PROPAGATION OF PROTEAS

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The family of plants named Proteaceae is very large and is indigenous to the southern hemisphere. Several of its genera have graced our California gardens for many years, such as the grevilleas, the hakeas, and macadamia. During the last 20 years there has been a growing interest in a number of proteas for flowers and foliage to be used in the cut flower industry. For the most part these are the banksias, the leucodendrons, the leucospermums, and the proteas.

It is the propagation of these plants that we will attempt to consider. As with most plants they are propagated by seed, by cuttings, and by grafting. With but one exception, seed can be obtained from plants already growing in the U.S. The exception is the large-flowered proteas which require hand pollination. In their native South Africa the sun bird *(Anthobaphes violacea)* does the pollinating. There are a number of seed merchants in both South Africa and Australia who will supply seed for very reasonable charge. The seed loses viability very rapidly so that fresh seed should be demanded.

The seed should be planted during October and the seed flats or seed beds should be located outdoors. It has been definitely noted that germination is increased by the changes in temperature from day to night. Seed from South Africa often carries pathogens which can later develop into serious diseases among the growing plants. Before planting, the seed should be immersed for 20 min. in water at 125°F.

The seed bed should be composed of 1 part perlite, 1 part sand, and 1 part ground redwood bark. The seed should be covered lightly with washed plaster sand.

Careful watch of the seed bed must be maintained for rodents. Mice seem to have a sixth sense in locating seed and can cause total destruction in a very short time. When the seed starts germination, a close watch must be kept for sow bugs. They, too, can cause great harm.

Watering will depend on location. Barring rainy weather, a light daily sprinkle is best. In colder areas some frost protection should be available for the unusual frosty night. The seedlings should be allowed to attain a height of 3 in. before being transferred to pots.

Cuttings should be taken during early summer, when the new growth has partially hardened. Length of the cutting is

usually 6 in. The lower leaves should be carefully stripped so as to cause no injury to the stem. An oblique cut with a sharp blade should be made just below a leaf node. It has been found that a dip of the cutting into 5000 ppm indolebutyric acid is helpful in inducing root growth. The cuttings should be stuck in a mixture of 1 part sand, 1 part perlite, and 1 part ground redwood bark.

The cutting flats should be placed under intermittent mist. The frequency of misting will vary with temperature and age of the cuttings. Good air circulation is essential. Bottom heat of 70° to 75°F is optional during summer but quite beneficial during winter. Periodic sprays of Captan and Benlate is helpful in controlling damping off.

The grafting of protea plants is a technique in a stage of development. Both cleft grafts and bud grafts have been made, but the rate of loss is extremely high. Perhaps with more experimentation success will be greater.

VOICE: Dr. Baker, what is the optimum concentration of chlorine to use in irrigation water?

KENNETH BAKER: It is 0.5 to 2.5 parts per million of residual chlorine at the point where the water comes out of the tap, and that level will not be harmful to plants.

VOICE: What is the contact time needed from the time chlorine is injected to the time you put it on the plants?

KENNETH BAKER: That is a very good point — the contact time. You can time it by putting in a dye at the point you are injecting chlorine to see how long it takes to come out, i.e., what the time interval is. At that concentration, a minute will be enough. Another method that some nurseries use is to pump the water into a tank overhead, then to add Clorox to bring the concentration to the desired level.

VOICE: Will wood shavings or other wood products break down to give toxicity when steaming?

KENNETH BAKER: In our experience this has not happened. However, I am sure all of these materials have not been tested. What ones would you plan to use?

VOICE: Redwood and birch.

KENNETH BAKER: As long as you have washed the redwood it should be all right. Ordinarily redwood is placed in piles with overhead sprinklers. A black material comes out in a gummy mass at the bottom. Materials such as horse manure or blood meal high in organic nitrogen give phytotoxicity troubles with steaming.

VOICE: For sanitizing pots or used containers, would you use ½ to 2½ ppm chlorine also?

KENNETH BAKER: No, I would go much higher than that, but you can also use methyl bromide to sanitize them. In using methyl bromide to sterilize containers have them wet before you treat them because when organisms and pathogens dry, they become very resistant to heat and chemicals. To make the treatments effective get the organisms in a moist condition. Do not treat soil or containers that are bone dry. Moisten them a day or so before you treat them.

VOICE: Polyethylene glycol — Would you tell us about using this to rejuvenate seeds?

KENNETH BAKER: This work was done in 1955 by Dr. Heydecker in England on seed treatment with polyethylene glycol 6000; and this has since been studied by a number of people. After treating seed with hot water or aerated steam, put the seed in a thin layer in a pan and cover with polyethylene glycol and then drain; this maintains an osmotic level specific for each kind of seed. The objective is to keep the seed as moist as possible without it germinating. This process was originally called "invigoration" of the seeds. If seeds are treated with polyethylene glycol, those seeds that are a little less mature than others will mature during that period, and when you plant the seeds there will be much more uniform germiantion. There seems to be some controversy in horticultural literature whether this is actually true. My experience is that it is true. It does tend to "invigorate" the weak seedlings so they will come up about as fast as the others, which is a very real help in the bedding plant industry.

