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Effect of sowing dates and variety on dry yield, yield attributes and post-harvest soil fertility in mid hill of Meghalaya under organic condition

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Abstract
A field experiment was conducted during *kharif* season of 2018 at the College of Agriculture, Kyrdemkulai, (Central Agricultural University, Imphal), Ri-Bhoi district, Meghalaya to evaluate the sweet corn hybrids under varied date of sowing in mid hill of Meghalaya. The experiment was carried out in a split plot design with three numbers of main-plot treatments, *viz.*, sowing date on 2nd July (S_1), 12th July (S_2) and 22nd July (S_3) four numbers of sub-plot treatments, *viz.*, ASKH-1 (V_1), ASKH-4 (V_2), ASKH-6 (V_3) and SWEET-77 (V_4) and replicated thrice with only FYM application Significant variation was witnessed among sowing dates regarding dry yield of sweet corn. While, it also varied significantly among the hybrids. Among the main-plot treatments sowing on 2nd July (S_1) (2.44 tha^{-1}) exhibited highest grain yield and was significantly superior over remaining treatments. While it was followed by S_2 (1.87 t ha^{-1}) and S_3 (1.39 t ha^{-1}). Among the sub-plot treatments ASKH-6 (V_3) witnessed significantly highest dry yield with (3.34 t ha^{-1}) followed by ASKH-1 (V_1) (2.04 t ha^{-1}). Data obtained for post-harvest nutrient availability was found to be non-significant among the main-plot treatments. However, among sub-plot treatments highest available nitrogen was registered by ASKH-4 (V_2) (232.11 kg ha^{-1}) followed by V_4 and V_1. While highest value for available phosphorous was recorded by ASKH-4 (V_2) (19.56 kg ha^{-1}) followed by V_4 and V_1. Available potash (K) was found to be highest in ASKH-4 (V_2) (382.91 kg ha^{-1}) which was statistically at par with V_4. Delay planting reduced dry grain yield and the length and diameter of cob.

Keywords: Dry grain yield, post-harvest nutrient availability, length and diameter of cob

Introduction
The diversified use of sweet corn both as human food and animal feed make it as a remunerative crop for the Northeast marginal farmers. In a particular locality not all the cultivars are suitable for inclusion in the cropping system and there is a particular sowing window which offers maximum return. Keeping in view the production potential of maize in meghalaya and high economic returns from sweet corn, there is ample scope of growing maize as sweet corn to improve economic status of poor maize growers of northeast hill regions (NEH). This necessitates the evaluation of different sweet corn hybrids under varied date of sowing during *kharif* season through only application of FYM because organic manures like farm yard manures and compost have been traditionally used as input for improving soil physical, chemical and biological properties as well as maintain soil fertility which has resulted in yield stability. Guar *et al.* (1990) reported that organic nitrogen is slowly mineralized and about 30 percentage N, 60 to 70 percentage P_2O_5 and 75 percentages K_2O is likely become available to the first crop and rest of the nutrients to succeeding crops.

Materials and methods
The experiment was conducted at the College of Agriculture, Kyrdemkulai, (Central Agricultural University, Imphal), Ri-Bhoi district, Meghalaya, during *kharif* 2018. Sweet corn was grown in the strongly acidic soil of Meghalaya, North east India, with four sweet corn hybrids as main treatment and three sowing dates as sub plot treatment. The field experiment was replicated thrice under Split Plot Design (SPD). The results of the analysed soil sample representing the experimental field was sandy clay in texture, strongly acidic in nature, high in organic carbon (1.92%), low in available nitrogen (225.79 kg ha^{-1}), medium in available P_2O_5 (17 kg ha^{-1}) and high in available K_2O (242.6 kg ha^{-1}) with a pH of 5.32.
The dry yield was obtained from the moisture content (Fresh weight basis) and shelling percentage.

The available N, P_2O_5, K_2O in air dried soil were analysed by the standard procedure given by Subbiah and Asija (1956) [8], Bray and Kurtz (1945) [2] and Jackson (1973) [6], respectively. The length of five cobs obtained from five randomly selected plants was measured from the base of cobs to its tip with help of plastic scale. Then average length of cobs were calculated. The circumference of five randomly selected cobs was measured at centre with husk of cobs and mean is recorded as cob diameter in cm. The experiment was done in split-plot design and statistical analysis was carried out by using SPSS 16.0 and Microsoft Excel 2007. Data were further analyzed through a two-way ANOVA followed by Duncan's multiple range test.

