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Crop weather relationship in preseasonal sugarcane (Var. CoM 0265)

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ABSTRACT

A field experiment was carried out at Central Sugarcane Research Station Padegaon, during 2011-12 to 2013-14 to assess the crop weather relationship in preseasonal sugarcane (var. CoM 0265). Treatments were comprised of nine planting dates at 15 days interval starting from 15th October to 15th February. The results indicated that the early planting produced highest cane and CCS (commercial cane sugar) yield. Significantly the highest brix (21.3), sucrose (20.4%), purity (96.8%) and CCS (14.6%) were observed under early planting of sugarcane on 15th October, which was at par with the treatment 01st November, 15th November, 1st December planting. At harvest cane and CCS yield of sugarcane was positively correlated with maximum temperature, wind velocity and pan evaporation. Significantly positive correlation of millable cane, weight per cane was observed with cane and CCS yield.

Key words: Sugarcane, preseasonal, planting dates, crop-weather relationship

Sugarcane is a highly versatile plant and can be grown successfully under a wide range of soil and climatic conditions. Being a tropical plant it thrives best in hot, humid and sunny areas. Sugarcane grows all year round and thus passes through fluctuations in climatic factors such as very high temperatures in summer and very low minimum temperatures in winter. The ultimate yield of the crop is profoundly influenced by the weather elements. The global warming and climate variation have influenced the planting time, crop productivity and sugar recovery percentage (Duli Zhao and Young Rui, 2015). Also many predicted negative impacts like climate induced biotic and aboitic stresses, deterioration of soil and water resources, shift in weed species, pest and diseases patterns, cane quality deterioration, etc. ring the alarm bells and attract immediate research initiativesfor studying the impact as well as for developing strategies to overcome them (Bhaskaran and Nair, 2014). The preseasonal sugarcane planting is recommended during 15 October to 15 November for Maharashtra. The farmers of Maharashtra have started planting the sugarcane as per their convenience to get the higher prices from sugar factories. Unseasonal planting may affect the productivity of sugarcane. Since last few years it was observed that there is reduction in crop productivity and sugar recovery percentage, despite many important recommendations. Therefore, the experiment was planned with the objectives to find out the optimum planting dates of preseasonal sugarcane and to correlate meteorological parameters with yield and yield attributes of sugarcane.

MATERIALS AND METHODS

Field experiment was conducted during 2011-12 to 2013-14 at Central Sugarcane Research Station, Padegaon, Satara, Maharashtra. The experiment was laid out in randomized block design with treatments comprised of nine planting dates of pre seasonal sugarcane. The planting were done at fifteen days intervals viz., T_1 : 15th October, T_2 : 01st November, T_3: 15th November, T_4 :1st December, T_5: 15th December, T_6:1st January, T7: 15thJanuary, T_8: 1st February and T_9: 15th February. The sugarcane variety CoM 0265 was planted as per the treatments with 120 cm row spacing in gross and net polt size 10.0m X 7.20m and 8.00m X 4.80m, respectively. The two eye budded setts were planted at 15-20 cm distance. The crop was fertilized with the recommended fertilizer dose 340 kg N ha^{-1}, 170 kg $P_2O_5 ha^{-1}$ and 170 kgK ha^{-1}. The nitrogen was applied in 4 splits at planting (10%), tillering (40%), grand growth stage (10 %) and earthing up (40 %). Phosphorus and potassium were applied in 2 splits at planting (50 %) and earthing up (50 %). The soil of the experimental site was medium black. All the recommended plant protection measures were undertaken during the course of investigation. Data were recorded at harvest for yield and quality characters. The juice analysis was done by sampling five canes from each plot at harvest. The daily weather data of the crop season during three years was considered for correlation study.

Table 1: Growth and yield attributes, yield and quality parameters of sugarcane as affected by various treatments (Pooled three years 2011-12 to 2013-14)

Treatments (Planting time)	Germination (%)	TR	Millable cane height (cm)	Cane girth (cm)	No. of internodes cane^{-1}	NMC (ha^{-1})	Wt cane^{-1} (kg)	Cane yield (t ha^{-1})	CCS yield (t ha^{-1})	Brix (c)	Sucrose (%)	Purity (%)	CCS (%)
T_1- 15th October	74.0	1.70	290.6	11.4	29.6	106865	1.60	171.1	25.0	21.2	20.4	96.8	14.6
T_2-01st November	70.6	1.65	288.3	11.3	29.3	106720	1.59	169.0	24.3	21.0	20.1	95.8	14.4
T_3- 15th November	69.0	1.58	284.3	11.2	28.6	104941	1.58	165.6	23.3	20.7	19.8	94.8	14.0
T_4- 1st December	68.0	1.52	281.3	11.1	28.3	104458	1.56	163.3	23.0	20.6	19.6	95.1	14.1
T_5- 15th December	65.6	1.40	271.0	10.6	27.0	100117	1.50	150.2	20.4	20.2	19.0	93.4	13.6
T_6- 1st January	63.3	1.35	265.6	10.3	26.3	98540	1.49	146.5	19.8	19.9	18.9	93.3	13.5
T_7- 15th January	60.6	1.29	264.0	10.2	26.0	95786	1.49	143.3	19.1	19.8	18.7	93.4	13.3
T_8- 1st February	58.0	1.27	260.3	10.1	25.6	93447	1.51	140.6	18.6	19.2	18.4	93.6	13.2
T_9- 15th February	54.3	1.13	255.6	9.7	25.0	92368	1.50	138.4	17.8	18.5	18.0	93.5	12.9
SE±	3.4	0.10	3.3	0.1	0.9	2468.7	0.09	6.7	0.8	0.3	0.3	0.9	0.2
CD at 5 %	11.0	0.27	9.9	0.4	1.1	7264.1	NS	19.8	2.9	0.9	1.1	1.8	0.7
CV %	4.6	9.28	2.1	4.3	6.2	4.25	7.62	8.1	8.2	2.5	3.3	1.7	3.1

