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Effect of different sowing dates on growth, yield parameters and yield of local glutinous maize (*Zea mays* L.): Cultivars

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Abstract
A field experiment was conducted at the reseach farm of College of Agriculture, Central Agricultural University, Imphal, during the *Kharif* season of 2020, in collaboration with DST-CCP (HICAB programme) on clay soil to assess the performance of three local glutinous maize cultivars under different three different date of sowing. The experiment was laid out in factorial randomized block design with three replications. Significantly higher growth parameters *viz.*, plant height, number of leaves, dry matter accumulation and leaf area was recorded in Chak Hao Chujak Angouba (White kernel) followed by Chak Hao Chujak Amuba (Black kernel) and the lowest values of growth parameters were recorded with Chak Hao Chujak Angangba (Red kernel). The highest kernel yield (4443.00 kg ha^{-1}) and stover yield (24883.42 kg ha^{-1}) were recorded in Chak Hao Chujak (Angouba). Maize crop sown at 30^{th} May, 2020 showed superior performance among all the cultivars with the highest mean kernel yield (4835.67 kg ha^{-1}) and stover yield (24750.87 kg ha^{-1}).

Keywords: Plant height, cultivars, sowing date, maize, yield

Introduction
Maize is one of the important cereal crops of the world, occupying third rank in production (590.8 m t) after wheat and rice with an average yield of 4.23 t ha^{-1} (FAO 2002). Maize has been an important cereal crop sowing to its highest production potential and adaptability to wide range of environment hence called as ‘Queen of Cereals’ (Choudhari and Channappagouda, 2015) [5]. It can be grown in *kharif*, rabi and summer seasons.
Maize is grown in almost all the states of India. It occupies an area of about 9.86 million hectares with a production of 26.26 million tones and productivity of 2664 kg ha^{-1} (Anon., 2017) [1]. In Manipur, it covers an area of 26.19 thousand hectares with a production of 57.94 MT and productivity of 2240 kg ha^{-1} (Anon., 2016-17) [2].
Various local glutinous maize cultivars are grown popularly by the farmers of Manipur. It has unique characteristic of soft and stickiness of kernel even though it is dried and stored for long time unlike the normal maize. Among the agro-techniques non-monetary inputs like sowing date is one of the management aspect to be considered for improving the yield of maize. The optimum time of sowing ensures better harmony between the plant and the weather. Early as well as delayed sowing in *Kharif* causes severe problems of insects and pests, birds and moisture stress at critical stages of crop growth.
Sowing dates have a pronounced effect on the yield of maize. Maize is generally sown from mid-week of April to last week of May in lower belts of Manipur valley. However, the field may not be vacant at this appropriate time due to delay in harvesting of some rabi crops. Late sowing results in a significant decline in maize production (Khan *et al*., 2011 and Singh *et al.* (2018) [12, 17]. Maize productivity is highly variable in rainfed system and to combat the adverse weather conditions, the research topic was planned at the experimental field of College of Agriculture, Central Agricultural University, Imphal, to find out the optimum sowing dates and suitable cultivars for valley condition of Manipur.

Materials and Methods
The field experiment was undertaken during the *kharif* season of 2020 at the research farm of College of Agriculture, CAU, Imphal, Manipur to study the Effect of Different Sowing Dates on Growth and Yield of Different Local Maize Cultivars under Rainfed Condition of Manipur.

The experiment was laid out in factorial randomized block design, replicated thrice in clay soil. The treatment consisted of three local glutinous maize cultivars *viz*, V_1: Chak Hao Chujak Angouba (White kernel), V_2: Chak Hao Chujak Amuba (Black kernel) and V_3: Chak Hao Chujak Angangba (Red kernel), which were sown under three different planting dates i.e. S_1 (15th May), S_2 (30th May) and S_3 (14th June), which were combined into 9 treatment combination of V_1S_1, V_1S_2, V_1S_3, V_2S_1, V_2S_2, V_2S_3, V_3S_1, V_3S_2 and V_3S_3.

