Indian J. Agric. Res., 49 (4) 2015: 353-357
Print ISSN:0367-8245 / Online ISSN:0976-058X

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
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Growth and yield of Baby Corn (*Zea Mays* L.) as influenced by varieties, spacings and dates of sowing

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Recieved: 30-06-2014 Accepted: 08-06-2015 DOI: 10.5958/0976-058X.2015.00064.5

ABSTRACT

A field experiment was conducted during the rabi season of 2007-08 and 2008-09 on sandy loam soil at Crop Research Farm, Allahabad Agricultural Institute - Deemed University, Allahabad (U.P.) to study the effect of two varieties (VL Baby Corn-1 and HM 4), two spacings (45×25 cm and 60×25 cm) and three sowing dates (1st October, 30th October and 29th November) on performance of baby corn (*Zea mays* L.). The results indicated that variety HM 4 recorded significantly higher growth, yield contributes and yields *viz*., plant dry weight (19.07%), crop growth rate (31.85%), days to tasselling (38.64%), days to silking (34.79%) number of cobs/ plant (8.40%), weight of corn with husk (8.49), weight of corn without husk (1.30%), corn yield (8.68%) and fodder yield (21.60%) was found to be higher over VL Baby Corn-1, according pooled data. The maximum length of corn (3.90%), corn yield (32.55%) and fodder yield (26.21%) was found to be higher over 60×25 cm spacing. The baby corn planted on 30th October recorded significantly higher number of cobs/ plant (47.33%), corn yield (35.79%) and fodder yield (20.59%) was found to be higher over sowing on 1st October. Variety HM 4 sown on 30th October at 45×25 cm spacing resulted in maximum gross return, net return and benefit cost ratio.

Key words: Baby corn, Growth, Sowing dates, Spacings, Varieties, Yield contributes, Yield.

INTRODUCTION

Baby corn is dehusked maize ear, harvested young especially when the silk have either not emerged or just emerged and no fertilization has taken place or we can say the shank with unpollinated silk is baby corn. Baby corn ears in light yellow colour with regular row arrangement, 10 to 12 cm long and a diameter of 1.0 to 1.5 cm arrangement are preferred in the market (Golada *et al*., 2013). Baby corn is an important crop of Thailand, Taiwan and India; Recently, baby corn has gained popularity as valuable vegetable in Delhi, Uttar Pradesh, Haryana, Maharashtra, Karnataka, Andhra Pradesh, Rajasthan and Meghalaya States of India. In India, it is grown on 9.43 m ha area with the production and productivity of 24.35 m t and 2583 kg ha^{-1}, respectively (Government of India, 2014).

Baby corn production being a recent development has proved enormously successful in countries like Thailand, Taiwan, Sri Lanka and Myanmar. The countries like Zambia, Zimbabwe and South Africa have also started cultivation. Today, Thailand and China are the world leaders in baby corn production. Attention is now being paid to explore its potential in India for earning foreign exchange besides higher economic returns to the farmers. Baby corn cultivation is now picking up in Meghalaya, Western Uttar Pradesh, Haryana, Maharastra, Karnataka and Andhra Pradesh (Kheibari *et al*., 2012).

Srikanth *et al*., (2009) revealed that normal spacing of 60×20 cm recorded taller plants, while wider spacing of 75×20 cm recorded higher number of leaves/plant, stem girth, leaf area index, dry matter production, yield contributes and yield. Singh and Singh (2006) reported highest grain yield and stover yield under 83,000 plants/ha maintained right from sowing were observed which may be attributed to more number of harvestable cobs per unit area. The better development of yield attributes at lower plant density could not compensate the loss in grain yield due to less number of harvestable cobs per unit area. The spacing of 60×20 cm significantly increased the number of prime cobs (54,108/ha), green-cob yield (9.21 tonnes/ha) and accrued highest net return (Rs 48,571/ha) and benefit: cost ratio (3.55), followed by 45×30 cm spacing (Kar *et al*., 2006).

The highest and lowest ear yield belonged to 1,20,000 plant/ha and 90,000 plant/ha plant density by 9987 kg/ha and 8780 kg/ha ear production respectively. Anthesis silking duration (ASI), ear number per plant, ear height, leaves number, leaves number above ear, ear leaf diameter, ear length, ear diameter, stalk fresh weight and husked ear yield affected by plant density. The highest ear per plant (2.3 ear/plant) produced by 1,20,000 plant/ha. Leaves number above ear, ear leaf length and diameter, fresh stalk weight and diameter affected by interaction between plant density