TR: Tillering Ratio, NMC: Number of Millable canes CCS: Commercial Cane Sugar

RESULTS AND DISCUSSION

Growth and yield attributes

Among the different growth parameters (Table 1) significantly highest germination percentage (74%), tillering ratio (TR) (1.70), millable cane height (290.67 cm), cane girth (11.46 cm), number of internodes per cane (29.67), and number of millable cane (NMC) (106865) was observed under planting of sugarcane on 15th October (T_1). Which was at par with three subsequent peanting dates (T_2, T_3 and T_4). The weight per cane (kg) was found to be non significant due to different treatments under study. The time of planting in the year has a significant importance on the yield achieved in the plant cane crop. This is because of the emerged cane has a longer growth period and is better to attained full tillering and leaf canopy, before commencement of rapid stalk elongation with the onset of warmer condition.

Cane and CCS yield

The highest cane 171.15 t ha^{-1} and CCS yield 25.01t ha^{-1}of sugarcane was recorded under planting on 15th October (T_1) and which was at par with the treatment T_2, T_3 and T_4. This might be due to the increased contribution of growth and yield attributing characters. The delay in sowing caused reduction in cane and CCS yield over T_1 which were to the extent of 12.2% and 18.2%, 14.3% and 20.8%, 16.2% and 23.2%, 17.8% and 25.4% and 19.1% and 28.5% in treatments T_5, T_6, T_7, T_8 and T_9, respectively. The increased cane and CCS yield might be due to increased contribution of growth and yield attributes. Also as per the correlation studies different growth and yield attributes were significantly affected due to different weather parameters *viz.* maximum temperature, wind velocity and pan evaporation. The results are corroborative to those reported by Kumar and Sharma (2014), Duli and Yang (2015) and Bhengra *et al.* (2016) . The data on quality parameters revealed that, the highest brix (21.2), sucrose (20.4%), purity (96.8%) and CCS (14.6%) were observed under planting on 15th October (T_1). However, it was at par with the treatment T_2, T_3 and T_4. (Table 1)

Correlation with weather parameters

The correlation data with respect to biometric, yield and quality characters with meteorological parameters are presented in Table 2. At harvest cane and CCS yield of sugarcane was positively correlated with maximum temperature, wind velocity and pan evaporation. Significantly positive correlation of millable cane, weight

Table 2: Correlation between growth, yield attributes and cane and CCS yield with weather parameters at harvest

Parameters	Plant height	No. of Internodes	Internode Length	Girth ofcane	Cane yield	CCS yield	Millable cane	Sucrose %	Brix	CCS %	Purity %	Wt per cane
TMax	0.69*	0.68*	0.62	0.70*	0.66	0.66	0.77*	0.74*	0.84**	0.67*	0.58	0.47
TMin	-0.58	-0.56	-0.63	-0.57	-0.62	-0.61	-0.50	-0.52	-0.36	-0.58	-0.61	-0.70*
RH I	-0.62	-0.63	-0.50	-0.63	-0.59	-0.58	-0.70*	-0.66	-0.77*	-0.59	-0.48	-0.43
RH II	-0.99**	-0.97**	-0.96**	-0.98**	-0.98**	-0.98**	-0.98**	-0.98**	-0.96**	-0.97**	-0.92**	-0.88**
BSS	-0.53	-0.50	-0.65	-0.51	-0.56	-0.56	-0.44	-0.50	-0.35	-0.56	-0.62	-0.59
Rainfall	-0.89**	-0.87**	-0.92**	-0.88**	-0.90**	-0.90**	-0.83**	-0.86**	-0.77*	-0.89**	-.089**	-0.88**
Wind speed	0.93**	0.91**	0.97**	0.92**	0.92**	0.93**	0.88**	0.93**	0.87**	0.95**	0.95**	0.85**
EP	0.72*	0.72*	0.63	0.72*	0.68*	0.68*	0.79*	0.76*	0.85**	0.69*	0.60	0.52

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.01 level (2-tailed)
Tmax (Maximum temperature), Tmin (Minimum temperature), RHI (Morning relative humidity, RH-II (Afternon relative humidity), BSS (bright sunshine hour), and EP (Pan evaporation).

per cane was observed with cane and CCS yield. The study revealed that there was significant impact of different weather parameters on growth and yield attributes at different stages and on yield and quality of sugarcane. The impact of climate change on growth and yield of sugarcane was also reported by Singh *et al*. (2010). Mali *et al*. (2014) and Kumar and Sharma (2014).

CONCLUSION

Under the changing climatic condition the planting of preseasonal sugarcane (CoM 0265) was found suitable from 15 October to 30 November for higher CCS yield without reduction cane yield in medium to deep black soils of Western Maharashtra.

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