 224.0 | 12.0 | 2.37 | 0.07 | 0.41 | 4.6 | 6.9 | 7.2 | 0.115 | 0.85 | 2.71 | 2.12 | 0.82 |
| $S_2$ :40 x 20 | 209.7 | 12.7 | 2.61 | 0.09 | 0.59 | 3.9 | 5.1 | 5.7 | 0.132 | 0.98 | 2.77 | 2.35 | 0.69 |
| $S_3$ :50 x 20 | 208.8 | 13.0 | 2.68 | 0.10 | 0.62 | 3.4 | 4.6 | 5.0 | 0.133 | 1.05 | 2.75 | 2.68 | 0.57 |
| $S_4$ :60 x 20 | 200.6 | 13.5 | 2.71 | 0.11 | 0.66 | 3.3 | 4.4 | 4.4 | 0.140 | 1.03 | 2.97 | 2.76 | 1.08 |
| S.E(m) ± | 3.56 | 0.26 | 0.03 | 0.01 | 0.03 | 0.1 | 0.2 | 0.1 | 0.00 | 0.02 | 0.04 | 0.07 | 0.09 |
| CD(0.05 %) | NS | 0.90 | 0.12 | 0.02 | 0.1 | 0.6 | 0.6 | 0.5 | 0.01 | 0.07 | 0.15 | 0.25 | 0.31 |
| **Sub plot: Nitrogen levels (kg/ha)** | | | | | | | | | | | | | |
| $N_1$: 75 | 207.8 | 12.3 | 2.50 | 0.08 | 0.4 | 3.5 | 4.9 | 5.3 | 0.12 | 0.89 | 2.68 | 2.10 | 0.90 |
| $N_2$: 100 | 210.1 | 12.8 | 2.57 | 0.09 | 0.6 | 3.6 | 5.0 | 5.4 | 0.13 | 0.99 | 2.84 | 2.64 | 0.58 |
| $N_3$: 125 | 214.5 | 13.2 | 2.71 | 0.11 | 0.6 | 4.4 | 5.7 | 6.0 | 0.14 | 1.04 | 2.88 | 2.69 | 0.89 |
| S.E(m) ± | 2.18 | 0.07 | 0.03 | 0.01 | 0.04 | 0.05 | 0.1 | 0.09 | 0.00 | 0.02 | 0.03 | 0.06 | 0.07 |
| CD (0.05 %) | NS | 0.22 | 0.10 | 0.02 | 0.1 | 0.1 | 0.3 | 0.2 | 0.01 | 0.05 | 0.10 | 0.18 | 0.21 |
| Interaction (SXN) | NS | NS | NS | NS | NS | S | S | S | NS | S | S | S | S |

TABLE 1.1
Green fodder yield (q/ha) of baby corn maize at harvest as influenced due to interaction effect of crop geometry and nitrogen levels

| Treatments | Crop geometry | | | | |
|---|---|---|---|---|---|
| | $S_1$: 30 x 20 | $S_2$: 40 x 20 | $S_3$: 50 x 20 | $S_4$: 60 x 20 | Mean |
| **Nitrogen levels** | | | | | |
| $N_1$ : 75 | 287.2 | 272.4 | 246.9 | 220.0 | 256.6 |
| $N_2$ : 100 | 330.9 | 294.0 | 253.1 | 243.6 | 280.4 |
| $N_3$ : 125 | 348.3 | 297.1 | 259.4 | 259.3 | 291.0 |
| Mean | 322.1 | 287.8 | 253.1 | 240.9 | 276.0 |
| | | | S.E(m) ± | CD (0.05 %) | |
| Main plot: Crop geometry | | | 37.50 | 14.98 | |
| Sub plot: Nitrogen levels | | | 13.73 | 7.85 | |
| Comparison of two nitrogen levels means at the same level of crop geometry treatment | | | 54.92 | 62.81 | |
| Comparison of two crop geometry means at the same or different level of nitrogen levels Treatment | | | | 55.3 | |

which was significantly superior to other levels of nitrogen at all growth stages.At 80 DAS – harvest maximum growth was found in plot recieving 75 kg N $ha^{-1}$(N1). Maximum crop growth rate was recorded during 20- 40 DAS was under the interaction effect of planting geometry 40 x 20cm(S2) coupled with treatment receiving 125 kg N $ha^{-1}$(N3). During 40- 60 DAS the maximum crop growth rate was observed under the treatment 50 x 20 cm(S3) planting geometry along with combination of 125 kg N $ha^{-1}$ (N3)during 60- 80 DAS combination of 60 x 20 cm(S4) planting geometry with treatment receiving 100 kg N $ha^{-1}$ (N3), During 80 DAS- harvest the maximum crop growth rate was noted under the treatment combination of planting geometry of 60 x 20 cm (S4)along with 75 kg N/ha (N1) which was found superior over other remaining treatment combinations.