VOICE: Dr. Baker, I don't understand your logic on "suppressants" on strawberry, because strawberry plant growers commonly use suppressants. It is like you have a disease and don't take penicillin, pretending it will go away. You have to do something to attack the problem.

KENNETH BAKER: I think you missed the essential point. The commercial propagator, who is selling plants to someone else is different from the fellow who takes those propagules and grows them on. The propagator's obligation is to produce plants that are free of pathogens, not just plants that are free of symptoms. The man who is growing them on for commercial production may use soil drenches. For the propagator to use drenches as a means of suppressing disease in his nursery, only to have it break out later when the grower plants the stock is unethical, irrational, and should be illegal. The grower cannot undo the problem passed on by the propagator.

The point is that the propagator should be producing a plant that is free of disease rather than merely free of symptoms. The growth potential of that plant when grown on is what is important.

A person who is growing the crop on can get along with what you may call household cleanliness, sanitation, and hygiene. The commercial propagator who is selling plants to people who get their livelihood from them has a responsibility for hospital, rather than mere household cleanliness.

VOICE: Are there any products that actually eradicate diseases?

KENNETH BAKER: There are fumigants such as chloropicrin and methyl bromide.

VOICE: No drenches such as Subdue, Ridomil?

KENNETH BAKER: Ridomil won't; it is just inhibitory. This is the problem. These materials simply inhibit growth of the pathogen for the time they are there. They do not reduce the potential of the pathogen to kill the plant after it has been planted in the home yard. Some of you are questioning whether this is true, but I can assure you that it is. A whole body of evidence bears it out. It becomes a question of whether the propagator should be allowed to produce material that is actually transmitting the pathogen to the soil, so that the man who buys the plants is going to inherit the trouble.

Many avocado orchards in southern California are planted with nursery trees that carried *Phytophthora cinnamomi* when planted. This sort of thing I would say is immoral. The assumption has been that, if a plant has root infection with *Pythium* or *Phytophthora*, it will show symptoms of the tops. That isn't true, because these root "nibblers" may be present and the only visible symptom will be that the plant will be a little smaller. It is a time bomb that will go off sooner or later. The cripplied plant is in your yard, or worse in a commercial orchard, and it will go along for maybe 3 or 10 years, and then, in an especially wet winter, the trees will collapse. The question is, is it not better to have avoided that in the first place rather than to have it die when the value of that tree is a great deal higher?

VOICE: Where do we go from here in terms of developing the concepts outlined in Manual 23? Will we be able to use some of these biological procedures to inoculate the good bacteria or reduce harmful bacteria and fungi? What can you say about extending this concept a little further? Once things are clean, how do we continue making use of some of these organisms?

KENNETH BAKER: Bacterization is at the forefront today, one of the really hot topics in plant culture. It has enormous potential; it is the only way I know of that we can increase yield of agricultural crops without increasing environmental pollution, without increasing land area, and without increasing energy demands. A number of laboratories and commercial companies obviously think the same. Gustafson Seed Co. has been running trials with peanuts this year on 12,500 acres. This is bacterization or innoculation of the seed with certain bacteria selected for the crop and the given area. These bacteria spread along the roots and even from row to row along them. They form a protective screen, a biological control through antibiosis. They control deleterious bacteria, of which there are many in the soil, that are inhibitory to plant growth. These harmful bacteria are not true parasites and do not cause root rot. You are not aware of their presence other than the plant does not grow well. They don't invade the plant — they are nonparasitic exopathogens on the surface of the roots. I do not know of any place you can yet obtain these microorganisms commercially; it is a frontier subject, but I would bet that in five years many of you will be using them. The reason for bringing it up is to make you aware of what is coming.

BRUCE BRIGGS: We grow many plants in a tissue-culture lab and they are basically clean, and they go into a clean mix. However, before they are shipped out, we do use Ridomil and Subdue to clear up mildew. With a good ventilation system we now do not have a mildew problem. Should we continue with these fungicides or should we drop them? When such plants leave us and go to an Eastern grower, I know his soil is not clean and his water system may be contaminated. If his plant has a little protection, he will come out better than if it did not have any. Can we look at it from that standpoint, or should we leave it out?

KENNETH BAKER: You should go ahead and use it for this reason: you are not using it to suppress disease to make the plant appear healthy while it is in your nursery. You are producing pathogen-free plants to the best of your ability. You are preventing various molds that may develop during shipments, if I understand correctly. There is nothing wrong with that because you are not attempting to suppress and defer diseases so that you will not suffer loss, but the secondary grower will.