



# Enhancing Crop Growth, Yield and Economics of Spring Baby Corn through Different Spacing and Irrigation Regimes

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

A field experiment was conducted during spring season of 2019 at Agronomy Research Farm, CCS Haryana Agricultural University, Hisar, Haryana to investigate the effect of different spacing and irrigation regimes on growth and yield of spring's baby corn (*Zea mays* L.). The experiment was laid out in split-plot design with four irrigation treatments viz. one irrigation - 6 leaf stage, two irrigation - 6 leaf and knee high stage, two irrigation - knee high and pre-tasselling stage and three irrigation - 6 leaf, knee high and pre-tasselling stage in main plots and four spacing treatments viz. 60 × 20 cm, 60 × 15 cm, 45 × 20 cm and 45 × 15 cm in sub-plots. The results showed significantly higher

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growth parameters and cob yield in three irrigation – 6 leaf, knee high and pre-tasselling stage. One irrigation – 6 leaf stage recorded early 50% days to tasselling and silking. In case of spacing treatments, 45 × 15 cm recorded higher growth parameters i.e. plant height, dry matter accumulation and LAI. Yield attributes i.e. cob girth, length and weight was observed higher in 60 × 20 cm spacing treatment and yield was recorded maximum in 45 × 15 cm. The highest gross returns, net returns and benefit cost ratio was recorded higher in 45 × 15 cm spacing.

*Keywords: Baby corn; spacing; irrigation; yield.*

## 1. INTRODUCTION

Baby corn is a young maize cob harvested within 2-3 days of silk emergence. Baby corn ears are light yellow in colour with regular arrangement of rows, 10 - 12 cm in height and having diameter around 1.0 -1.5 cm are preferred for use in consumer market. A crop of baby corn gets ready within 60-70 days. Being a very short duration crop farmer can grow it 3 to 4 times in a year depending upon the agro-climatic conditions and can also be a good substitute at times when other crop fails. Baby corn is not only a 'cash crop' but also a very good 'catch crop'. Thus, it is one such new crop, which can improve the economic status of poor farmer. For diversification of the crop and value addition to maize as well as for the growth of food processing industries, paper textile and fermentation can be a better option. By offering diverse food items worldwide, baby maize has modernized its food habits. Therefore, the economic prominence of poor farmers can be improved by this different crop. It is not only a vital human food, but a worthy source of nutrients and a simple feedstuff and raw material for the manufacture of many industrial products. Baby corn is rich in nutrient value and comparable with many vegetables. It is rich source of phosphorus, iron, vitamin A and C, low calories (low density lipoproteins) and more fiber.

"Whilst baby corn is gaining popularity in India, systemic development of agro-techniques, namely adequate plant population through optimum spacing and water management methods, are equally vital for achieving better yield in a certain agro-climatic environment. There is plenty of room for agricultural output to increase through better management strategies such as early planting, adequate plant density, balanced fertiliser, optimum irrigation, and need-based plant protection measures. Maximum yield can be expected only when plant population allows individual plant to achieve their maximum inherent potential. Therefore, there is need to work out an optimum population density by

adjusting inter and intra row spacing in relation to other agronomic factors" [1]. "For higher yield, spacing management is the most important factor. Crop geometry is recognized one of the most significant aspects for capturing maximum solar radiation and exploits soil resources effectively and in exchange, improved photosynthesis" [2]. "In spring season (Feb to March), crop water requirement increases with increase in temperature. Precision water management can not only improve growth and development of plants by ensuring optimal soil moisture across the growing season with lower environmental impacts" [3]. "The provision of irrigation water as well as optimal nutrients to baby corn may result in a breakthrough in crop output" [4].

Considering the above view, research on the effects of different spacing and irrigation regimes on baby corn output is limited. As a result, the current experiment was designed to investigate the influence of various irrigation levels and planting geometry on the growth and cob yield of baby corn.

