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Evaluation of different spacing and Irrigation Regimes on Nutrient uptake of spring's Baby Corn

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ABSTRACT: A field experiment was conducted at CCS HAU, Hisar in Spring season of 2019 to investigate the effect of different spacing and irrigation regimes on nutrient uptake 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. Baby corn cob contain (1.73N%, 0.28P%, 0.54K%) and total nutrient uptake in cob was (26.80N, 5.31P and 8.36K kg/ha, respectively) in three irrigation – 6 leaf, knee high and pre-tasselling stage significantly higher over other treatments. In case of spacing treatments, 45 × 15 cm spacing baby corn cob contain (1.69N%, 0.28P%, 0.53K%) significantly higher over other treatments. Three irrigation - 6 leaf, knee high and pre-tasseling stage gave significantly higher protein content (11.05 %) and 45 × 15 cm spacing recorded highest protein content (10.73 %) over all other treatments. This crop has a great scope in agriculture and farmer's field, more focus on the production and marketing of this crop is needed.

Keywords: Baby corn, spacing, irrigation, nutrient, nitrogen.

INTRODUCTION

Baby corn is a young maize cob harvested within 2-3 days of silk emergence. A dehusked ear of corn called "baby corn" is plucked before pollination, two to three days following the appearance of silk. Due to its several applications as a vegetable for human nutrition, premium green fodder for animal feed, and a raw material for the canning and pickling industries, it is suitable for crop rotations (Bazrgar *et al.,* 2023). 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 (Anu, 2020). 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 (Neelam and Rinjumoni Dutta 2018). 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 (Aravinth *et al.,* 2011).

Crop productivity could be affected by seed quality, water table, seed health, insect, pest and disease and weather (Shweta *et al.,* 2022a). High crop production can only be achieved with optimum input used. The vertical practice viz. irrigation scheduling, use of mulch, anti transpirants etc. can improve moisture availability for long duration. Water scarcity for growing crops is most important natural resource issue. In Indian condition, the ground water goes down day by day, so become necessary irrigation to crops to get high crop production. Mazloom *et al.* (2020) reported a drop of upto 40% in maize yield owing to world wide water scarcity, also supported by Shweta *et al.* (2022c).

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 and spacing regimes on the nutrient uptake of baby corn.

MATERIALS AND METHODS

A study was carried out using split plot design in three replication 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 during spring season, 2019. The soil of the experimental field was in the upper 30 cm layer.

The field experiment was laid out in split-plot design with three replication. 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^{-1} 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.

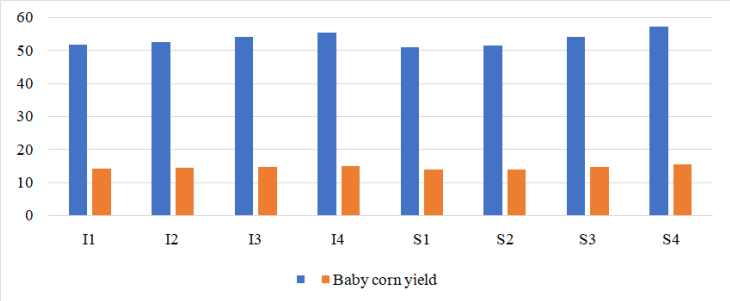
Baby corn variety 'Hybrid baby corn (G-5414)' was sown on 25th February, 2019. Plant-protection measures were implemented as per package practices and need. The harvesting of baby corn was started from 1st week of May onwards by four pickings in 5-6 days interval.

For determining cob nutrient status, the samples of baby corn were collected at harvest and firstly sun-dried and then dried in a hot air oven at 70 °C ± 5 for 48 hours. The samples grounded, passed through 40 mm sieve, and then used for determination of NPK content in baby corn cob samples as per following methods of analysis were adopted. Nitrogen content in cob sample was estimated by method described by Lindner (1944). The tri-acid digested plant samples were analyzed for phosphorus content by vanado – molybdo phosphoric acid yellow colour method (Jackson, 1973). Potassium content of the extract of tri-acid digested material was determined using ELICO flame photometer. The nitrogen, phosphorus and potassium uptake was calculated by multiplying the content of NPK respectively, with the respective yield and expressed in kg/ha. The nutrient uptake in fodder was calculated by multiplying the content of NPK respectively with respective dry matter yield and expressed in kg/ha. Standard techniques were used to statistically analyze the data and interpret the results.

