STUDIES ON FLOWERING OF SUGAR CANE IN THE SOUTH OF HAINAN, CHINA

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ABSTRACT

Suinan, in the south of Hainan Island is suitable for sugarcane breeding. The place however, also has less rainy days resulting to lack of rainfall and low humidity which prevents many hard flowering varieties from flowering. Chungshen is another locality in the south of Hainan Island. Unlike Suinan, it has higher rainfall, more rainy days and higher humidity. For comparison, two hundred sugarcane varieties were planted in both places. Throughout more than ten years of experimentation and observations, flower initiation was found to be better in Chungshen than in Suinan. Fertility of pollens and settings of seeds were however, not different in both places. Even then, Chungshen is still a more ideal breeding place.

INTRODUCTION

Flowering is a process of interest to sugarcane breeders. The viability of the fuzz produced after fertilization is determined by many factors directly or indirectly influencing the process. Coleman found that in Hawaii a higher minimum temperature, less hours of sunlight and higher rainfall are important factors for floral initiation.

EXPERIMENTAL PROCEDURES

World germplasms of Saccharum and its "relatives" were collected at the start of the study. Among the two hundred clones collected, twenty of varieties Black Cheribon, Badila and POJ 3016 did not flower in Suinan. Many of varieties such as CO 290, CO 419 and F108 (Tw.C. 108) flowered, but produced little or no viable pollens. Some (such as of varieties NCO 310) produced pollens of high sterility. Those producing high percentage of viable pollens, were mostly used as male parents, but their flowering were unstable. Therefore a need on one hand,
to study flowering habits of the sugarcane varieties so as to control them as when we want them to flower, and on the other hand to locate new breeding place to compensate the defect of Suinan, are established.

Two hundred varieties of sugarcane were planted in Suinan and Chungshen. The different factors affecting the flowering of the crops were studied in both places.

RESULTS

Different Factors Affecting Sugarcane Flowering

1. Moisture, rainfall and rainy days

F 134 (Tw.C. 134) was used in the study as an experimental material. In 1963, it did not flower in Suinan. It flowered however, in Suinan Chuen where the soil was more moist. As indicated in Table 1, those planted in the moist fields flowered freely, while those planted in the dry fields did not. An irrigation experiment was conducted to test the relationship of soil moisture and the flowering of sugarcane. The results showed that weekly irrigation gave a 50.0 % flowering. Irrigating once every two weeks caused a 41.5 % flowering while no irrigation gave no flowers at all. Irrigating F 134 was effective but for hard flowering varieties, it is ineffective. The application of a misting spray made Badila flowered at 15.5 %, POJ 3016 at 0.5 % and Yellow Caledonia at 30.0 %.

2. Nitrogen content

It is well known that nitrogen fertilizer reduces sugarcane flowering remarkably. In this experiment, sulphate of ammonia applied at 0, 90, 150 and 240 kg/acre gave 5, 18, 10 and 0 % tasseling respectively.

TABLE 1. Moisture (%) of the flowering cane fields in Suinan Chuen.

<table>
<thead>
<tr>
<th></th>
<th>Chuen 1</th>
<th>Chuen 2</th>
<th>Chuen 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flowering</td>
<td>13.41</td>
<td>9.34</td>
<td>8.80</td>
</tr>
<tr>
<td>Non Flowering</td>
<td>9.70</td>
<td>4.88</td>
<td>8.23</td>
</tr>
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</table>

From a series of irrigation experiments in 1964-1967, it was observed that water holding capacity of over 80 % was the best during the floral initiating period.
FIGURE 1. Effect of different periods of irrigation on the growth of sugarcane.

FIGURE 2. Relationship between leaf chlorophyll and the nitrogen content upon the effect of tasseling of sugarcane.
3. Photoperiodism

An experiment on photoperiodism was conducted at Suinan beginning July 13 to September 9, 1964. Varieties used for the experiments were CP 49/50, POJ 3016, and F 134. Each variety was planted in a large porcelain pot, placed on carts and rolled in and out the photoperiod house every day with photoperiod control at 12 hours and 25 minutes as required for flowering of sugarcane. The results in Table 2 showed that only CP 49/50 initiated flowering from November 18 to 21, with 50% of arrowing while the other two varieties gave no response. This illustrated that in Suinan, light is not a limiting factor for flowering of sugarcane.

4. Temperature and others

In 1965, varieties of Black Cheribon, Fiji, Crystalina, POJ 3016, Yellow Calodonia, Loethers and Striped Cheribon were planted in both places. The results showed that in Suinan, none of varieties had any sign of flowering but in Chungshen, all varieties flowered freely. Temperature and moisture conditions in both localities where some factors were considered to explain these results. As shown in Table 2, the average temperature, average minimum temperature and average maximum temperature in August, September and October were higher in Suinan than in Chungshen. The relative humidity, rainfall and rainy days however, were higher in Chungshen than in the Suinan. In these two tropical places, it seems that temperature is not a limiting factor for flowering of sugarcane while relative humidity, rainfall and rainy days are.