## Green fodder yield (q/ha)

Table 1.1 indicated that the green fodder yield of baby corn was significantly influenced by plant geometry and nitrogen level. Significantly higher green fodder yield was recorded with 30 x 20 cm plant geometry (322.15 q/ha ). Whereas, planting geometry of 40 x 20 cm and 50 x 20 cm recorded green fodder yield of 287.83 and 253.15 q/ha. However, lowest green fodder yield (240.94 q/ha) was observed with

TABLE 1.2
Dry fodder yield (q/ha) of baby corn maize at harvest as influenced due to interaction effect of crop geometry and nitrogen levels

| Treatments | Crop geometry | | | | |
|---|---|---|---|---|---|
| | $S_1$: 30 x 20 | $S_2$: 40 x 20 | $S_3$: 50 x 20 | $S_4$: 60 x 20 | Mean |
| **Nitrogen levels** | | | | | |
| $N_1$: 75 | 52.1 | 51.1 | 49.4 | 46.3 | 49.7 |
| $N_2$: 100 | 61.7 | 57.5 | 51.5 | 51.7 | 55.6 |
| $N_3$: 125 | 67.9 | 58.9 | 53.7 | 55.7 | 59.1 |
| Mean | 60.6 | 55.8 | 51.5 | 51.2 | 54.8 |
| | | | S.E(m) ± | CD (0.05 %) | |
| Main plot: Crop geometry | | | 2.04 | 3.49 | |
| Sub plot: Nitrogen levels | | | 0.96 | 2.08 | |
| Comparison of two nitrogen levels means at the same level of crop geometry treatment | | | 3.87 | 15.08 | |
| Comparison of two crop geometry means at the same or different level of nitrogen levels Treatment | | | | 7.9 | |

wide spaced crop geometry 60 x 20cm (83,333 plants/ha). The reduction of fodder yield might be associated with lower plant height and lower internodes growth. The close relation between biomass yield and nitrogen availability in the soil has been reported by Delgado (2001). Akmal*et al* (2010) has reported differential response of maize varieties in producing biological yield at various nitrogen levels. These findings are in accordance with Haque *et al* (1996) and Uhart and Andrade (1995) who reported that nitrogen enhances vegetative growth. Similar results have been reported by Muhammad *et al* (2002) and Jokela *et al* (1989).

Significantly higher green fodder yield (291.03 q $ha^{-1}$) was recorded by the plot of nitrogen level of 125 kg N $ha^{-1}$ followed by the plot received by nitrogen level of 100 kg N/ha (280.39 q/ha) whereas, lowest green fodder yield (256.63 q/ha) was recorded in 75 kg N/ha). Chaudry *et al* (1998) revealed that fodder yield increases with increasing nitrogen rate. The interaction of planting geometry and nitrogen levels in green fodder yield was found significant. Maximum green fodder yield(348.3 q/ha) was observed in treatment combination of planting geometry of 30 x 20cm along with 125 kg N/ha which was at par with the treatment combinations of 40 cm x 20cm with plot of 125 kg N/ha and 100 kg N/ha, respectively and also at par with treatment combination of planting geometry of 30 x 20 cm with 100 kg N/ha. The lowest fodder yield (220 q/ha) was observed in treatment combination of planting geometry of 60 x 20cm along with 75 kg N/ha.

**Dry fodder yield (q/ha)**

Table 1.2 revealed that the green fodder yield of baby corn was significantly influenced by plant geometry and nitrogen level. Narrow plant geometry of 30 x 20 cm recorded significantly higher dry fodder yield (60.58 q/ha) than 40 x 20 cm. Lowest green fodder yield (51.24 q/ha) was observed in 60 x 20cm (83,333 plants/ha). Significantly higher dry fodder yield (59.07 q/ha) was recorded by the plot received 125 kg N/ha followed by 100 kg N/ha (55.61 q/ha) whereas, lowest dry fodder yield (49.71 q/ha) was recorded in 75 kg nitrogen/ha. The interaction of planting geometry and different nitrogen levels in dry fodder yield was found significant. Maximum dry fodder yield(67.9 q/ha) was observed in treatment combination of planting geometry of 30 x 20cmalong with 125 kg N/ha which was at par with the treatment combinations of planting geometry of 30 x 20 cm along with nitrogen level of 100 kg N/ha *i.e* 61.7 q/ha. The lowest dry fodder yield (46.3 q/ha) was observed in treatment combination of planting geometry of 60 x 20 cm (83,333 plants/ha) along with plot received nitrogen level of 75 kg N/ha.

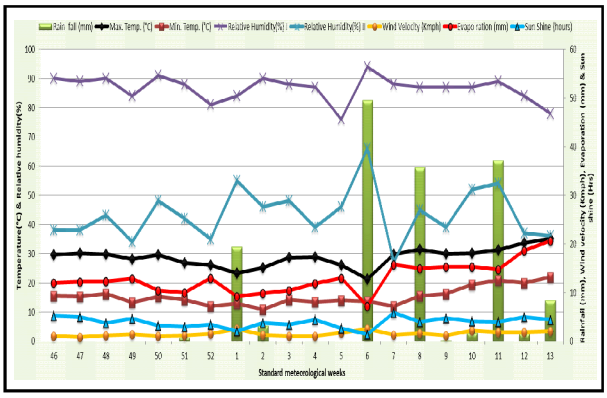


Fig. 1.1: Weekly meteorological data during crop growth of baby corn G-5414 (Rabi 2019-2020).

## CONCLUSION

Green fodder yield of baby corn sown in planting geometry of 30 x 20 cm (1,66,666 plants/ha) along with the application of 125 kg N/ha provides the maximum yield (322.15 q/ha, 67.9 q/ha, 3.4 q/ha day, 0.7 q/ha day), respectively as compare to other treatment combinations. Planting geometry of 50 x 20 cm (1,00,000 plants/ha ) along with the application of 125 kg N/ha, produce maximum cob yield without husk of (31.93 q/ha) and with husk (159.9 q/ha) as compared to other treatments.

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