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Research Article

GROWTH, YIELD AND ECONOMICS OF BABY CORN (*Zea mays* L.) AS INFLUENCED BY PLANT POPULATION AND INTEGRATED NITROGEN MANAGEMENT

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Abstract- Two Field experiments were conducted during *Kharif* and *Rabi* seasons respectively in 2004 to study the effect of plant population and integrated nitrogen management on yield and quality of baby corn. The experiments were laid out in split plot design with three replication. The treatments comprised of three different plant populations of high, low, medium with a spacing of 45 x 15 cm (higher population), 45 x 30 cm (low population) and 60 x 15 cm (medium population) respectively and seven integrated nitrogen management practices *viz.*, 100% recommended dose of fertilizer (RDF) N (150 kg ha^{-1}) and FYM (12.5 t ha^{-1}), 75% RDF N plus 25% N substitution through FYM along with FYM @ 12.5 t ha^{-1}, 50% RDF N plus 50% N substitution through FYM along with FYM @ 12.5 t ha^{-1}, 100% RDF N alone, 75% RDF N alone, 50% RDF N alone and without fertilizer N and FYM application (Control). The growth characters were found higher under low plant population and the LAI and DMP were higher in 45 x 15 cm at 60 DAS during both *kharif* and *rabi* seasons. Among the integrated nitrogen management practices, application of 100% recommended dose of fertilizer N and 12.5 t of FYM enhanced all the growth characters of baby corn at 60 DAS of observation during both the seasons. Higher husked baby corn and fodder yield were produced in higher plant population combined with 100% RDF N and 12.5 t ha^{-1} FYM during both the seasons.

Keywords- Farm yard manure, DMP, Husked bay corn, Dehusked baby corn

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Introduction

Baby corn (*Zea mays* L.), is one of the most important dual purpose crops, is grown widely round the year for baby corn as well as green fodder in India [1]. It is an offshoot of grain maize becoming popular among city elite and middle class people. Normally, it is grown for vegetable purpose, which is a rich source of phosphorus, iron, vitamin A and C, high fiber content and without cholesterol gained popularity as a vegetable [2]. It is a widely accepted as a vegetable in foreign countries. In India, cultivation of baby corn is of recent addition. Baby corn is quite popular worldwide but good agricultural management practices particularly nutrient management to maximize the production in India is the need of the day [3]. The yield of any crop depends to a greater extent on the number of plants per unit area. It is essential to establish the optimum plant population for the region concerned, because of non tillering habit, baby corn cannot compensate the loss of space unlike other tillering cereals like rice and wheat. Proper nutrient management is essential to get higher yield in any crop. Among the nutrients, nitrogen (N) is the primary one in the fertilizer programme in cereal crops particularly as it is the key to realize the yield potential of modern high yielding varieties of maize. Chemical fertilizer application may leads to get maximum production of baby corn but it leads to hazardous effect on environment and also increasing production cost [4]. In view of the above the present study was conducted to find out the optimum plant population and suitable integrated nitrogen management for baby corn.

Materials and methods

Two field experiments were conducted during *kharif* and *rabi* seasons of 2004 at Agricultural College and Research Institute, Killikulam, Tamil Nadu. The texture of the experiment soil was sandy clay loam. The nutrient status of the experimental field was low, medium and high in available N, P and K respectively and neutral in reaction (pH 7.6). The experiments were laid out in split plot design with three replication. The treatments comprised of three different plant populations of high (P_1), low (P_2), medium (P_3) with a spacing of 45 x 15 cm (1.48 lakh plants ha^{-1}), 45 x 30 cm (0.74 lakh plants ha^{-1}) and 60 x 15 cm (1.11 lakh plants ha^{-1}) respectively in main plots and seven integrated nitrogen management practices in subplots *viz.*, 100% recommended dose of fertilizer N (150 kg ha^{-1}) and FYM(12.5 t ha^{-1}) (T_1), 75% recommended dose of fertilizer N plus 25% N substitution through FYM along with FYM @ 12.5 t ha^{-1} (T_2), 50% recommended dose of fertilizer N plus 50% N substitution through FYM along with FYM @ 12.5 t ha^{-1} (T_3), 100% recommended dose of fertilizer N alone (T_4), 75% recommended dose of fertilizer N alone (T_5), 50% recommended dose of fertilizer N alone (T_6) and without fertilizer N and FYM application (Control) (T_7). The baby corn composite Co (BC)-1 genotype was used as the test crop in the experiments. The recommended dose of N: P: K (150:60:40 kg NPK ha^{-1}) was applied as per the treatments. Phosphorus applied as basal (Full dose) and N and K were applied as basal (50%) and at 25 DAS (50%). The data were observed during the 60 DAS and subjected to statistical analysis for testing significance.

