Granular herbicides can be applied with modified fertilizer drills, certain seeders or dusters. The greatest difficulty in applying granular materials is proper calibration. Most granular applicators are equipped with gravity flow control devices which are very difficult to properly set. The most satisfactory type of applicator for large scale use is a tractor mounted Cyclone seeder, but it has several disadvantage the major one being a reduction in out put as the hopper becomes empty. For general usage it would be best to weigh or measure the amount of material needed for a given area and apply it with a small applicator, going over the area two or three times if necessary.

Both spray and granular applications should be applied shortly after planting or cultivating before the weeds get started. In general only annual weeds are satisfactorily controlled by a pre-emergence application. Granular applications should not be applied when the nursery stock foliage is wet.

RESIDUAL PROPERTIES AND USES OF SOME PRE-EMERGENCE HERBICIDES

The action of pre-emergence herbicides effected greatly by environmental conditions such as soil moisture, subsequent rainfall, temperature, soil type, weed species present and many other factors. It would therefore, be impossible to suggest weed control treatments that could be safely and effectively used in various sections of the country. The following herbicides (table 1) have been used with success in Virginia, but they should be used with caution until the grower becomes familiar with their performance in his own nursery.

MODERATOR CHADWICK: Thank you, Dr Chappell. I am sure there will be some questions for you later on.

We will now turn to John Newhouse, Bagatelle Nursery, for his comments. John!

Mr. Newhouse presented his paper on weed control in the nursery.

CHEMICAL WEED CONTROL IN THE NURSERY

JOHN NEWHOUSE
Bagatelle Nursery, Inc
Huntington Station, New York

Chemical weed control, properly used, is one of the best money-savers that has been introduced to the nursery business in many years. The days of planting material by hand and hand weeding or hoeing are fast disappearing.

Any material that will kill certain types of plant growth while allowing others to grow is dangerous if indiscriminately used When using any of the materials on the market today, it will certainly pay to follow the manufacturer's recommendations and try the material to be used on a small scale to ascertain how it will act under local conditions.

In our case, the young stock planted in beds was the most expensive area of the nursery to keep clean. The material planted in field rows is planted so that mechanical cultivation is possible, leaving very little hand work to be done Labor in our section of the country is probably quite a bit higher than it is in most, making it nearly economically impossible to grow our own liners.

Our area of bedded stock consists of about 2½ acres. In an area planted for two years, on heavily manured soil, and irrigated during the entire growing season, the weed population was just too expensive to keep under control. This led us to try chemical weed control. Crag herbicide, while doing a fairly good job without damage, did not last long enough, and chloro IPC damaged some material severely. While we have heard of good results with both of these materials, neither of them solved our problem.

Our next trial was with simazine. We have had such good results with this material that now we are using it exclusively. As you all know, this is not a new material, having been on the market for two or more years It has been used in nearly all sections of the country with equally good results.

The Geigy Chemical Corporation, like all other herbicide manufacturers, give recommendations for use of their product, but assume no responsibility for damage resulting from its use Geigy's recommendations include its use on a wide variety of plants such as arborvita, barberry, boxwood, junipers, yews, and others. Elsewhere in the recommendations it states . . . "unless otherwise stated, do not apply simazine to land planted to any other crop, or damage to the crop may result ." They also recommend it be used on established stock only.

We have not followed these recommendations to the letter. We decided on a solution of five ounces of simazine 80 to 30 gallons of water. We have used this mixture on newly transplanted cuttings, with excellent results. Applied within a few days after transplanting, after irrigating the beds and loosening the soil when it was dry enough to work, we had good control with a minimum of damage. When I use the term "good control," I do not mean a complete elimination of weeds, but rather control to the point where it is possible to weed an acre of liners in a very short time Strengthening the mixture to the point where all weeds are eliminated for a year in newly transplanted stock would, in my opinion, bring the concentration too close to the danger point.

In addition to the list of material contained in the manufacturer's recommendations, we have used it on several other varieties of plants with success Rhododendron, *Pieris japonica* and azalea cuttings and grafts of *Acer palmatum atropurpureum, Fagus sylvatica rivesi* and *Tsuga canadensis sargenti* were treated with good results.