Results and Discussion

Effect of different sowing dates on plant height (cm) of different local maize cultivars under rainfed condition of Manipur

The height of different local maize cultivars was significantly influenced by different sowing dates and presented in Table 1. The maximum plant height was recorded in Chak Hao chujak Angouba (White kernel). Higher plant height in the cultivars might be due to genetical character of the cultivar. Different sowing time significantly influenced the growth of different local maize cultivars. Significantly highest plant height was observed in 30th May (S_2) sowing but which remained at par to 15th May (S_1) sown plants. Taller plant at 30th May sowing might be due to optimum sowing time and favourable climatic conditions. The variation in plant height with different sowing time was also reported by Verma (2013) [21], Imran and Asad (2015) [9] and Sulochana *et al.*, (2015) [18] in maize.

Interaction between different sowing dates and different local maize cultivars gave significant effect on plant height at all growth stages.

Effect of different sowing dates on number of functional leaves per plant of different local maize cultivars under rainfed condition of Manipur

The data regarding mean number of functional leaves per plant as influenced by different treatments at 30, 60, 90 DAS and at harvest are presented in Table 2.

The highest number of functional leaves per plant was recorded with Chak Hao chujak Angouba (White kernel) where it remained at par to Chak Hao chujak Amuba (Black kernel), at 60 and 90 DAS but significantly superior at 30 DAS. However, there was no significant difference in number of functional leaves among all the three cultivars at harvest.

Highest number of functional leaves per plant was observed in 30th May (S_2) sowing at 30, 60 and 90 DAS, respectively and it was significantly higher over rest of the treatments but except at harvest, there was no significant difference among the sowing dates. It enhanced the leaf area resulting in more photosynthesis, which improved the growth, development and dry matter production per plant with respective date of sowing due to optimum sowing time, favourable climatic conditions especially temperature and suitable growth period. Similar finding was also reported by Noferesti (2006) [14], Ma *et al.*, (2007) and Girijesh *et al.*, (2011) [8].

Interaction between different sowing dates and different local maize cultivars showed significant effect on number of functional leaves at 30, 60 and 90 DAS.

Table 1: Plant height (cm) of local glutinous cultivars of maize at different growth stages as influenced by date of sowing

Plant height (cm)																
	30 DAS				60 DAS				90 DAS				Harvest			
Treatment	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
V_1	28.48	36.25	25.71	30.15	273.87	282.90	256.70	271.16	275.57	284.77	258.67	273.00	276.27	285.60	226.10	262.66
V_2	26.78	31.11	19.23	25.71	206.60	216.20	197.13	206.64	208.70	218.20	199.10	208.67	209.57	219.07	199.90	209.51
V_3	20.52	26.51	15.22	20.75	193.20	202.80	174.73	190.24	195.33	204.53	176.83	192.23	196.43	205.30	177.57	193.10
Mean	25.26	31.29	20.05		224.56	233.97	209.52		226.53	235.83	211.53		227.42	236.66	201.19	
	S	V	S x V		S	V	S x V		S	V	S x V		S	V	S x V	
SEd ±	1.89	1.89	3.27		10.28	10.28	17.81		10.33	10.33	17.90		15.59	15.59	27.01	
CD	4.00	4.00	6.93		21.79	21.79	37.75		21.91	21.91	37.95		33.05	33.05	57.25	
CV %	15.68				9.79				9.76				14.91			

Table 2: Number of functional leaves per plant of local glutinous cultivars of maize at different growth stages as influenced by date of sowing