Results and Discussion

Effect on growth parameters

Significant variation had been observed for growth parameters of baby corn. Taller plants and higher RGR were recorded with low plant population while a significant increase in LAI and DMP was evident with high plant population [Table-1]. At 60 DAS, the DMP in high plant population (P_1) was 6682 and 6822 kg ha^{-1} during

kharif and *rabi* season respectively. The minimal competition minimal competition among the plants under the low plant density, which might have provided sufficient space to the crop to harness the solar energy and utilization of soil nutrients and moisture effectively which resulted in taller plants in low plant density [5]. The higher LAI recorded with high plant population is ascribed to the lesser value of spacing. Similarly, the more plants accommodated in the high plant population treatments resulted in higher dry matter production.

Application of recommended dose of fertilizer N and FYM increased the plant height of 140 and 146 cm during *kharif* and *rabi* respectively. A similar trend was observed in LAI, DMP and RGR, whereas, without fertilizer and FYM application (T_7) resulted in poor growth. The increased plant height, LAI, DMP and RGR might be due to more availability of nutrients and beneficial effect of organic manure (FYM) on the soil microbial population, nutrient mobility and soil properties *etc*., during the crop growth period [6].

Effect on yield parameters

The number of baby corn plant^{-1} was higher (14.28 per cent) in medium plant population over high plant population during *Kharif* season and low plant population recorded 16.92 per cent higher than high plant population during *Rabi* season. The other yield parameters *viz*., husked baby corn girth, husked baby corn weight, dehusked baby corn weight were greatly influenced by plant population and recorded higher values with low plant population (P_2) [Table-2]. This may be due to the reduced inter plant competition which resulted in adequate availability of moisture, nutrients and solar radiation which might have contributed to the superiority of yield parameters [7].

With respect to nutrient management, application of RDF N and FYM increased all yield components *viz*., husked baby corn girth, husked baby corn weight, and dehusked baby corn weight.

Table-1 *Effect of plant population and integrated nitrogen management on growth characters of baby corn at 60 DAS*

Treatments	Plant height (cm)		RGR (mg g^{-1} day^{-1})		LAI		DMP (kg ha^{-1})	
	Seasons							
	kharif	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*
P_1	121	127	14.7	15.4	8.13	8.21	6682	6822
P_2	127	132	15.8	16.7	4.29	4.33	3505	3576
P_3	122	127	15.0		5.91	5.97	5041	5141
SEd	0.8	0.7	0.1	0.2	0.01	0.37	292	382
CD (p=0.05)	2.2	2.0	0.4	0.5	0.21	1.02	795	958
T_1	140	146	18.0	19.1	7.89	7.97	5978	6096
T_2	133	138	16.5	17.8	7.00	7.07	5625	5738
T_3	123	128	15.0	17.1	6.15	6.21	4902	5014
T_4	132	138	17.2	18.0	6.75	6.81	5636	5749
T_5	122	126	16.3	16.4	6.07	6.13	5366	5475
T_6	116	121	15.7	15.9	5.33	5.38	4965	5065
T_7	99	102	7.41	6.7	3.59	3.63	3058	3119
SEd	2.1	2.2	0.5	0.6	0.03	0.34	107	129
CD (p=0.05)	4.3	4.5	1.1	1.3	0.07	1.02	217	262

Table-2 *Effect of plant population and integrated nitrogen management on yield characters of baby corn*

