Research Note

OFF-SEASON FLOWERING IN SUGARCANE[1]

Among the factors governing sugarcane flower induction, the role of a specific photoperiod occurring on a descending day-length period is widely regarded as critical. The importance of decreasing-day length is stressed by the fact that sugarcane almost never flowers on an ascending day-length period, even though the correct photoperiod is received in both spring and autumn seasons. However, a case of extensive late-spring flowering of the variety N.Co. 310 planted the previous fall was observed by the senior author in June 1956 on a farm located in the central part of Taiwan. Spring flowering was observed again during mid-May 1972 at the Gurabo Agricultural Experiment Substation, University of Puerto Rico. The investigations presented herein were aimed at determining whether the off-season tassels had developed from floral primordia initiated during the spring photoperiods or were merely delayed tassels initiated during the previous fall season.

Inflorescences emerged from the clones P.R. 61-902, P.R. 67-3246, and P.R. 70-3388 in mid-May of 1972. The three clones were among hundreds of selections planted for yield evaluation and increase of seed. All plants were cultivated and managed in accordance with local commercial methods.

Based upon the expectation that no leaves or internodes will be produced after the meristem is transformed from a vegetative to a reproductive structure, a comparison was made of the number of internodes on the flowering and non-flowering stalks in two of the three clones, namely, P.R. 61-902 and P.R. 70-3388. The intensity of initiation, tassel emergence, and pollen status were also recorded (table 1). All data were submitted to statistical analysis of paired *t* test.

Statistical analyses showed that in P.R. 61-902 the number of internodes per flowering stalk was significantly greater than that of the non-flowering stalks ($P < .05$). In P.R. 70-3388 the difference was not statistically significant. In view of the fact that during September and October new cane leaves usually emerge at the rate of about four per month, the average number of internodes per flowering stalk would be markedly less than that of nonflowering stalks having continually vegetative growth. This was not the case for either clone shown in table 1. It is thus reasonable to assume that the off-season tassels were inducted in the spring season. The critical day length for autumn initation at Gurabo varies from 12 hours, 7 minutes to 12 hours, 17 minutes.[2] An identical range occurs from March

[1] Manuscript submitted to the Editorial Board October 20, 1972.

[2] Chu, Teh-ling, and Serapión, J. L., Flower initiation and tassel emergence in surgarcane, J. Agr. Univ. P.R. 55(1): 101-13, 1971.

20 to March 30, corresponding to the period when the spring tassels would have had to initiate.

The intensity of initiation and tassel emergence for both clones is considered to be quite normal. The percentages of normal pollen from off-season tassels were comparable to those of regular season tassels.

That flowering occurs but rarely in nature during the spring photoperiods is only partially explained. Clements[3] in Hawaii concluded that sugarcane received a stronger stimulus to flower during lengthening nights than during shortening nights. Chilton and Moreland[4] maintained that day

TABLE 1.—*Parentage and flowering data for P.R. 61-902 and P.R. 70-3388 at Gurabo, Puerto Rico, 1972*

Clone	Parentage	Planting date	Flowering date	Floral initiation	Emerged inflorescence	Internodes per stalk	Normal pollen
				Percent	*Percent*	*Number*	*Percent*
P.R. 61-902	C.P. 43/64 X P.R. 1016	April 15, 1971	Mid-May, 1972	34.9[a]	27.3[a]	Flowering: 28.7[c] Non-flowering: 27.5	96.0[e]
P.R. 70-3388	P.R. 1140[f] X ?	April 18, 1971	Mid-May, 1972	50.0[b]	50.0[b]	Flowering: 30.2[d] Non-flowering: 29.6	89.0[e]

[a] A total of 467 stalks were observed.
[b] A total of 40 stalks were observed.
[c] Each figure represents the mean of 50 stalks.
[d] Each figure represents the mean of 20 stalks.
[e] Through iodine solution test.
[f] The clone is a product of a poly cross.

length must be decreasing for induction to occur. Coleman[5] suspected soil temperatures of being too low in the spring but failed to induce flowering by raising soil temperature to autumn levels. However, studies by Paliatseas[6] in Louisiana suggested that photoperiods of increasing, decreasing,

[3] Clements, H. F., Lengthening versus shortening dark periods and blossoming in sugar cane as affected by temperature, Plant Physiol. 43: 57–60, 1968.

[4] Chilton, S. J. P., and Moreland, C. F., Experiments on the flowering of sugar cane, Sug. Bull. 32, 1954.

[5] Coleman, R. E., Control of flowering and the use of pollen storage as techniques in a sugarcane breeding programme, Proc. Intern. Soc. Sugar Cane Technol. 11: 533–40, 1962.

[6] Paliatseas, E. D., Further studies in flowering of sugar cane in Louisiana, Proc. Intern. Soc. Sugar Cane Technol. 11: 504–15, 1962.

or constant duration made little difference in artificial flowering induction. Inadequate high intensity light of 12.5 hours duration,[7] low temperature,[8,9] and high soil moisture stress[10] might all contribute to spring flowering inhibition.

A night temperature of 65° F. or lower has completely prevented flowering when extended more than 10 days,[11] or when exceeding about 20 percent of the potentially inductive days.[12] An examination of temperature records for 1972 compiled at the Gurabo Substation revealed about 25 nights having a minimum temperature of 65° F. and below, ranging from 57° F. to 65° F. in February; 22 nights ranging from 58° F. to 65° F. in March; and 21 nights ranging from 59° F to 65° F. in April. Low temperatures during the spring photoinduction period thus appear to be a principal factor in preventing flowering during the spring season at Gurabo, Puerto Rico. Of several hundred clones, the three reported upon herein may be less sensitive to inhibition by low night temperature.

Teh-ling Chu
J. L. Serapión
Gurabo Agricultural Experiment Substation

[7] Coleman, R. E., Physiology of flowering in sugarcane, Proc. Intern. Soc. Sugar Cane Technol. 13: 992–1,000, 1968.

[8] Chu, Teh-ling, and Serapión, J. L., Effect of certain climatic factors on flowering of sugarcane at Gurabo, Puerto Rico, J. Agr. Univ. P. R. 53(4): 221–29, 1969.

[9] Coleman, R. E., Effect of temperature on flowering in sugarcane, Int. Sugar J. 65: 351–53, 1963.

[10] Chu, Teh-ling, and Serapión, J. L., loc. cit., p. 271.

[11] Paliatseas, E. D., loc. cit., p. 272.

[12] Coleman, R. E., loc. cit., p. 272.