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Impacts of date of planting and crop geometry on growth and yield of baby corn (*Zea mays* var. *rugosa*)

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ABSTRACT

The experiment was conducted during 2012-13 and 2013-14 to study the effect of date of planting and crop geometry impacts on growth and yield of baby corn (Var. G-5414) in a split plot design with five dates of planting viz,October (D_1), November (D_2), December (D_3), January (D_4) and February (D_5) and three levels of plant population viz. 45 x 30 cm (S_1), 45 x 20 cm (S_2) and 45 x 10 cm (S_3) with three replications. Plant height, corn yield and fodder yield were higher when baby corn planted wider spacing of 45 x 30 cm. December sowing took the longest duration for 50% germination, which was at par with that of November sowing. Number of leaves per plant was the highest in February sowing and it did not vary with that of October sowing. Whereas, closer spacing of 45 x 10 cm resulted in shorter plant height and reduction of both corn and fodder yield. Days to 50% flowering did not vary among the spacing but this character did vary significantly across the sowing dates and the longest and shortest durations being in the December and February sowings respectively. The growth and yield parameters of baby corn were clearly indicative that they were thermo- sensitive and baby corn cobs and fodder yield are higher at closer spacing.

***Keywords*:** Baby corn, growth, sowing dates, spacing, yield

Baby corn is the ear of maize and plants are harvested young, especially when the silks have either not emerged or just emerged and no fertilization has taken place.The dehusked young ears of baby corn are eaten as a vegetable whose delicate sweet flavour and crispiness are much in demand. The important attributes relevant to baby corn are early maturity, prolificacy (ability to produce multiple ears), synchronized ear emergence and yellow kernels (Kumar and Kalloo, 1998). Ears are ideal for baby corn when they attain size of 8-10 cm long and 1-1.5 cm in diameter at the base and weigh 7-8 g. To meet these criteria, harvest ears 1 to 3 days after silks become just visible (Bar-Zur and Saadi, 1990). For baby corn purpose, harvest ears every 2-3 alternate days. In 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 8.5 m ha area with the production and productivity of 21.3 m t and 2507 kg ha^{-1}, respectively (Govet of India, 2011). Cultural requirement is same as maize but topping or detasselling is important to baby corn for its quality of ears. Baby corn can be grown throughout the year and its growth and yield potential vary across the growing season. Growth and yield attributes also vary according to plant density or population. But, the research on impacts of dates of sowing and spacing on growth and yield attributes has been lacking in this region. Hence, the present experiment was carried out to study the growth and yield efficiency of baby corn to different dates of planting and crop geometry in West Bengal.

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MATERIALS AND METHODS

The experiment was carried out at the AB Seed Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani Simanta, Nadia, West Bengal, during 2012 and 2013. The experiment was conducted with the variety G-5414 in a split plot design with five date of planting *viz*, October (D_1), November (D_2), December (D_3), January (D_4) and February (D_5) and three levels of plant population viz. 45 × 30 cm (S_1), 45×20 cm (S_2) and 45 × 10 cm (S_3) replicated thrice. Five levels of date of plantings were allotted in the main plots and three levels of plant population were allotted randomly to the subplots. Therefore, the total number of plots was 45. Each sub plot size was 3 × 2.25m (6.75 m^2), accommodating 50, 75 and 150 plants per plot for 30, 20, and 10cm plant to plant distance respectively. The soil was sandy loam type with pH 6-6.5.

The five sowing dates ranged from 15th October to 15th February at monthly interval in 2012-13 and

2013-14; each crop was harvested 70 days after sowing. The crop was fertilized @ 100 kg N, 60 kg P_2O_5 and 60kg K_2O ha $^{-1}$. FYM was applied @ 20t ha^{-1} before four weeks of sowing. Young cobs were harvested 2-3 days after silking and the harvesting was done by hand picking. The observations were recorded on plant height, days to 50 % flowering, days to 50% germination, leaves plant^{-1}, cobs plant^{-1}, ear length, ear diameter, ear weight, cob yield and fodder yield. Standard crop husbandry was followed to raise the crop (Anon., 2011).

RESULTS AND DISCUSSION

December sowing took the longest duration for 50% germination, which is *at par* with that of November sowing in both the years. Comparatively, it took lower duration in case of 2013-2014. Marginal mean of date of plantings for 50% germination when compared in descending order the following sequence appears *i.e.* $D_3>D_2>D_4>D_1>D_5$. It is to be noted that treatment values > or <CD value, are generally accepted as statistically significant or not significant, respectively. Statistically higher value of d_3 indicates that December sowing took longer time to germinate than others.

The best plant height was noted at spacing of 45 x 30 cm which was statistically significant and it was higher in 2013-2014. Maximum and minimum plant heights were observed in February and December planting dates in both the years (Table 1).The interaction effects of planting dates and spacing were found to be insignificant in both the years in most of the cases, as also reported by Khan and Yasmeen (2005). Better plant height at wider spacing could be assigned to the fact that with more available area per plant, energy is always harvested better; the same outcome was also observed by Jiotode *et al.*(2002).

