term means that prior to the time the crop comes up we apply a chemical which will effectively control weeds, we hope, and not damage the crop. Then we have post-emergence treatment. Here we use directed sprays ordinarily with selective herbicides where we have a crop plant that will tolerate the chemical and a weed species that are susceptible to the chemical. You will hear more about these later two methods of weed control from the other members of the panel

I think one of the important things to remember, from my experience with herbicides, is that you cannot guess on any of these things. You cannot guess on susceptibility of crop plants Everyone of these crop plants is going to be a little bit different and you are dealing with thousands of them and what may work on taxus will not necessarily work on viburnum. I am sure you all realize this, but I think it is worth an additional word of warning that just because you have had success with one particular species don't assume the chemical is safe on others. Thank you very much.

MODERATOR CHADWICK: Thank you, Ken. There will be an opportunity to ask questions after the other members of the panel have presented their material.

We will now turn to a few comments on pre-emergence materials by Dr Chappell, Department of Plant Physiology, Virginia Agricultural Station, Blacksburg, Virginia

DR. W. E. CHAPPELL: When Mr. Van Hof wrote me back in the summer asking me to participate in this program, he suggested that I confine my remarks to pre-emergence weed control. This is what I have done.

Dr. Chappell presented his paper covering the aspects of pre-emergence weed control

PRE-EMERGENCE WEED CONTROL IN NURSERY CROPS

W. E. CHAPPELL
Virginia Agricultural Experiment Station
Blacksburg, Virginia

INTRODUCTION

The term "pre-emergence" when used in reference to weed control usually means an application of chemicals after planting, but before the emergence of the crop or weeds. In the case of transplants or liners, however, it would be pre-emergence to the weeds only. The selection of the chemicals to be used for pre-emergence weed control will depend on whether it is being used on direct seeded crops or whether it is to be applied as a directed spray on lining out stock and also whether a liquid or granular application is being made. Certain sprays cannot be used on liners even when it is directed at the base of the plants without taking some chance of producing some injury The same chemical might be applied as a granular formulation without any injury.

PRINCIPLES INVOLVED IN PRE-EMERGENCE WEED CONTROL

Most weeds are much easier to kill about the time they germinate and wherever possible, it is desirable to kill them before they become established. In pre-emergence applications a thin film of chemical is applied on the surface of the soil which will prevent growth of young weed seedlings and they are usually killed before they ever become visible above the ground.

In the case of direct seeded crops, such as dogwoods, pin oaks, etc., these seeds are planted fairly deep and germinate slowly in comparison with most weed seeds. This being the case, a fairly high concentration of a very toxic chemical can be applied to the surface and kill the weed seedlings without endangering the desirable seedlings which come up later. In some instances as in the case of seeded crops that do not germinate for a long period, a delayed pre-emergence application can be made even after the weeds are up. In such cases it is necessary to use a chemical that has both contact killing properties as well as leaving a residue in the soil that will keep other weeds from growing. An example of this type of application is the amine salts of dinitro-o-sec-butylphenol oil (DNBP).

Selectivity of herbicides may be physical or chemical. A chemical may be very toxic to established nursery stock when applied as a spray. but if the same chemical is applied in the granular form, it may be safe to use on a variety of plants as a pre-emergence application for the control of weeds. This is known as physical selectivity. A truly chemically selective herbicide can be applied safely as a spray on certain species of nursery crops. Unfortunately very few herbicides are available that possess this property

In general pre-emergence herbicides may be classified as (1) non-selective (2) selective residual Since most herbicides are non-selective in so far as nursery crops are concerned, they must be applied either in the granular form or as a directed spray so as to avoid contact injury. The principle involved in granular applications is that the particles do not adhere to the plants and fall to the ground where they act as a residual pre-emergence chemical and in some cases will kill small weed seedlings by contact With directed sprays the principle is merely to physically keep the chemical off the leaves and stems of nursery stock.

Many chemicals are more effective pre-emergence herbicides when applied in the granular form Some exceptions to this are simazine and atrazine. The principle involved here is that granular forms remain on the surface and are not leached as readily as sprays.

A good example of a selective residual treatment is dacthal, a chemical for pre-emergence control of crabgrass in lawns. Most established lawn grasses are resistant to dacthal, but it is very toxic to germinating crabgrass seed.

APPLICATION TECHNIQUES INVOLVED

Pre-emergence herbicides are applied as a spray or in the dry or granular form. The application of an overall spray to seeded crops is relatively simple and can be accomplished with little difficulty. All

that is needed is to determine the amount of liquid that a sprayer is delivering per unit area and then add the desired amount of chemical to make that volume For applying directed sprays, however, the procedure is more difficult In order to keep the spray off the nursery stock the nozzle must be correctly spaced and be set at a proper angle. Also the rows must be uniform in width if more than one row is to be sprayed at a time. Unless large acreage are to be sprayed, it would probably be safer to apply the chemical with a single nozzle that is controlled by the applicator.

Table 1.—Summary of herbicides used for control of weeds in nursery stock.

Situation	Herbicide	Formulation	Rate lbs/A (active)	Known Intolerant Species	Effective Control
Winter weeds in·					
Directed seeded crops peach, walnut, dogwood, oaks, etc	DNBP	Spray or granular	8-10	All small seeded crops	3-4 months
	Simazine	Spray	2-3	All small seeded crops	4-6 months
	Naburon	Spray or granular	5	All small seeded crops	4-6 months
	CIPC	Granular	8-10	None	3-4 months
Summer weeds in					
Bare Rooted Stock	None	—	—	All	—
Rooted Transplants					
In Field or Cans	DNBP	Granular	8-10	Barberry	4-6 weeks
	CIPC	Granular		None	3-5 weeks
Liners — one month or more after planting	DNBP	Granular	8-10	None	4-6 weeks
	CIPC	Granular	8-10	None	3-5 weeks
	Neburon	Direct spray or granular	5	Azaleas	4-6 weeks
Established Liners					
(two annual applications only)	DNBP	Granular	8-10		4-6 weeks
	CIPC	Granular	8-10		3-5 weeks
	Simazine	Direct spray or granular	2-3	Azaleas	6-8 weeks
	Neburon	Spray or granular	5	Azaleas	6-8 weeks
Field Stock					
(two annual applications only	DNBP	Granular or direct spray	6-8		4-6 weeks
	Simazine	Direct spray	7	Azaleas	8-12 weeks
	3 lbs + Amitrol 1 lb (Amizine)	Fall or early spring only. Keep 12"away from plants-		Barberry	
	CIPC	Granular	8-10		3-5 weeks
	Simazine	Granular or direct spray	3	Azaleas	6-8 weeks
	Neburon	Granular or direct spray	5	Azaleas	6-8 weeks
Crabgrass in Lawns	Dacthal	Granular	10	None	Season
	Zytron	Granular	15	None	Season

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.