RESULTS

Effect on baby corn yield. Cob yield was significantly influenced by different irrigation treatments (Fig. 1). Significantly higher baby corn yield i.e. husked and dehusked cob (55.27 q ha^{-1} and 14.96 q ha^{-1}) 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 Shweta *et al*. (2022b).

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). This might be due to regular supply of all nutrients at progressive growth stage of crop allowed satisfactory metabolic process in plant. Similar findings were also reported by Shweta *et al.* (2022b).



I1: one irrigation - 6 leaf stage, **I2**: two irrigation - 6 leaf and knee high stage, **I3**: two irrigation - knee high and pre-tasselling stage **I4**: three irrigation - 6 leaf, knee high and pre-tasselling stage, **S1**: 60 × 20 cm, **S2**: 60 × 15 cm, **S3**: 45 × 20 cm, **S4**: 45 × 15 cm.

Fig. 1. Effect of different spacing and irrigation regimes on husked and dehusked cob yield of baby corn.

Nutrient content in cob. Results revealed that crop grown (Table 1) under three irrigation - 6 leaf, knee high and pre-tasselling stage recorded significantly highest nitrogen, phosphorus and potassium content in cob (1.73, 0.28, 0.54%, respectively) over other treatments. One irrigation – 6 leaf stage showed lowest nitrogen, phosphorus and potassium content in cob (1.60, 0.25, 0.49%, respectively). It might be due to the competence of available water which had synergistic effect on uptake of nutrients by plants and maintenance of favourable soil moisture, resulting in increased availability of nutrients, which ultimately leading to increased uptake of all these nutrients by the crop. These findings were in agreement with Singh *et al.* (2012); Dutta *et al.* (2015).

In spacing treatments, highest nitrogen, phosphorus and potassium content in cob (1.69, 0.28, 0.53%, respectively) was found in 45 × 15 cm than other treatments. A noticeable improvement in nutrient concentration in crop seems to be due to their greater availability in soil environment and enhanced translocation in plant system, thus ultimately uptake of nitrogen increased. Similar findings were reported Singh *et al.* (2012); Golada *et al.* (2013).

Table 1: Effect of different spacing and irrigation regimes on nutrient content (nitrogen, phosphorus and potassium) in cob.

Treatments	Nitrogen content in cob (%)	Phosphorus content in cob (%)	Potassium content in cob (%)
One irrigation (6 leaf stage)	1.60	0.25	0.49
Two irrigation (6 leaf stage and knee high stage)	1.61	0.25	0.50
Two irrigation (knee high stage and pre-tasseling stage)	1.66	0.27	0.52
Three irrigation (6 leaf stage, knee high stage and pre-tasseling stage)	1.73	0.28	0.54
S.Em. ±	0.01	0.003	0.004
C.D (p=0.05)	**0.05**	**0.009**	**0.01**
Spacing			
60 × 20 cm	1.61	0.26	0.50
60 × 15 cm	1.63	0.26	0.51
45 × 20 cm	1.67	0.27	0.52
45 × 15 cm	1.69	0.28	0.53
S.Em. ±	0.01	0.002	0.004
C.D (p=0.05)	**0.03**	**0.006**	**0.01**

Nutrient uptake in cob. Results revealed that the crop grown (Table 2) under three irrigation - 6 leaf, knee high and pre-tasselling stage recorded significantly higher nitrogen, phosphorus and potassium uptake by cob (26.80, 5.31 and 8.36 kg/ha, respectively) over other treatments. Increase in total NPK uptake observed was due to increased moisture level which might have increase nitrate reductase activity, nitrification and P diffusion through the soil to root surface (Pushpa *et al.*, 2007). Similar results were corroborated by Shruthi *et al*. (2018).

