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## THE ACORN ODYSSEY\*

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### Oak Morphology

The requirements needed in the Southern hemisphere to establish an oak lawn or oak arboretum are much more exacting than is the case in the Northern hemisphere where the genus is native. A few oaks are found below the equator in the high mountain areas of New Guinea and some high up in the Andes into Colombia, but they might properly be classed under the hard-shelled acorn genus *Lithocarpus*.

The terms white and black oak originated in Europe where a distinction between the two roburs needed to be made. This naming was carried over to America although the reasons for the differentiation were not the same.

The flowers of oaks differ between the two classifications. The white oaks (section *Quercus*) flowers are impregnated and mature in the first year while the red oaks (including the red oaks, section *Lobatae*) produce undeveloped flowers which do not become fertile until the second year by the maturation of the ovaries. Upon fertilization only one ovary develops and the others abort and become incorporated within the acorn. With the white oaks, these aborted ovaries cluster at the hilum or scar end; with the red oaks they cluster at the embryo end.

### Acorn Handling and Treatment

All acorns are live seed and moist internally until germination, so all seed must be kept this way. In some white oak species germination begins almost immediately while others do delay for varying periods. Red oaks have dormancy which is usually only broken by stratification (maintained under moist conditions at temperatures 1° to 4°C for periods up to two months -- not less than five weeks). Some scientific work and theory suggests that the acorn has a balance of hormones giburellin and dormin. The latter gradually disappears under the prolonged cold moist conditions when the growth hormone giberellin takes over and begins the germination process.

Species of oak are not uniform in their ripening process both on the tree and afterwards. Some roburs can be harvested off the tree as soon as they begin changing color to brown and can be removed easily from the cup. They continue to ripen and will begin germination in moist conditions at the same time as if naturally dropped.

Seed which fall to the ground is almost immediately infected with fungi, mostly at the embryo end which can seriously reduce germination and the strength of the tree as it emerges.

Commercial suppliers of seed sell only commercial quantities (i.e. in pounds or kilograms, 1000 to 5000 acorns, useless for small collectors). Larger orders receive priority so that small orders are end-of-season dregs. Germination rate is poor. No explanation is given if seed is unavailable or sold out. No research is done to ensure best possible and cheapest form of delivery. No follow-up ever occurs to find the outcome and no guarantee is given as to the true nature of the seed, whether as to species or likelihood of hybridization (i.e. seed is gathered without regard to its situation in regard to other trees).

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## Quarantine Practices in Australia

Quarantine services are strictly enforced in Australia, thank goodness, but officers do not handle exclusively one set of rules for each type of seed, but a general procedure is drawn up for all those incoming. This is if disease is present even in one seed in 100, then the consignment is destroyed or treated with methyl bromide. This is warranted for dry dormant seed but not for live moist seeds, like acorns, which absorb the methyl bromide at the embryo and destroy the whole consignment. Some officers are sympathetic and they notify by phone when a package has arrived provided there is advance notice. They will then allow the outer husks to be removed individually and only infested acorns or grubs destroyed. This is a concession to me by several officers and is not acceptable or even considered by "by the book" conservatives.

Air freight express from the U.S. guarantees 3 days delivery but this doesn't happen in practice. If the acorns are sent on late Monday or Tuesday, they arrive Melbourne say Thursday night or Friday at the airport. They are then taken to Melbourne Mail Exchange. Quarantine officers cannot take delivery at any point except to redirect to the Quarantine stations. No deliveries are made Friday to the sorting room on Friday even though it is only 400 yards from the Quarantine Office. On Monday delivery takes place to the Quarantine Office but not usually until after the examining officers have gone home. (They start at 7:30 a.m.). So the first contact can take place on the Tuesday but commercial larger quantities receive instant attention so that it is common for the first inspection to take place on the Wednesday. If I'm lucky, I am informed and I reach there on early Thursday morning.

It takes a good part of the day to remove the outercoat of every acorn (under supervision) and I am allowed to remove those considered sound enough to be viable. Other than this concession, based solely on long acquaintance and trust, the result is usually zilch and costly.

With this period of delay white oaks can develop roots, exhaust the total moisture supply and die. Infestations of weevils almost invariably in USA consignments, fortunately, are found within this extended period but it would be preferable if a pre-consignment treatment was available and guaranteed on all consignments. Hot water at 50° C for 30 minutes is effective but the difficulty of overseas accreditation and reliability makes it almost impossible to be practical.

Some time ago I was asked by Quarantine Executives what I thought about allowing commercial importation of chestnuts from Italy. I spoke out strongly. However, the importer was a very wealthy organization and received permission to import as long as the nuts were heat treated under supervision and certification. The nuts arrived and were distributed commercially at a time to beat the locally grown (at the highest retail price). They had been kept in cool storage overseas to make this possible. I bought some seed and although considered dead by Quarantine officers I grew them within three weeks by which they showed stem lesions from fungus infection. I reported it to the Head of Quarantine in our capital city, Canberra, and then the rush started. Cans were rushed 60 miles to me and a friend. Lorries [trucks] began picking up all chestnuts in supermarkets all over Australia on information from the distributor. Eventually they were all destroyed and the matter was not made public but the importer lost three container loads (about 90 tons with a probable loss of up to half million dollars). The company has not imported any since and cannot. I was told off the record that the nuts had come out of refrigeration and had been dumped into 50°C water, half a tone at a time, left for the requisite 30 minutes as specified. But the requirements

did not mention that the temperature had to be maintained. Everyone carried out the laid down procedure but how do you police the enforcement overseas on the word of an inspector who doesn't know what he is doing and why -- just for the benefit of some far away land -- Australia. I have made requests for heat treatment of acorns on arrival across the board -- as a necessary condition of entry in place of methyl bromide. I have been refused even though the equipment is present, because the senior officers cannot trust their own officers who cannot be expected to know what they are doing and why.

