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In-Ground Procedure for Rooting Tea Cuttings

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The long-term goal of the UH-CTAHR Tea Project is to create a new industry for Hawai'i agriculture based on the tea plant, *Camellia sinensis*. This plant is the source of the "true" teas, including white, green, oolong, and black teas. CTAHR is also researching the processing methods needed to create these teas and "signature" tea-based products unique to Hawai'i. These tea products may in turn lead to further value-added products, such as foods and teapots, as well as to agricultural tourism activities. The foundation of all this potential is the raw material harvested by growers.

Growers and potential growers have cited the lack of propagative material as a major bottleneck, if not *the* major bottleneck, to growth of the industry. Plants and cuttings for vegetative propagation from existing sources outside Hawai'i are costly, and a real danger of importing them into the state is the possibility of inadvertently introducing new pests and diseases that might limit or even stop the development of a tea industry here. Hawai'i currently has none of the severe pest and disease problems that plague other tea-producing areas, and thus we have cost and market advantages that would be negated should those problems be imported.

Mealani Research Station manager Milton Yamasaki and other CTAHR Tea Project personnel experimented with a procedure for in-ground rooting that was observed on farm tours in Japan. A simple and inexpensive tunnel structure was used to provide shade and retain humidity for the cuttings. Five trials of this method were conducted beginning in 2004, with success rates of at least 80–85 percent. Similar success rates were obtained with five varieties. More than 8700 plants were produced using the method. The procedure described here targets production of 2000 cuttings, but it can be customized to fit individual needs.

The procedure involves these major steps:

1. preparing the planting bed
2. setting up the irrigation system
3. constructing the frame of the shade tunnel
4. preparing and sticking the cuttings
5. placing the shade cloth over the tunnel frame
6. adding a plastic sheet over the tunnel frame
7. removing the tunnel and growing the plants
8. transplanting the plants into the field.

Equipment and materials list

The following list is for a bed 3½ feet by 50 feet (175 square feet), to produce 2000 cuttings.

- 10 7-ft lengths of 9-gauge or thicker wire, for the hoop-frame
- posts (rebar or similar material); two at least 3½ ft tall and four around 2 ft tall
- 175 feet of 16-gauge or similar wire (for guide wires)
- twist-ties to fasten guide wires to hoops
- 8 ft x 60 ft plastic sheeting
- 8 ft x 60 ft saran 80% shade cloth
- about 55 ft of ½-inch black "poly" irrigation tubing
- about 50 ft of "spaghetti" tubing
- 20 O-Jet (180 degrees, 12.6 gallons per hour) or similar misters or spray jets
- 20 wire supports for misters or spray jets
- irrigation timer
- electrical tape to fasten misters to wire supports
- shears and bucket (for collecting shoots)
- optional: hydrogen dioxide (Oxidate®)* to disinfect cuttings
- fertilizer.

*The current Oxidate® label appears to allow its use as a pre-planting dip treatment and a soil drench treatment for all crops. Check the label on the product before purchasing to ensure that it has not been changed.

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Prepare the planting bed

The area to be used for the bed should be weed-free. Till the soil to break up clods and form a planting bed that is 4–6 inches high, about 42 inches wide, and 50 feet long.

Set up the irrigation system

Our irrigation system consisted of mini-sprinklers connected by spaghetti tubing to the ½-inch poly tubing running down the middle of the planting bed. The mini-sprinklers were spaced at 4-foot intervals along the length of the two outer edges of the bed. Sprinkler heads were taped to wire supports so that they were pointing inward from 12 inches above the bed surface. The mini-sprinklers were staggered (off-set from those on the opposite side of the bed) to get better coverage of the bed. The system was timer-operated to run about 10–15 minutes once a day, depending on weather conditions, to keep the soil and cuttings from drying out.

Construct the frame of the shade tunnel

Construct only the frame of the tunnel (photo 1) before sticking the cuttings so that the cuttings may be shaded as soon as they have been placed into the ground. Do not place the shade on the frame yet, to allow free movement while sticking cuttings. Form the heavy gauge wire into semicircular hoops that are 2 feet high at the center (peak). Stick each end of the hoop 6–8 inches deep into the soil at the sides of the bed. Place hoops 5–6 feet apart.

The metal posts are used to provide support at the ends of the tunnel. The two long posts are placed in the middle, and the four short posts are securely anchored at both ends of the row. Three guide wires—one at the peak and one each about 15 inches above the ground on either side—are strung between the posts and used to stabilize the hoops. Use twist ties or string to fasten the guide wires to the hoops.

