ROOTING MONTEREY PINE CUTTINGS

RICHARD E. PUFFER

University of California Agricultural Extension Service
San Bernardino, California

Monterey pine (*Pinus radiata*) is used to a considerable extent in landscaping and for Christmas tree farms in Southern California.

One of the biggest problems has been the effect of air pollution on the trees. Monterey pine trees vary considerably in their susceptibility to air pollution, ranging all the way from no damage to, in a few cases, death of the tree. Most of the susceptible trees show a yellow mottling of the needles and, occasionally, will turn brown immediately after a heavy attack. This problem led to the study of the rooting of cuttings from resistant trees to see if clones could be developed that would be resistant to air pollution. As we studied the variability among Monterey pine seedlings, we discovered that an occasional tree would grow into an almost perfect Christmas tree shape with very little pruning. Some of these trees also had desirable color and needle characteristics that made them very desirable for Christmas trees. We visited farms that had planted thousands of Monterey pine seedlings and searched for the few "perfect" trees. Cuttings were taken from these trees and rooted in sand with mist sprays. We soon discovered that cuttings from one tree did not root at all, while cuttings from another tree would root quite satisfactorily, showing that the seedlings not only vary in the aspects described above, but also in their ability to root. This is shown in Table 1.

Table 1. Variability in rooting ability of cuttings taken from individual Monterey pine trees.

Number of trees	Percent of cuttings rooted
1	60
2	20
2	13
1	10
4	1
2	0.3
3	0

Fred Dorman, who has a Christmas tree farm in Highland, Calif., has been working on rooting cuttings of Monterey pine since 1968. He has shown rather conclusively that cuttings taken from trees resistant to air pollution are also resistant to air pollution and, conversely, cuttings taken from susceptible trees are also susceptible to air pollution.

Mr. Dorman has grown rooted cuttings to fairly large trees and then took cuttings from these trees and found that they also rooted satisfactorily.

Table 2 shows the results of Mr. Dorman's trials over the past two years. To simplify the data, the percent of the cuttings that rooted from each tree were put in one of ten classifications. Each classification has a range of 10%. If a certain trial had 35% of the cuttings from one tree that rooted, that tree would be listed in the fourth classification identified as 31-40%. The mid-points of rooting in each trial for the trees are indicated. The last trial did not do as well as the previous ones because it was done in the summer; it is much easier to root cuttings in the winter in San Bernardino County.

It can be seen from this table that, as the trials continued, there was an increasingly higher percentage of cuttings rooted. This is because the techniques for rooting were continually being improved and the trees producing cuttings with a high rooting percentage were kept for retrial, while the trees giving poor rooting cuttings were discarded. In each trial, new trees were introduced to test their rooting capabilities.

It is evident from Mr. Dorman's work that we can find so-called "perfect" trees that will root satisfactorily on a commercial basis. This could be very important to the landscaping and Christmas tree industries.

MODERATOR BRIGGS: Thank you, Dick. Jolly, do you have a question?

JOLLY BATCHELLER: Were these cuttings placed in flats or in the ground?

DICK PUFFER: All of Fred's cuttings are in beds—raised beds. He uses sand as his rooting medium; bottom heat with mist. The sand is about 4" deep.

JOLLY BATCHELLER: In Rotarura, New Zealand, I saw a bed of 5,000 Monterey pine cuttings placed in the ground in June (the equivalent of our December). They were to be dug the following June. Out of the 5,000 I saw, five were counted as dead.

DICK PUFFER: Yes, I didn't want to get into that much detail, but thank you for bringing it up. Dr. Libby has been able to do the same thing at Berkeley, but we can't do it in southern California. It think it

Table 2. Results from seven trials in rooting Monterey pine cuttings.

Period of taking cuttings	Number of trees per trial	Number of stock trees whose cuttings rooted in the indicated percentages.									
		0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%
2 / 69-5 / 69	11	2	2	1	[a]4	0	1	0	1	0	0
5 / 69-8 / 69	12	4	[a]4	1	1	1	1	0	0	0	0
8 / 69-11 / 69	22	2	5	[a]5	3	1	5	1	0	0	0
2 / 70-5 / 70	45	7	10	[a]10	9	3	3	1	2	0	0
1 / 71-5 / 71	25	0	1	6	4	[a]2	4	2	4	2	0
2 / 71-5 / 71	16	4	2	0	0	2	[a]1	3	2	1	1
5 / 71-9 / 71	8	1	3	[a]3	0	0	0	0	1	0	0
Total	139	20	27	26	21	9	15	7	10	3	1

[a]Mid-point in each trial for rooting percentages obtained.

has to do with the dormancy of the tree, perhaps at the time the cuttings are selected. In southern California the tree never really goes dormant. You know, you go and choose a tree at a tree lot at Christmas time, and you're quite apt to see new young growth coming out. This is one of the problems they have next to smog, which is their biggest problem—and tree variability. But in the Berkeley area, the trees do become more dormant.