## 2. MATERIALS AND METHODS

A field experiment was conducted during spring season, 2019 at the Research Farm, Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar which is situated at 29°10' North latitude, 75°36' East longitude and at the elevation of 215.2 m above mean sea level under subtropical climate in India to investigate the effect of different spacing and irrigation regimes on growth and yield of spring's baby corn.

The soil of the experimental field was sandy loam in texture with pH 8.0, organic carbon (0.33%) and available N, P and K contents were 140, 15.1 and 272.3 kg ha<sup>-1</sup> respectively.

The experiment was laid out in split-plot design and replicated thrice. Main plots treatments consisted of 4 irrigation treatments, viz. one irrigation - 6 leaf stage, two irrigation - 6 leaf and

knee high stage, two irrigation - knee high and pre-tasselling stage and three irrigation - 6 leaf, knee high and pre-tasselling stage and sub-plots consists of four spacing treatments viz. 60 × 20 cm, 60 × 15 cm, 45 × 20 cm and 45 × 15 cm. Recommended doses of N and P @ 120:60 kg ha<sup>-1</sup> were applied in the form of urea and diammonium phosphate, respectively as basal dose. The half dose of N was applied as basal and remaining half dose was applied at 25-30 days after sowing, depending on the availability of the soil moisture. The potash was not applied since the soil of the experimental field was rich in available potassium. The mean weekly maximum and minimum temperature ranged from 22.6 to 41.4 °C and 7.8 to 24.5 °C, respectively during crop growing period.

Baby corn variety 'Hybrid baby corn (G-5414)' was sown in last week of February, 2019 with 6 × 2.5 m plot size. Plant-protection measures were implemented as needed. Additional cultural operations were carried out in accordance with recommendations. The harvesting of baby corn was started from 1st week of May onwards by four pickings in 5-6 days interval. The growth parameters like plant height, leaf area index and dry matter accumulation etc. were recorded periodically. Observations on yield-attributing and yield parameters were recorded at the time of harvest. According to the treatments, three irrigations were applied in baby corn at 6-leaf stage, knee high stage and pre-tasseling stage that differs according to the given treatments. The total rainfall during the crop growth period was 19.4 mm (feb-may). The profile soil moisture from the soil sample was determined by collecting the soil sample from central row of each plot from successive depths, 0-15, 15-30 and 30-60 cm before sowing, before two days of irrigation and after 2 or 3 days of irrigation.

The mean data was utilized to calculate economics based on the current market price of the product and inputs used in the experiment. Standard techniques were used to statistically analyze the data and interpret the results.

### 3. RESULTS AND DISCUSSION

#### 3.1 Growth and Yield Attributes

Different irrigation treatments significantly enhanced the growth parameters and yield attributes of baby corn (Table 1). Higher plant height (175.72 cm) was recorded with three irrigation – 6-leaf, knee high and pre-tasseling stage which was statistically at par with two irrigation – 6- leaf and knee high stage (174.99

cm) and two irrigation – knee high and pre-tasseling stage (173.70 cm). Other growth parameters such as LAI and dry matter accumulation (6.80 and 17.28 g plant<sup>-1</sup> respectively) were significantly higher in irrigation treatment three irrigation – 6-leaf, knee high and pre-tasseling stage. Maintaining the adequate moisture level required by the crop resulted in higher growth parameters in three irrigation – 6 leaf, knee high and pre-tasseling stage. This might be due to rapid meristematic cell division and elongation because water helps in dissolving nutrients in soil. Higher dry matter accumulation can be due to the effect of optimum soil moisture in maintaining the cell turgidity and cell elongation, thus attaining more leaf area and hence, dry matter accumulation. Shirazi et al. [5] reported higher growth parameters in optimum moisture supply.

"Similarly, the significantly higher number of cob plant<sup>-1</sup> (2.16), cob weight (6.25 g), cob length (6.36 cm) and cob girth (1.25 cm) were recorded with three irrigation – 6 leaf, knee high and pre-tasseling stage. More vigorous vegetative growth, which favoured a better partitioning of assimilates from source to sink". Bharathi et al. [6].

