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# Effect of plant population on baby corn yield: A review

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**Abstract**
Baby corn is the dehusked young cob of maize plant harvested just after emergence of silk. Plant population plays an important role to obtain timely growth and yield of baby corn. Spatial arrangement of plant influences the shape and size of leaf area that affects interception of solar radiation. Crop geometry has positive correlation on yield and yield attributes of baby corn. Although single plant yield of baby corn and fodder is higher in case of widely spaced crop, the total yield per unit area was found more in densely spaced crop. Economics of cultivation goes in favour of closely spaced crops due to enhanced yield of baby corn and green fodder. There is sporadic evidence regarding effect of plant population on quality parameters of baby corn. Planting distance of baby corn can be decided depending on local agro-climatic situation and management practices. Wherever possible, higher plant population may be adopted to obtain maximum yield of baby corn and green fodder.

**Keywords:** Baby corn, *Zea mays*, plant population

## Introduction

Maize (*Zea mays*) is an important cereal crop used for diversified purposes such as human food, animal feed, fodder and industrial raw material. Recently, specialized corns such as baby corn and sweet corn are gaining popularity in various areas. Baby corn is the dehusked young ear of maize plant, harvested at emergence of silk and before fertilization (Pandey *et al*., 2002) [22]. As per Bairagi *et al.* (2015) [2], baby corn is the dehusked young cob of maize plant, harvested before or just after emergence of silk. Important features of baby corn cultivation are early maturity, ability to produce multiple ears, synchronized emergence of ears and yellow kernels (Kumar and Kalloo, 1998) [14]. Various authors have described the characteristics of baby corn from visual observation. Muthukumar *et al*. (2005) [17] mentioned that light yellow coloured dehusked baby corn with regular row arrangement of kernels and with length of 10 to 12 cm & diameter of 1.0 to 1.5 cm has better preference in the market. Baby corn is good for health as it contains low calorie with higher fibre content and zero cholesterol (Dar *et al*., 2017) [5]. Baby corn can be a remunerative crop, which can be consumed as food for human and fodder for animal. In the present time, production and consumption of baby corn is gaining momentum in India (Rathika, 2014) [24]. Baby corn has ample of potentiality to provide opportunity for crop diversification, value addition and revenue generation (Bindhani *et al*., 2007; Ghosh *et. al*., 2017) [3, 7].

Among various agronomic management practices, plant density plays a vital role to obtain suitable growth and yield of baby corn. Planting geometry is a non-monetary input, which plays a crucial role to obtain higher yield from the crop. Suitable crop geometry helps in effective utilization of solar radiation and available soil resources for dry matter production through enhanced photosynthesis. Optimum plant density helps in appropriate utilization of solar radiation by proper interception of sunlight due to enhanced leaf area (Moosavi *et al*., 2012) [16]. As maize plant do not produce tillers, plant population play an important role in deciding yield of baby corn (Dar *et al*., 2017) [5]. Hence, plant population of baby corn cannot adjust to variation in plant stand. Optimum plant density for baby corn production varies depending on environmental factors, varietal characteristics and management options. The performance of single-plant can be improved under low plant density, but the yield per unit area decreases due to inadequate plant population. Similarly, excess plant population results in enhanced competition among individual plants, which ultimately affects the yield adversely.

Spatial arrangement of plant influences the shape and size of leaf area, which affects the interception of solar radiation. Development of suitable agro techniques, especially planting geometry is crucial to improve yield and quality of baby corn and fodder (Rathika, 2014) [24].