RALPH SHUGERT: I would like to direct this to Dieter on his lilac propagation. I'm not familiar with the cultivar he discussed. He said that he has had no success in budding this particular cultivar. I'm wondering have you ever tried budding it on *Syringa villosa* rather than *Syringa vulgaris?*

DIETER LODDER: No, we haven't. We haven't tried budding or grafting. I have seen grafted plants in large containers but there was a lot of suckering from the understock, which happened to be a *Ligustrum* variety. These plants were suckering heavily. We did not attempt to bud or graft but it is quite possible that it works.

RALPH SHUGERT: I just bring it up because I have had some experience with some lilac cultivars in the Midwest. We have had very poor bud take, down as low as 15 to 20% on *Syringa vulgaris,* but using *Syringa villosa* as the understock we have increased, sometimes doubled, our percentage of takes with those cultivars that are tough to graft on *S. vulgaris.*

DIETER LODDER: No, we haven't tried this yet. Maybe we should and see what happens. But I think the fact that the understock will sucker too heavily will probably prohibit this sort of thing.

RALPH SHUGERT: That's the only point in bringing this up. You will not find the suckering with *S. villosa* that you have with *S. vulgaris.*

ANDY LEISER: Another question for Dieter. On your difficulty in breaking dormancy of lilac buds, have you tried gibberellic acid treatments? We used it on a number of other things—I haven't worked on lilacs with this. In certain deciduous plants that we root, we want to break bud dormancy. The rooted cuttings go dormant during the summer but we can force them into growth with GA treatments.

DIETER LODDER: No, we haven't tried GA. The experiment in forcing growth in the first year was only done this year on a very small scale. We had four flats which were moved into cold storage; they were not treated in any other way. As a matter of fact, they were almost neglected. We brought them out of cold storage and placed them in the lathhouse, and watered them well. A few days later, the buds started to break. I was afraid of this hot spell we have just had; the plants actually stopped growing but I looked at them yesterday again to see if I had some additional information and they had started to grow again. The ones that were propagated this spring, potted and

not moved to cold storage have not shown any activity up to now. But we might try GA and see if we get better results.

MODERATOR BRIGGS: Did I understand you right that cold storage did help break dormancy?

DIETER LODDER: Right.

MODERATOR BRIGGS: Now, what is the time we are talking about—a week, two weeks, a month, two months—what length of time is necessary in cold storage to do this?

DIETER LODDER: Well, with this experiment we used two months. We put them in cold storage for two months and took them back out again. We took them out about six weeks ago (mid-August). They were barely established in the pot. The cuttings taken earlier this spring were potted—we moved them into a greenhouse to get a fairly heavy root system developed in the pot—then we moved them straight to cold storage. They started to grow immediately after they were taken out of cold storage.

MODERATOR BRIGGS: Thank you. Andy, if someone wants to play around with gibberellic acid, what would you say would be the concentration to try, in parts per million, to try to break dormancy?

ANDY LEISER: We work with a fairly wide variety of plants, sometimes in small quantities and often, with the deciduous plants they do go dormant, we can't get them into a flush of growth before fall. By spring they're pretty well debilitated. We usually use 1000 parts per million. Cold storage may be fine, but when you can spray a little gibberellic acid on the buds and in a week or two have them pushing vigorously, it might be a real economic advantage.

MODERATOR BRIGGS: Thank you. I believe on rhododendrons to break dormancy, they went up as high as 1% (10,000 ppm) when it was put on with an eye dropper on the buds. So that would be a good range—1000 to 10,000 ppm—this might be something to work around.

ANDY LEISER: It can be quite variable and we've had to repeat—certain species don't respond to one application. We go back ten days later and apply it again. The second time around we get good results—sometimes.

MODERATOR BRIGGS: Any other questions? I have one on pumice. How do you get the fine particles out of pumice, or do you even care about the fine particles?

KEN INOSE: The grade we buy is screened quite well and most of the dust is eliminated.

MODERATOR BRIGGS: That is an important point; we have found this to be a problem in our area. Most pumice we buy has too many fine particles; it packs and there is poor drainage. I was curious to see how you got around this problem.

HOWARD BROWN: How many times can you re-use pumice?

KEN INOSE: We can re-use our pumice, but we steam sterilize it after the first time. But I find it works well in our soil mix so we just throw it into our soil mix. Usually we only use it once, but it can be used twice—but before the second time it must be sterilized.

MODERATOR BRIGGS: When you re-use it, do you find that you have lost something from the pumice that helped, that you didn't have when using new pumice? Did you ever encounter this?

KEN INOSE: Last year, early in the year, the source from which I was getting my pumice was unable to supply me so I had to re-use my pumice for a while until I found a second source. I found that it worked well after we sterilized it—it gave as good results as the first time.

ANDY LEISER: I have a question for you, Dick, or possibly Jolly can fill in. I'm fascinated about this pine rooting; we have located a very fine pine in a place from which it is difficult to get seed. I've been writing for almost a year trying to get seed; we think it might be amenable to this type of cutting propagation. I have a two or three-part question: What hormones are used and at what levels? In your mist propagation, what time of year is this done? And, Jolly, in New Zealand, do they use bottom heat under their beds, wounding, hormone treatments, or anything?

