SUGARCANE QUARANTINE PROCEDURES AT BELTSVILLE, MARYLAND

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ABSTRACT

The current sugarcane quarantine procedures and facilities of the USDA at Beltsville are described. Imported sugarcane plant material is inspected, treated for insect contaminants, and sent from the inspection station to the quarantine station. Material is then germinated and grown under close inspection. When mature, seedling cuttings are treated for insect control and sent to the secondary quarantine station. Mature plants from stalk or root cuttings are hot-water treated and regrown before sending to secondary quarantine or to other quarantine facilities.

INTRODUCTION

Movement of vegetatively reproduced plants such as sugarcane requires strict screening to insure that diseases and insects are not moved with the material. Stokes et al.2 completely described the quarantine practices and facilities of the USDA at the 10th Congress of ISSCT. Coleman1 briefly mentioned quarantine practices in his discussion of the World Collection of sugarcane varieties at the 14th Congress of ISSCT. There have been some changes since these papers were published and our purpose is to describe the current methods for sugarcane quarantine and, briefly, the facilities at Beltsville.

The procedure relies on vegetative reproduction of imported sugarcane clones in a greenhouse about 1,000 miles from sugarcane production areas of the country for at least one year. The sugarcane is grown in the quarantine greenhouse at Beltsville, Maryland, under the inspection of a pathologist. When they have grown, and have been submitted to control treatments, the plants must pass a visual inspection. Then cuttings may be sent to the secondary quarantine station, to the breeding station, or to other approved locations requesting them.

MATERIALS AND METHODS

Facilities currently in use by the USDA sugarcane quarantine program in Beltsville include an insect-free greenhouse, an electrically-heated germinator, an electrically-heated hot-water treatment tank, and a steam sterilisation box.

The greenhouse is constructed of glass on a wooden frame and is 3 m high at the eaves, 6.4 m high at the crown, and 12.2 m wide (Fig. 1). There are two sections 15.2 m long, and one 12.5 m long. The small section is equipped with benches for pot culture and the others are open so that plants can grow in galvanised metal cans placed on the concrete floor (Fig. 2). Top and side ventilators are manually operated and all openings are covered with 32-mesh copper screen. The ventilator arms are enclosed in canvas sleeves. The entrance to the greenhouse has a vestibule with 2 sets of doors. On the floor in the
vestibule is a tray in which is placed a fiber mat soaked in a coal tar oil disinfectant to destroy any insects that might be brought in on shoes (Fig. 3). The greenhouse is fumigated every week with 2,2-dichlorovinyl dimethyl phosphate. The greenhouse is heated to 80 ± 2°F by a forced steam system with thermostatically controlled electric modulating valves.

The germinator, located in the quarantine greenhouse, has a wooden frame surrounding a fiberglass and sheet-metal liner (Fig. 4). It is heated by forced air blown over electric heating elements and into the bottom of the chamber. Temperature is thermostatically controlled at 32,2°C and water in a reservoir at the base of the chamber keeps the humidity high. The germination chamber will hold 240 five-inch clay pots in 12 wooden trays, or about 300 three-eye cuttings.

FIGURE 1. Quarantine greenhouse, Agricultural Research Center-West, Beltsville, Maryland.

FIGURE 2. Plants of imported varieties that are ready for transfer to secondary quarantine.
The hot-water treatment tank in the headhouse is framed in wood with a sheet-metal liner. The tank measures 0.6 m wide, 1.2 m long, and 0.6 m deep. Water temperatures for short (52°C 30 min) and long (51°C 2 hr) treatments are maintained by an electric heating element submerged in the water, an electric pump, and a thermocouple controlled by a mercury relay.

FIGURE 3. Floor mat soaked with coal tar oil disinfectant to destroy insects on shoes of persons entering the vestibule of quarantine greenhouse.

FIGURE 4. Germinator used for imported sugarcane varieties.
Before they are used, all containers such as clay pots, metal flats, and metal cans are steam sterilised in a wooden box with a metal liner into which live steam is piped. All sugarcane plants showing disease symptoms are destroyed in this steam box.

The choice of methods used to obtain germination of eyes of sugarcane cuttings after they are received is important, especially when the eyes are weak or hard to grow. Usually 3- or 4-eye cuttings are placed in trays in the germinator between 2 thick layers of newspaper and moistened thoroughly with water. If the seed pieces have already started to decay, whole sphagnum moss is used instead of newspaper. The seed pieces remain in the germinator until eyes and roots have sprouted. Those which germinate are then planted in soil in clay pots.