**Growth and Development**

Appropriate planting density facilitates proper utilization of solar radiation by influencing leaf area interception, which ultimately affects dry matter accumulation and biomass production (Ramachandrappa *et al*., 2004) [23]. Enhanced relative growth rate was observed with lower plant population, whereas increased leaf area index was recorded with higher plant population (Ravichandran *et al*., 2016) [25]. Thakur *et al*. (1997) [31] reported significant increase in growth and yield characters in closely spaced crop. Higher leaf area index in closely spaced crops facilitated better utilization of solar radiation and proper exploitation of ground area (Moosavi *et al*., 2012) [16]. Meena *et al*. (2017) [15] from Udaipur recorded maximum leaf area index of 3.46 at 40 DAS with the plant population of 83,333 per ha. Closely spaced crop produced taller plants due to increase in competition by the plants for sunlight, nutrients, space and water (Neelam and Dutta, 2018) [18]. Under Kerala condition, Archana and Lalitha Bai (2016) [1] recorded 25 per cent increase in tallness of plants with closure spacing of 40 cm x 15 cm as compared to 60 cm x 15 cm due to intra-row plant competition to receive more solar radiation. Thavaprakaash and Velayudhan (2008) [32] reported that a spacing of 60 cm x 19 cm intercepted more light at 25, 45 and 60 days after sowing than the spacing 45 cm x 25 cm during kharif season. On the contrary, Bairagi *et al*. (2015) [2] reported tallest plants with wider spacing of 45 cm x 30 cm as compared with the spacing of 45 cm x 20 cm or 45 cm x 10 cm.

**Yield attributes**

Yield of any crop is a function of various yield attributes, which are dependent on vegetative and reproductive growth. Crop geometry has a positive correlation with the yield attributes of baby corn, those ultimately affect the yield. The yield attributing characters of baby corn viz. number and weight of ears are considerably affected by crop geometry (Dar *et al*., 2017) [5]. Golada *et al*. (2013) [8] opined that maximum yield can be achieved with optimum planting density, which allows individual plant to realize the maximum inherent potential. Ghosh *et al*. (2017) [7] recorded the lowest fresh weight of baby corn at a planting density of 1,20,000/ha. Pandey *et al*. (2002) [22] observed that increase in plant density had adverse effect on cob count due to presence of more barren plants in densely planted crop. Neelam and Dutta (2018) [18] observed that wider spacing of 45 cm x 25 cm recorded higher values for weight, length and girth of baby corn as compared to the spacing of 40 cm x 20 cm, 40 cm x 25 cm and 45 cm x 20 cm because of less crowding in widely spaced crop. Wider spacing of 60 cm x 20 cm resulted in higher values with respect to cobs per plant and length & weight of baby corn over the spacing of 30 cm x 20 cm (Gosavi and Bhagat, 2009) [9]. Under Varanasi situation, plants with wider spacing (40cm x 15cm) produced heavier cobs (6.95 g without husk) as compared with narrow spaced crop (30cm x 15cm) (Neupane *et. al*., 2011) [19]. Thavaprakaash *et al*. (2005) [33] observed that wider spaced (60 cm x 19 cm) crop had noticeable effect on yield and yield attributing characters of baby corn as compared with closely spaced (45 cm x 25 cm) crops. Faiguebaum and Olivares (1995) [6] did not observe any significant effect of plant to plant spacing of 12.5 cm, 16.7 cm or 25 cm with constant row spacing of 75 cm on length and weight of cob. Meena *et al*. (2017) [15] realized the longest (8.26 cm), thickest (1.45 cm) and heaviest (21.38 g) cob of baby corn with a plant population of 83,333/ha. From the above discussion, it can be derived that yield attributing characters of individual plant is more in widely spaced crop as compared with closely spaced crop.

