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Research Communication

Plant population and nutrient requirement for baby corn hybrids (*Zea mays*)

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ABSTRACT

A field experiment conducted at the Indian Agricultural Research Institute, New Delhi shows that 'HM 4' was a better baby corn hybrid (*Zea mays* L.) than 'PEHM 2' as it had early cob initiation, produced more and heavier cobs and recorded higher cob yield. Of the two plant population tested, a plant population of 83,333 was better than 66,666 plants/ha in terms of cob yield and other characters studied. The two hybrids did not differ in terms of N, P, K concentration in cobs or fodder. Increasing the application of N, P, K increased cob yield, fodder yield and gave a high value for most characters studied. The highest N, P, K concentration in cobs and fodder was recorded with an application of 187.5 kg N, 32.75 kg P and 62.5 kg K per hectare.

Key words : Baby corn, Nutrient management, Plant population

Maize, the third most important cereal crop of India as well as the world, has diversified uses as food for human, feed for livestock and raw material in industries. Among the different kinds of maize, baby corn is a speciality corn and provides a viable option for crop diversification and enhancing profitability particularly in peri-urban areas. It can easily fit in an intensive cropping system due to its short duration (Dass *et al.*, 2008). Though the baby corn is quite popular worldwide, systematic development of agro-techniques particularly selection of variety, plant population and nutrient requirement to achieve higher production in India is the need of the day.

A field experiment was therefore conducted during *kharif* season of 2010 at the Indian Agricultural Research Institute, New Delhi, on a sandy loam soil having low OC, available N (alkaline permanganate oxidizable) and medium in available P (Olsens) and K (1N ammonium acetate exchangeable) and pH 7.6 determined as per the procedure described by Prasad *et al*. (2006). The experiment was conducted in split plot design with four combinations of hybrids ('HM 4' and 'PEHM 2') and plant population (66,666 and 83,333 plants/ha) in main plots and four nutrient levels (control, $N_{112.5}$ $P_{19.6}$ $K_{37.5}$; N_{150} $P_{26.2}$ K_{50} and $N_{187.5}$ $P_{32.75}$ $K_{62.5}$ kg/ha) in sub plots and replicated thrice. The crop was planted on 5 July, 2010 on the ridges made at 60 cm apart and was harvested between 25th August and 2nd September, 2010. The plant populations of 66,666 and 83,333 plants/ha as per treatments were maintained one week after sowing by keeping the intra-row spacing of 25 and 20 cm, respectively. Half the dose of nitrogen, full amount of phosphorus and potassium as per treatment was applied as basal and remaining nitrogen applied in two equal splits at knee high and pre-tasseling stage. Beside this crop received zinc sulphate at 25 kg/ha. The total rainfall of 569 mm was received during the crop period. To avoid the pollination, detasseling was done immediately after the tassel initiation. Growth parameters *viz*. leaf area index, dry matter accumulation were measured from three randomly sampled plants. The baby corn ears were harvested within 2-3 days of silk emergence and baby corn yield with husk and without husk was worked out. The samples of five plants of baby corn were collected at harvest and nitrogen, phosphorus and potassium concentration in these samples were estimated by following the standard methods. The N, P and K uptake by plant was calculated by multiplying dry matter yield/ha with corresponding concentration of nutrients and dividing by 100. The economics was worked out on the basis of prevailing rates of inputs and produce.

Plant height differed significantly due to varying baby corn hybrids at 50 DAS (Table 1). 'HM 4' recorded taller plants than 'PEHM 2' with greater dry matter accumulation. The superiority of 'HM 4' over 'PEHM 2' in respect

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of growth parameters might be attributed to better root system in 'HM 4' that might have helped in more uptake and availability of nutrients to the plants. Increase in plant population from 66,666 to 83,333 plants/ha improved the plant height at 50 days after sowing. The taller plants with more plant population might be due to intra-row plant competition for light and other environmental resources. Kumar (2008) also reported taller plants in popcorn with higher plant population. However, dry matter accumulation/plant and leaf area index reduced with the increase in plant population level from 66,666 to 83,333 plants/ha. Higher competition between plants for space, moisture, nutrients, light and other environmental resources under 83,333 plants/ha might be the reason for reduction in dry matter accumulation/plant and leaf area index with increasing plant population. Each increase in NPK level from control to $N_{187.5}P_{32.75}K_{62.5}$ recorded taller plants and more dry weight/plant (Table 1). But leaf area index improved only up to $N_{150}P_{26.2}K_{50}$ level. The better growth with enhanced nutrient levels might be due to increased photosynthesis rate at higher availability of N, P and K.

