THE RAPID EXPANSION OF 14 SELECTED COTTONWOOD CLONES

James L. McConnell 1/

In the late winter of 1969 a project to produce 600,000 Superior Cottonwood cuttings was started by the Southeastern Area, Division of State and Private Forestry at the Forest Service's Southern Hardwoods Laboratory at Stoneville, Mississippi. Plans are to distribute the cuttings in the fall of 1971 to cottonwood-growing State and industrial nurseries in the lower Mississippi River Valley. Each year, approximately 6000 acres are planted to cottonwood in the rich alluvial bottoms of the lower Mississippi River Valley. Planters are actively seeking cottonwood clones that have proven superiority in growth rate and other economically important traits.

Scientists at the Hardwood lab began work in 1961 to select genetically improved trees to serve as a base for future breeding experiments. Randall and Mohn discussed the Cottonwood Selection Program at the 10th Southern Conference on Forest Tree Improvement.

The following is a description of the procedure used to vegetatively expand the 14 selected clones.

The initial planting area was a four-acre site that was fairly level, with enough slope to permit satisfactory drainage. An adequate water supply was close at hand. The site was divided into management blocks, with blocks for each clone. Rows within the blocks were spaced 40" apart. Because this is the standard row width used at the Delta Branch Experiment Station at Stoneville, interchange of equipment between projects was easily accomplished. There were 10 rows to each block and each row was 100' long. Cuttings were planted 1' apart in the rows, permitting the planting of 1000 individual cuttings in each block. A 10' aisle was left on the ends and sides of each block.

Initial cuttings came from small clone banks, survival test sites that had served their purpose, stump sprouts and tops from thinnings of long term studies. Most of the material consisted of one-year-old wands several feet long. In this initial stage numbers of plants were important, so the wands were cut into 12-inch lengths instead of the standard 20-inch field planted cutting.

1/ Hardwoods Regeneration Specialist, U. S. Forest Service, SE Area, State and Private Forestry, Cooperative Forest Management, Stoneville, Mississippi.

Hardwood cuttings from the wands were cut with a 10-inch electric bench saw with a fine-toothed blade.

All short hardwood cuttings, tips and branches too small to make normal cuttings were cut into 6-inch lengths. These cuttings were placed in peat pots in the greenhouse, watered daily, and field planted as they rooted and the danger of late spring frost passed.

A major part of the rapid expansion project centers around the concept of mist propagation of greenwood cuttings. The mist technique makes possible the rooting of soft, succulent, fast-growing plant material. Also, intermittent mist will keep relatively slow-rooting cuttings alive for a long period of time, giving them a chance to root before they die of desiccation.

Elaborate equipment and facilities were not needed. Mist benches were constructed in the open in a small well-drained area surrounded by an 8-foot constructed windbreak. The benches, which hold approximately 360 greenwood cuttings, are built of redwood and are 4-feet wide, 12 feet long, and 3 feet off the ground. This affords the most comfortable working height and reach for project workers. The bottom of the mist bench consists of 1" x 2" galvanized hog wire that allows excess water to move away freely. Four inches of washed gravel provided a comfortable surface on which to work, although it remained wet.

The irrigation apparatus consisted of three 3/8" riser pipes 4 feet apart with mist nozzles on each bench. Half-inch pipe placed under the gravel supply water to the riser pipes and nozzles.

Cutoff valves, solenoid valves, line strainers and timing clocks were at one central location away from the mist benches. Six mist benches were built for the project with sets of two attached to a solenoid, filter and clock. This allows use of any combination of one to six mist benches at a time.

Two timer clocks and one 24-hour day-night or on-off timer regulates the mist cycles. One timer clock has a 30-minute cycle with 15-second trippers, the other has a 5-minute cycle with 2-1/2-second trippers. The clocks are mounted on a plywood control panel in a small metal building. Lines from the solenoid valves can be plugged into either mist cycle timer and the mist cycle timers can be plugged into the 24-hour day-night timer. (See Figure 1).

The normal water source at the lab supplies a 1,000 gallon storage tank which furnishes water to a 300-gallon pressure tank. Pressure in the tank is regulated by the pressure switch on the pump. Most mist nozzles operate best between 20 to 60 psi., although we have found the more pressure the better. The tank has a float valve that can be turned on at night or weekends when the demand

for water at the laboratory is low. The 1,000 gallons of water is about a 3-day supply.

