Original Research Article

Effect of Potassium and Spacing on yield and Economics of Baby corn (*Zea mays* L.)

ABSTRACT

The Crop Research Farm of the Department of Agronomy, SHUATS at Prayagraj (Uttar Pradesh) was the experimental area for the present study. The present study was about a field experiment performed during *Zaid* 2021. The texture of the experimental area's soil was sandy loam. It is neutral in reaction and have lower content of organic carbon (0.72%). Moreover, rich in available N (278.48 kg/ha), available P (27.80 kg/ha) and available K (233.24 kg/ha). The experiment was designed using Randomized Block Design having nine treatments, replicated thrice for a time of one year experimentation. The treatments which are T_1: 30 kg/ha K_2O + 30cm x 15 cm, T_2: 30 kg/ha K_2O + 40cm x 15 cm, T_3: 30 kg/ha K_2O + 50cm x 15 cm, T_4: 40 kg/ha K_2O + 30cm x 15 cm, T_5: 40 kg/ha K_2O + 40cm x 15 cm, T_6: 40 kg/ha K_2O + 50cm x 15 cm, T_7: 50 kg/ha K_2O + 30cm x 15 cm, T_8: 50 kg/ha K_2O + 40cm x 15 cm, T_9: 50 kg/ha K_2O + 50cm x 15 cm used. The results revealed the application of 50 kg/ha K_2O + 50cm x 15 cm reported maximum number of plants (2.74), larger plant height (16.28 cm), utmost cob weight with husk (43.14 g), and cob weight without husk (16.91 g). However, applying 50 kg/ha K_2O + 30cm x 15 cm resulted in higher cob yield with husk (6.52 t/ha), cob yield without husk (3.85 t/ha) and green fodder yield (34.63 t/ha). Moreover, it also gives maximum gross profit(Rs. 1,54,000.00 /ha), net returns (Rs. 1,01,421.10 /ha) and benefit cost ratio (1.92).

Key words: *Economics, Potassium, Spacing, yield, Baby corn.*

INTRODUCTION

Maize is extensively farmed as a rainfed crop in India during the kharif season, but it may also be grown successfully under irrigation throughout the Rabi and summer seasons. More than 85% of maize produced in India is used for human consumption. Maize is one of the most adaptable crops, able to grow in a variety of soils and climates. Maize is renowned as the "Queen of Cereals" because it has the largest genetic yield potential of all cereals because to its superior dry matter accumulation efficiency in a unit area and time, especially up to 300 North and 300 South latitude. It is grown on an area of around 184 million hectares in 160 countries, in a variety of soil types, climates, and management approaches with a greater plant biodiversity, accounting for roughly 36% of world food grain production. The United States, China, Brazil, Argentina, Mexico, South Africa, Yugoslavia, and India are the top maize producers (Anonymous 2018).

Baby Corn is a dehusked maize ear picked when the silk has not yet emerged or has just emerged and no fertilisation has occurred, or a shank with unpollinated silk. In the market, baby corn ears in a light yellow colour with a regular row arrangement, 10-12cm long and a diameter of 1.0-1.5cm are chosen. Thailand, Taiwan, Sri Lanka, and Myanmar are among the countries that grow baby corn. Guatemala, Zambia, Zimbabwe, and South Africa are also some of the examples. Some of the Indian states include the list of Maharashtra, Karnataka, Andhra Pradesh, Rajasthan and Meghalaya. It is farmed on 8.49 million hectares in India, with yields and productivity of 21.28 million t and 2507 kg/ha, respectively. Baby corn is a successful crop that enables production diversification, value accumulation, and revenue growth **(Pandey *et al.* 2002).**

Maize can be used to make food, feed, fuel, and fodder. It also acts as a basic raw material for a variety of industrial goods, such as starch, oil, alcoholic beverages, food sweeteners, cosmetics, and bio-fuel. It is useful in various life amenities such as 25% in food, 12% in animal feed, 49% in poultry feed, 12% in starch, and 1% in brewery and seed (Daas et al., 2008). Furthermore, maize is nutritionally rich and substantial source of starch (72%). It also contains 10% of protein, 8.5% of fibre, 4.8% of oil, 3% of sugar, 1.7% of ash and notable amount of vitamin A, Vitamin E and nicotinic acid.