Number of leaves per plant																
	30 DAS				60 DAS				90 DAS				Harvest			
Treatment	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**
V_1	3.33 *(1.95)	4.67 (2.27)	3.33 (1.95)	3.78 (2.06)	7.33 (2.80)	10.67 (3.27)	6.67 (2.68)	8.22 (2.91)	10.00 (3.19)	11.67 (3.41)	9.67 (3.14)	10.44 (3.25)	3.67 (2.04)	3.67 (2.04)	3.33 (1.95)	3.56 (2.01)
V_2	3.00 (1.87)	3.67 (2.04)	2.67 (1.77)	3.11 (1.89)	6.33 (2.16)	10.33 (3.21)	6.33 (2.51)	7.67 (2.78)	9.33 (3.05)	11.33 (3.37)	9.00 (3.05)	9.89 (3.16)	3.33 (1.95)	3.67 (2.04)	3.33 (1.95)	3.44 (1.98)
V_3	3.00 (1.87)	3.67 (2.04)	2.33 (1.68)	3.00 (1.86)	5.33 (2.31)	10.33 (3.24)	5.33 (2.41)	7.00 (2.65)	8.33 (2.97)	10.67 (3.26)	7.67 (2.85)	8.89 (3.03)	3.00 (1.87)	3.33 (1.95)	3.00 (1.87)	3.11 (1.90)
Mean	3.11 (1.90)	4.00 (2.12)	2.78 (1.80)		6.33 (2.57)	10.44 (3.24)	6.11 (2.53)		9.22 (3.07)	11.22 (3.35)	8.78 (3.01)		3.33 (1.95)	3.56 (2.01)	3.22 (1.93)	
	S	V	S x V		S	V	S x V		S	V	S x V		S	V	S x V	
SEd ±	0.23 (0.06)	0.23 (0.06)	0.39 (0.10)		0.32 (0.05)	0.32 (0.05)	0.56 (0.09)		0.39 (0.06)	0.39 (0.06)	0.68 (0.10)		0.25 (0.06)	0.25 (0.06)	0.44 (0.11)	
CD	0.48 (0.12)	0.48 (0.12)	0.83 (0.22)		0.68 (0.11)	0.68 (0.11)	1.18 (0.20)		0.83 (0.12)	0.83 (0.12)	1.44 (0.21)		NS	NS	NS	
CV %	14.60 (6.42)				8.96 (4.13)				8.53 (3.95)				15.90 (6.83)			

* The value in the parentheses is the transformed data

Table 3: Shoot dry matter (g plant^{-1}) of local glutinous cultivars of maize at different growth stages as influenced by date of sowing

Shoot dry matter (g plant^{-1})																
	30 DAS				60 DAS				90 DAS				Harvest			
Treatment	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
V_1	6.03	6.53	5.93	6.17	69.79	73.29	69.01	70.70	299.48	313.04	296.75	303.09	319.44	335.28	315.61	323.44
V_2	5.63	5.82	5.33	5.59	66.91	68.22	64.81	66.65	278.62	283.56	270.50	277.56	306.72	312.39	297.08	305.39
V_3	4.80	5.21	4.33	4.78	60.94	63.86	57.55	60.78	255.57	267.07	243.10	255.25	279.43	293.57	265.10	279.37
Mean	5.49	5.85	5.20		65.88	68.46	63.79		277.89	287.89	270.12		301.86	313.74	292.60	
	S	V	S x V		S	V	S x V		S	V	S x V		S	V	S x V	
SEd ±	0.22	0.22	0.38		1.52	1.52	2.63		5.91	5.91	10.24		6.83	6.83	11.82	
CD	0.46	0.46	0.80		3.22	3.22	5.58		12.53	12.53	21.70		14.47	14.47	25.06	
CV %	8.37				4.88				4.50				4.78			

Table 4: Leaf area (cm^2) of local glutinous cultivars of maize at different growth stages as influenced by date of sowing