Earlier cob initiation was recorded in 'HM 4', which resulted in more cobs/plant than 'PEHM 2' (Table 1). The lower plant population (66,666 plants/ha) advanced the baby corn initiation and also recorded higher cobs/plant and cob weight compared to 83,333 plants/ha probably due to more synthesis of photosynthates with more availability of space and resources at lower planting density and its translocation to the sink. The days to baby corn initiation were reduced with increasing nutrient levels from control to the $N_{187.5}P_{32.75}K_{62.5}$. Application of $N_{187.5}P_{32.75}K_{62.5}$ and $N_{150}P_{26.2}K_{50}$ being at par gave more cobs/plant compared to $N_{112.5}P_{19.6}K_{19.6}$ and control. But cob weight with and without husk showed marked improvement with each increase in nutrient level from the control to the highest level of $N_{187.5}P_{32.75}K_{62.5}$. The higher leaf area index for longer duration due to more availability of nutrients might have resulted in more translocation of dry matter in to the source; consequently enhanced the yield attributes. The increased levels of nutrients might have resulted in balanced nutrition with easy and greater availability of nutrients NPK to the plants and translocation of photosynthates towards sink, especially due to high K availability, and consequently improved the yield attributes of baby corn.

'HM 4' recorded 10.2, 12.4 and 5.3 % more baby corn yield with and without husk and green fodder yield over 'PEHM 2', respectively and these differences in yields were of significant level. The better growth in terms of leaf area and dry matter production

Table 1. Effect of hybrids, plant population and nutrient levels on growth parameters, yield attributes, yield, total nutrient uptake and economics of babycorn

Treatment	Plant height (50 DAS)	Dry matter accumulation (g/plant) (50 DAS)	Leaf area index (50 DAS)	Baby corn initiation (DAS)	Cobs/plant	Cob weight without husk (g)	Cob yield with husk (t/ha)	Baby corn yield (t/ha)	Green fodder yield (t/ha)	Total nutrient Uptake (kg/ha) N	P	K	Net returns (×10³ ₹/ha)	Benefit: cost ratio
Hybrid														
'HM 4'	111.8	58.6	4.2	46.8	2.1	7.6	5.9	1.2	21.1	77.0	11.7	62.5	50.2	2.5
'PEHM 2'	105.8	56.9	4.1	50.7	1.9	7.4	5.4	1.1	20.0	70.0	10.5	56.7	42.9	2.1
SEm±	0.7	0.2	0.06	0.05	0.02	0.1	0.1	0.01	0.2	0.6	0.2	1.3	0.1	0.5
CD (P=0.05)	2.3	0.8	NS	0.2	0.06	NS	0.4	0.04	0.6	2.3	0.6	4.6	4.2	0.2
Plant population (plants/ha)														
66,666	106.9	59.1	4.2	48.3	2.0	7.7	5.3	1.1	19.1	70.1	10.7	58.0	43.9	2.2
83,333	110.8	56.4	4.0	49.2	1.9	7.2	5.9	1.2	22.0	77.0	11.1	60.6	49.2	2.4
SEm±	0.7	0.2	0.06	0.05	0.02	0.1	0.1	0.01	0.2	0.6	0.2	1.3	0.1	0.5
CD (P=0.05)	2.3	0.7	0.2	0.2	0.06	0.3	0.5	0.04	0.6	2.3	NS	NS	4.2	0.20
Nutrient level (kg/ha)														
Control	91.8	40.6	3.0	51.0	1.6	6.3	3.8	0.7	17.2	56.7	7.7	42.2	28.2	1.6
$N_{112.5}P_{19.6}K_{37.5}$	107.9	55.5	4.1	48.8	2.0	7.4	5.6	1.1	20.6	73.2	10.5	51.2	47.0	2.4
$N_{150}P_{26.2}K_{50}$	116.1	65.8	4.5	47.9	2.1	7.9	6.3	1.2	21.8	80.1	12.9	71.6	53.8	2.6
$N_{187.5}P_{32.75}K_{62.5}$	119.6	69.1	4.7	47.3	2.1	8.2	6.8	1.3	22.6	85.5	14.5	72.9	57.3	2.7
SEm±	0.9	0.8	0.1	0.2	0.04	0.05	0.13	0.02	0.3	1.5	0.3	2.86	0.9	0.2
CD (P=0.05)	2.7	2.3	0.3	0.48	0.1	0.14	0.38	0.06	1.0	4.5	1.09	8.37	2.7	0.4