Potassium is a key nutrient for crop yield and quality. It is a critical component for plant growth. It is required in greater quantities than phosphorus within live plant tissue, and the average percentage of K is around 8 to 10 times that of phosphorous. It was also discovered that hay or dry matter had up to four times the potassium content of phosphorus. During the vegetative growth cycle, it accumulates in large amounts. Potassium is required for the preservation of potential gradients across cell membranes as well as the formation of turgor pressure in plants. It helps in the regulation of many necessary processes like photosynthesis, protein synthesis and starch synthesis **(Mengel and Kirkby, 1996)**. It maintains the ionic balance and provide resistance against insects, diseases, cold weather and drought.

The most significant component in achieving a better cob yield is maintaining stand density. The form and size of plant-1's leaf area are governed by the plant's spatial organisation, which determines efficient radiant energy absorption, as well as the proliferation and growth of shoots and their activity. Only when the population of plants allow each plant to reach its full natural potential, maximum production can be expected **(Aravinth et al., 2011)**. One of the most significant criteria for increased productivity is optimal plant population. There is efficient use of subsurface resources as well as maximal solar radiation harvesting, which leads to improved photosynthesis **(Monneveux *et al*. 2005)**. All crop species have an optimum plant population for best economic output, which varies depending on cultivar and environment. **(Bruns and Abbas, 2005)**. Plant density improves yield up to a maximum for a corn genotype cultivated under a set of certain environmental and management circumstances, then drops as plant density is increased further. (**Gozobenli *et al*. 2004)**.

MATERIALS AND METHODS

The Crop Research Farm of the Department of Agronomy, SHUATS at Prayagraj (Uttar Pradesh) was the experimental area for the present study during *Zaid* 2021. The research centre is located at 25.28^{o}N latitude, 81.54^{o}E longitude and 98 m altitude above the mean sea level. The experiment was designed using Randomized Block Design having nine treatments, replicated thrice with T_1: 30 kg/ha K_2O + 30cm x 15 cm, T_2: 30 kg/ha K_2O + 40cm x 15 cm, T_3: 30 kg/ha K_2O + 50cm x 15 cm, T_4: 40 kg/ha K_2O + 30cm x 15 cm, T_5: 40 kg/ha K_2O + 40cm x 15 cm, T_6: 40 kg/ha K_2O + 50cm x 15 cm, T_7: 50 kg/ha K_2O + 30cm x 15 cm, T_8: 50 kg/ha K_2O + 40cm x 15 cm, T_9: 50 kg/ha K_2O + 50cm x 15 cm.

The geography of the experimental site was uniform. The texture of the experimental area's soil was sandy loam. It is neutral in reaction and have lower content of organic carbon (0.38%). Moreover, rich in available N (225 kg/ha^{-1}), available P (19.50 kg/ha^{-1}) and available K (213.7 kg/ha^{-1}). Urea, DAP, and MOP were used as nutrient sources to meet the nitrogen, phosphorous, and potassium requirements. At the time of sowing, the fertilisers were applied as a basal application.Attributes like cobs/plant, cob length/plant (cm), cob weight (g) with husk and without husk, cob yield (t/ha) and green fodder yield (t/ha) were documented and statistically analyzed using analysis of variance (ANOVA) (Gomez K.A. and Gomez A.A. 1984). Cost of cultivation, net returns, gross returns, and B: C ratio was also determined for the economics part.

RESULTS AND DISCUSSION

Yield attrubutes and Yield

No. of Cobs/Plant

Significantly higher quantity of cobs/plant (2.74) was documented with the treatment 50 kg/ha K_2O + 50cm x 15 cm over all the treatments. However, the treatments 50 kg/ha K_2O + 40cm x 15 cm (2.67) and 40 kg/ha K_2O + 50cm x 15 cm (2.63) which were established statistically at par with 50 kg/ha K_2O + 50cm x 15 cm. Potassium supplementation promotes the production of robust cell walls and boosts pollen germination in the florets, resulting in increased fertility and cob formation. The results were in accordance with **Kalpana and Anbumani (2003)**.