We have had some damage from the use of simazine in only one case. This was an area of approximately 150 square feet planted with yew. A check of the records for this particular area showed that it had received five applications of the material in a space of eleven months. This was nearly three times the dosage the other areas had received.

Although the damage was slight, it did show that care should be taken in the use of this chemical.

The problem of any possible buildup of the material in the soil has been a topic of discussion ever since this material was put on the market. I am not able to offer much along this line After using it for two years, at the strength mentioned earlier, we did sow one of the areas to rye after the liners were removed. As far as we could see, it did not make any difference in the germination of this seed.

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MODERATOR CHADWICK. Thank you, John, for those comments, and I am sure again there will be some questions relative to the use of chemicals for weed control. I hope that we might have approximately half an hour so we can get out some of the problems that are of interest to you Because of this I am only going to take a very few minutes as far as my part of the program is concerned I was going to make some general remarks, but I think we will turn directly to the slides and I will make some comments while we are going through them.

(Dr. Chadwick presented slides and remarked on the research being done on nursery weed control at the Ohio Agricultural Experiment Station.)

We will continue with this panel discussion by opening the floor up for questions.

DR. MAHLSTEDE: How does the temperature of the soil in the can in the greenhouse compare with the temperature in the field? I am thinking here about the rate of breakdown of simazine in those cans as compared to that under field conditions.

MODERATOR CHADWICK: I will have to admit, John, we did not take soil temperatures on these. These cans were in a relatively cool greenhouse during the spring of the year, maintained at roughly 60 to 64 degrees. My guess is that the soil temperature in those cans would not be greatly different from what we would find in the field at the time we normally would sow oats.

MR MARTIN VAN HOF: I would like to ask John Newhouse if the application he makes is over the course of a year or do you apply it at several times of the year?

MR NEWHOUSE: The material I use is sprayed on just once a year.

MR VAN HOF: Is there any build-up of the material in the soil? If you use it more than once a year would it retard final growth?

MR. NEWHOUSE.I don't think it would retard growth, although you might get some burning. I haven't found a case where I can say that it retarded growth. I did have a few cases of burning resulting from over-application.

MR. DE WILDE. We tried simazine under the direction of the agricultural representative of Geigy, putting it on azaleas and on ar-

temisia. We used as much as four times the recommended strength and we got no damage to the azaleas. It did quite a bit of harm to the artemesia, however. This was put in in May and during that summer the artemesia was retarded but not killed. The interesting thing was that the following spring we got much more kill on the artemesia. This is the thing that scared me for field crops. The stuff doesn't work down nearly as fast as the manufacturers think or I wouldn't have got more kill the second year with no more application

MR. JIM WELLS. I want to direct the question to John Newhouse, but before I do this I would say that we have been testing simazine on azaleas and rhododendrons and we have had no damage whatsoever. We took azalea liners, made up our beds in the normal manner with the addition of the peat, rototilled and put simazine on the top. There was a virtual elimination of weeds We used the granular at about the rate of three pounds to the acre. There was no noticeable effect at all on the growth of the plants The following year the small area treated was clear of weeds It was again rototilled, planted and again treated with simazine. There was no noticeable effect on the azaleas and there were no weeds. We have, therefore, come in two years in the same area without damage so far.

Now, John, I was interested in your statement that you had sprayed young plants of rhododendron and azalea in beds and had no damage. Was this immediately after planting and at the rate you mentioned?

MR NEWHOUSE: That was within four days after they were planted, on about the 10th of June. We applied the chemical at the rate of five ounces to thirty gallons of water.

MR. WELLS: The question here is what area did you cover, John, with that spray?

MR. NEWHOUSE: Well, to answer that one, maybe I better tell you how I do it We plow under a cover crop of rye, then we rototill in about two inches of a mixture of peat and manure. We still do things the old-fashioned way. We bed our horses with peat moss. It sounds expensive but it makes wonderful manure. Naturally, you get a few more weeds that way After it is planted we irrigate it As soon as it is dry enough so it will work up and on a good drying day so the color of the soil will change after it is worked, we spray on just enough to change the color. Now how many pounds you end up with to the acre, it is hard to figure out. I found that is a pretty foolproof method.