In spacing treatments, highest nitrogen, phosphorus and potassium uptake in cob (25.04, 6.20 7.79 kg/ha, respectively) was found in 45 × 15 cm than other treatments. More nutrient uptake by plant with optimum row spacing was due to better root growth ultimately producing higher growth and yield attributes noted by Dutta *et al.* (2015).

Table 2: Effect of different spacing and irrigation regimes on phosphorus content and uptake in cob and fodder of baby corn.

Treatments	Nitrogen uptake in cob (kg/ha)	Phosphorus uptake in cob (kg/ha)	Potassium uptake in cob (kg/ha)
One irrigation (6 leaf stage)	22.27	4.60	6.88
Two irrigation (6 leaf stage and knee high stage)	22.28	4.65	6.92
Two irrigation (knee high stage and pre-tasseling stage)	24.50	5.25	7.66
Three irrigation (6 leaf stage, knee high stage and pre-tasseling stage)	26.80	5.31	8.36
S.Em. ±	0.41	0.14	0.12
C.D (p=0.05)	**1.45**	**0.50**	**0.42**
Spacing			
60 × 20 cm	22.61	3.99	7.03
60 × 15 cm	24.00	4.72	7.45
45 × 20 cm	24.15	4.89	7.55
45 × 15 cm	25.04	6.20	7.79
S.Em. ±	0.23	0.08	0.06
C.D (p=0.05)	**0.68**	**0.25**	**0.19**

Total nutrient uptake. Results revealed that the crop grown (Table 2) under three irrigation - 6 leaf, knee high and pre-tasselling stage recorded significantly highest total nutrient uptake (61.02, 11.25 and 50.86 kg/ha, respectively) over other treatments. In spacing treatments, highest nitrogen, phosphorus and potassium uptake in cob (63.11, 11.76, 58.27 kg/ha, respectively) was found in 45 × 15 cm than other treatments.

Protein content in cob. Results revealed that (Table 3) protein content of cob was found significant due to irrigation regimes. Three irrigation - 6 leaf, knee high and pre-tasseling stage gave significantly higher protein content (11.05 %) than that of all other treatments.

Variation due to spacing were significant in spacing treatment. Higher protein content (10.73 %) of cob was recorded in 45 × 15 cm than that of other spacing. Interaction between irrigation regimes and spacing with respect to protein content in cob was non-significant.

Table 3: Effect of different spacing and irrigation regimes on total nutrient uptake of baby corn.

Treatments	Total nitrogen uptake (kg/ha)	Total phosphorus uptake (kg/ha)	Total potassium uptake (kg/ha)	Protein content in cob (%)
One irrigation (6 leaf stage)	52.99	9.53	6.88	9.90
Two irrigation (6 leaf stage and knee high stage)	53.21	9.61	6.92	9.31
Two irrigation (knee high stage and pre-tasseling stage)	58.66	10.72	7.66	10.52
Three irrigation (6 leaf stage, knee high stage and pre-tasseling stage)	61.02	11.25	8.36	11.05
S.Em. ±	0.94	0.15	0.12	0.10
C.D (p=0.05)	**3.33**	**0.53**	**0.42**	0.35
Spacing				
60 × 20 cm	48.45	9.02	7.03	10.03
60 × 15 cm	55.16	10.05	7.45	10.19
45 × 20 cm	56.15	10.26	7.55	10.46
45 × 15 cm	63.11	11.76	7.79	10.73
S.Em. ±	0.64	0.10	0.06	0.08
C.D (p=0.05)	**1.89**	**0.30**	**0.19**	0.24

CONCLUSIONS

According to the findings of the study, three irrigation at 6 leaf, knee-high and pre-tasseling stage significantly increased nutrient uptake in plants as compared to other treatments. Additionally, 45 × 15 cm spacing treatment having a significant impact on crop yields, protein content and nutrient uptake when compared to other spacing treatments.

FUTURE SCOPE

Availability of water at critical stages play an important role in improving the yield and in preventing losses. Optimum spacing treatments, reduces weed growth, plant to plant competition for sunlight, water and other resources for its growth. So, optimum spacing and water availability plays critical role in crop growth.

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Conflict of Interest. None.

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