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and planting method respectively. 1,50,000 plant/ha produced the highest de husked ear yield by mean of 1969 kg/ha. Ear yield did not affected by planting method (Sarjamei *et al*., 2014). The crop spacing 60×15 cm significantly influenced yield contributes. Maximum green cob yield, baby corn yield and green fodder yield was recorded at 60×15 cm spacing which was higher over 90×10 cm (Golada *et al*., 2013, Thavaprakaash *et al*., 2008). Time of sowing is a non monetary input which plays significant role in production and productivity of any crop. In order to achieve higher ear yields, maintenance of stand density is the most important factor. A spatial arrangement of plant governs the shape and size of the leaf area per plant, which in turn influences efficient interception of radiant energy and proliferation and growth of shoots and their activity. Maximum yield can be expected only when plant population allows individual plant to achieve their maximum inherent potential. The objective of this study was determining the best plant population and dates of sowing for highest baby corn production of VL Baby Corn-1 and HM 4 varieties and investigating agricultural and morphological characteristics.

MATERIALS AND METHODS

A field experiment was conducted during rabi of two consecutive years of 2007-08 and 2008-09 on sandy loam soil at Crop Research Farm, Allahabad Agricultural Institute - Deemed University, Allahabad, which is situated at 25°57' N latitude, 87°19' E longitude and at an altitude of 98.0 m above mean sea level. Soil was moderately alkaline pH (8.1), available nitrogen (343.75 kg/ha), available phosphorus (14.32 kg/ha) and available potassium (100.25 kg/ha). The total rainfall during crop growing period was 49.50 mm in 2007-08 and 76.40 mm in 2008-09. The experiment was laid out in factorial randomized block design (2×2×3 factorial) with three replications. There were 12 treatment combinations comprised of two varieties (VL Baby Corn-1and HM 4), two spacings (45×25 cm and 60×25 cm) and three sowing dates (1st October, 30th October and 29th November) were allocated as per factorial randomized block design. The gross and net plot sizes were 6.0×3.6 m and 5.4×3.0 m, respectively. The fertilizer was applied at the rate of 120:60:40 kg NPK/ha. Half dose of nitrogen and full dose of phosphorus and potassium was given as basal through urea, DAP and muriate of potash, respectively. Remaining half nitrogen was top dressed at knee high stage as per recommendation. The seeds of baby corn were treated with Bavistin @ 2.0 g/kg seeds to ensure good crop stand. Baby corn varieties were sown manually at varying row spacing as per treatment. Crop was harvested at just after silk emergence. Length, diameter and weight of the cob from representative plants were measured from which mean values were attained. Cob sheath of tagged plants in each plot was peeled-off and the length, diameter and weight of corn inside the sheath were measured. Number of cobs from the tagged plants was counted and from that mean number of cobs was calculated. The cobs from net area of each plot were harvested separately, weighed and recorded as young cob yield (kg/ha). For working out the economics, prevailed market prices for baby corn seeds (Rs. 60/kg), urea (Rs. 6.50/kg), DAP (Rs. 11.50/kg), MOP (Rs. 5.00/kg) and cost of labour (Rs. 100/day) were considered. Observations on morphological traits were recorded for ten randomly selected plants while as Baby corn yield and green fodder yield were recorded on plot basis. The data were statistically analysed as the results of individual years. The raw data was subjected to appropriate statistical procedure as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The variety HM 4 recorded significantly higher indices of the growth; yield contributes and yield *viz*., leaves nos. /plant, leaf length, plant dry weight, crop growth rate, days to tasseling, days to silking, number of cobs/ plant, weight of corn with husk, weight of corn without husk, length of corn, corn yield and fodder yield during both years (Table 1,2&3). The maximum leaves nos. /plant (1.79%) , leaf length (10.75%), plant dry weight (19.07%), crop growth rate (31.85%), days to tasseling (38.64%), days to silking (34.79%), number of cobs/ plant (8.40%), weight of corn with husk (8.49%), length of corn (1.87%), corn yield (8.68%) and fodder yield (21.60%) was found to be higher over VL Baby Corn-1, according pooled data.

The spacings recorded significant indices of the growth; yield contributes and yield *viz*., plant dry weight, days to tasseling, days to silking, length of corn, corn yield and fodder yield during both years (Table 1,2&3). The maximum, plant dry weight (12.10%), days to tasseling (0.81%), days to silking (0.59%), length of corn (3.90%), corn yield (32.55%) and fodder yield (26.21%) was found to be higher over 60×25 cm spacing, according pooled data. The crop spacing 45×25 cm might have resulted in higher photosynthesis and finally higher plant^{-1} dry matter accumulation. Higher dry matter is believed to have maintained adequate supply of metabolites for development of reproductive structures. While days to tasseling and silking was superior under medium spacing, which was mainly due to better resource availability and reduced interplant competition in the community. This view is close conformity with the findings of Thavaprakaash *et al*. (2008), who recorded higher yields as a result of remarkable improvement in different growth and growth contributes.