MR. GEORGE HOYSIC (Rochester, New York): We have quite loose soil with plenty of organic matter. We have used the 4-W granular simazine on *Euonymus vegetus, alatus* and *alatus compacta,* and observed that we got quite a bit of defoliation on the *E. vegetus,* and quite a bit of yellowing on the *E. alatus.* We discussed this with a number of the members who have some knowledge of chemicals. One of these men stated that simazine lowers the pH of the soil and if we would apply lime to the soil it would compensate for it. Well, we went along and did it, and our soil is roughly around pH 6.3. This was done in May and again in July. We noticed the coloring was coming back to

the plants. The new foliage on the *Euonymus vegetus* was coming along in fairly good shape, also, in fact, some looked so good that we used some on landscape jobs.

What do you have on that condition?

MODERATOR CHADWICK: Any comments over here on pH change caused by simazine?

DR CHAPPELL: I have no data on the effect of the chemical on soil pH I don't think two to four pounds per acre is going to change the soil pH very much, regardless of how acid alkaline it is.

On the general subjct of granular simazine, we have had considerable injury in some instances where we put on an application as low as two pounds per acre on azaleas. Now in spray form we have had some temporary damage on some species, especially on the younger liners. In those cases, they recovered. I would like to point out under certain conditions you may get some injury. Most of these gentlemen have indicated they haven't had any injury, and I am sure they haven't had it However, I would just like to throw that in because there is this possibility.

MODERATOR CHADWICK: I want to throw this question in here, if you will pardon me. I think one of the interesting aspects of this problem is the correlation between the granular material and a spray application The gentleman over at the end of the table here, down at Ohio, is known as "no granular Alban." so I would like to have him make a few comments on this phase of the problem. Ken!

DR. ALBAN: I am not so much against granulars as I am against the method we have to apply them. We do not at the present time have adequate equipment to get a good even distribution of granules at the two to three pounds distribution rate that we need The performance of these chemicals, indicated by the abstracts which I just received from the North Central Weed Control Conference indicate that, in general, you can expect about the same results whether you spray or whether you use the granules. I think this has been holding up right along. On this simazine question, I would just like to point out Chad, that we are dealing with a fairly insoluble material and as long as you don't have very much rain and if you don't irrigate very much, you can put a lot of simazine in and not get any damage. I did put two and four pounds on potatoes and I never hurt the potatoes until one year I got 11 inches of rain in nine days. The two pounds of simazine knocked out all the potatoes. I have just recently, this summer, completed an evaluation of 90 varieties of sweet corn. Simazine is recommended on sweet corn Seventeen out of the 90 had a 10-pound rate per acre which we might compute from putting on two to three pound applications. Seven of these varieties had a significant reduction in yield. Now this is with sweet corn, a crop that very delinitely simazine is recommended. for.

I think we have to move very carefully in incorporating simazine in some of these soil beds, because we may end up having to pull some of this soil up and throwing it away.

MR DICK VANDERBILT: I would like to make a statement about simazine on azaleas. I believe one of the most important things

why Jim didn't get injury and why we didn't, is the high level of organic matter in our beds. We have gone up to 16 pounds actual of simazine on all varieties of azaleas that we grow and the same with rhododendron. Not one rhododendron was injured at the 16 pound level. I would say there is at last 25 per cent organic matter in our soil. In the field, on *Ilex rotunda* one year we used 2.2 pounds of simazine and got no injury. The organic matter was approximately 1.97. The following year the organic matter dropped to 1.2. There was quite some injury with the same rate.

Dr. Chadwick, do you know of any correlation between organic matter and injury?

MODERATOR CHADWICK: We have made no observations on the use of simazine under various amounts of organic matter in the soil. I wonder if there are any comments from the panel on that.

DR. CHAPPELL: I think that is generally true with any chemical. The higher the organic matter the more chemical it will stand, including fertilizer. If you have enough organic matter there to absorb the chemical you are not as likely to have trouble with injury.

MR NEWHOUSE: It all goes back to what I said a while ago. I recommend that it be tried out locally under your own conditions. What works well for me may not work so good for you. Now if I were to move out to Illinois and start growing out there, I would start experimenting out there. I have hit on a mixture that works fine for me under my conditions.

