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Sugarcane Eye Propagation in Northern Florida

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In northern Florida, sugarcane (*Saccharum officinarum* L.) is grown on a small-scale production basis and in backyard landscapes. Normally sugarcane is planted during September and November by planting stalks in furrows. Since sugarcane is highly susceptible to frost, it is important that growers use propagation methods that help mitigate the effects of freezing temperatures. The objective of this study was to propagate sugarcane from cane nodes in a protective environment to overcome early and late frost damage on seed stock and to evaluate the germination rate of selected varieties after hot water treatments. The two varieties used in this trial were CP31-511, a chewing variety, and CP67-500, a syrup variety. These are the most desired varieties for chewing and syrup making, respectively. To overcome early and late season frost, sugarcane was propagated using cane nodes in a protected environment. By using this technique, one can increase the number of plants per stalk and shorten the field growing season. Sugarcane nodes were treated with hot water to break dormancy and increase germination. The hot water treatments consisted of a control, 100 °F, 110 °F, and 120 °F for 10 seconds. Canes were divided into segments and designated as tops, middles, and bottoms. Overall sugarcane tops had the best germinating rate (83% to 94%), compared to middles (11% to 67%) and bottoms (0% to 39%); there were significant differences in germination between segments. But, there was no significant difference between temperature treatments for any of the tested varieties. These finding are important because of the high demand for planting material for homeowner landscapes and small-scale farming.

Sugarcane (*Saccharum officinarum* L.) is a main row crop in tropical and subtropical regions. Its environmental and climatic requirements are well suited for mass production in the southeastern United States. According to Baucum et al. (2006) and USDA National Agricultural Statistics Service (2009), Florida is the largest producer of sugarcane in the United States, followed by Louisiana, Hawaii, and Texas. However, most sugarcane produced in the northern Florida area is destined for local markets or individual home use.

Chewing and syrup making sugarcane varieties are grown in northern Florida at the UF/IFAS North Florida Research and Education Center (NFREC)–Quincy. These varieties are grown as part of an annual fall sugarcane field day where seed stock material is provided.

The field day has become a popular event for small farmers and homeowners in northern Florida, as well as southern Georgia and southern Alabama. The annual sugarcane field day is a source of planting material for growers to obtain syrup and chewing cane varieties. Eighteen sugarcane varieties are being evaluated at NFREC for sugarcane production in northern Florida, including CP67-500 for syrup and CP31-511 for chewing. Growers are encouraged to grow the varieties on their farms or backyard landscapes via vegetative propagation (Baucum at al., 2006). To insure against potential frost killing temperatures in northern Florida, it is recommended that planting should be done in September through early October (Baucum at al., 2006). Because the field day is usually held in the fall, many growers may not have the opportunity to vegetatively propagate them in the field or home landscapes. One way to overcome the potential for frost killing temperatures would be to propagate sugarcane nodes indoors for spring planting. As a result, efficient seed stock propagation practices can be achieved that would enhance its sustainability and marketability of sugarcane for local, small-scale production.

Sugarcane is normally propagated through stem cuttings of immature canes that are 8–12 months old (Baucum at al., 2006; Legendrem, 2001). These are usually planted in furrows. Sugarcane buds or eyes on the stem nodes sprouts and develops into young cane plants. A key factor that influences germination in sugarcane is temperature (Bakker, 1999). Some temperature treatments have been used to control pathogens and some effects on germination have been published (Pastor, 2008). However, not much information on indoor (greenhouse) propagation of sugarcane is readily available.

The overall objective of this study was to demonstrate greenhouse cane stock propagation techniques to overcome early frost killing. Specific objectives were to 1) compare germination rates of the two most popular varieties, 2) evaluate the effect of temperature on germination, and 3) evaluate the effect of cane segments on germination rates.

