produce the maximum amount of plants per square foot of growing space. Also growers need to increase dollar sales per flat when shipping. Two directions are being followed. The first is by pot growers changing from a 4-inch pot to 3¼-inch or 3½-inch pots for items such as annuals which are generally grown pot to pot. The second direction is by growers of green paks moving to slightly larger paks which will allow plants to bloom. Both systems achieve more dollar sales per square foot of greenhouse and truckload. Most important to growers is careful cultivar selection and the use of cultural techniques such as using growth retardants, like B-NINE, or maintaining even growth with cool temperatures.

Either to the small specialized grower or the large diversified grower, spring color production still requires a lot of HUSTLE!

VEGETATIVE PROPAGATION OF TEXAS LIVE OAKS

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Live oaks (*Quercus* spp.) have been grown from acorns commercially for years. Most species of oaks are wind pollinated and are highly heterozygous; as a result, the progeny of a single tree may not resemble its genetic parent. Live oak trees commonly differ in drought hardiness, salt tolerance, height, earliness to leaf, and the presence of insect galls. These characteristics are not reproducible through seed propagation.

Plants propagated asexually (vegetatively) through cuttings reproduce all the genetic information of the parent plant. This is why the unique characteristics of any plant can be perpetuated by establishing a clone. Cuttings taken from a tree genetically resistant to the formation of insect-induced mealy-oak galls, for example, should be expected to grow into gall-free trees.

There may exist further reasons for vegetative propagation of oaks, such as availability of cutting material when acorn crops are poor or out of season; it may prove easier, more rapid, and more economical to take cuttings than to grow trees from seeds. For our purpose clones, because of their uniformity, are unequalled as research material.

Studies at Texas A&M's Research and Extension Center at Dallas during the last five years were designed to determine the feasibility of asexual propagation of live oaks, so that superior

trees might be produced to study inheritable characteristics, made available to the nursery industry, and offered to the public.

METHODS

Live oak cuttings in full leaf were collected from field-grown trees of different ages at Storm Nursery near Premont in South Texas during the spring-fall growing season. They were moistened, put in plastic bags, placed on ice, and returned to our laboratory where they were quick-dipped in several experimental concentrations of a rooting hormone, indolebutyric acid (K salt), and placed in a greenhouse bench under intermittent mist. The medium was a well-drained 3:1 perlite:peat (v/v).

Cuttings that rooted were transferred into containers of 1:1 peat:perlite, hardened under reduced mist frequency, and allowed to grow in the greenhouse. About 50 rooted cuttings were placed in urban landscapes, on nursery property, and in the tree nursery at the Texas A&M Research Center.

RESULTS

Cuttings treated with IBA hormone concentrations of 10,000 ppm (mg/l) and higher, and those that remained under mist for 12 weeks provided the greatest number of roots.

In general, the younger the plant, the greater the rooting, providing evidence that the phenomenon of juvenility and rooting are closely related in live oak. Cuttings from trees 5 to 8 years old rooted poorly, with the older ones providing the poorest rooting.

The dates during the summer months when cuttings were taken had little effect on rooting. Cuttings taken during the early, warm days of October rooted equally with those taken in the May to August period. Cuttings taken during the colder months of November to March, however, failed to root.

Trees carried an apparent genetic propensity to root, or not to root, an effect observed through several collection dates. Selected seedlings consistently provided cuttings which rooted at higher numbers, while others, equally as consistent, yielded non-rooting cuttings.

Finally, cuttings taken from rooted propagules of a selected tree at Storm Nursery rooted in greater numbers than did cuttings taken directly from the original parent tree itself. Furthermore, these second "vegetative generation" plants provided better root systems than did cuttings taken from the parent tree, still in the field.

DISCUSSION

Because these "second generation" propagules had been maintained year-round in the greenhouse, the dual effects of greater numbers of stronger roots may be attributable to environmental conditions and height control (hedging).

For whatever reasons, an avenue of asexual propagation of live oak may have been opened through this method of successive propagation: cuttings taken from rooted cuttings.

In sum, the following determinations have shown to be consistent:

1. Cuttings taken from young trees root more readily than those from mature, acorn-producing (adult) seedlings.
2. Hormone application is essential; concentrations of 10,000 ppm IBA and higher was most effective.
3. Stem-tip cuttings from the outer branches have rooted well, but non-terminal cuttings (where carbohydrates may accumulate) also have rooted.
4. Cuttings will root if taken at any time during the growing season, but they should be semi-hardwood — very soft, green cuttings seldom produced roots. Likewise, old, hardened wood is difficult to root. Second-year wood generally is harder and of better quality for rooting.
5. Cuttings should be slightly smaller than pencil size in diameter.
6. Cuttings rooted best under mist; a Wardian case or similar closed propagation chamber may produce heat and desiccate the leaves.
7. Cuttings should remain under mist for 12 weeks. Bottom heat by cables should be provided when greenhouse temperatures drop.
8. Like most mist-propagated woody plants, rooted cuttings of the live oak should be hardened gradually under reduced misting.

Additional investigations are continuing. Clones now growing in the field are being evaluated for growth habit, fertility response, growth rates, and insect gall resistance. These propagules will be further used as sources of cutting material for successive propagation, and compared with cuttings from greenhouse-maintained clones. Selected clones are being employed in fertility (nitrogen) studies in containers.