MR. BEN DAVIS (Oklahoma): We have just recently tested simazine on our orchard nursery We used two pounds actual per acre on a band spray. We run on a four and a half foot middle, and we sprayed a foot on each side of our row with two nozzles, using a John Bean type sprayer. We calculated our sprayer very carefully so we maintained the same two pounds actual per acre during every tankful of spray. We sprayed several different varieties of both evergreens and deciduous stock and got no injury. We also got only about two-thirds control of the weeds.

MODERATOR CHADWICK: Thank you. I might comment that this banding method of application is being used fairly extensively in nurseries at the present time.

MR TOM PINNEY, JR (Evergreen Nursery, Sturgeon Bay, Wisconsin): Simazine I would like to say, is something I would be real concerned about. We have had a lot of experience or we feel we have. We have about five million liners and a lot of these are conifers that are spruces and pines. Most of them are under this program. We have injured conifers with as low as half a pound per acre, actual. This we know. Our records are pretty accurate, and I think we have set up a long-term plot. We are working on the residual for five years. We are applying as high as 20 pounds per acre of simazine, seeing what we get, and you would be amazed. I would just like to suggest that you take it a little bit easy. We have had a lot of injury to 50.000 fir

MODERATOR CHADWICK: Tom, can I ask what other types of conifers have you had injury on at low rates?

MR. PINNEY: Chad, it depends a great deal on the time. I am not getting it on Concolor fir if applied before they start to grow. If you apply it after they start to grow, in other words, let's say in August when you feel they have hardened up a little bit, it will stop the buds right in their tracks and defoliate the plants. However, the roots looked in good shape because there were some that were direct sprayed but we didn't direct it good enough. Also, Scotch pine and Ponderosa pine behaved in the same way. If you apply it in the late winter months, before the plants start to grow in the spring, all these are pretty tolerant. You have to learn when to apply it.

MR. DICK BOSLEY (Bosley Nurseries, Mentor, Ohio): Chad, there were a couple of other chemicals discussed and I would like to pose a question to the panel on amino triazole. There was quite a fuss a year ago on this at Thanksgiving. Is this amino triazole the same amino triazole we are using and have been using for years on grass? What justification is there for us to use it? Is it safe or isn't it safe?

MODERATOR CHADWICK: Any comment on it? Ken?

DR. ALBAN: As long as we don't eat nursery stock we are all right.

MR. BOSLEY: *The men are handling it.*

DR. ALBAN: Any time we handle herbicides we have to be careful. I think in normal handling you would have no trouble. I try to give all our workers instructions to be careful and wash their hands and not get a lot of this material on them. I would not worry about amino triazole if I were you and normally use it.

MODERATOR CHADWICK: We have time for about one more question.

MR ART VUYK: We started to use simazine last year for the first time on Japanese yew in established field plantings. We treated only a small area in June, and in September when we planted our oat cover crop we had definite signs of chlorosis in the oats but no injury on the Japanese yew. This year we treated that whole block with simazine in June and we planted the oat crop again in September. In the particular spot in the plot which had the second application, the chlorosis in the oats was very severe. The oats in the rest of the field, which was treated only once, are eight to ten inches high and considered a good stand. In the particular block that was treated twice now, at the rate of two and a half pounds to the acre, the oats are not any bigger than three to four inches and as yellow as yellow can be.

It might be interesting to you fellows that the Experiment Station in Boskop has been using simazine for a few years now. They are consistently watching not to use it any later than the end of June. They are afraid of a buildup of the chemical, especially when it is applied later than June. They are warning about this in practically every paper they send out.

MODERATOR CHADWICK: We are going to call a halt to the questions. I know some of you have other questions. I think we should give the panel members a good round of applause.

I think Hugh Steavenson has an announcement.

MR STEAVENSON: I would like to see the Awards Committee right after we break up, at the back of the room. That consists of Roy Nordine, Harvey Templeton, Joe McDaniel, and Zophar Warner We also have to get the West Coast representatives on it so Don Hartman and Herman Sandkuhle are also invited.

The session recessed at 12:00 o'clock.

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