

Role of Environmental Factors on Sucrose Contents in Sugarcane

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The influence of different environmental factors viz., rainfall, maximum and minimum temperature, humidity and sunshine during growth and ripening period on sucrose content of sugarcane variety Isd 16 was studied for consecutive 6 years. Highly significant negative correlation ($r = -0.935^{**}$) was found between sucrose content and rainfall during ripening period. Sucrose content showed significant negative association ($r = -0.909^*$, $r = 0.822^*$) with higher minimum temperature and humidity percentage respectively. The effect of rainfall, average maximum temperature and bright sunshine hours per day during growing period showed nonsignificant correlation with sucrose content. It is evident that soil moisture in the field related to rainfall during ripening period tremendously affect the sucrose content of sugarcane.

Sucrose content in sugarcane is one of the most important character. In Bangladesh, increase or decrease of one percent sugar recovery involves increase or decrease of Tk. 550 million per year in sugar industry. Sucrose content in sugarcane is related with the heredity of variety and environment where it is grown. Environmental factors in many cases mask the genetic expression of an individual. In the early days of genetics, controversies arose as to whether heredity or environment was more important. Actually both are important. The heredity determines the potential and environment determines to what extent the individual reaches its potential (Singleton, 1969). This paper describes how the sucrose content in sugarcane is influenced by different environmental factors like rainfall, temperature, humidity and sunshine.

Recoverable sucrose (%) variation in different cane ripening seasons were studied with high potential sucrose content sugarcane variety Isd 16 for six years from 1976-77 to 1981-82 at SRTI Farm Ishurdi, Pabna. In each seasons, juice analysis for sucrose content was performed twice a month starting from October to March. Sucrose content was determined from 40 stalks (10 stalks from each replication) by Saccharimeter (Meade, 1963). Rainfall during sugarcane growth period (March to September), ripening period (October to February), average maximum and minimum temperature, humidity percent and bright sunshine per day hours for the study periods were recorded from Metrology section, SRTI.

The average data on sucrose content and environmental factors are presented in the Table 1. Month wise rainfall in growth and ripening period from 1976-77 to 1981-82 is shown in the Table 2. Simple correlation between sucrose content and environmental factors are shown in the Table 3. Remarkable variation in sucrose content was observed in different years. The highest sucrose content 11.74 percent was found in 1978-79 ripening season

followed by 11.37 percent in 1981-82. Whereas the lowest sucrose 8.88 percent was recorded in 1980-82 followed by 8.89 percent in 1977-78.

In 1978-79 ripening season, where the highest sucrose content was found, the lowest rainfall of 5.05 cm in ripening period was recorded. The second lowest rainfall ripening period was noted in 1981-82 season where the second highest sucrose content of 11.37 percent was found. On the other hand, the highest rainfall of 22.86 cm in ripening period was recorded in 1980-81 where the lowest recoverable sucrose was found. It is vivid from the Table 1 and 2 that rainfall in the month of October is very important. Higher the rainfall in the month of October recorded lower sucrose content in the respective year. On the other hand, lower the rainfall in the month of October, higher sucrose content was found in the respective year. Simple correlation studies indicated that sucrose content is highly and negatively correlated with the rainfall during ripening period. The result was supported by the findings of Hartt (1936). She reported that heavy rainfall on the ripening cane, causes renewed growth. In renewed growth process some of the stored sugar moves upward towards utilization areas in the region of the apical meristem. This process thus accompanied by severe sucrose losses from the stalks. On the contrary, less moisture in soil resulting from low rainfall restricts further plant growth and consequently allows sucrose to accumulate in stalks. Sucrose content was also found negatively and significantly correlated with most lower temperature and humidity. It is generally assumed that in higher temperature and humidity sugarcane plant produce more photosynthate but also as utilizing more in translocation, growth and respiration, ultimately causing a net decrease of sucrose in storage.

The influence of rainfall during growth period, average maximum temperature and bright sunshine hours per day on sucrose content was negligible. Legendre (1975) also reported negligible effect of total rainfall, sunshine and temperature on cane ripening in some varieties. Remarkable variation in average recovery of sugar percent was noted in 1995-96 crushing year with the same highest sugar recovery (10.48%) in Gujrat and Maharashtra, whereas the lowest sugar recovery (6.04%) in West Bengal, India (Anon., 1997). Variation of recovery in different year is also clear. It is generally assumed that this variation is due to changed environmental factors in different years and different states.

Table 1. Recovery (%) and environmental factors indifferent growing seasons at SRTI, Ishurdi.

Cane growing season	Recovery (%)	Rainfall during growth period, Mar.-Sept. (cm)	Rainfall during ripening period Oct.-Feb. (cm)	Average Max.Temp. ($^{\circ}$ C)	Average Min. Temp. ($^{\circ}$ C)	Humidity (%)	Average bright sunshine (hrs/day)
1976-77	10.43	177.80	16.25	28.46	15.85	78.08	7.65
1977-78	8.99	223.95	23.27	27.60	16.13	84.05	5.73
1978-79	11.74	124.07	5.05	27.70	15.10	78.63	5.67
1979-80	9.50	174.90	13.73	28.43	16.77	89.17	7.26
1980-81	8.88	118.30	22.86	29.11	16.65	86.20	8.14
1981-82	11.37	143.79	6.44	29.93	15.05	76.18	7.45

Table 2. Month wise rainfall (cm) from 1976-77 to 1981-82 at SRTI, Ishurdi.

	Month	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Growth period	March	0.25	5.03	0.84	3.00	5.87	8.81
	April	3.10	20.98	12.29	8.99	5.13	23.37
	May	17.70	14.04	24.46	2.18	29.13	24.46
	June	36.89	106.88	21.74	51.57	19.46	16.64
	July	50.05	40.59	12.52	37.18	19.40	32.59
	August	48.81	23.98	24.08	49.00	20.95	16.63
	September	21.39	12.42	28.14	22.58	18.36	23.49
	Total	177.80	223.95	124.07	174.90	118.30	143.79
Ripening period	October	10.44	13.41	0.96	3.48	16.00	0.15
	November	0.35	0.74	-	3.23	-	-
	December	-	5.64	-	1.70	-	5.66
	January	1.04	-	1.37	2.97	0.94	-
	February	4.42	3.48	2.72	0.35	5.92	0.63
	Total	16.25	23.27	5.05	13.73	22.86	6.44

Table 3. Simple correlation (r) between sucrose content and environmental factors.

Factors	r
Rainfall during growing period	-0.405
Rainfall during ripening period	-0.935**
Average maximum temperature	0.144
Average minimum temperature	-0.909*
Humidity	-0.822
Bright sunshine (hours/day)	-0.241

*** Significant at 0.01, 0.05 levels respectively.

From the study, it is evident that soil moisture in the field related to rainfall during ripening period tremendously affected the sucrose content of sugarcane.

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