Number of leaves per plant was the highest in February and it did not vary with that of in October sowing and no. of leaves in different spacing has been found to be not significant in both the years. The joint effect of date of sowing and plant spacing was also found to be insignificant. Number of leaves is an important parameter because appearance of cobs is correlated to it, depending on the variety or type of corn.

Days to 50% flowering (appearance of female flower) did not vary among the spacingbut this character did vary significantly across the sowing dates, the longest and shortest durations being in the December and February sowings respectively in both the years. It took longer duration in 2012-2013 than the following year and shorter duration in the latter. The interaction effect of main plot and subplot treatments showed that February planting date took significantly lower number of days to 50% flowering. Flowering date is associated with plant height in corn because internodes formation ceases at floral initiation.

It has been observed that maximum no. of cobs per plant obtained from the February sowing in both the years and the lowest in December due to cooler temperature and it was higher in 2013-2014 (Table 2). It did not significantly vary with spacing and the same trend was observed in both the years. Thakur *et al.* (1997) though found significant increase in all growth and yield characters, yet concluded that narrower spacing could outsmart others in yield.

Ear length highest when sown in February, 2013 and 2014; it did significantly vary from the other dates of sowing. It indicates that baby corn sown in February produces the longest ear length. Spacing did show insignificant effect in influencing this trait. The main plot and subplot treatments interactions were found to be insignificant.

Ear diameter was comparatively lower when sown in January and February as cobs emerged and developed quite quickly and harvested, which did not allow them to thicken to produce quality baby corn to be preferred by the consumers, thinner diameter is a prime quality aspect. It was almost the same in both the years.

A wider row spacing of 60 cm can significantly increase almost all the growth and yield attributes in baby corn but could not compensate yield obtained in narrower spacing(Thakur, 1997). Among the different dates of sowing cob weight did not vary much;it was higher in December date of planting in both the years. It did not vary significantly at spacing.

Closer spacing, in case of the present experiment (45 x 10 cm), possibly intercepted more light owing to higher plant population that might have helped higher photosynthetic activity and concomitant better yield. The earlier work of Thavaprakaash and Velayudhan (2006) recorded the same trend with wider spacing of 60 x 19 cm. When Baby corn was planted at spacing of 45 x 30 cm, 45 x 20 cm and 45

x 10 cm, the best yield was noted at spacing of 45 x 10 cm in both the years (Fig1) and it was significantly higher in 2014 due possibly to higher temperature regime (Table 2). Closer spacing could increase Baby corn yield by approximately about 10% when planted at 40 x 10 cm (Thakur *et al,* 1997). The present work recorded highest yield with the lowest spacing. In consonance with the present experiment Kotch *et al*. (1995) observed closer spacing and summer planting can produce satisfactory yield. Among the all sowing dates the lowest and the highest yields were observed at December and February sowing dates respectively, in both years (Fig. 2).Cob yield did not vary significantly during the cooler growing months (Mid. November – Mid. January) with lower night temperature. The trend was same in both the years.

In case of fodder yield, almost the same trend was observed as was noted in case of cob yield. Though the highest cob and fodder yield was obtained at 45 x 10 cm spacing in the present experiment, (Sahoo and Panda, 1999) got the highest yield of babycorn in both wet and winter season at a spacing of 40 x 20cm. Fodder yield was *at par* in October and February sowings and were significantly higher than other sowing dates. Plant population showed significant differences in fodder yield the lowest being recorded with the wider spacing. Ramachandrappa *et al.* (2004) and Thakur *et al.* (2000) noticed that with an increase in plant density there was increase in green fodder yield in baby corn. With a closer spacing of 45 x 10 cm the February sowing date performed at par with that of October and January sowing dates and was significantly different from the rest. Dar *et al.* (2014) worked with six planting geometry *i.e.* 40 x 15 cm (166,666 plants ha^{-1}), 40 x 20 cm (125,000 plants ha^{-1}), 50 × 15 cm (133,333 plants ha^{-1}), 50 x 20 cm (100,000 plants ha^{-1}), 60 x 15 cm (111,111 plants ha^{-1}) and 60 × 20 cm (83,333 plants ha^{-1}) and 50 x 15 cm resulted in higher growth and yield attributes and finally yield of baby corn and its fodder. The plant height, leaf area index, baby corn and green fodder yield were higher in 50 ×15 cm crop geometry than all other planting density. The crop spacing 60×15 cm significantly influenced yield attributes. Golada *et al*. (2013) recorded maximum green cob yield, baby corn yield and green fodder yield was recorded at 60×15 cm spacing which was higher (14.0%, 24.3% and 8.8%, respectively) over 90×10 cm spacing.