Results and discussion

Effect of sowing dates and variety on dry yield of maize, length and diameter of cob. Different letters in a column are significantly different at $p<0.05$ according to Duncan's multiple range test

Significant variation was witnessed among sowing dates regarding dry yield of sweet corn. While, it also varied significantly among the hybrids Table 4.16. Among the main-plot treatments sowing on 2nd July (S_1) (2.44 tha^{-1}) exhibited highest grain yield and was significantly superior over remaining treatments. While it was followed by S_2 (1.87 t ha^{-1}) and S_3 (1.39 t ha^{-1}). Among the sub-plot treatments ASKH-6 (V_3) witnessed significantly highest dry yield with (3.34 t ha^{-1}) followed by ASKH-1 (V_1) (2.04 t ha^{-1}). Due to decrease in dry matter partitioning to grain and number of kernel per row, grain yield decreases in late sown conditions as suggested by Cirilo and Andrade, 1994 [3].

Cob length vary significantly among sowing dates. Among the main plot treatments maximum length of cobs (16.29 cm) was recorded at 2nd July (S_1) followed by (14.28 cm) 12th July (S_2). Whereas, late sowing on 22nd July registered lowest length of cobs. Significant result was found for length of cobs, among the sub-plot treatments also. ASKH-6 (V_3) reported significantly higher (15.94 cm) length of cobs which was statistically at par with ASKH-1 (V_1) (15.08 cm). Whereas SWEET-77 (V_4) recorded (13.97 cm) of cob length which was statistically at par with ASKH-4 (V_2) (13.18 cm). Interaction effect between date of sowing and hybrids on cob length was found to be non-significant.

Cob diameter not only vary significantly among sowing dates but also for hybrids. Among the main plot treatments maximum diameter of cobs (6.02 cm) was recorded at 2nd July (S_1) which was statistically superior to (5.75 cm) 12th July (S_2) and (5.53 cm) 22nd July sowing. Among the sub-plot treatments ASKH-3 (V_3) reported significantly higher (5.93 cm) diameter of cobs which was statistically at par with ASKH-6 (V_1) (5.81 cm) and SWEET-77 (V_4) (5.72 cm). Whereas ASKH-4 (V_2) registered lowest cob diameter (5.60 cm). At delayed planting reduction in LAI and dry matter accumulation due to shorter vegetative stage and poor partitioning of dry matter in sink might be responsible for lower values of yield attributes. Kolo *et al*. (2012) [7] confirm the findings.

Table 1: Effect of sowing dates and variety on dry yield of maize. Different letters in a column are significantly different at $p< 0.05$ according to Duncan's multiple range test

Variety/Sowing Date	Dry yield				
	V_1	**V_2**	**V_3**	**V_4**	**Mean**
S_1	2.51^b	2.11^a	2.86^c	2.27^{ab}	2.44
S_2	2.11^b	1.55^a	2.21^b	1.63^a	1.87
S_3	1.50^b	0.84^a	1.97^c	1.28^b	1.39
Mean	2.04	1.50	2.34	1.73	1.90
	S.E.(m) ±		**C.D(P=0.05)**		
Spacing	0.05		0.20		
Variety	0.05		0.16		
S× V	0.09		NS		
CV % (a)	9.08				
CV % (b)	8.61				

Table 2: Effect of sowing dates and variety on length and diameter of cob. Different letters in a column are significantly different at $p< 0.05$ according to Duncan's multiple range test

Variety/Sowing Date	Length of the cob					Diameter of the cob				
	V_1	**V_2**	**V_3**	**V_4**	**Mean**	**V_1**	**V_2**	**V_3**	**V_4**	**Mean**
S_1	16.60^a	15.33^a	17.50^a	15.71^a	16.29	14.4^a	13.6^a	14.5^a	14.1^a	14.2
S_2	14.82^{ab}	12.77^a	16.01^b	13.53^a	14.28	13.5^a	12.9^a	13.9^a	13.1^a	13.3
S_3	13.81^b	11.43^a	14.30^b	12.68^{ab}	13.06	12.7^a	12.1^a	13.3^a	12.5^a	12.7
Mean	15.08	13.18	15.94	13.97	14.54	13.5	12.9	13.9	13.2	13.4
	S.E.(m) ±		**C.D(P=0.05)**			**S.E.(m) ±**		**C.D(P=0.05)**		
Spacing	0.26		1.01			0.21		0.81		
Variety	0.41		1.21			0.23		0.67		
S× V	0.70		NS			0.39		NS		
CV % (a)	6.15					5.33				
CV % (b)	8.37					5.08				