Use of the mist system for young, succulent, green plant material is adequate as long as the cuttings do not desiccate. Cuttings root best in the hot summer months, but they die after 10 minutes without water. The most commonly used solenoids are normally closed; when the tripper on the clock strikes the switch, the power flows and the solenoid opens. With no power the solenoid closes. A normally open solenoid works just the opposite. As long as you have electric power the normally open solenoid remains closed. (See Figure 2). If the power goes off the normally open solenoid opens and allows the water to flow for as long as there is no power. Thus the cuttings will not dry out during an unexpected power failure. Static pressure in the pressure tank keeps the nozzles on for about 60 minutes when electric power is off. On a hot day this feature could save an entire crop of cuttings. This solenoid is easily built into the system by connecting it to the front and rear of the normal control valves.

Rooting media consists of equal parts of perlite and sand, mixed in a 4-1/2 cubic foot, electric, portable concrete mixer. Twenty, 3-inch peat pots containing the media put into a flat and each flat contains cuttings from one clone which is identified by a 6-inch wooden pot label. A marked aluminum tag is dropped in the bottom of the flat in case the pot label is lost.

The best schedule for collecting greenwood cuttings is early in the morning while the dew is still on the plants. The fast-growing terminals are cut from the plants in the nursery with pruning shears and placed in ice chests containing tap water for transport to the mist benches. At the mist area, all but the terminal leaves are trimmed with a sharp knife and cut back to a uniform 6-inch length. Immediately after trimming the cuttings are placed in the prewatered media in the peat pots. A pencil-sized hole punched in the rooting media down through the peat pot allows excess water to run freely through the pot. Also the tender cuttings can be inserted without damage. Cuttings are placed in the rooting media while the mist is intermittently on.

The length and frequency of mist is an empirical thing and depends upon the temperature and amount of sunlight. A normal mist cycle on a hot clear day would consist of 5 seconds of mist every 20 to 30 seconds. In the early morning and late afternoon hours the time between mist can be lengthened and shut down completely after sundown. If constructed properly, all of the timing cycles can be worked automatically and need only periodic adjustments.

Under normal summer weather conditions in the deep South, hot days and warm nights, the cuttings root in 7 to 14 days. When roots appear through at least half the peat pots in a flat, they are moved out of the mist chamber and into a shadehouse (50% shade) for hardening-off. The sprinkling system has a timing clock with a 30-minute cycle and 15-second trippers. Thus the first day in the hardening-off shed the cuttings receive 15 seconds of water every 10 or 15 minutes. The second day the mist is cut back to 15 seconds of water every 20 to 30 minutes, and the third day, to each 30 minutes. Usually after 3 or 4 days in the hardening-off shed the cuttings are ready to plant in the field. Immediately after planting in the nursery they are thoroughly watered.

Disease is usually not a problem with the use of mist since the water spray tends to inhibit the development of powdery mildews. However, a black stem rot was a problem in the spring of 1970. The micro-organisms associated with the symptoms were Alternaria and a bacterum (rot shaped-gram negative). Alternaria has been implicated with other stem diseases. Further research is being conducted at Stoneville to determine the cause and control of this disease.

Frequent and thorough cultivations are necessary. When the plants are small, weekly cultivations are needed.

When the plants are small, a tractor-mounted cultivator does a fine job. Later, as the cottonwood plants outgrow the tractor, a rototiller appears to be the most efficient method of weed control with a small amount of hand hoeing.

Irrigation of the nursery area is done with a 6" 30-foot section portable aluminum irrigation pipe. Sprinkler nozzles on 8-foot risers are satisfactory initially but late in the season, as the plants grow, the risers need extending to 10 feet.

The first year we applied about 1" of water a week to the established plants. In retrospect, this is too much water. The stump diameter of many of the plants at harvest time was so large they had to be discarded.

However, newly rooted plants fresh from the mist area must be kept moist for at least two weeks after being planted in the field.

Insect control in the nursery was achieved with the systemic insecticide. The insecticide, carbofuran was used on an experimental basis with rates varying from 2 to 6 pounds per acre to control insects. More work is being done with this chemical at Stoneville. It shows great promise for the control of the cottonwood clearwing stem borer (Paranthrene dollii), the cottonwood twig borer (Gypsonoma haimbachiana) and the cottonwood leaf beetle (Chrysomela scripta). Carbofuran is a granular substance and was applied in the nursery with a subsoil blade about 6 inches deep.

During the winter of 1971 the dormant hardwood cuttings from the initial 4 acre cottonwood nursery were harvested, cut into 12" lengths and planted on an additional 12 acres. Cuttings from both of these nursery sites will be harvested in the winter of 1971-72 for distribution.

Farmer, R. E., Jr. 1963. Distilled-water mist chamber for propagating greenwood cuttings. U. S. Dept. Agr. Forest Service Tree Planters' Notes 59, pp.28-29.