## **Recommendations**

With acorns which have gone through this whole handling process for the small collector, like myself, and arriving out of season to their normal ripening period up to germination, some special techniques have to be evolved:

### **Seed Treatment**

1. The acorns must be gathered off the tree.
2. The tree must be sufficiently separated from other whites or other reds as the case may be to eliminate cross pollination.
3. The trees should be identified correctly, their situation recorded and protected in the wild (acorns from arboreta or botanical gardens are useless)
4. Each tree must be harvested and set off to their destination as soon as ready. Do not wait till several species are collected and sent as a joint consignment.
5. All orders should be taken up to perhaps August and then the list closed off.
6. Orders to be from an arranged list at prefixed prices according to crop estimates.
7. The same definable person to collect and remit seed with properly established reward plus expenses.
8. For Australia, do not mark customs declaration certificates \$100 Aust or higher. This makes them commercial and liable to duty of 25 percent.
9. In addition to address of recipient show clearly an instruction: Quarantine, Please notify addressee upon arrival at - telephone number. This can save several days.
10. Pre-treat acorns at 50° C for 30 minutes. This kills weevils and fungus before leaving and eliminates the possibility of seed being destroyed outright or by methyl bromide treatment. Weevil treatment must be immediate on collection as the period between egg laying and emergence can be as low as 14 days. This can coincide with arrival in Australia so prevention is the better alternative.
11. A network of preferably amateur accredited collectors should be established not only in the USA, but in Mexico (which has the largest range of species) and in Eastern Europe as well as China and Japan.
12. Lists should show whether species sent are red or white (treatment for germination is different); source of seed; approximate growth habit -- scrubby, bush, small or large tree, uses of acorns as food and timber -- eventual value, etc. For Australia, stress that oaks are fireproof and fire resistant.
13. Encourage insurance companies to reduce premiums where houses, etc., are surrounded by oaks in preference to eucalyptus in all country areas (California). Also for forest plantations with oaks surrounding squares of Eucalyptus from which back burning can commence for fire control within a minimal time from outbreak.

## Growing Practices

For germination (in order to speed up growth, the trees must reach a degree of maturity before autumn) I use the following procedure:

All acorns, whether white or red, are placed flat on a wooden board, and with a very short very sharp knife cut through -- removing the hilum. The coat down to the seed is peeled off towards the embryo end and all removed making sure the embryo is not split or damaged. I prepare a large plate with a layer of some woolen or water-holding material, and place upon it two layers of cotton material such as bed sheeting and then another layer of thick woolen or water-holding material on top. The acorns are then placed separated but closed between the layers of cotton material. The whole plate is then saturated under a tap and excess water drained off by laying the plate at about 45°. The plate and contents are then put in a warm spot. As long as the top layer is damp to the touch, no water-adding is needed. Examination of the acorns can be made at any time by peeling back the two top layers and replaced without disturbance. Acorns usually show signs of germination in about a week.

I use milk cartons for growth, puncturing six holes in the bottom, filling with a tightly packed potting mix to the brim, and laced with slow release (6 to 9 months) fertilizer granules. Litre cartons hold 1 to 2 acorns in opposite corners and 4 or sometimes 5 in 2 litre cartons. The cartons are filled to the top and acorns placed in a finger hole, flat, no more than 1/4" deep. Emergence varies between species and ambient temperature. The cartons are usually stood on concrete not on soil which allows excess water, upon re-watering to disappear. For a relatively short period of time, the depth of the carton is sufficient for a tap root without turning at the bottom but trees must not exceed one year's growth before planting out. With single trees the carton is torn off and the whole tree and mixture is planted. With multiples the carton is removed and all potting mix is hosed off and the plants separated very carefully to disentangle any side roots without tearing. The trees are kept in a bucket of water until immediate planting with the soil turned below its planting depth. With red oaks the procedure is exactly the same except for one detail: the embryo receives a treatment of gibberellin (less than a drop), strength .005% Potassium gibberellate (inert ingredients alcohol).

I used this process on the assumption of the theoretical balance between gibberellin and dormin so that an excess of gibberellin at the embryo would break the dormancy. It has worked. Red oak germination is reduced to about a week or so. The above treatments are, of course, only for amateurs with limited access to seed, but in terms of final supply of healthy trees the system is well warranted. I have even used it in the vegetable garden with pomsipo (very slow to germinate) just for the fun of the trial using tweezers to transfer the seed after germination and obtaining an even-row spaced crop.

On the assumption that except for bushy scrubby species all the holes will be used, all trees are pruned each winter judiciously according to the last seasons growth and vigor up to a height of 8 to 10 feet (i.e. within reach). They are then let go. Support is needed because boles width is suppressed in favour of height. However, they quickly develop straight smooth boles enlarging quickly ahead of upward growth. I am well protected from wind, or this procedure may not have been successful.