sawdust in the greenhouse at 15°C and kept moderately moist. The understock will show suckering within 2 to 3 weeks after grafting and the plants are then potted up into a light, well drained soil in 6" pots. Shoot development during the first season seldom exceeds 3 to 6 cm. Success is between 10 and 60% for patch budding. Winter protection is advisable for the first winter.

In the following spring, the grafted plants are planted out into beds and usually 30 cm shoots develop. Wild shoots have to be removed periodically. When transplanting again, the plant is planted below the bud union and this prevents suckering of the understock best. The ultimate would be to have a variegated plant on its own roots. At present only a variegated seedling would accomplish this and production costs would be very cheap as root cuttings could be used. The plant, in our experience, is virtually insect and disease proof and hardy to Zone III.

MANIPULATION OF HERBICIDES AND EFFECT OF HERBICIDES ON ROOTING

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Abstract. Ten herbicides were applied on *Cotoneaster dammeri* 'Lofast' in 1 gal containers in three different concentrations from low to medium to high ranges. While some of the low rates did tend to promote rooting and some of the excess rates did retard rooting, in general the normal dosages of herbicides which are adequate for weed control, showed little effect on the rooting of cuttings taken from the treated plants. The timing, condition of the wood, wounding and hormone treatment appear to be more critical factors than the normal rate of herbicide applied to the treated plants.

A second research project was set up to determine what properties the active herbicide would have on root formation when applied to the base of the cutting in a liquid solution. Eight different herbicides were applied to the base as a 5 sec dip in strengths of 5, 100 and 1000 ppm. The cuttings were then suspended through black poly and placed to grow under controlled conditions. They were observed and evaluated as to the effect on callus, root formation and hormonal reaction. While callus was slightly increased on some and decreased on others, no significant pattern developed. No attempt was made to correlate callus with rooting. In general, no hormonal reaction was observed that produces increased number or shorter roots.

The results of these two projects on *Cotoneaster dammeri* 'Lofast' seem to support other literature from former IPPS meetings, that a normal application of the herbicides tested to a stock plant, does not greatly affect the rooting ability of cuttings subsequently taken from that plant.

As many of our nurserymen have questioned the advisability of continued and repeated applications of herbicides on stock plants, the subject has come up several times in the past literature of the IPPS. In the early 1960's, Myhre (7) made reference to taking cuttings from treated plants without much inhibitory effect. George Ryan, who succeeded Myhre, propagated most of his plant materials from herbicide-treated stock blocks with no apparent damage to the rooting of the cuttings. Ticknor (8,9) gave data showing that plants in his treated blocks were not materially affected in rooting capabilities when the herbicides were applied at normal rates, with some chemicals even enhancing the rooting. Andy Sherwood, now retired, but once a large grower of lining out stock in Oregon, was one of the first nurserymen in the West to use Simazine in very heavy applications. He applied up to 8 lb/A actual, to his stock blocks, with repetitions over a number of years. His records show that, even with visible damage to the large conifers in the stock block, there was no noticeable effect to the rooting of cuttings. Ahrens (1,2) and McGuire (5,6) report about the same results with some variations, depending upon time of application, cultivar or plant, and kind of herbicide.

MATERIALS AND METHODS

Cotoneaster dammeri 'Lofast' was chosen because it is easily rooted and we have research data about its hormonal reactions (4). In both projects, cuttings were taken from plants direct rooted in 1 gal cans and growing in a plastic covered pipe house.

In Project I the stock plants were treated with ten different herbicides, at three strengths. Two weeks later, cuttings were taken from the new growth tips. No wounding was done and no hormones were applied. The cuttings were inserted through black poly and allowed to root in air, (3) so that we could observe the callus and root formation.

RESULTS OF PROJECT I

Table 1 shows results taken after observation of about 6 weeks. This test was set up in September, and rooting was a little slower than it would have been earlier in the summer. Some treatments did increase callus and roots, while others reduced both callus and rooting. Simazine and Casoron acted as promoters at a low rate, while Ronstar stimulated rooting only at a high rate. Chloro IPC at mid to high rates was the most restrictive to rooting. The rate that callus and roots formed was not entirely consistent, but would not have been noticeable had the cuttings been put into soil under normal procedures. In general, the normal dosages of herbicides which are adequate for weed control, showed little effect on the rooting of cuttings taken from the treated plants.

Table 1. Effect on rooting of granular herbicides applied to *Cotoneaster dammeri* 'Lofast' in 1 gallon cans.