Treatments	Number of babies plant^{-1}		Husked baby girth (cm)		Husked baby weight (g)		Dehusked baby weight	
	Seasons							
	kharif	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*
P_1	1.96	1.95	4.62	4.70	21.93	22.15	9.9	10.4
P_2	2.21	2.28	5.23	5.43	24.26	24.50	10.5	10.6
P_3	2.24	2.27	4.64	4.74	22.79	23.01	9.7	9.9
SEd	0.04	0.03	0.05	0.10	0.21	0.21	0.1	0.1
CD (p=0.05)	0.11	0.09	0.16	0.20	0.58	0.59	0.3	0.3
T_1	2.69	2.72	5.34	5.44	26.92	27.19	12.4	12.6
T_2	2.47	2.43	5.19	5.26	26.15	26.41	10.9	11.2
T_3	1.84	1.88	4.54	4.62	22.62	22.84	9.5	9.8
T_4	2.48	2.53	5.24	5.34	26.64	26.09	11.2	11.3
T_5	2.29	2.32	5.16	5.21	24.40	25.65	10.6	10.8
T_6	1.76	1.77	4.49	4.73	22.27	22.49	9.5	9.6
T_7	1.43	1.50	3.84	4.12	10.96	11.07	6.0	6.1
SEd	0.07	0.04	0.06	0.08	0.58	0.59	0.3	0.4
CD (p=0.05)	0.14	0.10	0.12	0.17	1.19	1.20	0.6	0.8

Effect on husked baby corn yield and fodder yield

Increased husked baby corn yield (6084 and 6236 kg ha^{-1}) during *kharif* and *rabi* season was obtained from the high plant population over low plant population. Increased fodder yield obtained in higher plant population [Table-3]. Even though the low plant population recorded higher values for most of the yield attributing characters, because of lesser plant population per unit area, it could not compensate the husked baby yield and fodder yield obtained in higher plant population (1.48 lakhs plants ha^{-1}).

The treatment with application of 100% recommended dose of fertilizer N and FYM (T_1) significantly increased husked baby corn yield and fodder yield during

both *kharif* and *rabi* seasons. It appears that conjunctive application of organic and fertilizer N can not able to supply sufficient N at critical growth stages of plant because of slow nutrients release pattern and proved inferior than fertilizer N source [8].

Effect on economics

Gross return and net return were markedly influenced by various plant population and integrated nitrogen management practices. Among the different treatment combinations, adoption of high plant population and application of 100% recommended dose of fertilizer N and FYM had given the highest gross return and net return. The higher green cob and fodder yield recorded under this combination resulted in the highest gross return and net return ha^{-1}. If it is viewed from the point of low cost, chemical free, eco-friendly food and sustained soil health and productive system, a premium price may be obtained and would result in better B:C ratio in long run [9].

Table-3 *Effect of plant population and integrated nitrogen management on husked baby yield, fodder yield and economics*

Treatments	Husked baby corn yield (kg ha^{-1})		Fodder yield (t ha^{-1})		Net return* (Rs ha^{-1})		B:C ratio*	
	Seasons							
	Kharif	*Rabi*	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
P_1	6084	6236	18.8	19.1	44224	45785	3.18	3.25
P_2	4739	4715	14.4	14.5	32325	32098	2.83	2.83
P_3	5274	5386	16.9	17.0	36643	38075	2.91	2.98
SEd	145	199	0.3	0.6				
CD (p=0.05)	402	553	0.9	1.6				
T_1	6659	6816	20.3	20.7	49623	51276	3.35	3.42
T_2	6218	6103	17.2	17.4	43311	42197	2.94	2.87
T_3	4634	4758	17.5	17.4	26318	27538	2.12	2.16
T_4	6386	6528	18.0	18.2	49241	50694	3.68	3.76
T_5	5403	5547	17.7	18.2	39757	41234	3.21	3.29
T_6	4795	4906	15.6	15.7	33673	34806	2.94	3.00
T_7	3403	3459	10.6	10.7	22193	22825	2.60	2.65
SEd	152	189	0.3	0.4				
CD (p=0.05)	308	384	0.6	1.0				

* Statistically not analysed

Conclusion

From this study, it is concluded that, the adoption of higher plant population with the spacing of 45 x 15 cm and application of 100% RDN and FYM found to be the best management practices to maximize the husked baby yield and fodder yield and to get higher net return from irrigated baby corn.

Conflict of Interest: None declared

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