with early cob initiation and more cobs/plant and their cumulative effects could be reasoned for increased yields of this hybrid. Higher plant population level of 83,333 plants/ha recorded significant increase in baby corn yield with and without husk and fodder yield to the tune of 9.6, 8.4 and 15 %, respectively. Though the values of yield attributes were poor with higher planting density of 83,333 plants/ha but this plant population might have compensated reduction in yield attributes because of more number of plants/ha. Similarly, application of $N_{112.5}P_{19.6}K_{37.5,}$ $N_{150}P_{26.2}K_{50}$ and $N_{187.5}P_{32.75}K_{62.5}$ significantly improved (45.8, 63.7, and 76.2; and 46.8, 61.0 and 70.1 %) baby corn yield with and without husk over control, respectively. However, fodder yield showed increasing trend with increasing nutrient level only up to $N_{150}P_{26.2}K_{50}$. These increase in yields might be attributed to the fact that increased NPK levels increased the growth and yield attributing factors due to more availability of nutrients and consequently enhanced the yield levels. Singh *et al.* (2010) also reported similar increase in baby corn yield with application of 180 kg N + 38.7 kg P + 74.7 kg K/ha.

The two baby corn hybrids did not differ significantly in respect of NPK concentration in cobs or fodder; the average N, P, K concentration in cob was 2%, 0.4% and 1.15 %, respectively. The average NPK concentration in fodder was 1.36, 0.2 and 1.18 %, respectively. Plant population did not significantly affect NPK concentration in cobs, while K concentration was significantly more with lower plant population. N and K concentration in fodder was also significantly more with lower plant population. The highest uptake of all the nutrients with each increasing N, P and K level was found. The K uptake improved significantly with each increase in nutrient level from control to the highest dose ($N_{187.5}$ $P_{32.75}$ $K_{62.5}$ kg/ha)(Table 2). The nutrient uptake by the crop is determined by its nutrient content and yield. It was evident that yields had overriding effect on nutrients by the crop. Thakur *et al.* (1998) reported that nitrogen uptake by plants increased significantly with an increase in N level up to 150 kg/ha, whereas N uptake by baby corn increased significantly up to 200 kg N/ha. Higher benefit: cost ratio was obtained with 'HM 4' hybrid and 83,333 plants/ha, compared to 'PEHM 2' and 66,666 plants/ha respectively (Table 1). The content of N, P and K in baby corn, husk and fodder did not differ between 'HM 4' and 'PEHM 2' (Table 2). Considerable reduction in contents of N in fodder and K in cobs and fodder was found due to increasing plant population (83,333plants/ha). These reductions were attributed to the fact that there is dilution in nutrient contents with the higher yields. Each Increase in N, P and K levels from control to the highest level of nutrients i.e. $N_{187}P_{32.75}K_{62.5}$ kg/ha, enhanced the P contents in baby corn, husk and fodder. However, N contents in fodder and K content in baby corn husk and fodder were the highest with $N_{150}P_{26.2}K_{50}$ level. Higher nutrient availability in soil with NPK application can be reasoned for more nutrient uptake by plant.

Table 2. Effect of nutrient levels on nutrient concentration (%) in cob and fodder of baby corn

Nutrient level (kg/ha)	N	P	K
Cob			
Control	1.93	0.37	1.07
$N_{112.5}P_{19.6}K_{37.5}$	1.95	0.40	1.14
$N_{150}P_{26.2}K_{50}$	2.05	0.43	1.18
$N_{187.5}P_{32\cdot75}K_{62.5}$	2.15	0.46	1.20
SEm±	0.03	0.01	0.03
CD (P=0.05)	0.11	0.03	0.08
Fodder			
Control	1.32	0.18	1.04
$N_{112.5}P_{19.6}K_{37.5}$	1.36	0.19	1.17
$N_{150}P_{26.2}K_{50}$	1.38	0.20	1.20
$N_{187.5}P_{32\cdot75}K_{62.5}$	1.40	0.24	1.30
SEm±	0.02	0.006	0.05
CD (P=0.05)	0.07	0.01	0.16

Based on the experimentation it may be concluded that 'HM 4' hybrid is a better hybrid of baby corn for getting higher productivity and the crop should be planted with 83,333 plants/ha with an application of 187.5N, 32.75P, 62.5K kg/ha.

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