

The medium used is a modified Murishige fern medium. Culture tubes are placed under Gro-Lux fluorescent tubes in a 16 hours light/8 hours dark regime at 80°F. Originally we used Murishige fern medium, but we found that we were getting too much differentiation during the multiplication stage which made division for subculturing rather tedious. To overcome this, we made adjustments to the auxin and cytokinin balance. In our medium we use 2 mg indoleacetic acid, 0.04 mg kinetin, 1.126 mg N⁶-benzyl amino purine (BAP) per litre. We found that, using this balance instead of only 2 mg kinetin per litre, the resultant multiple bud development was rapid and much easier to subdivide for the next two sub-cultures prior to transfer to a pre-transplanting medium. In the pre-transplant stage we delete the kinetin and BAP from the medium. The clumps of multiple buds are divided and planted approximately 30 per jar. These start to differentiate in 2 to 3 weeks and at about 6 weeks we transplant into tubes of sterile U.C. type medium under mist in shaded greenhouse.

The resultant plants develop fairly rapidly and have a very bushy habit which fills the container much better than when traditional propagation methods are used, possibly because of a slight carryover of BAP in the plant system.

Components	mg/Litre	Components	mg/Litre
CaCl ₂	332.00	NH ₄ NO ₃	1,650.00
CoCl ₂ ·6H ₂ O	0.025	MgSO ₄	181.00
Na ₂ MoO ₄ ·2H ₂ O	0.25	MnSO ₄ ·H ₂ O	16.9
NaH ₂ PO ₄ ·H ₂ O	255.00	ZnSO ₄ ·6H ₂ O	8.60
CuSO ₄	0.025	Sucrose	30,000.
KH ₂ PO ₄	170.00	Inositol	100.00
KI	0.83	IAA	2.00
KNO ₃	1,900.00	Kinetin	0.04
FeNa EDTA	36.7	BAP	1.126
H ₃ BO ₃	6.20	Thiamine	0.4
Agar	8,000.00		

Note: Delete kinetin and BAP for pre-transplanting.

SPRING COLOR PRODUCTION

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Spring has always been a magic time for gardeners, bringing an influx of buyers to nurseries for flower and vegetable plants. Plants providing immediate color play a very important role in spring sales for nurseries and mass merchandisers. In re-

cent years people have become more and more interested in "instant color" resulting in increasing sales of 3-inch, 4-inch, 6-inch, and 1 gallon color items. For the wholesale operation this means getting an early jump in winter. The name of the game is to pack your greenhouses for the spring explosion.

In Northern California, spring sales generally break loose in early March. For many greenhouse operations this means spring color production must get off to a fast start in December and January. For most growers, this means waiting for poinsettias to clear out and then quickly replanting. It is extremely important to have seedlings, cell paks, bulbs, or pots for shifting ready to fill up emptying greenhouses. These crops can be for finishing in early spring (for example: 4 inch annuals, geraniums, or perennials) or for holidays, such as Valentine's Day or Easter (chrysanthemums or Easter lilies). Having crops that can be shifted or brought in to finish for Valentine's Day can often help get an extra rotation off benches. These benches can then be used to spread spring color (i.e. geraniums) or start late spring crops.

Much of the volume in spring color is from annuals. Popular plants include marigolds, dahlias, petunias, impatiens, begonias, zinnias, cellosia, and vinca, among others. Dwarf cultivars of these plants are most desirable for flowering in pots. Careful attention should be paid to daylength and temperature requirements. Most annuals tend to do well in a wide range of temperatures, depending on how quickly the crop must be brought along. Some crops, such as marigolds and dahlias, can tolerate nights as low as 45°F, but temperatures ranging from 50°F to 60°F are more acceptable. Crops like vinca and celosia will suffer until temperatures become milder, unless they are kept in a warm greenhouse.

While many nurseries in Southern and Coastal California are able to employ outdoor growing year-around, Northern California's Central Valley provides some cool temperatures, often resulting in frosts. Nevertheless, as soon as the weather breaks in spring, outdoor or saran areas are very economical sites to grow color annuals. Petunias and dianthus are excellent for outdoor growing. Later in the season most all popular sun requiring plants can be either moved out or directly planted outside. In the San Joaquin Valley the outdoor area is frequently employed to finish a crop, allowing more plants to be started on the benches. In the very early spring, direct planting outside can be tough on the new seedlings and, later in the season, as the heat begins, seedlings may require some temporary shade.

From seedlings brought up in a well controlled greenhouse, annuals can be transplanted directly to 4-inch pots. Transplant-

ing can be done several ways. One method is to lay out soil filled pots and have planters come along planting them in place on the benches. Pots can also be planted in a central area and then set out on benches or outside. Regardless of what method is employed, efficiency must be used to keep profitability in annual crops. In all stages of production, labor must be kept to a minimum. Sprinkler or automated water systems should be employed to reduce labor. While transplanting can be quickly learned, cultural techniques and quality control in orders is best handled by more experienced greenhouse personnel.

For many years zonal geraniums have been a popular color item throughout the country. Until recent years, cutting-grown cultivars were the only commercially available geraniums. With the introduction of seed geraniums, whole new systems for producing this crop have evolved. Seed geraniums can provide more consistency in crop timing, more consistency in plant size and quality, and elimination of many disease problems associated with propagating and producing cutting-grown cultivars. Some problems that still exist are bloom shattering in shipment, plants that do not self-clean well in the garden and, to date, a lack of double flowered cultivars. The cost of buying cuttings or maintaining motherstock also makes seed geraniums more attractive to greenhouse growers. While the last couple of years have brought large increases of seed geraniums to the marketplace at the expense of cutting types, there will probably be some shifting back as consumers find that cutting types can be used in different ways. The most popular way to market geraniums in California is in 4-inch pots, with bud or color. Six-inch pots or gallons are also available in the latter part of the season.

There are many perennials that are good spring color. Begonias, such as richmondensis doubles; New Guinea impatiens, with their colorful foliage and bright flowers, ivy geraniums, transvaal daisies, dwarf and standard marguerites, dwarf pinks or carnations, and the ever-popular fuchsias are among some of the many fast growing perennials that can be grown for spring. Often these plants are sold as small liners early in the season, but as spring progresses, they are good items to grow in 4-inch, 6-inch or 1 gallon cans. Most often these plants are started from cuttings and then grown on either in the greenhouse or outside as temperatures warm up.

Profitability is still an important gauge of what plants can be commercially grown for spring color. Annual pots are sold in great volumes but often have a minimum of profit after growing and shipping. Motivated by increasing costs of production and competition in the marketplace, many growers are trying to

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