Materials and Methods

Two sugarcane varieties were chosen for this study, CP67-500, a syrup variety, and CP31-511, a chewing variety. These varieties were selected from available sugarcane stock grown at the NFREC–Quincy. Selections were based on the two most harvested varieties at the annual fall sugarcane field day. Two factors, temperature and plant section, were evaluated using a randomized complete-block design with three replications. Each sugarcane stalk was divided in three sections: tops, middles, and

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bottoms. Sections were determined by counting the total number of nodes per cane and dividing by three. It should be noted that the first node is considered to be the first mature node and the sugarcane is harvested above the first visible node above ground. Each nodal section was dissected at 2.54 cm (1 inch) away from the node center, resulting in a 5.08-cm (2 inches) disc. Nodal sections were dipped into one of three hot water temperature treatments for 10 s (R. Rice, University of Florida, personal communication). Hot water temperatures consisted 100 °F, 110 °F, and 120 °F (37.77 °C, 43.33 °C, and 48.88 °C). An untreated control, no hot water treatment, was also included. Once each cane section was treated, the discs were transferred onto planting trays, 50.8 × 35.6 × 10.2 cm (20 × 14 × 4 inches) containing one part germinating mix (Fafard/Super fine germinating mix) and one part vermiculite (Therm-o-Rock). Each planted tray contained an equal number of disc sections per stalk divisions, i.e., six top nodal sections, six middle nodal sections, and six bottom nodal sections, corresponding to each temperature treatment. Nodal sections were placed vertically into the tray and covered with media. Trays were place under a bench top misting irrigation system that delivered 1.91 cm (0.75 inches) of water per day. Germination data were collected twice per week for 12 weeks by counting visual germination at the soil level. Data collected were analyzed using the General Linear Models (GLM) procedure in Statistical Analysis Software (SAS) for windows version 9.1.

Data were analyzed independently for chewing and syrup canes. An identical two-way analysis of variance (ANOVA) model was used in both cases with germination percentage as the single response variable. Temperature (temp), the section of the plant from which cuttings were obtained (sect) and an interaction variable to capture any joint effects of temperature and plant section (temp × sect) were used as explanatory variables (factors). A post hoc test using Tukey's honestly significant differences (HSD) was applied whenever ANOVA results indicated significant differences in germination percentages.

Results and Discussion

Chewing cane. The results indicated a significant interaction effect between temperature and the section of the cane used for planting ($P < 0.05$). Upon examination of the main effects, temperature by itself had no significant effect on the germination rates. The germination percentages for the three temperature treatments used were not significantly different to that of the control (Fig. 1). The highest germination percentage (41%) was obtained from the 120 °F (48.88 °C) treatment, while the lowest (36%) was obtained from the control. The section of the cane used was a significant contributor to germination ($P < 0.0001$). The percentage of cuttings that germinated from the top portion of the plant was significantly higher compared to those obtained from the middle and bottom portions. The highest germination percentage was obtained from the tops (74%) compared to (29%) and (12%) from the middle and bottom portions respectively (Fig. 2). It must also be noted that the germination percentage obtained from the middle of the plant was also significantly higher compared to that obtained from the bottom.

Syrup cane. The results obtained for the syrup canes were similar to those obtained from the chewing canes. Once again, we found a significant interaction effect between temperature and the section of the cane used for planting ($P < 0.05$). As observed for the chewing canes, the germination percentages obtained from the three different temperature treatments were not significantly different to that of the control (Fig. 3). However, this time, numerically higher germination rates (34%) were observed from the 110 °F (43.33 °C) temperature treatment. Examination of the main effects also indicated that temperature had no significant effect on the germination rates. The section of the plant used for planting was a significant contributor to germination ($P < 0.0001$). The percentage of cuttings that germinated from the top portion of the plant was significantly higher compared to that of the middle and bottom (Fig. 4). The highest germination percentage was obtained from the tops, then middles and finally bottoms at 73%, 18%, and 0%, respectively. The low germination rate of bottoms could be attributed to prolong dormancy of the older nodes at the bottom as that variety had taller stalks.