JOLLY BATCHELLER: As I recall it right now, they take 8 to 10 inch cuttings, unwounded, untreated, line them out about 4-6'' apart in beds in rows about 10'' apart, directly in the ground, open sun, no mist. Then, along about 6 to 8 months after they've been placed they get callusing and rooting started. Then they run a vertical disc or a cutter down through the bed about every two weeks. At the end of one year they have a compact mass of roots and transplanting is no problem at all; the plants go directly into the field where they grow them to mature timber size in 20 years.

ANDY LEISER: What kind of soil mix?

JOLLY BATCHELLER: It is a sandy loam.

ANDY LEISER: And where is this in New Zealand—so we can guess as to climate.

JOLLY BATCHELLER: Rotarura is near Auckland in the north island of New Zealand.

MODERATOR BRIGGS: Now, Jolly, is this the wet season over there—in weather where there is no dehydration of the top?

JOLLY BATCHELLER: Well, Rotarura is, I believe, at an elevation of about 2,000 feet. New Zealand's temperature and range of rainy seasons would be like that of southern Oregon. There is no place more than 60 miles from the ocean—they have the influence of the ocean. The rains come throughout the season; they don't have a long dry period.

MODERATOR BRIGGS: They do get morning fog from the ocean then, maybe?

JOLLY BATCHELLER: No, Rotarura is about 30 to 40 miles from the ocean; they don't have morning fog but I wasn't there all year, however.

VOICE: Do they remove the needles from that part they put in the ground?

JOLLY BATCHELLER: I wasn't there but the propagator said, "we just stick them in the ground."

VOICE: Do they use hormones?

JOLLY BATCHELLER: No hormones.

GORDON WATTS: I heard a report on this and it mentioned the mixture of sawdust and dirt in the Australian and New Zealand propagation of their trees; and they did remove the bottom needles from cuttings before they stuck them in the ground.

MODERATOR BRIGGS: Going along with this—three or four years ago we had two Japanese exchange students that were with us some 18 months. We had a language barrier, but we could find out enough between us to learn that in Japan—in southern Japan—they take cuttings in the same manner, except they stick the cuttings in the river for about four or five days. This actually removes something from the cuttings—possibly a rooting inhibitor. Then they do the same thing—they line them out in an open field. But this is their monsoon period which is real wet—they do get rooting and do it very nicely. We tried this method in western Washington but we had nearly 100% dehydration and loss going through the winter—it wouldn't work. That's why I'm curious—how they get by without mist on such large pine cuttings outside.

ROBERT WARNER: Can you use root cuttings to start Douglas fir?

MODERATOR BRIGGS: Has anyone used root cuttings for Douglas fir? I don't know of any literature on this. When you dig a Douglas fir seedling you never see a root that shoots a sprout and grows. I presume the percentage take of root cuttings would be pretty small, if any. I've never seen a Douglas fir in the woods or a Douglas fir in the nursery that ever had any root sprouts. Would anyone like to make a comment—root cuttings of Douglas fir?

ROBERT WARNER: Root cuttings are almost the only way you can propagate breadfruit—but I'm sure not many people are doing that.

MODERATOR BRIGGS: There are a lot of trees that could be propagated from root cuttings, but we don't think enough about this, perhaps. We have tried quite a few trees that do sucker but even then

we have a problem of getting the root cuttings to grow. Maybe again, this is a matter of technique.

WEDNESDAY AFTERNOON SESSION

October 6, 1971

MODERATOR RAY HASEK: It gives me great pleasure to introduce a colleague of mine for a good many years, Dr. Tok Furuta, Extension Ornamental Horticulturist, at the University of California, Riverside. And he will talk to us about controlled environment seed propagation. Tok:

THE PHYTOTRONIC ENTERPRISE

TOKUJI FURUTA

University of California
Riverside, California

The room was gleaming white and seemingly sterile. Occasionally a door opened and music from a transistor radio entered from somewhere outside. Otherwise, there was an air of hushed expectation.

The only sound was a gentle hiss as air passed through the adjustable louvers into the room, combined with a faint hum from the lights. This was all the sound that could be heard as women robed in white moved about silently inspecting the rows and rows of white plastic trays. From time to time they would stop to more closely inspect and manipulate one of the living creatures on the white trays.

The room was divided into two parts by a lightproof curtain. Half of the room was brilliantly lit from overhead lights. On the basis of the glow from each lamp one determines that at least two types were used. The other half of the room was dimly lit for part of the time, in darkness the remainder. Every 12 hours, the curtains automatically parted and the lights moved to the dark side.

Through special tubes attached to the trays, water and nutrients reached the tiny creatures. There was no waste, the floor remained spotless. The workers inspected the controls and monitoring devices to be certain the composition of gases and the temperature and relative humidity were within acceptable limits for the creatures to grow vigorously.

Reached through large sliding doors at one end of the room was a smaller room whose walls were lined with shelf after shelf. Over each shelf were fluorescent lights. On the shelves were more of the white trays seen in the larger room.