Observed marked increases in baby corn yield appear to a resultant of remarkable improvement in different yield attributes which was brought about due to adoption of this crop spacing. This view is close conformity with the findings of Golada *et al*. (2013), Lashkari *et al*. (2011) and Thavaprakaash *et al*. (2008), who recorded higher yields as a result of remarkable improvement in different growth and yield attributes

TABLE 1. Growth of baby corn (*Zea mays* L.) as influenced by varieties, spacings and dates of sowing.

Treatment	Plant height (cm)			Leaves (No./plant)			leaf length (cm)			Plant dry weight at maturity (q /ha)			CGR at maturity (g/m^2/day)		
	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
Varieties															
VL Baby Corn-1	40.13	33.03	36.58	5.67	5.50	5.58	32.04	30.82	31.43	1.49	1.56	1.52	0.0265	0.0280	0.0270
HM 4	35.82	31.00	33.41	5.72	5.59	5.68	36.09	33.53	34.81	1.79	1.82	1.81	0.0356	0.0356	0.0356
S. Em. (±)	1.84	0.95	0.85	0.25	0.32	0.25	1.86	1.28	1.13	0.07	0.08	0.07	0.0025	0.0023	0.0025
C D (P=0.05)	3.81	1.98	1.76	0.51	0.65	0.51	3.85	2.65	2.34	0.14	0.16	0.14	0.0052	0.0048	0.0052
Spacings (cm)															
45×25	36.04	30.77	33.40	5.65	5.50	5.57	32.03	30.67	31.35	1.74	1.78	1.76	0.0268	0.0282	0.0275
60×25	39.92	33.26	36.59	5.74	5.59	5.69	36.11	33.69	34.90	1.54	1.60	1.57	0.0354	0.0354	0.0352
S. Em. (±)	1.84	0.95	0.85	0.25	0.32	0.25	1.86	1.28	1.13	0.07	0.08	0.07	0.0025	0.0023	0.0025
C D (P=0.05)	3.81	1.98	1.76	0.51	0.65	0.51	3.85	2.65	2.34	0.14	0.16	0.14	0.0052	0.0048	0.0052
Dates of sowing															
1st October	79.14	79.57	79.36	9.08	9.25	9.17	69.02	56.51	62.76	5.72	4.94	5.33	0.0956	0.0921	0.0941
30th October	76.71	58.79	67.75	8.75	8.36	8.58	65.00	57.09	61.05	2.79	2.91	2.85	0.0228	0.0250	0.0236
29th November	37.22	37.25	37.23	8.33	8.28	8.31	37.20	39.44	38.32	2.13	2.15	2.14	0.0705	0.0704	0.0704
S. Em. (±)	2.25	1.17	1.04	0.31	0.39	0.31	2.27	1.56	1.38	0.08	0.09	0.08	0.0031	0.0028	0.0031
C D (P=0.05)	4.66	2.42	2.16	0.64	0.82	0.63	4.71	3.25	2.87	0.17	0.20	0.17	0.0064	0.0058	0.0064

TABLE 2. Yield contributes of baby corn (*Zea mays* L.) as influenced by varieties, spacings and dates of sowing.