Prepare and stick the cuttings

We have not determined the best time of year for selecting shoots, although weather might be a factor in the growth of the cuttings. Shoots are allowed to grow out on the desired plants to be propagated (photo 2). The best plant material for cuttings comes from shoots that have hardened but are not too woody; that is, are between the red and green wood (photo 3). Shoots should be harvested when the weather is cool and placed into a bucket with water. Cuttings should be prepared and stuck as soon as possible after harvesting.

Shoots can be dipped in a disinfecting solution, such as hydrogen dioxide, for 2–3 minutes just prior to sticking. We use two-node cuttings and keep the leaves intact. Typically two, sometimes three, cuttings can be made from each shoot, depending on the length of the internodes of the shoot (photo 4). Cuts are made at an angle about 3 mm (⅛ inch) above the node. This will leave 20–40 mm (about ¾–1½ inch) of stem to insert into the ground. Stick cuttings up to the bottom node immediately after making the cuts. We have not noticed any difference between sticking cuttings at an angle or orienting them straight up and down.

Make rows across the 40-inch width of the bed. Stick the cuttings 2 inches apart, 20 cuttings per row. Space the rows 6 inches apart; there should be 100 rows (2000 plants) in a 50-foot bed.

Place shade cloth over the tunnel frame

Once the cuttings are stuck, 80-percent shade cloth is used to form the tunnel (photo 5). The sides and ends should be buried, anchored, or otherwise securely fastened to the ground. Provide shade immediately after sticking the cuttings to protect them from sun and wind, and irrigate them. Leave the bed covered and continue irrigation for a month.

Add a plastic sheet to the tunnel

Remove the shade cloth after a month and place a plastic sheet over the tunnel frame to create a totally enclosed, warm, humid environment. Replace the shade cloth. Bury or otherwise securely anchor the sides and ends of the sheeting and the shade cloth. We have found that the plastic sheet lasts longer if it is placed under the shade cloth. Keep the tunnel closed for 2 more months. Under our conditions, irrigation was not needed for the entire 2 months that the beds were under the plastic cover.

1. Shade tunnel frame with wire hoops secured to posts and connected by guide wires

2. Shoots have been allowed to grow out and are ready to be cut.

3. The area between the red and green wood is the best for cuttings.

Remove the tunnel and grow out the plants

Three months after planting, remove the shade cloth, plastic sheeting, and tunnel frame (photo 6). Pinch off any flowers or seeds to encourage shooting, and remove any weeds. From this point, treat the cuttings as regular plants for irrigating, weeding, and fertilizing. We irrigated twice a week for 15–30 minutes, or more often as needed to avoid drying out the soil. After 2 weeks (14 weeks after planting), we applied a complete, slow-release fertilizer. Avoid over-fertilization, which could burn young shoots and roots.

4. A shoot (above) and two two-node cuttings

Transplant into the field

At 9 months, the cuttings should be about 18 inches tall and ready for transplanting directly into the field (photos 7, 8). We suggest topping the plants to about 12 inches tall to help balance the top growth with the reduced root mass due to transplanting. Dig plants out carefully so as to retain as much of the root system as possible. We obtained a 100-percent survival rate with transplants in most of the trials. Although the plants are generally ready for transplanting at 9 months, the plants could be held in the bed for a longer period if necessary (photo 7). We have even transplanted plants held up to 2 years in the bed with good survivorship, although we do not recommend holding plants in the bed for this long.

End notes

In-ground rooting is a simple procedure that does not require an expensive greenhouse structure and can produce field-ready plants in a short period of time. Because the plants are at ground level, there is a possibility of weather damage if there is excessive rain and flooding. Plants may also be exposed to soil-borne diseases, which when present may necessitate initial soil preparation, such as fumigation. However, these problems are similar to those that might occur after any out-planting to the field. If the soil is shallow or excessively sticky or rocky, it might be worthwhile to create a bed with suitable media. In Japan, paper pots have been used, but in Hawai‘i such pots currently are difficult to obtain and costly. Our experience suggests that such pots are not necessary, but it may be worth experimenting.

5. Shade tunnel opened at end to show interior. The mature bed at left is the same one shown in photo 6 after growing out for 9 months.

6. The shade tunnel has just been removed from these beds. Note the high percentages of "takes."

7. Nine- and 14-month-old rooted cuttings

8. A 9-month-old rooted cutting, ready for transplanting

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Caution

Pesticide use is governed by state and federal regulations. Read the pesticide label to be sure that the intended use is included on it, and follow all label directions. The pesticide user is responsible for the proper use, application, storage, and disposal of the pesticide.

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