**Baby corn yield**

Planting geometry has substantial effect on yield of baby corn due to variation in final plant stand. Higher plant population in closely spaced (45 cm x 10 cm) crops intercepted more light, which has helped higher photosynthetic activity and ultimately resulted in better yield (Bairagi *et al.*, 2015) [2]. Sobhana *et al*. (2012) [28] reported that there is increase in yield of baby corn with increase in plant population. A wider row spacing of 60 cm increased almost all the growth and yield attributes in baby corn, but did not compensate the yield obtained in closer spacing (Thakur *et al*., 1997) [31]. Neelam and Dutta (2018) [18] recorded the maximum baby corn yield (1865 kg/ha) at a spacing of 45 cm x 20 cm, which was statistically at par with the yield (1812 kg/ha) obtained with a spacing of 45 cm x 25 cm. Thavaprakaash and Velayudhan (2008) [32] recorded 10.7 per cent higher yield of baby corn yield with a spacing of 60 cm x 19 cm than the spacing of 45 cm x 25 cm due to effective utilization of applied plant nutrients and better nutrient uptake by the plant. Kotch *et al.* (1995) [13] recommended a spacing of 90 cm x 10 cm with a plant population of 1,10,000 per hectare to obtain higher yield of baby corn. Ghosh *et. al*. (2017) [7] realized the maximum yield of baby corn with husk (6367 kg/ha) with a plant population of 1,00,000/ha, which was at par with the plant population of 60,000 and 80,000 plants/ha. Increase in plant population from 80,000 to 1,40,000 plants per hectare resulted 30 per cent increase in baby corn yield (Jarumayan and Baldos, 1993) [11]. Koauychai *et al*. (2001) [12] also recorded maximum baby corn yield with higher plant density of 1,00,000 plants/ha. Under Almora condition, Pandey *et al*. (2002) [22] reported comparable yield of baby corn with plant population of 1,66,000 plants/ha (1148 kg/ha) and 1,33,000 plants/ha (1086 kg/ha). Ravichandran *et al*. (2016) [25] from Tamil Nadu recorded maximum yield of husked baby corn (6084 kg/ha during kharif & 6236 kg/ha during rabi) with a plant population of 1.48 lakh/ha (spacing 45 cm x 15 cm) due to higher values of various yield attributing characters.

The spacing of 45 cm x 20 cm recorded significantly higher baby corn yield as compared to the spacing of 60 cm x 20 cm and 30 cm x 20 cm. (Gosavi and Bhagat, 2009) [9]. Under Coimbatore situation, Rathika (2014) [24] observed that planting of baby corn at a spacing of 75 cm x 16 cm yielded 6.7 per cent more green cob as compared with the spacing of 60 cm x 20 cm due to effective utilization of plant nutrients, enhanced sink capacity and maximum nutrient uptake by the crop with wider row spacing. Higher yield of baby corn (32.55%) and fodder (26.21%) was recorded with a spacing of 45 cm × 25 cm as compared with the spacing of 60 cm × 25 cm (Singh *et al*., 2015) [27]. But, Hargilas (2015) [10] reported that narrow plant spacing of 60 cm x 15 cm produced 8.47% higher yield of baby corn than the yield obtained from the crop with wider plant spacing of 60 cm x 20 cm. Sahoo and Panda (1999) [26] realized the highest yield (1620 kg/ha) of baby corn at a spacing of 40 cm x 20 cm during wet season under Odisha situation. Similar finding was also reported by

Thakur *et al.* (1997) [31], who recommended a spacing of 40 cm x 20 cm to obtain maximum yield of baby corn (1737 kg/ha). Under Bengaluru situation, Ramachandrappa *et al*. (2004) [23] recorded the maximum baby corn yield at the spacing of 45 cm × 30 cm due to increased number of ears per plant (2.16) and heavier baby corn. Under Rajasthan situation, Golada *et al*. (2013) [8] recorded the highest yield of baby corn (2065 kg/ha) from a spacing of 60 cm x 15 cm, which was statistically at par with yield (2015 kg/ha) obtained from the spacing of 45 cm x 20 cm. Archana and Lalitha Bai (2016) [1] recorded 43 per cent enhanced yield of baby corn with closer planting of 30 cm x 15 cm as compared with wider spacing of 60 cm x 15 cm. Under Udaipur situation, Meena *et al*. (2017) [15] recorded the highest baby corn yield (5617 kg/ha with husk & 2172 kg/ha without husk) from the plant population of 83,333 per ha, which was statistically at par with the yield (5488 kg/ha with husk & 2033 kg/ha without husk) obtained from the population of 66,666 plants/ha. Pal and Meena (2016) [21] from Pantnagar obtained 24.7% higher yield of baby corn with a spacing of 60 cm × 15 cm when compared with the yield obtained from the spacing of 45 cm × 15 cm.