Leaf area (cm^2)																
	30 DAS				60 DAS				90 DAS				Harvest			
Trt.	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
V_1	477.45	768.73	453.75	566.64	2355.10	4705.33	2157.01	3072.48	4223.98	6311.99	3731.66	4755.88	1782.91	2345.35	1466.03	1864.76
V_2	447.41	566.43	336.64	450.16	1847.69	4338.70	1685.25	2623.88	3485.61	5773.58	2867.10	4042.10	1454.20	2076.07	1053.18	1527.81
V_3	422.48	525.10	279.80	409.12	1517.00	3433.65	1253.30	2067.98	3010.00	5592.85	1886.25	3496.37	1276.22	1666.88	883.47	1275.52
Mean	449.11	620.08	356.73		1906.60	4159.23	1698.52		3573.20	5892.81	2828.34		1504.44	2029.43	1134.23	
	S	V	S x V		S	V	S x V		S	V	S x V		S	V	S x V	
SEd ±	26.37	26.37	45.67		125.61	125.61	217.57		215.92	215.92	373.98		92.32	92.32	159.90	
CD	55.90	55.90	96.83		266.30	266.30	461.24		457.75	457.75	792.84		195.72	195.72	338.99	
CV %	11.77				10.30				11.18				12.59			

Effect of different sowing dates on shoot dry matter of different local maize cultivars under rainfed condition of Manipur

The shoot dry matter of different local maize cultivars was significantly influenced by different sowing dates and presented in Table 3. Among the different local maize cultivars, the highest plant shoot dry matter was observed in V_1 showed significantly superiority over the rest of the cultivars. The findings are in agreement with those of Khan *et al*., (2002) [12]. It is found that the maximum shoot dry matter accumulation per plant was the positive effect of yield characters.

The maximum plant shoot dry matter was obtained in 30th May (S_2) sowing which remained at par to 15th May (S_1) sown plants at 30, 90 DAS and at harvest but significantly higher to 14th June (S_3) sowing. However, at 60 DAS, shoot dry matter differ significantly with maximum recorded at 30th May sowing followed by 15th May and 14th June sowing. Higher plant dry matter accumulation during last week of May might be due to higher heat use efficiency and more efficient utilization of plant growth resources. Such variation in shoot dry matter of maize among different sowing time was supported by Joshi *et al.*, (2005) [11], Estakhr and Choucan (2006) [6], Girijesh *et al.*, (2011) [8], Imran and Asad (2015) [9] and Sulochana *et al.*, (2015) [18].

Interaction between different sowing dates and different local maize cultivars varied significant effect on shoot dry weight at all growth stages.

Effect of different sowing dates on leaf area (sq. cm) per plant of different local maize cultivars under rainfed condition of Manipur

The LA of different local maize cultivars was significantly influenced by different sowing dates and presented in Table 4. The significantly higher LA were observed in V_1 followed by V_2 and V_3 at 30, 60, 90 DAS and at harvest. In the succeeding all stages, maximum LA was recorded in V_1 and it showed significant superiority over the other cultivars.

Significantly highest LA was observed in 30th May (S_2) sowing at 30, 60, 90 DAS and at harvest compared to 15th May (S_1) sowing and 14th June (S_3) sowing in all the stages. It enhanced the leaf area index resulting in more photosynthesis, which improved the growth, development and dry matter production per plant with respective date of sowing due to optimum sowing time, favourable climatic conditions especially temperature and suitable growth period. Similar finding was also reported by Noferesti (2006) [14], Ma *et al.*, (2007) and Girijesh *et al.*, (2011) [8]. Interaction between different sowing dates and different local maize cultivars gave significant effect on leaf area (sq. cm) at all growth stages.