The different spacing treatments had significantly influenced both growth and yield attributes of baby corn (Table 1). Baby corn raised at 45 × 15 cm exhibited significantly higher plant height (177.75 cm), higher LAI (6.39) and maximum dry matter accumulation (17.05 g plant<sup>-1</sup>). This might be due that more severe competition for light and higher intra and inter-row competition for nutrients and water might be responsible for increasing the plant height. Similar result was reported by Kunjir et al. [7] and Gaikwad et al. [8] and Zarapkar [9] also found that plant height was significantly higher under the closer spacing than wider spacing. Increase in plant height and dry matter production in high plant density resulted in increase in LAI per plant. Similar findings were recorded by Meena et al. [10] and Chamroy et al. [11].

In spacing treatments, 60 × 20 cm produced significantly higher baby cob weight (8.11 g), cob length (12.56 cm) and cob girth (1.33 cm) which was statistically at par with 60 × 15 cm spacing treatment. This might because of better growth of plants in optimum spacing, which results in better utilization of accumulated photosynthates that contributed in the growth and development of yield attributes. These findings were corroborated with Meena et al. [10].

**Table 1. Effect of different spacing and irrigation regimes on growth and yield attributes of spring's baby corn**

Treatments	Baby corn cob						
	Plant height at harvest (cm)	LAI	Dry matter accumulation (g plant <sup>-1</sup> )	No. of cobs/ plant/ha	Cob weight (g)	Cob length (cm)	Cob girth (cm)
<b>Irrigation Regimes</b>							
One irrigation (6 leaf stage)	168.90	5.45	15.37	2.07	7.46	10.64	1.26
Two irrigation (6 leaf stage and knee high stage)	173.70	5.73	16.67	2.13	7.53	11.52	1.29
Two irrigation (knee high stage and pre-tasseling stage)	174.99	6.13	17.07	2.15	7.95	12.41	1.31
Three irrigation (6 leaf stage, knee high stage and pre-tasseling stage)	175.72	6.80	17.28	2.20	8.35	13.29	1.32
<b>S.Em. ±</b>	<b>1.40</b>	<b>0.05</b>	<b>0.16</b>	<b>0.02</b>	<b>0.28</b>	<b>0.15</b>	<b>0.006</b>
<b>C.D (p=0.05)</b>	<b>4.92</b>	<b>0.21</b>	<b>0.48</b>	<b>0.07</b>	<b>0.83</b>	<b>0.46</b>	<b>0.02</b>
<b>Spacing</b>							
60 × 20 cm	169.68	6.03	16.29	2.02	8.11	12.56	1.33
60 × 15 cm	172.45	6.18	16.31	2.04	7.90	12.10	1.29
45 × 20 cm	172.80	6.20	16.60	2.16	7.70	11.72	1.28
45 × 15 cm	177.75	6.39	17.05	2.31	7.58	11.47	1.26
<b>S.Em. ±</b>	<b>1.32</b>	<b>0.06</b>	<b>0.12</b>	<b>0.03</b>	<b>0.33</b>	<b>0.13</b>	<b>0.010</b>
<b>C.D (p=0.05)</b>	<b>3.90</b>	<b>0.18</b>	<b>0.35</b>	<b>0.09</b>	<b>0.67</b>	<b>0.48</b>	<b>0.03</b>