**Fodder yield**

Plant stand has direct effect on yield of green fodder. Bairagi *et al*. (2015) [2] opined that opined that there is reduction in fodder yield in wider spaced crop. Similarly, Sukanya *et al*. (1998) [29] observed significant increase in green fodder yield with increase in plant population. There was more green fodder yield with increase in plant population (Thakur *et al*., 2000) [30]. Narrow spacing of 45 cm x 20 cm resulted in higher green fodder yield (28.9 t/ha) as compared with wider spacing of 45 cm x 25 cm possibly due to more plant stand per unit area in case of narrow spacing (Neelam and Dutta, 2018) [18]. Ramachandrappa *et al*. (2004) [23] observed increase in fodder yield with narrow spacing due to the increased plant stand per unit area. Gosavi and Bhagat (2009) [9] reported higher green fodder yield at a spacing of 30 cm x 20 cm, which was superior to the spacing of 45 cm x 20 cm and 60 cm x 20 cm. The fodder yield increased steadily with increase in plant density and the highest value (19.62 t/ha) was recorded with a plant population of 1,20,000 plants/ha, which was statistically at par with 1,00,000 plants/ha (Ghosh *et. al*., 2017) [7]. But, Pandey *et al*. (2002) [22] obtained maximum yield (24.5 t/ha) of green fodder with still higher plant population of 1,66,000 plants/ha, which was statistically similar to the yield (23.4 t/ha) obtained from the population of 1,33,000/ha. Ravichandran *et. al*. (2016) [25] from Tamil Nadu obtained the maximum green fodder yield (18.8 t/ha during kharif & 19.1 t/ha during rabi season) with a plant population of 1.48 lakh/ha. Hargilas (2015) [10] reported that narrow plant spacing of 60 cm x 15 cm produced 16.4% higher yield of green fodder than wider spacing (60 cm x 20 cm). Under Udaipur situation, Meena *et al*. (2017) [15] recorded the green fodder yield (29.19 t/ha) with a plant population of 83,333 per ha, which was statistically at par with the 66,666 plants/ha.

**Quality parameters**

The market preference of baby corn is considerably influenced by various quality parameters such as protein and sugar content. Some researchers have observed variation in such quality parameters due to variation in plant population. Dar *et al*. (2014) [4] observed that planting geometry of 60 cm x 20 cm resulted in higher crude protein content of baby corn. Neupane and Mahajan (2013) [20] observed that there was increase in various quality parameters of baby corn when sown at a row spacing of 40 cm x 15 cm. However, Ramchandrappa *et al*. (2004) did not find any significant variation of nutritional parameters due to variation in spacing. Similarly, Rathika (2014) [24] from Coimbatore did not observe any effect of crop geometry on crude protein and crude fibre content of baby corn fodder.

**Economics**

The plant population has a direct effect on the economics of baby corn production. Hargilas (2015) [10] observed 16.52% higher net return when sown at a spacing of 60 cm x 15 cm than the spacing of 60 cm x 20 cm. He also recorded higher B:C ratio (3.08) at a spacing of 60 cm x 15 cm as compared with the spacing 60 cm x 20 cm (2.71). Ghosh *et al*. (2017) [7] observed that baby corn crop grown at a density of 1,00,000 plants/ha resulted the highest net return of Rs 62,368/ha and benefit:cost ratio of 4.34. Sahoo and Panda (1999) [26] obtained maximum net profit of Rs 83,000/ha from a spacing of 40 cm x 20 cm during wet season. But, Pandey *et al*. (2002) [22] recorded higher net return and benefit: cost ratio with increase in plant population up to 1,33,000 plants/ha. Under Kerala condition, closer planting (30 cm x 15 cm) was more remunerative than other plant spacing (Archana and Lalitha Bai, 2016) [1].

Depending on agro-climatic situation, growing conditions and management practices, baby corn can be grown at a suitable spacing for yield enhancement. However, wherever possible, higher plant population may be opted to obtain maximum yield of baby corn and green fodder.

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