The same varieties in these two places were also planted for observation of fertility of pollens, the results were not significant.

To test the setting of seeds, the same combinations of parents were planted in both places. The results were presented in Table 3, showing that there was no difference between them.

TABLE 2. Temperature relative humidity, rainfall and rainy days in Suinan and Chungshen, 1965.

<table>
<thead>
<tr>
<th></th>
<th>S</th>
<th>C</th>
<th>S</th>
<th>C</th>
<th>S</th>
<th>C</th>
<th>S</th>
<th>C</th>
<th>S</th>
<th>C</th>
<th>Relative</th>
<th>Rainfall</th>
<th>Rainy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. temp. (°C)</td>
<td>Av. Max. temp. (°C)</td>
<td>Av. Min. temp. (°C)</td>
<td>Relative humidity (%)</td>
<td>Rainfall (mm.)</td>
<td>Rainy days</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug. 27.5</td>
<td>25.2</td>
<td>32.0</td>
<td>80.9</td>
<td>23.9</td>
<td>22.0</td>
<td>86</td>
<td>123.0</td>
<td>219.0</td>
<td>10</td>
<td>18</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sept.</td>
<td>26.0</td>
<td>24.0</td>
<td>31.3</td>
<td>30.0</td>
<td>22.9</td>
<td>21.1</td>
<td>22.9</td>
<td>21.1</td>
<td>62.2</td>
<td>164.9</td>
<td>12</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Oct. 25.8</td>
<td>23.2</td>
<td>31.3</td>
<td>29.5</td>
<td>21.3</td>
<td>19.6</td>
<td>84</td>
<td>86</td>
<td>53.2</td>
<td>161.9</td>
<td>9</td>
<td>14</td>
<td></td>
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</tbody>
</table>

S = Suinan
C = Chungshen
TABLE 3. The percentage of germination of seeds of Suinan and Chungshen.

<table>
<thead>
<tr>
<th>Year</th>
<th>Parentage</th>
<th>Breeding house (%)</th>
<th>Outside (%)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>1967</td>
<td>CP 33/310 x F 134</td>
<td>2.1</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>CP 49/60 x F 134</td>
<td>4.2</td>
<td>1.6</td>
</tr>
<tr>
<td>1968</td>
<td>CP 33/310 x F 134</td>
<td>4.3</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>CP 49/60 x F 134</td>
<td>4.0</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>CO 419 x F 134</td>
<td>52.1</td>
<td>13.8</td>
</tr>
<tr>
<td></td>
<td>NCO 310 x F 134</td>
<td>11.3</td>
<td></td>
</tr>
</tbody>
</table>

*S = Suinan \quad C = Chungshen*

CONCLUSION

For more than 10 years of observations and experiments, it was found that Suinan is a suitable place for sugarcane breeding. Many hard flowering varieties however, do not flower in the locality due to lack of rainfall and lower humidity. To promote flowering of these varieties, irrigation may be necessary.

Chungshen is better than Suinan because it is situated at the foot of a mountain faces the south, is 335 meters above sea level and it has higher rainfall, more rainy days and higher relative humidity.

The morning temperature in Chungshen as compared with Suinan, is a little lower although it rises after a short period of time. The fertility of pollens and setting of seeds in the two places were not different from one another. These showed that short and low morning temperature period had no effect at all on the fertility of pollens and setting of seeds.

The varieties not flowering in Suinan, like the noble cane Black Cheribon and Crystalina, cannot be used as parents. This is a restriction in Suinan for selection of parents. At present however, this problem is already solved.

These varieties can be planted in Chungshen where they can flower freely and hybridization can be carried out directly or the arrowed stalks can be cut off and transferred to Suinan for hybridization with any selected parents. Today 30% of our crossing tassels in Suinan are transported in Chungshen every year.

REFERENCES

ESTUDIOS SOBRE LA FLORACION DE LA CAÑA DE AZUCAR EN EL SUR DE HAINAN, CHINA

Wong Kai Yeu

RESUMEN

Suinan se encuentra en el sud de la isla de Hainan, lugar adecuado para el mejoramiento de caña de azucar, pero con el defecto de falta de lluvias; con menos dias de lluvia y baja humedad, muchas variedades de dificil floracion no llegan a florecer en estas condiciones.

Chungshen esta en el sud de la isla de Hainan pero con mayor precipitacion, un mayor numero de dias de lluvia y alta humedad. A traves de mas de 10 años de observaciones y experimentos se encontró que la floracion es mejor en Chungshen que en Suinan. La fertilidad del polen y el desarrollo de las semillas no es sin embargo diferente en estas localidades. Esto prueba que Chungshen es una localidad ideal para establecer el programa de floracion con miras al mejoramiento genetico.