EFFECTS OF SEVERAL HERBICIDES ON PROPAGATION OF FOUR ORNAMENTALS

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Abstract. Cuttings of *Calluna vulgaris* 'Aurea', *Cytisus purgens, Ilex crenata* 'Howard,' and *Thuja occidentalis* 'fastigiata' (T. o. Pyramidalis) obtained from container grown stock plants which had received ten herbicide treatments were propagated. Only the *Calluna* showed a statistically significant difference in rooting

Review of Literature

In a talk to the Connecticut Nurserymen's Short Course (1), Dr. John Ahrens reported "none of mentioned herbicides affected rooting of cuttings taken from treated plants when the herbicide was used at the label rate." The herbicides mentioned were: Amiben, Betasan, Casoron, Chloro IPC, Dacthal, Dymid, Enide, Eptam, Princep, and Treflan.

In a previous report (2), I mentioned that several herbicides did not influence the rooting of *Juniperus sabina* 'Tamariscifolia'.

Materials and Methods

Cuttings of *Calluna vulgaris* 'Aurea' — golden Scotch heather, *Cytisus purgens* — Provence broom, *Ilex crenata* 'Howard' — Howard Japanese holly and *Thuja occidentalis* 'Fastigiata, — pyramidal arbor-vitae,were taken from container-grown stock plants which had received four applications of herbicides during a two year period. Ground fir bark was the mix in which the plants were grown. The herbicide treatments and the rates at which they were used are shown in Table 1.

Three replicates of 10 cuttings selected at random were used with each species for each herbicide treatment. Following applications of Hormodin No. 3, the cuttings were inserted into screen bottom flats filled with perlite, or peat-perlite 1:1 in the case of heather, on January 18, 1972. Bottom heat was maintained at 70° F with a minimum air temperature of 45° F. The cuttings were lifted and the rooting results recorded as the root systems of each species became large enough for transplanting. The date of recording was February 29 for the heather, March 1 for the broom, May 2 for the holly, and May 6 for the arbor-vitae.

Results and Discussion

Rooting results based on a rooting index value of 5 for a heavily rooted, 4 for a medium, 3 for a light, 2 for a callused, and 1 for a dead cutting are shown in Table 2. No significant difference caused

Table 1. Herbicides applied to container-grown stock plants.

Trade Name	WSSA Common Name or Chemical Name	Lbs. Rate Per Acre
Amiben 2EC	Amiben	2
Bladex 80W	2-(4-Chloro-6-Ethylamino-S-Triazin-2-Ylamino)-2-Methylpropionitrile	½
Bladex 80W	2-(4-Chloro-6-Ethylamino-S-Triazin-2-Ylamino)-2-Methylpropionitrile	1
Kerb 50W	N-(1,1-Dimethylpropynyl)-3, 5-Dichloro-benzamide	1
Check		
Kerb 50W	N-(1,1-Dimethylpropynyl)-3, 5 Dichloro-benzamide	1
+		
Princep 80W	Simazine	1
Princep 80W	Simazine	1
Casoron 4G	Dichlobenil	3
Lasso 4EC	Alachlor	3
Falone 4EC	2, 4 Dep	4
+		
Enide 50W	Diphenamid	4

by the application of herbicides to stock plants was found in the case of *Cytisus purgens, Ilex crenata* 'Howard' or *Thuja occidentalis* 'Fastigiata'. Rooting index values both statistically better and worse than the check were recorded with *Calluna vulgaris* 'Aurea'. Cuttings taken from plants treated with Amiben, 2 lbs / A; Bladex, ½ lb / A, and Casoron, 3 lbs / A rooted better than those taken from the untreated check plants. Cuttings taken from Lasso, 3 lbs / A, or Princep 1 lb / A treated plants rooted poorer than those from the check plants.

Casoron is the herbicide most often suggested as decreasing the rooting percentage. In this experiment, *Calluna* cuttings taken from Casoron treated plants actually rooted better than those taken from the check plant.

Herbicides applied to stock plants can influence the rooting of cuttings taken from them. However, not all herbicides or plant species will show this effect.

Table 2. Root index values[1] for cuttings of four plant species given 10 herbicide treatments.[2]

Herbicide and Rate (aia)		Calluna vulgaris 'Aurea'	Cytisus purgens	Ilex crenata 'Howard'	Thuja plicata 'Fastigiata'
Amiben	2	45.0 *	34.0	40.7	35 0
Bladex	½	45.7 *	35.7	39.0	32.3
Bladex	1	39.3	32.7	40.0	30.7
Kerb	1	40.3	36.3	38.7	38.3
Check		38.7	33.7	43.3	40.7
Kerb + Princep	1 1	44.0	36.7	39.7	34.1
Princep	1	32.3 *	31.0	39.0	40.7
Casoron	3	43.7 *	34.0	0	38.3
Lasso	3	32.3 *	32.7	39.7	36.0
Enide + Falone	4 4	33.3	34.0	40.7	37.3
LSD 5% *		5.5	N.S.	N.S.	N.S.
LSD 1% * *		7.9			

[1]Root index value: 5 heavy roots, 4 medium, 3 light, 2 callused, 1 dead
A value of 50 would indicate 10 heavily rooted cuttings.