Hartmann, H. T. and Kester, D. E. 1968. Plant Propagation - Principles and Practices. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 702 pp.

McAlpine, R. G. 1966. Vegetative propagation methods for hardwoods. Eighth South. Conf. Forest Tree Impr. Proc. pp. 14-20. Ga. Forest Res. Council Pub. No. 24, Macon, Ga.

McKnight, J. S. 1970. Planting cottonwood cuttings for timber production in the South. USDA Forest Serv. Res. Pap. SO-60, 17 pp. Sou. For. Exp. Sta., New Orleans, La.

Mohn, C. A., Randall, W. K., and McKnight, J. S. 1970. Fourteen cottonwood clones selected for midsouth timber production. USDA Forest Service Res. Pap. SO-62, 17 pp. Sou. For. Exp. Sta., New Orleans, La.

Mohn, C. A. and Randall, W. K. 1969. Preliminary selection of eastern cottonwood clones. Tenth South. Conf. Forest Tree Impr. Proc. pp. 41-48. Sponsored Pub. No. 30 Sou. Forest Tree Impr. Comm., Eastern Tree Seed Lab., Macon, Ga.

Randall, W. K. and Miller, A. J. E. 1969. Rapid expansion of eastern cottonwood clones, In Press.

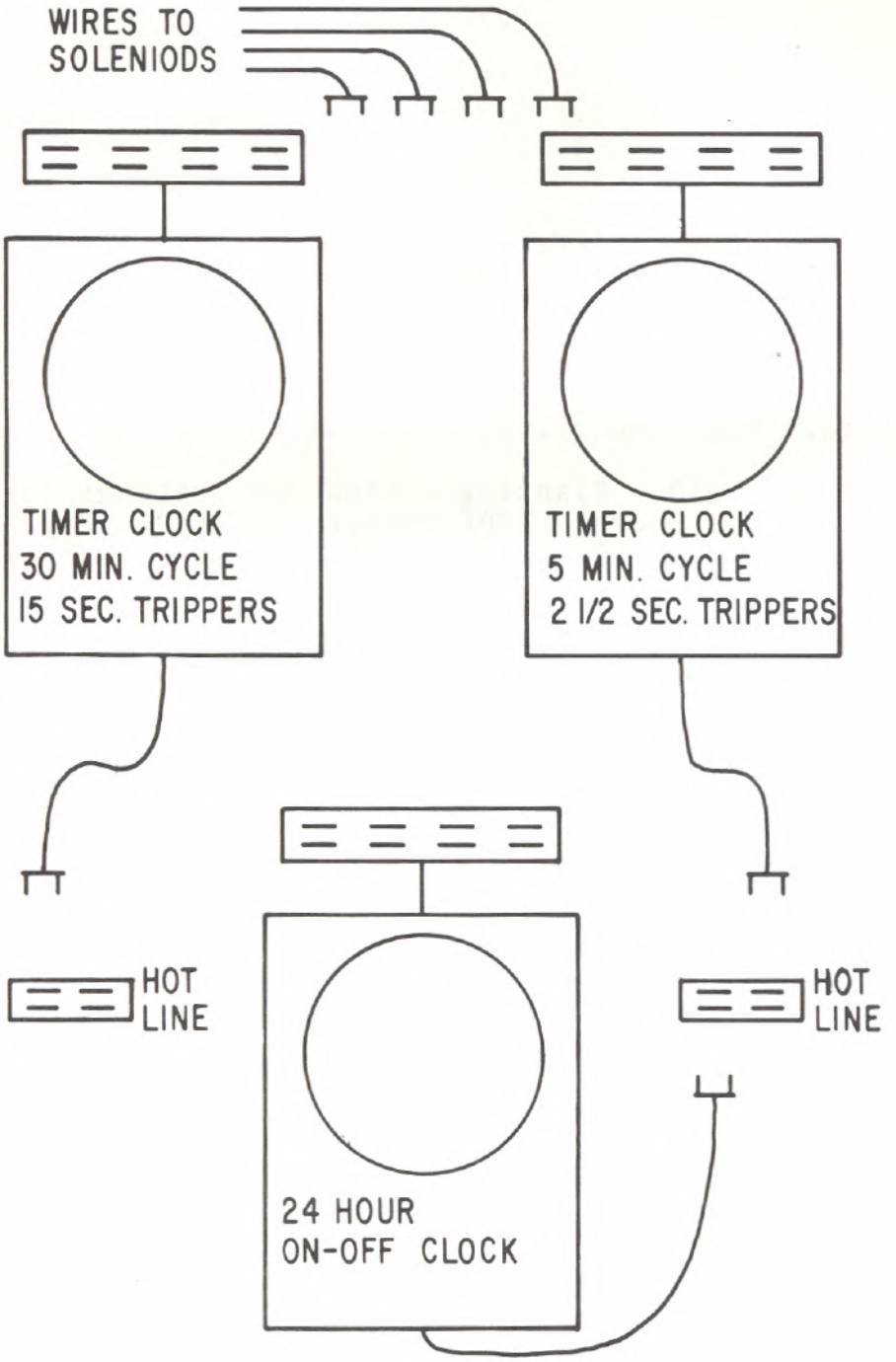

Figure 1. Diagram of clock central system

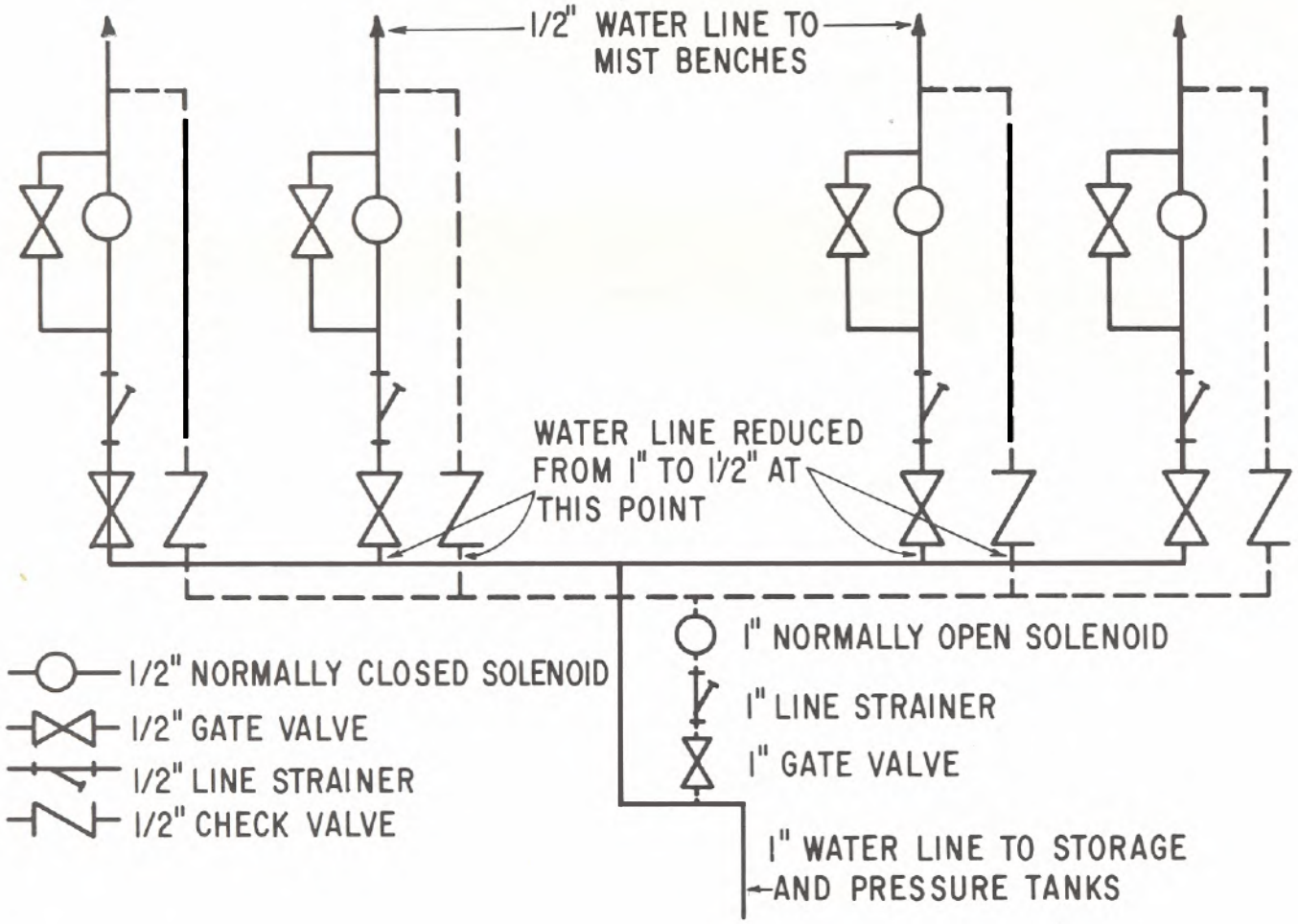

Figure 2. Diagram of water control system for mist propagation