Length of Cob/plant (cm)

Significantly highest length of cob/plant (16.28 cm) was documented with the with the treatment of application of 50 kg/ha K_2O + 50cm x 15 cm over all the treatments. However, the treatments 50 kg/ha K_2O + 40cm x 15 cm (15.70 cm) and 40 kg/ha K_2O + 50cm x 15 cm (15.53 cm) which were established statistically at par with 50 kg/ha K_2O + 50cm x 15 cm. Potassium could be linked to improved grain filling and, as a result, a rise in several yield-related characteristics. Similar results were observed by **Singh *et al.* (2010).**

Cob weight (g)

a) **With husk**

Over all treatments, the treatment application of 50 kg/ha K2O + 50cm x 15 cm resulted in the highest cob weight with husk (43.14 g). Treatments with (42.94 g) in 50 kg/ha K2O + 40cm x 15 cm and (42.39 g) in 40 kg/ha K2O + 50cm x 15 cm, on the other hand, were shown to be statistically equivalent to and 50 kg/ha K2O + 50cm x 15 cm.

b) **Without husk**

Over all treatments, the treatment application of 50 kg/ha K2O + 50cm x 15 cm resulted in the highest cob weight without husk (16.91 g). The treatments with (16.61 g) in 50 kg/ha K2O + 40cm x 15 cm and (16.06 g) in 40 kg/ha K2O + 50cm x 15 cm, on the other hand, were statistically equivalent to and 50 kg/ha K2O + 50cm x 15 cm.

Cob yield (t/ha)

a) **With husk**

Significantly maximum cob yield with husk (6.52 t/ha) was documented with the treatment administration of 50 kg/ha K_2O + 30cm x 15 cm over all the treatments. The treatments with (6.47 t/ha) in 50 kg/ha K2O + 40cm x 15 cm and (6.36 t/ha) in 40 kg/ha K2O + 30cm x 15 cm, on the other hand, were statistically equivalent to and 50 kg/ha K2O + 30cm x 15 cm.**Without husk**

Over all treatments, the treatment application of 50 kg/ha K2O + 30cm x 15 cm resulted in the highest cob yield without husk (3.85 t/ha). The treatment with (3.77 t/ha) in 50 kg/ha K2O + 40cm x 15 cm and (3.68 t/ha) in 40 kg/ha K2O + 30cm x 15 cm, on the other hand, was shown to be statistically equivalent to 50 kg/ha K2O + 30cm x 15 cm.

Potassium administration increases the cumulative effect of enhanced K nutritional availability, absorption, and translocation as well as improved yield parameters such as number of cobs per plant, cob length and thickness, and cob weight. **Mastoi *et al.* (2013)**. Increased cob yield may be related to less than 30cm x 15cm intra row spacing, as less intra row spacing than other treatments enhances competition for solar radiation. Even though the yield contributing variables were high when compared to the required spacing, the productivity was poor because fewer intra row plants reached reproductive phase. The findings were similar to the study of **Sarker *et al.* (2020).**

Green fodder yield (t/ha)

Over all treatments, the treatment application of 50 kg/ha K2O + 30cm x 15 cm resulted in significantly greater green fodder production (34.63 t/ha). However, the treatments with (33.47 t/ha) in 50 kg/ha K_2O + 40cm x 15 cm and (32.30 t/ha) in 40 kg/ha K_2O + 30cm x 15 cm which were established statistically equivalent to 50 kg/ha K_2O + 30cm x 15 cm.

Potassium supplementation promotes the production of strong cell walls, resulting in stiffer straw and maybe more tillering. Similar results were reported by **Patil and Basavaraja (2017).** Lower spacing resulted in increased plant population, which resulted in increased green fodder yield. Similar results were reported by **Hargilas (2015).**

Table1. Effect of Potassium and Spacing on Yield attributes and Yield of Baby corn.