[2]Average of three 10-plant replications.

LITERATURE CITED

1. Anon. 1972. Pest control tops program in Connecticut. *Amer. Nurs.* 135(7):15, 52-63.
2. Ticknor, R. L. 1965 The effect of herbicides on the rooting of juniper cuttings. *The Plant Propagator* 12(1):8.

BRUCE BRIGGS: Thank you, Bob. Now we'll get down to the real good part, the Question and Answer period. Andy, you had your hand up. Do you want to start it off?

ANDY LEISER: I just missed the amount of bicarbonate in that table you gave, Charlie, on the neutralization of bicarbonated gas in a thousand gallons. What was the figure on the bicarbonate?

CHARLIE PFEIFFER: One milliequivalent per thousand gallons.

EDWARD JELENFY: Linda, will HPM separate out or will it be suitable for use for the next day. Or how do you do it. Do you mix it again?

LINDA RUMGAY: Just the first time. That's all you need to do. You just continue to use it until it's finished.

BRUCE BRIGGS: On that, Linda, you mix it for twenty minutes. Do you consider this necessary to get a good mix? Fine, O. K

WILLIAM CURTIS: For this "HPM", as Linda calls it, we've got to thank Ted Van Veen for the start of this. I have never been one to change around much if I had pretty good luck, I leave it alone. I've been rather conservative. About two years ago we were talking to Ted and he told me what he was doing; and this is Ted's formulation. We mix this up and we leave it alone until we use it. Now, we get Hormodin 3 in an eight ounce tin. We take ten ounces of Hormodin 3 and put it in a fruit jar, also the Benlate,. We put this all in a fruit jar and then we shake it for twenty minutes. Or, as has been suggested that you take it to a paint store and they will shake it for you. Perhaps a quart can that you seal real tight may be better. If you shake it to get it well mixed it will fluff up. You can't put it into the same size vessel because it has a tendency to fluff way up and you've got twice as much after you shake it as you had before. We take a small amount and put it in a small vessel to dip our cuttings in, like you would with Hormodin 3 or any other powder. This came originally from Ted Van Veen but now Ted has another modification. Ted, do you want to add to this? He's got the latest dope.

TED VAN VEEN: Well that's basically what it is, Bill; we modified it only to the extent that we're putting a slight portion of boron into it this year and, offhand, I can't remember the amount.

GEORGE RYAN: I have another question on that, Bill; is this straight IBA or did I understand that you already diluted it?

WILLIAM CURTIS: It's been diluted in talc and it's fifty per cent Fifty per cent IBA, What did we pay this year? Seventy-five dollars for 100 grams.

ED SHULTZ: When I buy IBA it comes in a granular form and I use a mortar and pestle to grind it up. Now when you had this mixed with talc did you have this put through an alcohol solution in order to bring it into a solution and then mix with talc?

WILLIAM CURTIS: We get the mixing done for us by Miller Chemical Company. Evidently they take the crystals and dissolve it in alcohol just like the directions tell you to do, then they add the talc and regrind it. And it's fine, the same kind of texture as Hormodin 3. So I suppose they use the same grade of talc so you don't have any separation. If you use a coarser talc, or a finer talc, then you would have, perhaps, a separation.

RICHARD BOSLEY: I have a question regarding the use of Benlate. There are some reservations in the East regarding Benlate. I wonder if you have tried other fungicides?

WILLIAM CURTIS: "You can't beat success." You know the old saying. We've had excellent results with Benlate. But that's the only place we use Benlate — on cuttings. We only use it once because we were told it has inhibiting factors in regard to root growth. We use Captan. We don't use a second application of Benlate.

BRUCE BRIGGS: Charlie Pfeiffer, I believe there was some work in the greenhouse where they used Benlate in rooting and also I believe there was a breakage point not to use it over a certain strength. Do you wish to comment, Charlie?

CHARLIE PFEIFFER: This was on rooted cuttings of chrysanthemums and pot mums. At six ounces they got burning. But at three or four ounces to a hundred gallons, there was no problem. If you follow the rate that is on the package I think, in the experience of some of the growers, there may be burning.