The cut ends of stalk cuttings which are being prepared for shipment are dipped in melted paraffin, wrapped in newspaper, and then wrapped in heavily waxed paper. Root cuttings to be shipped are placed next to damp whole sphagnum moss and are then wrapped in heavily-waxed paper. Because movement or vibration damages eyes during shipment, packing material is placed between layers of sugarcane cuttings and in any empty space in the cardboard carton. The container is labeled "perishable" and is sent by the fastest route.

QUARANTINE PROCEDURES

New introductions of sugarcane from sources all over the world are received as seed, or as root or stalk cuttings at the Plant Inspection Station of the USDA in Washington, DC, where they are carefully inspected. The seeds are fumigated with methyl bromide (1.4 kg per 30 m³ for 2 hr at 30 C). The roots or stalks are treated with hot water (52 C for 30 min). All packing material is destroyed and the cuttings, wrapped in clean packing, are sent to the quarantine greenhouse at Beltsville.
In Beltsville, the plant material is again inspected (Fig. 5) for the presence of insects. All leaf and sheath material is removed and destroyed, allowing inspection of eyes. All the packing material is again destroyed.

The seed are germinated on a sterilised soil-peat moss mixture (3 parts: 1 part) in the greenhouse and the seedlings are observed for the presence of disease symptoms and insects. After about 3 weeks, the seedlings are transplanted to clay pots of sterilised soil. When there are enough mature eyes, the plants are examined by the pathologist and, if approved, are hot-water treated (52°C for 30 min). Cuttings are then sent to the US Sugarcane Field Station, Canal Point, Florida, where they are grown in a quarantine greenhouse for about 3-6 months. No seedlings from imported seed have ever been found to be diseased.

The root and stalk cuttings are placed in the germinator. As the eyes and roots sprout, the cuttings are potted in steam-sterilised soil and placed in screened isolation cages within the quarantine greenhouse. Knives used to divide cuttings into single-eye pieces are sterilised by soaking for 5 min or more in alkyl-(3,4-dichlorobenzyl) dimethylammonium chloride (800 ppm) to stop transmission of disease agents. After 3 months of observation in the isolation cages, the plants which do not show external symptoms of disease are placed on an open bench (Fig. 6). Any plant that shows disease is immediately destroyed. When the plants have a sufficient number of mature eyes (6-9 months), the stalks are cut, treated with hot water (51°C for 2 hr) to control ratoon stunting and other diseases, germinated in the germinator, and replanted in soil. Varieties not surviving the long hot-water treatment are tested for the presence of the ratoon-stunting disease agent by inoculation on to diagnostic cane varieties such as CP 43-47 or CP 44-101.
When the new plantings have grown large enough to survive shipment (at least 1 year after they were first quarantined), they are inspected for disease symptoms and are given a hot-water treatment (52°C for 30 min), wrapped and shipped to the USDA secondary quarantine station at Fort Pierce, Florida, to the quarantine greenhouse at the breeding station at Canal Point, Florida, or to other quarantine facilities. The pathologist issues a certificate of treatment for each shipment stating that no symptoms of disease are present. After sufficient growth in secondary quarantine, cuttings can be shipped to any location in the US or other parts of the world.

The diseases which were most often intercepted during the quarantine program were mosaic and ratoon stunting. The long hot-water treatment (51°C 2 hr) provides a method for cleaning up canes that may be infected with ratoon stunting disease agent or with one of the other thermolabile pathogens. Plants infected with mosaic, Fiji disease, red rot, and other diseases not cured by heat treatment are destroyed in the steam box.

WORLD COLLECTION OF SUGARCANE

In addition to the quarantine work with new importations, about 800 varieties of sugarcane, a part of the World Collections, are located at Beltsville. Many of these varieties are not resistant to disease and would be lost if grown under normal field conditions with the rest of the collection at Canal Point, Florida. The nursery in which they are grown is under strict quarantine regulations and is used by sugarcane breeders as a source of disease-free germplasm. It contains varieties which are being kept primarily for breeding purposes.

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REFERENCES


PROCEDIMIENTOS DE CUARENTENA DE CAÑA DE AZÚCAR EN BELTSVILLE, MARYLAND

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RESUMEN

Se describen los procedimientos y facilidades de cuarentena de caña de azúcar en el Departamento de Agricultura de Estados Unidos en Beltsville. Caña de azúcar importada se inspecciona y se trata por contaminación de insectos. Se envía a la estación de cuarentena. Se germina y crece bajo inspección controlada. Cuando maduran, los cortes de semillas se tratan para control de insectos. Las plantas maduradas de tallos o raíces se tratan con agua caliente y se sembran. Luego se envían a estaciones secundarias de cuarentena o a otras facilidades de cuarentena.