Treatments	No. of cobs/plant	Length of cob/plant (cm)	Cob weight (g)		Cob Yield(t/ha)		Green fodder Yield (t/ha)
			With husk	Without husk	With husk	Without husk	
1. 30 kg/ha K_2O + 30cm x 15 cm	2.21	12.81	39.31	13.21	6.26	3.43	29.67
2. 30 kg/ha K_2O + 40cm x 15 cm	2.32	13.24	40.08	13.92	5.96	3.11	26.27
3. 30 kg/ha K_2O + 50cm x 15 cm	2.50	14.12	41.18	14.74	5.85	2.95	25.80
4. 40 kg/ha K_2O + 30cm x 15 cm	2.41	13.63	40.38	14.26	6.36	3.68	32.30
5. 40 kg/ha K_2O + 40cm x 15 cm	2.58	14.95	41.90	15.48	6.32	3.48	30.93
6. 40 kg/ha K_2O + 50cm x 15 cm	2.63	15.53	42.39	16.06	6.07	3.23	27.53
7. 50 kg/ha K_2O + 30cm x 15 cm	2.54	14.43	41.39	15.04	6.52	3.85	34.63
8. 50 kg/ha K_2O + 40cm x 15 cm	2.67	15.70	42.94	16.61	6.47	3.77	33.47
9. 50 kg/ha K_2O + 50cm x 15 cm	2.74	16.28	43.14	16.91	6.23	3.31	28.63
S. EM (±)	0.04	0.30	0.27	0.29	0.05	0.06	0.47
CD (P = 0.05)	0.12	0.91	0.82	0.88	0.16	0.18	1.41

Economics

Gross returns (INR/ha)

Data in Table 2 revealed that Higher Gross returns have been recorded with the treatment 50 kg/ha K_2O + 30cm x 15 cm (Rs. 154000/ha) over rest of the treatments followed by 50 kg/ha K_2O + 40cm x 15 cm (Rs.150800/ha) whereas minimum gross return was recorded with 30 kg/ha K_2O + 50cm x 15 cm (Rs.118000/ha).

Net returns (INR/ha)

Data in Table 2 Higher Net returns have been recorded with the treatment 50 kg/ha K_2O + 30cm x 15 cm (Rs.101421.10/ha) over rest of the treatments followed by 50 kg/ha K_2O + 40cm x 15 cm (Rs.96061.10/ha) whereas minimum Net returns was recorded with 30 kg/ha K_2O + 50cm x 15 cm (Rs. 62321.10/ha).

Benefit Cost ratio (B: C)

Data in Table 2 revealed that Higher Benefit cost ratio have been recorded with the treatment 50 kg/ha K_2O + 30cm x 15 cm (1.92) over rest of the treatments followed by 40 kg/ha K_2O + 30cm x 15 cm (1.81) but with 30 kg/ha K2O + 50cm x 15 cm, the benefit cost ratio was lower (1.11).

Table 2: Effect of Potassium and Spacing on Economics of Baby corn.

Treatments	Cost of cultivation	Gross returns	Net returns	B:C Ratio
1. 30 kg/ha K_2O + 30cm x 15 cm	51448.90	137200	85751.10	1.66
2. 30 kg/ha K_2O + 40cm x 15 cm	54238.90	124400	70161.10	1.29
3. 30 kg/ha K_2O + 50cm x 15 cm	55678.90	118000	62321.10	1.11
4. 40 kg/ha K_2O + 30cm x 15 cm	52328.90	147200	94871.10	1.81
5. 40 kg/ha K_2O + 40cm x 15 cm	54488.90	139200	84711.10	1.55
6. 40 kg/ha K_2O + 50cm x 15 cm	55928.90	129200	73271.10	1.31
7. 50 kg/ha K_2O + 30cm x 15 cm	52578.90	154000	101421.10	1.92
8. 50 kg/ha K_2O + 40cm x 15 cm	54738.90	150800	96061.10	1.75
9. 50 kg/ha K_2O + 50cm x 15 cm	56178.90	132400	76221.10	1.35

CONCLUSION

When compared to alternative treatments, the application of treatment 30 cm x 15 cm + SHEKHAR 2 resulted in considerably greater Seed yield (1062.86 kg/ha), gross returns (Rs. 63771.6/ha), net returns (Rs. 39866.95/ha), and benefit cost ratio (1.66). Since the conclusions are based on a single season of research.

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