Treatment	Days to tasselling			Days to silking			Number of cobs/plant			Weight of corn with husk (g)			Weight of corn without husk (g)			Length of corn (cm)			Diameter of corn (cm)		
	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
Varieties																					
VL Baby Corn-1	49.50	50.11	49.81	54.50	56.61	55.56	3.33	3.33	3.33	43.24	44.54	43.89	6.23	6.02	6.12	7.41	8.63	8.02	1.12	1.13	1.13
HM 4	68.41	69.72	69.06	73.94	75.83	74.89	3.59	3.63	3.61	47.01	48.23	47.62	6.28	6.11	6.20	7.82	8.52	8.17	1.12	1.13	1.12
S. Em. (±)	0.47	0.59	0.44	0.34	0.36	0.31	0.04	0.02	0.02	1.01	1.75	1.30	0.20	0.20	0.14	0.30	0.39	0.27	0.04	0.04	0.03
C D (P=0.05)	0.97	1.22	0.92	0.71	0.74	0.63	0.09	0.05	0.05	2.09	3.64	2.69	0.41	0.41	0.27	0.61	0.79	0.54	0.09	0.09	0.05
Spacings (cm)																					
45×25	59.22	60.11	59.67	64.44	66.39	65.42	3.46	3.48	3.47	44.99	45.38	45.19	6.24	6.05	6.15	7.83	8.67	8.25	1.11	1.11	1.11
60×25	58.68	59.72	59.19	64.00	66.06	65.03	3.46	3.48	3.47	45.27	47.39	46.33	6.26	6.08	6.17	7.40	8.48	7.94	1.14	1.15	1.14
S. Em. (±)	0.47	0.59	0.44	0.34	0.36	0.31	0.04	0.02	0.02	1.01	1.75	1.30	0.20	0.20	0.14	0.30	0.39	0.27	0.04	0.04	0.03
C D (P=0.05)	0.95	1.19	0.89	0.69	0.73	0.62	0.09	0.05	0.05	2.09	3.64	2.50	0.41	0.41	0.28	0.61	0.79	0.54	0.09	0.09	0.05
Dates of sowing																					
1st October	47.00	46.92	46.96	52.58	53.00	52.79	3.00	3.00	3.00	47.75	39.42	43.58	6.33	6.16	6.25	8.48	9.33	8.90	1.06	1.15	1.10
30th October	55.83	59.00	57.42	61.33	65.92	63.63	4.39	4.45	4.42	38.44	43.25	40.85	5.89	5.68	5.78	6.40	7.79	7.10	1.13	1.08	1.10
29thNovember	74.03	73.83	73.92	78.75	79.75	79.25	3.00	3.00	3.00	49.19	56.48	52.84	6.53	6.36	6.45	7.96	8.60	8.78	1.18	1.16	1.17
S. Em. (±)	0.57	0.72	0.54	0.42	0.44	0.37	0.05	0.03	0.03	1.23	2.15	1.59	0.25	0.25	0.17	0.37	0.47	0.33	0.05	0.04	0.03
C D (P=0.05)	1.19	1.49	1.13	0.87	0.91	0.78	0.11	0.06	0.06	2.56	4.45	3.29	0.52	0.52	0.36	0.76	0.98	0.68	0.11	0.09	0.05

TABLE 3. Yield and economics of baby corn (*Zea mays* L.) as influenced by varieties, spacings and dates of sowing.

Treatment	Corn yield (q/ha)			Fodder yield (q/ha)			Cost of Cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	Benefit cost ratio
	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled				
Varieties										
VL Baby Corn-1	16.05	15.52	15.78	306.36	312.26	308.81	22497	94362	71865	3.19
HM 4	17.27	17.02	17.15	371.29	379.76	375.52	22796	104504	81708	3.58
S. Ed. (±)	0.57	0.71	0.48	5.90	10.90	6.91	–	–	–	–
C. D. (P = 0.05)	1.19	1.48	1.00	12.23	22.62	14.32	–	–	–	–
Spacings (cm										
45 x 25	19.05	18.50	18.77	379.88	383.75	381.82	22815	112963	90148	3.95
60 x 25	14.27	14.04	14.16	296.77	308.27	302.52	22478	85904	63426	2.82
S. Ed. (±)	0.57	0.71	0.48	5.90	10.90	6.91	–	–	–	–
C. D. (P = 0.05)	1.19	1.48	1.00	12.23	22.62	14.32	–	–	–	–
Dates of sowing										
1st October	14.78	14.44	14.61	324.39	308.29	316.34	22646	88875	66228	2.92
30th October	20.09	19.60	19.84	371.90	391.07	381.49	22646	118288	95642	4.21
29th November	15.10	14.78	14.94	318.68	338.67	328.67	22646	91137	68490	3.02
S. Ed. (±)	0.70	0.87	0.59	7.22	13.36	8.46	–	–	–	–
C. D. (P = 0.05)	1.46	1.81	1.23	14.98	27.70	17.54	–	–	–	–

The baby corn planted on 30th October recorded significantly higher indices of the yield attributes and yield *viz*., number of cobs/ plant, corn yield and fodder yield during both years (Table 2&3). The maximum, number of cobs/ plant (47.33%), corn yield (35.79%) and fodder yield (20.59%) was found to be higher over sowing on 1st October, according pooled data.

Economics: Variety HM 4 resulted in maximum gross return (Rs. 1, 04,504/ha), net return (Rs. 81,708/ha) and benefit cost ratio (3.58). Sowing the crop at 45×25 cm spacing resulted in maximum gross return (Rs. 1, 12,963/ha), net return (Rs. 90, 148/ha) and benefit cost ratio (3.95). Among the three dates of sowing, sowing on 30th October resulted in maximum gross return (Rs. 1, 18,288/ha), net return (Rs. 95,642/ha) and benefit cost ratio (4.21) during the experimentation (Table 3).

Thus, it can be concluded that the variety HM 4 sown on 30th October at spacing of 45×25 cm in addition to recommended dose of nutrients was found optimum for baby corn crop for getting higher growth, yield and net returns in sandy loam soil of Allahabad (U.P.).

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