BRUCE BRIGGS: Has anyone else had experience with Benlate and what strength would it inhibit the rooting? Is there any comment? Bob.

ROBERT TICKNOR: Several of the growers in this area are using Benlate as a dip for cuttings before they put them in the bench. Last year we tried some of this and we also had Benlate in the mix. It was 10% of 50W. So there was about 5% of actual Benlate in the hormone mix. And when we doubled up with the dip before and the Benlate afterwards, we had poorer rooting than not including the Benlate. I don't know whether there is any particular advantage in our system for using Benlate as a pre-dip; but I know a lot of growers have and have rooted things that they haven't rooted before. So, again, there can be a particular group of disease organisms or whatever is around the place that can make a difference.

JOHN EICHELSER: We used Benlate this year on Exbury azaleas; we dipped our cuttings in the Benlate and then used it later over the bench. And, so far — we're just taking them off now — but we're having the best take we've had in several years.

HAROLD CLARKE: Last year we dipped all our cuttings in

Benlate. We put them into a tub of Benlate solution and we also used it as a spray over the cuttings in the bench — and we had very good results Next, about this HPM formula, George Ryan here just figured it comes to about 1 5% indolebutyric acid. Several years ago we tried 2% for certain rhododendrons. We got considerable injury and burning and it seems to me it's getting pretty close to that concentration. The question I was going to ask Bob, are there any other fungicides you can mix in the hormone? We have used some Captan. We also used Arasan originally very well.

BRUCE BRIGGS· Thank you. Going back for some information to bring you up to date. At the Eastern Meeting, there was documented work showing that Benlate did stimulate rooting when used alone. I believe this was on Kwanzan cherries, I'm not sure. It was definitely proved that it did stimulate rooting.

TED VEN VEEN: As long as we're on that subject, George's calculation is correct. It is 1½% IBA. There are a few varieties of rhododendrons that will show some burning if they are taken quite early; we take our cuttings starting the first of July, so we do have some tender things We have a list of varieties that we don't use the full strength on; so you will get some burning at that rate. But later in the season — we do take some in October and November also — they seem not to burn. I think it's just a matter of the succulence of the cutting.

DON DILLON: I want to question whether other materials could be used in the hormone mix; we have used IBA with talc and Fermate. Fred, do you remember how much was in it?

FRED REAL: I let the druggist take care of that

DON DILLON: We have ours compounded at the local druggist and its's in the Proceedings of some years back when we presented our paper on twig grafting. I can get the information but I think Fermate came out as a recommendation of the Soil and Plant Lab, actually as a additive to the hormone treatment.

RICHARD BOSLEY· I want to ask Dr. Pfeiffer about chlorination of pond water. How much chlorine, what equipment?

CHARLES PFEIFFER: Basically a sufficient amount of chlorine to react with the organic matter that is in the water: this will vary anywhere from 4 to 5 ppm. As long as there is about 1 ppm residual; the exposure time should ideally be about ten minutes. Frequently, about five minutes is about all you can achieve. But ten minutes is considered the ideal time for exposure: and this will help tremendously in controlling water mold organisms.

RICHARD BOSLEY· How do you tell how much remains in the water?

CHARLES PFEIFFER: Ask Bruce, he's the one who has had experience in that

BRUCE BRIGGS: Normally if you chlorinate water, unless it vaporizes or goes out through the air, or goes out into the soil or something, the chlorine will remain there and it disappears only in reacting with the bacteria and the fungi that are in the water The indicator we use gives parts per million on a color scale — the same as the cities use. So what you do is to take the water that you have, put this in and add a little chemical to it and then you get a certain coloring. Then you can tell the parts per million, by this little meter, of free chlorine. Anytime you want, you can check it. What we do — we may have as high as 4 or 5 ppm at the pump — then when it finally reaches the destination, when it's ready to go on to the field, we again check it and it will be over 1 ppm — this is all. The difference between where it goes in at the pump and the area where it goes out on the field is consumed in the process; it was in the pipe, killing the fungus or bacteria in the water.

Yesterday it was mentioned, I believe, on tissue culture, using chlorine as a disinfectant. There were comments coming from the East last year in regards to *Phytophthora*. It was said to be very bad for us to keep dipping cuttings into a bath of water since we would be recontaminating cuttings because the water would contain things that we normally wouldn't kill with Benlate or with Captan, and so on — that we were doing harm. We always felt in the West that if we used Clorox the water would remain clean. So two years ago, we checked ourselves out. Because, they said, the chlorine in 20 minutes would all be gone in this bath. So we used the city indicator which we normally use and we found if we use Clorox, as it comes out of the bottle, not calcium chloride as is used in dairies, the chlorine will remain high all day long. It does not deteriorate in the water; so it stays there active as a disinfectant.