The results of this study bear strong implications for produc-

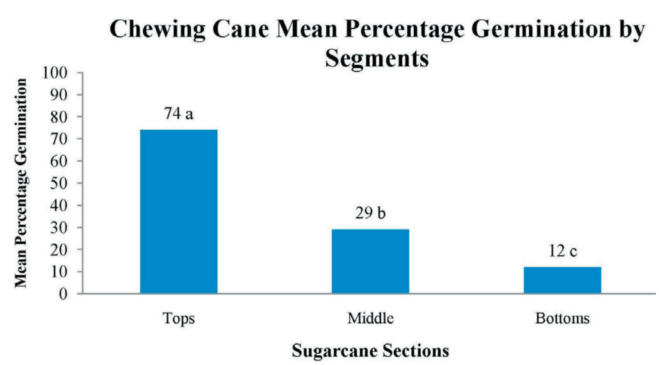

Fig. 2. Germination percentage based on sugarcane segments (tops, middles, and bottoms) of chewing cane (CP31-511).

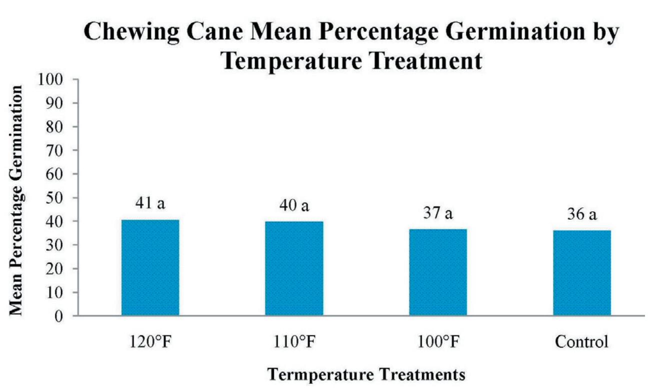

Fig. 1. Temperature treatment effects on chewing cane (CP31-511) germination.

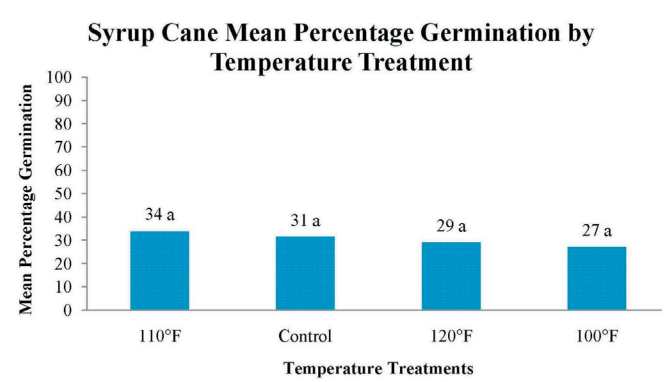

Fig. 3. Temperature treatment effects on syrup cane (CP67-500) germination.

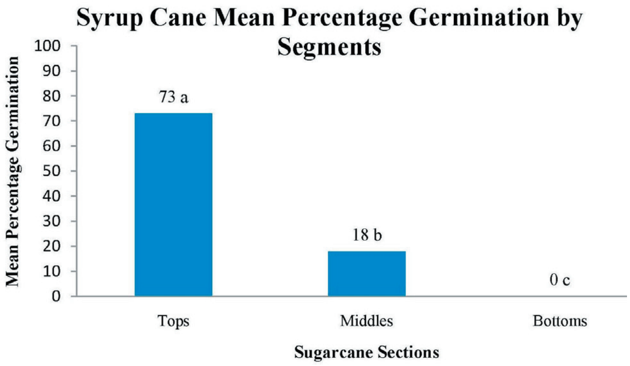

Fig. 4. Germination percentage based on sugarcane segments (tops, middles, and bottoms) of syrup cane (CP67-500).

tion. Growers can maximize sugar cane usage for propagation purposes. Apart from planting sugarcane in double rows to ensure uniformity in the field, using this information, growers can primarily use sugarcane tops for propagation and other sections can be used for both syrup production and or chewing purposes. Other options could be to use sugarcane tops for germination in the greenhouse during the winter and have the plants ready for field establishment in early spring.

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