Herbicide	Rate lbs/A		
Simazine 5G	1 *	2	4
Casoron 4G	2 *	4	4
Ronstar 2G	2	4	6*
Goal 2G	1 *	2	4
Lasso 15G	3	6	9
Dymid 5G	2.5	5	10
Surflan 5G	3	6	9**
Devrinol 5G	2	4	6**
Lasso 8G + Simazine 2G	3	6	9**
Chloro IPC 10G	3	6**	12**

* = Improved rooting
** = Retarded rooting

MATERIALS AND METHODS PROJECT II

The cuttings used in Project II were taken from the same block of untreated *Cotoneaster dammeri* 'Lofast' in gallon cans as in Project I. They were taken from new growth tips in September, treated with eight different herbicides in liquid dips of 5 sec and inserted through black poly as in Project I for observation. Wettable powders of the herbicides listed in Table 2 were dissolved in water to 1000, 100, and 5 ppm. This gave us eight herbicides at three strengths to test.

Table 2. Effect on rooting of wettable powder herbicides applied to *Cotoneaster dammeri* 'Lofast'.

Herbicide	Rate in ppm 5	100	1000
Tenoran 50W	+	+	0*
Casoran 50W	0	0*	+*
Dacthal 75W	0	0	+*
Simazine 80W	0*	0*	0*
Kerb 50W	0	0	0
Atrazine 80W	0	0	–
Surflan 75W	0**	0	–*
2, 4-D Lithate	0	–*	–*

\+ = Increased rooting — * = Retarded callus
– = Retarded rooting — ** = Increased callus

RESULTS OF PROJECT II

No startling effects were observed as you can see in Table 2. We were looking for hormonal effects; no hormone producing fewer roots in a greater length of time; and higher concentrations of hormone showing reduced time for root initiation with more and shorter root growth. Little effect from herbicide application was observed. The lack of decisive effect of Lithate might be due to the fact that it tends to react better in combination with other hormones like IBA and the rate of application is very critical. The Lithate did tend to retard callus at the medium to high rates, but had no noticeable effect on rooting at the low rate. Tenoran was the only one that increased rooting at the low rates.

DISCUSSION

While the above research indicates little apparent direct effect of herbicides on rooting, we must be aware of possible indirect effects from use in combination with other chemicals (10) or under different physical conditions. Each new herbicide should be checked out and information kept to evaluate its impact on different crops in different locations.

Simazine can cause plants to temporarily stop growth, causing the wood to harden faster. By reducing the length of time we can take prime cutting wood, it might consequently reduce the number of plants we would root successfully. This is noticeable in plants such as *Rhododendron* 'Jean Marie du Montague', which is more difficult to root than some others on hard wood in hot weather. Some plants may be inhibited by a normal application of simazine because it temporarily closes the stomates.

Casoran applied with nitrogen sulphate in hot weather may cause herbicide burn on leaves. Atrazine can be converted to nitrogen by some conifers in our area. The Christmas tree industry uses this to advantage getting the fringe benefit of a better, brighter color along with the weed control.

Many chemicals are used in growing plants to maturity; other chemicals are applied to the cuttings taken from mature plants. More information is needed to be able to manipulate the use of herbicides to the best advantage as related to the rooting of cuttings.

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CAPILLARY IRRIGATION OF CONTAINER PLANTS[1]

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Abstract. Selected cultivars of rhododendrons and azaleas were grown in two container media under capillary and overhead irrigation and under five fertilizer regimes. Of the fertilizers incorporated into the container media at manufacturer's recommended rates, Osmocote 14-14-14 produced the best overall growth. The capillary system using the Chapin twin walled tubes on a sand base produced growth comparable to that obtained with conventional overhead irrigation but with only half as much water used.

Container plant production of nursery crops is of ever-increasing importance to the industry due to rising land values and labor costs in producing field grown (balled and burlapped) stock. It is important because it allows a greater efficiency of production per unit of land. Container plant production offers advantages including: extended sales and planting seasons, development of attractive sales packages, greater transportability, better control of environmental and cultural factors, and more efficient use of labor, production and sales areas (1).

Growing plants in containers, however, presents special problems of watering and fertilizing not experienced in field production. Frequent excessive overhead irrigation, besides being inefficient, can cause severe leaching of nutrients from containers (1). Therefore, the practice of subirrigation, whereby water is absorbed into containers by capillary action from a saturated substrate below, is proposed to provide a more efficient alternative irrigation system.

Subirrigation or capillary irrigation theoretically offers other advantages to the grower for increased plant growth. Capillary irrigation should reduce compaction of the growing

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