Table 5: Number of cobs per plant, Cob length (cm), Number of rows per cob and 100 Kernels weight (g) of local glutinous cultivars of maize as influenced by date of sowing

	No. of cobs per plant				Cob length (cm)				No. of rows per cob				100 Kernels weight			
Treatment	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
V_1	1.87 (1.54)	2.00 (1.58)	1.80 (1.52)	1.89 (1.54)	16.77	16.83	16.60	16.73	18.26	18.33	18.14	18.25	18.07	18.55	17.52	18.04
V_2	1.87 (1.54)	1.93 (1.56)	1.73 (1.49)	1.84 (1.53)	14.60	14.90	14.17	14.56	15.69	15.98	14.93	15.53	15.77	15.82	15.48	15.69
V_3	1.73 (1.49)	1.80 (1.52)	1.73 (1.49)	1.76 (1.50)	14.27	14.47	13.33	14.02	15.26	15.50	14.86	15.21	14.86	14.86	14.68	14.80
Mean	1.82 (1.52)	1.91 (1.55)	1.76 (1.50)		15.21	15.40	14.70		16.40	16.60	15.98		16.23	16.41	15.89	

	S	V	S x V	S	V	S x V	S	V	S x V	S	V	S x V
SEd ±	0.09 (0.03)	0.09 (0.03)	0.15 (0.05)	0.39	0.39	0.68	0.35	0.35	0.61	0.32	0.32	0.56
CD	NS	NS	NS	NS	0.83	1.44	NS	0.75	1.30	NS	0.68	1.19
CV %	10.12 (4.00)			5.51			4.60			4.23		

Table 5: Number of cobs per plant, Cob length (cm), Number of rows per cob and 100 Kernels weight (g) of local glutinous cultivars of maize as influenced by date of sowing

	No. of cobs per plant				**Cob length (cm)**				**No. of rows per cob**				**100 Kernels weight**			
Treatment	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**
V_1	1.87 (1.54)	2.00 (1.58)	1.80 (1.52)	1.89 (1.54)	16.77	16.83	16.60	16.73	18.26	18.33	18.14	18.25	18.07	18.55	17.52	18.04
V_2	1.87 (1.54)	1.93 (1.56)	1.73 (1.49)	1.84 (1.53)	14.60	14.90	14.17	14.56	15.69	15.98	14.93	15.53	15.77	15.82	15.48	15.69
V_3	1.73 (1.49)	1.80 (1.52)	1.73 (1.49)	1.76 (1.50)	14.27	14.47	13.33	14.02	15.26	15.50	14.86	15.21	14.86	14.86	14.68	14.80
Mean	1.82 (1.52)	1.91 (1.55)	1.76 (1.50)		15.21	15.40	14.70		16.40	16.60	15.98		16.23	16.41	15.89	
	S	V	S x V		S	V	S x V		S	V	S x V		S	V	S x V	
SEd ±	0.09 (0.03)	0.09 (0.03)	0.15 (0.05)		0.39	0.39	0.68		0.35	0.35	0.61		0.32	0.32	0.56	
CD	NS	NS	NS		NS	0.83	1.44		NS	0.75	1.30		NS	0.68	1.19	
CV %	10.12 (4.00)				5.51				4.60				4.23			

Table 6: Kernel Yield (kg ha^{-1}), Stover Yield (Kg ha^{-1}) and Harvest Index (%) of local glutinous cultivars of maize as influenced by date of sowing

	Kernel Yield (kg ha^{-1})				**Stover Yield (Kg ha-1)**				**Harvest Index (%)**			
Treatment	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**
V_1	4353	4966	4010	4443.00	24569.39	26216.04	23864.82	24883.42	18.09	18.94	16.94	17.99
V_2	3950	4831	3550	4110.33	21057.42	24786.13	19282.77	21708.77	20.51	19.68	17.31	19.17
V_3	3844	4710	3444	3999.33	20354.17	23250.44	18692.11	20765.57	18.98	20.37	18.60	19.32
Mean	4049.00	4835.67	3668.00		21993.66	24750.87	20613.23		19.20	19.66	17.61	
	S	V	S x V		S	V	S x V		S	V	S x V	
SEd ±	35.60	35.60	61.66		1264.85	1264.85	2190.79		1.06	1.06	1.83	
CD	75.47	75.47	130.72		2681.48	2681.48	4644.47		NS	NS	NS	
CV %	1.80				11.95				11.90			

Effect of different sowing dates on No. of cobs per plant, Cob length (cm), No. of rows per cob and 100 Kernels weight (g) of different local maize cultivars under rainfed condition of Manipur

Number of cobs per plant

Data on number of cobs per plant recorded at harvest as influenced by different treatments are presented in Table 5.