**Table 2. Effect of different irrigation regimes and spacing on total yield (q/ha) and economics of baby corn**

Treatments	Husked baby corn yield (q/ha)	Dehusked baby corn yield (q/ha)	Fodder yield (q/ha)	Cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	B:C
<b>Irrigation regimes</b>							
One irrigation (6 leaf stage)	51.66	14.06	241.46	51,819	1,14,544	62,725	2.21
Two irrigation (6 leaf stage and knee high stage)	52.48	14.23	243.64	54,739	1,15,851	61,112	2.11
Two irrigation (knee high stage and pre-tasseling stage)	53.90	14.57	249.98	54,739	1,18,608	63,869	2.16
Three irrigation (6 leaf stage, knee high stage and pre-tasseling stage)	55.27	14.96	254.55	57,659	1,21,529	63,870	2.10
<b>S.Em. ±</b>	<b>0.42</b>	<b>0.12</b>	<b>1.92</b>	-	-	-	-
<b>C.D (p=0.05)</b>	<b>1.25</b>	<b>0.29</b>	<b>5.65</b>	-	-	-	-
<b>Spacing</b>							
60 × 20 cm	50.84	13.77	235.67	53,492	1,12,049	58,557	2.09
60 × 15 cm	51.35	13.91	242.16	54,710	1,13,715	59,005	2.07
45 × 20 cm	53.98	14.64	249.57	54,710	1,18,882	64,172	2.17
45 × 15 cm	57.13	15.50	262.67	56,042	1,25,884	69,842	2.24
<b>S.Em. ±</b>	<b>0.51</b>	<b>0.11</b>	<b>2.68</b>	-	-	-	-
<b>C.D (p=0.05)</b>	<b>1.81</b>	<b>0.41</b>	<b>9.24</b>	-	-	-	-

### 3.2 Yield

Cob yield was significantly influenced by different irrigation treatments (Table 2). Significantly higher baby corn yield i.e. husked and dehusked cob and fodder yield (55.27 q ha<sup>-1</sup>, 14.96 q ha<sup>-1</sup> and 254.55 q ha<sup>-1</sup>) was recorded in three irrigation – 6 leaf, knee high and pre-tasseling. The increase in baby corn yield was mainly because of sufficient moisture availability and augmented nutrients uptake all the way through the crop growth stages, having positive effect on yield. Similar findings was reported by Shivakumar et al. [12]. The increase in fodder yield might be due to better vegetative growth and higher dry matter production. Similar findings was confirmed with Shweta et al., [13].

Spacing of 45 × 15 cm (1,42,857 plants/ha) recorded highest baby corn yield with and without husk (57.13 q/ha, 14.96 q/ha) and highest fodder yield (262.67 q/ha). “This might be due to regular supply of all nutrients at progressive growth stage of crop allowed satisfactory metabolic process in plant”. Shweta et al., [14]. Higher fodder yield at 45 × 15 cm treatment might be due to closer spacing due to more number of plants per unit area and also contributing growth parameters i.e. plant height, dry matter accumulation and leaf area index [15,16].

### 3.3 Economics

The data revealed that three irrigation - 6 leaf, knee high and pre-tasseling stage treatment recorded highest gross returns in (₹ 1,21,529/ha) followed by two irrigation - 6 leaf and knee high stage (₹ 1,18,608 /ha) (Table 2). Whereas, three irrigation - 6 leaf, knee high and pre-tasseling stage treatment recorded highest net returns in (₹ 63,870/ha) and one irrigation - 6 leaf stage treatment recorded highest BC ratio (2.21).

Among spacing treatments, highest gross returns (₹ 1,25,884/ha), net returns (₹ 69,842/ha) and BC ratio (2.24) was observed in 45 × 15 cm, whereas lowest values were obtained from 60 × 20 cm.

## 4. CONCLUSION

In different irrigation regimes, better growth and yield was produced significantly higher in three irrigation – 6 leaf, knee high and pre-tasseling stage. Highest value of gross returns and net returns was obtained in three irrigation - 6 leaf, knee high and pre-tasseling stage The highest

BC ratio was recorded in one irrigation - 6 leaf stage being at par with two irrigation – knee high and pre-tasseling stage. In different spacing treatments, 45 × 15 cm produced significantly higher growth attributes and yield. Similarly, highest gross returns, net returns and BC ratio was obtained in 45 × 15 cm. It can be concluded from the results that three irrigation – 6 leaf, knee high and pre-tasseling stage along with 45 × 15 cm spacing is found beneficial to improve cob yield and economic returns of spring's baby corn in Hisar district of Haryana.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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