

Producing Containerized Oak Seedlings¹

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Abstract. Describes techniques used at the L.A.Moran Reforestation Center in Davis, California to produce containerized oak seedlings. With proper maintenance and protection, artificial regeneration efforts with oaks can be quite successful.

INTRODUCTION

Oaks, with nineteen native species, are an important part of many plant communities in California. While large areas of oak woodland remain, there is increasing pressure on the oak resource from grazing, clearing, firewood cutting and urban development. Several oak species are not regenerating well, particularly Blue Oak (*Q. douglasii*), Valley Oak (*Q. lobata*) and Engelmann Oak (*Q. engelmannii*). In order to reverse the effects of habitat loss and poor natural regeneration, techniques were needed for successful artificial regeneration. This paper covers methods used to produce containerized oak seedlings at the L.A.Moran Reforestation Center (California Department of Forestry & Fire protection) in Davis, California.

ACORN SOURCE

While seed zones are well-defined for conifers, there's not a lot of information available to indicate what a seed zone looks like for an oak species. Variability suggests that the zones might be fairly large. Experiments done with reciprocal transplants showed at least short-term survival of widely disparate acorn source/planting location combinations.

In growing oaks for an area as large as California, we decided to focus on the six large areas that would be obtained by dividing the great Central Valley into eastern and western halves and subdividing those into northern, central and southern parts. We hope to add a north coast range, central coast range and southern California source as time and resources permit. As with conifers, all collections are source-identified using the legal description, elevation and seed zone designation.

A second concern is how readily oaks hybridize. It is important to have someone with experience identify the oaks that collections will be made from. It is also important to maintain a broad genetic base by collecting from enough parent trees. We try to arrange collections from at least fifteen trees and specify that the individuals should be sufficiently separated to avoid collecting from closely related trees.

ACORN COLLECTION

Since acorns deteriorate rapidly in storage, a fresh collection must be made each year. Oaks in the white oak group, such as Valley and Blue Oak, produce acorns in one year while oaks in the black oak group, such as Black and Interior Live Oak, take two years for acorns to mature. These production times coupled with crop periodicity will determine which species of acorns are available in a given year.

Acorn collection isn't difficult, especially in comparison to conifers. It's best to collect the acorns directly from the branches, which can be done by spreading a tarp under the tree and beating the branches with a length of PVC pipe. If this isn't possible, an adequate

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collection can be made by picking acorns from the ground, if the gatherers are selective. Choose only those acorns that are large, heavy, evenly colored, have no cap and are without obvious cracks, holes or other damage. Acorns are sensitive to drying, so don't collect those that have been on the ground for a long time. Collections should usually be made in early to mid fall when the acorns are turning golden to brown.

ACORN PROCESSING

We upgrade the acorns as much as possible and sow one per container. The acorns are sorted to remove those that have mottled coloring, cracks, several holes, light weight, obvious mold, a mushy feeling and those with the endosperm shrunken from the seed coat such that it rattles. It takes four inmate crew members a day or two to hand sort 200 lbs of acorns. Depending on the quality of the lot, we may also screen the acorns to remove very small ones and/or use air separation to separate light from heavy acorns. Since we have an X-ray machine for use in processing conifer seed, it is used to take a preliminary and final look at each acorn lot.

A less intensive processing method is simply to pour the acorns into water, removing the "floaters" and keeping the "sinkers".

It is important to maintain acorn moisture content during processing. Acorns are stored in plastic bags or boxes and kept at 35 degrees F when not being handled.

SOWING

Acorns deteriorate during prolonged storage, and acorns of the white oak group will begin to germinate if cold storage is extended. Our best results have come from planting in early winter. We aim to sow before mid December, but have had success with sowings from mid November through late December. The acorns are sown one per container and are positioned on their side. They are covered by about half an inch of coarse vermiculite.

CONTAINER

We use a 13 cu.in. foil-covered, paper plant sleeve for conifer production and initially used the same 1 .5" sq. X 6"

deep container for oaks. We now use a 2"sq.X 8" deep plant sleeve and feel that the 40 cu.in. root system and somewhat greater depth result in a seedling with better characteristics for field survival and growth.

POTTING MIX

For ease of production, we tried our conifer mix and found it to be acceptable for oak production. Our mix is specific for our extremely poor water quality, but any well-drained conifer mix would probably work. A starter fertilizer is incorporated into the mix.

GERMINATION AND GROWTH

Following sowing, the containers are moved directly into the shadehouse. If there is no rainfall within a week or two, the acorns are watered in. Regular irrigation isn't usually required until spring.

Germination is highly variable. It varies by source, by species, and by year. While it averages about 70%, it has ranged from 14% to 93%. Top growth often starts in February, but the timing can be quite variable. When germination appears to be complete, the empty containers are removed and the remainder consolidated.

The oak seedlings receive the same fertilizer formulations as the conifers, though on a less frequent schedule. Irrigation also tends to be less frequent than the conifers.

The winter following sowing, the fallen leaves are removed and the seedlings are sized and graded. The seedlings are made available for sale from early November through the following spring.

PROBLEMS

Overall, problems with oaks are relatively minor. One of the most consistent problems is predation on acorns in the shadehouse. No matter how careful we are, a blue jay or two manage to sneak in and can cause significant damage by uprooting and removing acorns.

Powdery mildew can sometimes be a problem on the deciduous species. Occasionally, aphids can also attain levels that prompt us to treat.

To avoid a weed problem, we do keep the newly sown oaks and other fall-sown species in a separate shadehouse from the seedlings that have been grown for a full season.

SPECIES AND PRODUCTION

We've grown Valley, Blue, Black, Canyon Live, Interior Live and Scrub Oak and hope to add more seed sources of these species first, followed by additional species. The 1991-92 season is our fourth year of containerized oak production and 45M gross were sown last season.

TRIALS

At the request of the Magalia Nursery (California Dept. of Forestry & Fire Protection, Magalia CA), we initiated a study involving small oak plugs grown at our container facility and then transplanted into the bareroot beds at Magalia. The plug container was a foil-covered plant sleeve 1.5"sq.X 3" deep which resulted in a plug with a dense, fibrous root system about 2 inches deep. This gives the transplant more laterals in the upper part of its root system than can be obtained with undercutting alone on a bareroot seedling. Preliminary results have been very favorable and we plan to continue experimenting with this stock type.

SEEDLING MAINTENANCE AND PROTECTION

Competition for soil moisture and predation can severely limit the success of both artificial and natural oak regeneration. It is important to clear a

2-3 sq.ft. area of competing vegetation prior to planting each oak seedling. Mulching after planting will tend to slow the reinvasion of competition and aid moisture retention. Browsing by deer, rabbits, small rodents and grasshoppers can have significant impact on survival and growth. Protectors can be fashioned from wire window screen mesh stapled to a stake or commercially-available, rigid plastic tubes can be used as mini-greenhouses. Livestock and gopher predation require more extensive protection efforts. With proper weed control and seedling protection, oak seedlings can grow several feet a year, depending on rainfall.

OAK REGENERATION & RESTORATION IN CALIFORNIA

A very active, interagency cooperative effort is underway, including the Integrated Hardwood & Range Management Program with a substantial budget for oak monitoring and research. Several symposia have been held on oaks in California and there are numerous newsletters and publications on oaks. The California legislature declared 1990 the "Year of the Oak".

CONCLUSION

Techniques are available for successfully producing containerized oak seedlings. With proper maintenance and protection, seedling establishment and growth can be quite favorable. It is now possible to use artificial regeneration to reverse the decline of several California oak species and restore large areas of hardwood habitat.