No significant difference number of crop per plant was observed in all the treatment. The highest number of cobs per plant was recorded with Chak Hao chujak Angouba (White kernel) followed by Chak Hao chujak Amuba (Black kernel) and Chak Hao chujak Angangba (Red kernel). Similarly, the highest number of cobs per plant was observed at 30th May sowing, followed by 15th May and 14th June sowing.

Interaction between different sowing dates and different local maize cultivars could not give significant difference in the number of cobs per plant. The above findings are supported by works of Khan *et al*., (2002) [12], Noferesti (2006) [14], Ma *et al*., (2007), Girijesh *et al.,* (2011) [8], Imran and Asad (2015) [9] and Sulochana *et al.,* (2015) [18].

Cob length (cm)

The cob length (cm) of different local maize cultivars was significantly influenced by different sowing dates and presented in Table 5. Among the cultivars, significantly higher cob length was recorded in Chak Hao chujak Angouba (White kernel) followed by the cobs in Chak Hao chujak Amuba (Black kernel) and the cobs in Chak Hao chujak Angangba (Red kernel). Among the different sowing dates, could not give a significant influenced on cob length. Highest cob length was recorded in Chak Hao chujak Angouba (White kernel) and 30th May (V_1S_2) and lowest in Chak Hao chujak Angangba (Red kernel) and 14th June (V_3S_3). The observed results are in closed proximity with the findings of Thakur *et al.,* (2000) [20], Khan *et al.,* (2002) [12]. Noferesti (2006) [14], Ma *et al*., (2007), Girijesh *et al.,* (2011) [8], and Sulochana *et al.,* (2015) [18].

Number of rows per cob

Data on number of kernel rows per cob at harvest as influenced by different treatments are presented in Table 5.

The mean number of rows per cob was significantly influenced by the different local maize cultivars. Chak Hao chujak Angouba (White kernel) showed significant superiority over the rest of the cultivars. The next best cultivar was Chak Hao chujak Amuba (Black kernel) recorded significant higher number of grain rows per cob as compared to Chak Hao chujak Angangba (Red kernel). The number of rows per cob did not differ significantly among the different sowing dates. Different sowing dates could not give a significant influenced on number of rows, as the trait is influenced by its varietal character. Selvi *et al.,* (2005) [16]. Rajeshwari *et al.,* (2007) [15] Jadhav (2010) [10] and Abonmai *et al.,* (2019) [19] also reported similar findings. Interaction between different sowing dates and different local maize cultivars varied significant difference in the number of kernel rows per cob.

100 Kernels weight (g)

Data on 100 Kernels weight (g) recorded at harvest as influenced by different treatments are presented in Table 5 Significantly highest was recorded with the treatment of Chak Hao chujak Angouba (White kernel) followed by Chak Hao chujak Amuba (Black kernel) and Chak Hao chujak Angangba (Red kernel). Sowing at different date could not bring significant effect on test weight as individual seed weight and seed size are dependent on genetic character of the crop. The obtained result is thus supported by findings of Sulochana *et al.*, (2015) [18] and Abonmai *et al.*, (2019) [19].

Interaction between different sowing dates and different local maize cultivars gave significant influence on 100 Kernels weight.