Table 3: Effect of sowing dates and variety on final N, P_2O_5, K_2O status of soil. Different letters in a column are significantly different at $p<$ 0.05 according to Duncan's multiple range test

Variety/Sowing Date	N (Kg ha^{-1})					P_2O_5 (Kg ha-1)					K_2O (Kg ha-1)				
	V_1	**V_2**	**V_3**	**V_4**	**Mean**	**V_1**	**V_2**	**V_3**	**V_4**	**Mean**	**V_1**	**V_2**	**V_3**	**V_4**	**Mean**
S1	230^a	232.33^a	229^a	231.33^a	230.67	18.6^b	19.0^b	17.3^a	18.33^{ab}	18.33	380.30^a	382.7^a	379.53^a	380.23^a	380.69
S2	230.33^a	232.00^a	229.33^a	231.33^a	230.75	18.3^b	19.6^c	17.0^a	19.00^{bc}	18.50	380.70^a	382.93^a	380.23^a	381.37^a	381.31
S3	230.67^a	232.00^a	230.00^a	231.00^a	230.92	18.67^a	20.0^b	17.6^a	18.67^a	18.75	380.97^a	383.10^a	380.30^a	381.60^a	381.49
Mean	230.33	232.11	229.44	231.22	230.78	18.56	19.56	17.33	18.67	18.53	380.66	382.91	380.02	381.07	381.16
	S.E.(m) ±		**C.D(P=0.05)**			**S.E.(m) ±**		**C.D(P=0.05)**			**S.E.(m) ±**		**C.D(P=0.05)**		
Spacing	0.63		NS			0.32		NS			0.71		NS		

Variety	0.62	1.84	0.22	0.65	0.68	2.03
S× V	1.07	NS	0.38	NS	1.18	NS
CV % (a)	0.95		6.00		0.64	
CV % (b)	0.81		3.52		0.54	

Effect of sowing dates and variety on final N, P_2O_5, K_2O status of soil. Different letters in a column are significantly different at *p*< 0.05 according to Duncan's multiple range test

Effect of sowing dates and hybrid on post-harvest N, P_2O_5, and K_2O status of soil are presented. After harvesting of the sweet corn crop soil samples were collected and analyzed in the laboratory. The data obtained for available nitrogen, phosphorous and potash was found to be non-significant among the main-plot treatments, however for sub-plot treatments it was found to be significant.

Among the sub-plot treatments highest available nitrogen was registered by ASKH-4 (V_2) (232.11 kg ha^{-1}) followed by V_4 (231.22 kg ha^{-1}) and V_1 (230.33 kg ha^{-1}). The treatments V_2 and V_4 was found to be statistically at par with each other. While highest value for available phosphorous was recorded by ASKH-4 (V_2) (19.56 kg ha^{-1}) followed by V_4 (18.67 kg ha^{-1}) and V_1 (18.56 kg ha^{-1}). The treatments V_1 and V_4 was found to be statistically at par with each other. Similarly for available potash (K), ASKH-4 (V_2) (382.91 kg ha^{-1}) recorded highest which was statistically at par V_4 (381.07 kg ha^{-1}). The treatments V_1 and V_3 were also statistically at par with each other.

The data obtained for available nitrogen, phosphorous and potash was found to be non-significant among the main-plot treatments. However, among sub-plot treatments highest available nitrogen was registered by ASKH-4 (V_2) (232.11 kg ha^{-1}) followed by V_4 and V_1. While highest value for available phosphorous was recorded by ASKH-4 (V_2) (19.56 kg ha^{-1}) followed by V_4 and V_1. Available potash (K) was found to be highest in ASKH-4 (V_2) (382.91 kg ha^{-1}) which was statistically at par with V_4. Early sowing dates left the lowest available nitrogen, phosphorous, potassium in soil because of higher uptake of nutrients due to longer crop duration (Bender *et al.*, 2013) [1]. The hybrid ASKH-4 (V_2) left highest available nitrogen, phosphorous, potassium in soil which were similar to the findings of Heckman *et al*. (2003) [5].

Conclusion

The experiment was carried out to detect the best sowing date and finest hybrid of sweet corn and their combination outcomes under mid hills of Meghalaya. From the present investigation the following conclusions may be drawn that among the sowing date treatments significant variation as observed in the dry yield, cob length and diameter, therefore, early sowing on 2nd July may be preferred over the others and among the hybrids highest yield was given by ASKH-6 (V_3).

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