DOUGLAS PHILLIPS: I've been using chlorine a little bit on peaches and geraniums; one thing that has been pointed out to me is that the pH of the solution is very important. We're actually dealing with the active hypochlorite ion and the important thing is to have a pH at a point near neutral, because if it's alkaline, it is not active. If it's acid, it goes off too fast and you can have very rapid loss of activity of the hypochloride ion when it's put into an acid solution. What most of the people that I've been associated with strive for is a pH near 6.8 or 7. That is one of the factors.

I want to mention, too, that some of the fungi that I have been working with, particularly *Monolinea* — if it's adhering to the surface of a particle or a fruit, or something like that, it may take concentrations up to 100 ppm in order to get the kill. Another factor that is very important is the temperature. If you're dealing with cold water you get very poor kills at relatively high concentrations.

BRUCE BRIGGS: Very good. One other thing you might consider. If you are running an injector system and use calcium

nitrate as your liquid form, you lose your chlorine immediately because the chlorine breaks down. So unless you inject a different kind of element between when you inject the chlorine and when you put the fertilizer in, you will have no free chlorine because the calcium will chemically react with the chlorine and you immediately lose it.

HAROLD CLARKE: I'd like to direct a question to Louise Zachry. I'm not sure you mentioned your rooting hormone, your basic one.

LOUISE ZACHRY: Well, our hormone, generally speaking, is the old Jiffy-Grow solution.

BRUCE BRIGGS: I'm surprised that we don't have more confusion. I feel that we get more uniformity of results with a liquid. Louise, would you care to comment. You used both powder and liquid hormone preparations. How do you feel about the results from powder versus liquid?

LOUISE ZACHRY: Well, our results seem to be better with the liquid so I'll have to go with the liquid. We've tried both and used them in different strengths and so I still say we have to go with the liquid at this time.

BRUCE BRIGGS: We have not heard anything about rutin today; is anyone working with this? This is involved in some of the work that Dr. Tukey did back East. It was an interesting project. I know there must be a lot of work going on. How about it?

EDSAL WOOD: In some liquid trials we're trying right now, rutin is in it; it was done just this summer and it's all under mist. So far we can see absolutely no advantage at all from rutin under these conditions on succulent material.

ED JELENFY: A while back there was something mentioned about penetrants. Does somebody care to comment on just exactly what it is. What do you mean by the word?

BRUCE BRIGGS: A penetrant is something that will move a product within the plant. So, in other words, we want something that will translocate that product elsewhere within the plant. Like DSMO; it was, and still may be, one of the best ones we have.

HARRY LAGERSTEDT: Referring to Louise's talk — she mentioned using DSMO at 10 per cent. That sounded awfully high.

EDSAL WOOD: DSMO is put in the hormone stock solution at 10%.

BRUCE BRIGGS: O.K. Now, what strength are you running down to?

EDSAL WOOD: Well, you use about a one to ten dilution of the stock solution penetrant. The big advantage of the two new pharmaceutical penetrants has been that we can cut, for instance, on our

normal Jiffy-Grow, where we used a one to five, now we cut it to one to ten. We don't get the damage because our concentrations aren't as high. But we actually get better penetration and better rooting from the use of these penetrants. That is their purpose, of course, to carry in lower concentrations, almost half — right down the line. We cut our hormone strength by half.

ANDY LEISER: Would you name the new penetrants again, Ed.

EDSAL WOOD: Tetrahydroferberil. It is impossible to get it any place I know except England. These came out of a pharmaceutical research lab. They were working with DSMO as a topical application. They found they could use this without the ill effects of DSMO and accomplishing the same thing. The other is dimethylacetamide.

GEORGE RYAN: These are now available from chemical suppliers here.

BRUCE BRIGGS: What strengths of penetrants are in your solutions?

EDSAL WOOD: I think it's five per cent.

BRUCE BRIGGS: O.K., fine. That would be the total of each, one or the two combined?

EDSAL WOOD: We're trying to separate them out now and see which one does the best.

BRUCE BRIGGS: If you remember last year in California; it came up in discussion — they were using one per cent DSMO as the carrier. Now, where is your point of danger, if there is any danger; this is always a question. Harry.

HARRY LAGERSTEDT: I would like to comment on this. Eight or nine years ago, when DSMO first came out, we used it with IBA in class projects with about thirty different types of plants. If it worked at 0.1%, 1,000 parts per million, you're on the high side; we found a variation of results. With a few plants we seemed to get some response and in a few plants, we got injuries. So I think that you would first go below 1,000 ppm and then just experiment.