Table 1: Effect of planting dates and crop geometry on baby corn growth parameters

Treatment	Plant height (cm)		Leaves/ plant^{-1}		Days to 50% Germination		Days to 50% flowering	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
Planting date								
October	120.61	121.69	12.01	12.27	6.18	5.35	57.59	55.41
November	118.54	119.19	11.72	11.90	7.20	5.71	59.49	58.73
December	115.18	115.31	11.22	11.37	7.51	6.54	66.17	61.09
January	119.69	120.25	11.91	12.09	6.85	5.40	58.14	56.58
February	121.04	124.13	12.61	12.49	5.78	5.28	55.51	54.24
SEm (±)	**0.34**	**0.31**	**0.21**	**0.25**	**0.22**	**0.29**	**0.36**	**0.46**
LSD (0.05)	**0.98**	**1.02**	**0.70**	**0.72**	**0.64**	**0.72**	**1.18**	**1.53**
Crop geometry								
45 × 30 cm	122.25	123.104	12.16	12.40	6.35	5.58	58.92	56.96
45 × 20 cm	118.18	119.872	11.87	12.04	6.70	5.65	59.37	57.34
45 × 10 cm	116.61	117.376	11.65	11.64	7.05	5.74	59.84	57.35
SEm (±)	**0.29**	**0.20**	**0.15**	**0.13**	**0.15**	**0.13**	**0.26**	**0.22**
LSD (0.05)	**0.69**	**0.59**	**NS**	**NS**	**0.351**	**NS**	**NS**	**NS**
D × S								
SEm (±)	**1.10**	**0.53**	**0.37**	**0.45**	**0.38**	**0.50**	**0.62**	**0.80**
LSD (0.05)	**3.55**	**1.37**	**1.05**	**1.32**	**1.08**	**1.39**	**1.82**	**2.57**
S × D								
SEm (±)	**1.37**	**0.61**	**0.42**	**0.33**	**0.41**	**0.34**	**0.71**	**0.62**
LSD (0.05)	**4.01**	**1.98**	**1.28**	**1.12**	**1.32**	**1.17**	**2.18**	**1.94**

D= Dates of planting, S= Spacing

Table 2: Effect of planting dates and crop geometry on baby corn yield and yield components

Treatment	Cobs plant^{-1}		Length of ear (cm)		Ear diameter (cm)		Ear weight (g)		Cob yield (q h^{-1})		Fodder yield (q h^{-1})	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
Planting date												
October	3.02	3.17	10.62	10.60	1.26	1.26	10.17	10.52	34.20	36.56	372.1	385.58
November	2.94	3.13	10.72	10.64	1.27	1.27	10.24	10.78	31.75	31.66	362.24	337.33
December	2.87	3.03	10.71	10.70	1.31	1.36	10.29	10.83	30.39	30.35	357.69	358.47
January	2.94	3.15	10.74	10.64	1.23	1.24	10.23	10.35	32.90	36.87	369.32	369.91
February	3.10	3.23	11.08	10.54	1.17	1.17	10.01	10.40	36.67	39.73	379.62	392.96
SEm (±)	**0.02**	**0.02**	**0.05**	**0.05**	**0.01**	**0.01**	**0.14**	**0.14**	**0.47**	**0.46**	**2.58**	**3.29**
LSD (0.05)	**0.06**	**0.05**	**0.16**	**0.16**	**0.01**	**0.02**	**0.47**	**0.45**	**1.55**	**1.52**	**8.56**	**10.89**
Crop geometry												
45 × 30cm	3.04	3.23	10.80	10.75	1.27	1.28	10.23	10.73	22.65	23.59	254.93	256.97
45 × 20cm	2.98	3.14	10.79	10.65	1.25	1.26	10.19	10.56	33.16	35.06	369.71	351.14
45 × 10cm	2.89	3.05	10.73	10.47	1.23	1.24	10.14	10.45	43.88	47.86	479.88	498.44
SEm (±)	**0.02**	**0.02**	**0.03**	**0.03**	**0.00**	**0.00**	**0.08**	**0.09**	**0.27**	**0.38**	**2.47**	**2.17**
LSD (0.05)	**NS**	**NS**	**0.09**	**0.10**	**NS**	**NS**	**NS**	**NS**	**0.79**	**1.14**	**7.32**	**6.46**
D × S												
SEm (±)	**0.03**	**0.03**	**0.09**	**0.08**	**0.01**	**0.01**	**0.25**	**0.24**	**0.81**	**0.80**	**4.47**	**5.70**
LSD (0.05)	**0.11**	**0.10**	**0.26**	**0.27**	**0.02**	**0.02**	**0.73**	**0.63**	**2.87**	**2.63**	**16.84**	**15.11**
S × D												
SEm (±)	**0.05**	**0.03**	**0.10**	**0.07**	**0.01**	**0.01**	**0.30**	**0.21**	**0.93**	**0.87**	**5.17**	**4.86**
LSD (0.05)	**0.16**	**0.10**	**0.33**	**0.23**	**0.03**	**0.02**	**0.78**	**0.67**	**2.92**	**2.98**	**15.86**	**16.03**

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