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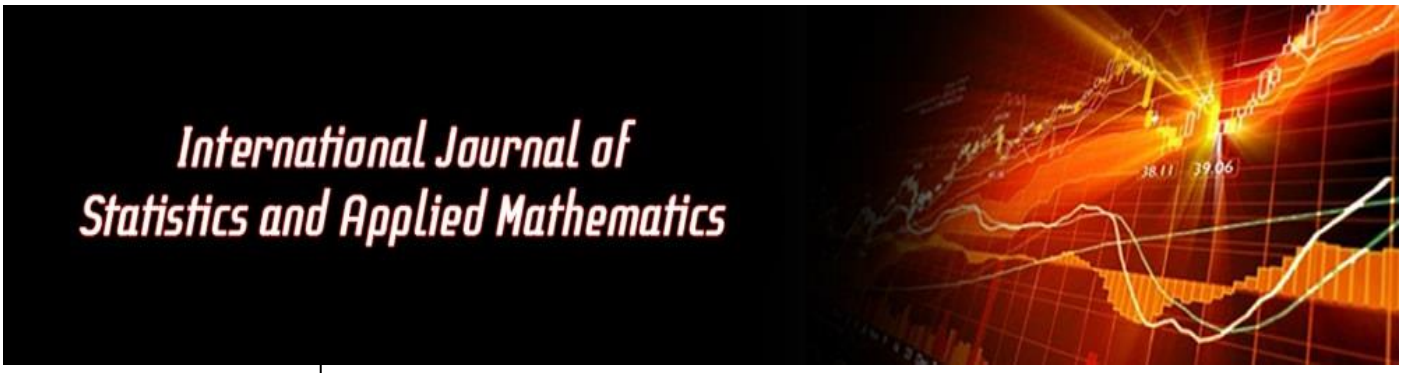

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Impact of crop geometry of maize (*Zea mays* L.) On growth and yield attributes

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Abstract
To investigate the impact of crop geometry on the growth and yield of the maize crop (*Zea mays* L.), a field experiment was carried out in rabi 2022 on clayey soil at the Agronomy Farm, G.H. Raisoni University, Saikheda, Chhindwara (M.P.), Department of Agronomy, School of Agricultural Sciences. The experiment consisted of six treatments which were replicated thrice in RBD Design. Result indicated that application of Highly plant density (45 x 20) (T_5) significantly increased growth attributes and yield of maize.

Keywords: Maize, crop geometry, spacing, plant density, growth, yield

Introduction
After rice and wheat, maize is the third-most significant grain crop in India. The most extensively cultivated highland cereal in the world and the most significant source of staple foods in many developing nations is maize (*Zea mays* L.). Because of its larger potential output, maize is referred to as the "queen of cereals."
In accordance with the endosperm, maize is divided into a number of species groupings, including flour corn, popcorn, dent corn, flint corn, sweet corn, waxy corn, and tripping corn. A unique form of corn called popcorn, which is distinguished by its hard, horn-like interior and is utilized for numerous reasons and is still a kid-favourite meal, has recently been grown as a vegetable. In cities, it can be used for a variety of things.
A total of 1147.7 million MT of maize are currently produced worldwide on 193.7 million ha of land, with a yield of 5.75 t/ha on average (FAOSTAT, 2020). India is ranked eighth in the world for producing maize and fifth for area. It is farmed in India on an area of 9.07 million ha, producing 24.26 million tons and 26.76 thousand cubic feet per hectare, respectively. Madhya Pradesh is one of the traditional maize-producing states. Comparatively to other nations that also produce maize, its output is extremely poor. Madhya Pradesh has the most maize-planted land among Indian states (15%).
Increased maize productivity has been achieved through the management of plant population and crop geometry (Mahapatra *et al.*, 2006) [4]. Reduced row spacing has been associated with yield increases of up to 10% and an increase in photosynthetically active radiation of 8% during silking. According to reports (Bangarwal *et al.*, 1997), concentrated population causes weak barren plants and resulting in reduced grain formation. Beyond a certain point, there is considerable intra- and inter-plant competition for sunshine, nutrients, and moisture, which could result in severe crop lodging.
Because it is believed to affect light intake, the site of photosynthesis, and the medium for energy production using the green section of the plant, crop geometry is a significant agronomic feature. Additionally, it has an impact on how well plants utilize the photosphere and rhizosphere, particularly when they are cramped and suffer from grouping together. Correct plant density and the No. of plants allowed on a given unit of land area are ensured by proper plant spacing. In accordance with the aforementioned, a field experiment was conducted in Sausar, Chhindwara, Madhya Pradesh, during the rabi season in the student research area of the agronomy department at the school of agricultural sciences of G. H. Raisoni University.

Materials and Methods

The field experiment took place in the Agronomy Farm, School of Agricultural Sciences, G.H. Raisoni University, Saikheda, Chhindwara (M.P.) during the month of october in the year 2022. Six treatments and three replications were used in the experiment's Randomized Block Design (RBD) design. The treatment consists of T_1- Recommended spacing (60 x 20), T_2- Low plant density (60 x 30), T_3- Medium high plant density (60 x 15), T_4- High planting (45 x 30), T_5- Highly plant density (45 x 20) and T_6- Skip row planting. applied in all treatments.