Effect of different sowing dates on kernel yield (kg ha^{-1}), stover yield (kg ha^{-1}) and harvest index (%) of different local maize cultivars under rainfed condition of Manipur

Kernel yield (kg ha^{-1})

The kernel yield of different local maize cultivars was significantly influenced by different sowing dates and presented in Table 6. Significantly higher kernel yield (4443.00 kg ha^{-1}) was observed in Chak Hao chujak Angouba (White kernel) followed by the yield (4110.33 kg ha^{-1}) in Chak Hao chujak Amuba (Black kernel) and the yield (3999.33 kg ha^{-1}) in Chak Hao chujak Angangba (Red kernel). Among the different sowing dates, 30th May (S_2) gave higher kernel yield (4835.67 kg ha^{-1}) followed by 15th May (S_1) which gave a kernel yield of 4049.00 kg ha^{-1} and 14th June (S_3) which gave a kernel yield (3668.00 kg ha^{-1}). Highest kernel yield (4966) was observed in Chak Hao chujak Angouba (White kernel) and 30th May (V_1S_2) and lowest (3444 kg ha^{-1}) in Chak Hao chujak Angangba (Red kernel) and 14th June (V_3S_3).

The observed result is supported by findings of Khan *et al*., (2002) [12]. Beiragi *et al*. (2011) [4], Thakur *et al*., (2000) [20], Noferesti (2006) [14], Ma *et al*., (2007), Girijesh *et al.*, (2011) [8], Imran and Asad (2015) [9] and Sulochana *et al.*, (2015) [18].

Stover yield (kg ha^{-1})

The stover yield of different local maize cultivars was significantly influenced by different sowing dates and presented in Table 6. Among the cultivars, significantly higher stover yield (24883.42 kg ha^{-1}) was recorded in Chak Hao chujak Angouba (White kernel) followed by the yield (21708.77 kg ha^{-1}) in Chak Hao chujak Amuba (Black kernel) and the yield (20765.57 kg ha^{-1}) in Chak Hao chujak Angangba (Red kernel). Among the different sowing dates, 30th May (S_2) gave significantly higher stover yield (24750.87 kg ha^{-1}) followed by 15th May (S_1) which gave a stover yield of 21993.66 kg ha^{-1} and 14th June (S_3) which gave a kernel yield (20613.23 kg ha^{-1}). Highest stover yield (26216.04 kg ha^{-1}) was recorded in Chak Hao chujak Angouba (White kernel) and 30th May (V_1S_2) and lowest (18692.11 kg ha^{-1}) in Chak Hao chujak Angangba (Red kernel) and 14th June (V_3S_3). Khan *et al*., (2002) [12]. Beiragi *et al*. (2011) [4], Thakur *et al.*, (2000) [20], Noferesti (2006) [14], Ma *et al*., (2007), Girijesh *et al.*, (2011) [8], Imran and Asad (2015) [9] and Sulochana *et al.*, (2015) [18] reported similar results which are in accordance to the finding of the experiment conducted. Owing to higher values of growth and yield attributes, the maximum grain yield was obtained in Chak Hao chujak Angouba (White kernel). The improved physical properties like water holding capacity and moisture retention provided a desirable soil condition for the root development, enhanced crop growth and yield (Abonmai *et al.*, 2019 [19] and Selvi *et al.*, 2005) [16]. Similar findings were also reported by Rajeshwari *et al.*, (2007) [15] and Jadhav (2010) [10].

Harvest index (%)

The data on harvest index as influenced by different treatments are presented in Table 6. There was no significant difference in the harvest index as influenced by the treatments. However, Higher harvest index was recorded in (V_2S_1) Chak Hao chujak Amuba (Black kernel) and 15th May (20.51) and the lowest (17.31) in Chak Hao chujak Amuba (Black kernel) sown at 14th June. As the economic yield of a crop is a function of the relative vegetative growth of the crop, the harvest index were found to be non-significant. The obtained result is thus supported by findings of Abonmai *et al.*, (2019) [19].

Conclusion

On the basis of results obtained from the present investigation, it can be concluded that the local glutinous maize (*Zea mays* L.) responded well to Chak Hao chujak Angouba (White kernel) in terms of growth and yield. Among the sowing time, the crop can be sown on 30th May for obtaining better growth and higher yield of the crop.

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