Results and Discussions

Growth attributes

At Highly plant density (45 x 20) (T_5), growth characteristics such plant heights, numbers of leaves, and dry matter production were much higher. Table 1 displays the information on plant height that was gathered, documented, and examined.

Table 1 displays the information on plant height that was discovered, recorded, and examined. Plant height was evident at the time of harvest, which was important. Over all of the treatments, the treatment with a high plant density (45 x 20) reported higher plant height (156.93 cm). Similar work was found by Agasibagil (2006) [1], who reported, at a spacing of 45 cm x 20 cm, more height was obtained and concluded that increasing the plant population ha^{-1} increases plant height.

Table 1: Growth attributes of maize influenced by various treatments

Treatments		Plant height (cm)	No. of leaves plant-1	Dry matter accumulation plant-1 (g)
T_1	Recommended spacing (60 x 20)	154.97	10.40	105.2
T_2	Low plant density (60 x 30)	142.79	8.13	105.8
T_3	Medium high plant density (60 x 15)	142.90	9.50	108.2
T_4	High planting (45 x 30)	146.75	9.57	109.2
T_5	Highly plant density (45 x 20)	156.93	11.90	111.0
T_6	Skip row planting	136.05	9.27	106.3
	SE (m) ±	3.14	0.47	0.79
	CD at 5%	9.91	1.48	1.68
	GM	146.73	9.79	107.61

Table 1 contains the information on leaf count that was gathered. At harvest, the T_5 treatment with the highest plant density (45 x 20) had a leaf count that was noticeably greater than all other treatments (11.90). Increased plant population m^{-2} also resulting higher numbers of leaves per plant Similar result was also expressed by Kole (2010) [10] who reported that if the plant-to-plant distance reduced from 20 cm to 10 cm, number of green leaves plant^{-1} increased.

Table 1 displays the recorded and examined dry matter buildup data. At harvest, plants with a high plant density (45 x 20 cm) (T_5) had the highest average dry matter accumulation (111 g) over the entire crop geometry. An increase in plant density resulting decrease in total dry matter production (TDMP) of plant^{-1} because the reduced spacing between plants resulted less penetration root compared to low plant population density ha^{-1} similar results were revealed by Dalvi (1984) [2].

Yield attributes

High plant density (45 x 20 cm) (T_5) was associated with significantly higher yield parameters, including No. of cobs plant^{-1}, length of cob (cm), cob girth (cm), No. of grains per cob, test weight (g), grain yield q ha^{-1}, and straw yield q ha^{-1} (Table 2).

With a high plant density (45 x 20 cm) (T_5), the most cobs plant^{-1} were observed (Table 2). With increasing plant population density/ha, the numbers of cobs each plant will be less due to the leaves being shaded fromeach other, the rate of photosynthesis is lowand the amount of nitrogen and water for the developing ear. If the plant population is dense, the number of cobs per plant will be significantly reduced. By Mahapatra et al. (2006) [4], Mashiqa (2012) [5], and Zheng (2009) [9], similar data were used in line with distinct experiments.

Table 2: Yield attributes of maize affected by various treatments

Treatments		No. of cobs plant-1	Grain yield ha-1 (q)	Straw yield ha-1 (q)
T_1	Recommended spacing (60 x 20)	2.00	52.91	85.24
T_2	Low plant density (60 x 30)	1.50	42.79	64.79
T_3	Medium high plant density (60 x 15)	1.70	47.59	81.59
T_4	High planting (45 x 30)	1.77	50.39	83.72
T_5	Highly plant density (45 x 20)	2.23	56.81	90.57
T_6	Skip row planting	1.60	45.96	80.96
	SE (m) ±	0.11	1.53	2.26
	CD at 5%	0.35	4.83	4.82
	GM	1.80	49.41	81.15

Table 2 displays the information on yield that was discovered, recorded, and examined. Over all of the treatments, the highest grain output was observed substantially at high plant density (45 x 20 cm) (T_5) (56.81 q/ha) (Table 2). Increased plant population, significantly decreased the grain yield ha^{-1} this happen because of plant competition for space, sunlight, nutrient, moisture this result is in consistent with different experiments by Schlegel (2004) [7], Ryan (2012) and Schlegel (2004) [7].

Over all of the treatments, T_5 (45 x 20 cm) plants produced the maximum amount of straw per hectare (90.57) (Table 2). The increase in plant density per hectare from low to high resulted in a significant decrease in the harvest index. (30 cm x 15 cm) the spacing very tall tree populations (2, 22,222) trees per hectare, the recorded harvest index was low compared to the low density of trees per hectare (60 cm x 30 cm) (55,555)) tree per hectare similar data was inline by Abraha (2013) [11].

Conclusion

The growth characteristics of maize, such as plant height, the number of leaves on a plant, and amount of dry matter accumulate in per plant, as well as the yield characteristics of maize, such as the No. of cobs/ plant, grains yield/ hectare, and straw production/ hectare, were higher when the plant density (45 x 20) (T_5) was high and also over all other treatments, highly plant density (45 x 20) (T_5) and (T_1) suggested spacing (60 x 20) recorded considerably greatest gross, net, and B: C ratios.

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