CHEMICAL WEED CONTROL IN NURSERY STOCK

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SUMMARY

MATERIALS used in chemical weed control in nursery production are either partial soil sterilants or residual seed germinant weedkillers. Partial seed sterilants currently used are MB at 1 lb a.i. per acre, SMDC at 1 lb a.i. per acre and DMTT at 1 lb a.i. per 100 sq. ft. Residual weedkillers are monuron and diuron at 1.6 lb a.i. per acre, simazine at 1 lb a.i. per acre, and CIPC at 4 lb a.i. per acre. Soil, weather, and potential annual weeds affect the choice of materials. Plants of *Ericaceae* are particularly susceptible to damage. Further experience is required with all materials and nurserymen need to be trained in their use.

The production of plants for sale is a very specialised form of horticulture, requiring a high degree of technical knowledge and involving a considerable amount of hand labour and mechanical cultivation. The plants being produced by a nursery may include some or all of the following: seedlings, bulbs, shrubs, ornamental and fruit trees, and forest trees.

The control of plant pathogens and weeds are two major operations in nursery production, and weed control is both expensive and time consuming.

Chemical weed control as practised in the nursery trade can be divided into two types, partial soil sterilisation and residual weed control. I am defining these terms as there may be some confusion between these terms as used in horticulture and as used by weed control specialists.

Partial soil sterilisation is the treatment of soil to control weeds and plant pathogens without making the soil inimicable for subsequent plant growth. Practising horticulturists usually refer to this as "soil sterilisation".

Residual weed control is the control of weeds among growing plants by the use of seed germinant weedkillers.

PARTIAL SOIL STERILISATION

Materials used for partial soil sterilisation are MB, SMDC, and more recently DMTT for weed control purposes. Other materials are used more specifically to control plant pathogens. These are chloropicrin and formalin and weed control obtained with them is limited.

I should also refer to the use of steam sterilisation, but here weed and pathogen control is by heat and not by chemical action.

Table 1 lists the materials, their usual rates of use, and their effectiveness for weed control and plant pathogen control. As this paper is specifically on weed control I shall refer only to MB, SMDC, and DMTT.

Details of materials and use are as follows:

MB

MB is widely used by nurserymen mainly for its weed control properties. Soil for propagation purposes is treated in shallow heaps under plastic covers. Areas outdoors are also treated where plants are to be raised from seed. In almost all cases MB is applied from 1 lb canisters.

Used correctly, MB is a most valuable material for weed control. Plants with hard seeds such as legumes and mallow (*Malva* spp.) are resistant at the usual rate of 1 lb a.i. to 100 sq. ft. However, if the soil is prepared for treatment and covered with the plastic cover for about a week before treatment, greater control of these types of weeds is obtained.

Occasional instances have been observed of bromine injury to the subsequent crop where the soil has not been sufficiently aerated before

sowing the crop. In appearance this injury is quite typical. In any one row of seedling plants subsequent growth is irregular, some groups of plants being yellow in colour and stunted, and remaining in this condition throughout the whole season. We now recommend that where seed is to be sown on MB treated soil in early spring, treatment should take place in late autumn, and the soil lightly cultivated two or three times before sowing the seed. If treatment is to be applied close to seed sowing, it is advisable to cultivate the soil deeply after treatment and before sowing the seed.

For perennial weed control MB at 1 lb a.i. per 100 sq. ft. has proved to be the most satisfactory material for the control of the summer flowering *Oxalis* sp., but 2 lb a.i. per 100 sq. ft. is required for adequate control of the winter flowering Bermuda buttercup (*Oxalis pes-caprae*).

SMDC

The use of SMDC in nursery production is increasing. Its advantage over MB is that it provides better plant pathogen control and also appears to give a stimulus to the subsequent growth of the plants. The main disadvantage with this material is the need to saturate the soil after application, and where the soil is to be used in pots or boxes it must be allowed to dry partially before use.

SMDC has been used in the field as a band application before the planting of crops such as anemone corms and young chrysanthemum plants. Subsequent weed control has been most satisfactory and it has therefore reduced production costs and improved the subsequent crop.

DMTT

So far there is only limited experience with DMTT, but this material appears to show promise, as its properties are somewhat similar to SMDC both for weed control and plant growth stimulus; it should therefore have similar uses. The fact that it is a dry powder makes it easier to distribute, but the need for drenching after application appears to be the main disadvantage.

RESIDUAL WEED CONTROL

Residual weed control by the use of carbamates, substituted urea compounds, substituted triazines, and other materials can provide a great saving in time, labour, and costs in the production of nursery stock. In one nursery one application of a weedkiller plus two hoeings replaced six hoeings.

Both experimentally and on a field scale results have proved variable. Used correctly with suitable soil and weather conditions excellent weed control has been obtained with no plant damage, but at other times weed control has been unsatisfactory and phytotoxicity observed. Overseas experience provides only limited application to New Zealand conditions and to date it is not advisable to give standard recommendations. The effectiveness of these materials can vary according to soil type, weather conditions, potential weeds, and the crops being grown. Phytotoxicity is, of course, a major factor and when one realises that one nurseryman may grow 3,000 varieties of plants and that there could be varietal susceptibility to the materials, it can readily be realised that no cut and dried recommendations can be made and that each producer's problem must be examined separately.

Table 2 lists materials commonly used for residual weed control in nursery stock, with recommended rates of application. Experience with these materials is as follows:

Chlorpropham: This gives good weed control in autumn and winter, and particularly controls *Poa annua*, a serious winter weed in over-wintering nursery stock. It is widely used by bulb growers on narcissus, tulips, hyacinths, and iris before the emergence of the growing point of these bulbs. It has also been used in winter between rows of hardwood cuttings of plants such as phebalium, escallonia, etc.

TABLE 1—TEMPORARY SOIL STERILANTS

Material	a.i.	Weed control	Fungi	Insects	Water	Temperature	Period before use
MB	1 lb to 100 sq. ft. = 2 cub. yds.	xxx	x	xxx	No	above 60° F	2 days
SMDC	1 lb to 100 sq. ft. = 2 cub. yds.	xxx	xx	xx	drench	above 60° F	1 week or more
DMTT	1 lb to 100 sq. ft. = 2 cub. yds.	xxx	xx	xx	drench	above 60° F	3 weeks
Chloropicrin	1 lb to 70 sq. ft. = 1½ cub. yds.	x	xxx	xxx	water seal	above 60° F	2 weeks
Formalin	1 pint to 12 sq. yds. = 2 cub. yds.	-	xxx	x	drench	above 45° F	2 weeks
Steam	10 mins. above 180° F	xxx	xxx	xxx	No	Any	After aeration

xxx = very good

xx = good

x = fair

— = poor

Weed control in narcissus with monuron at 1.6 lb s.i. per acre applied to weed-free soil in April when bulb tips were just emerging. Photographed in mid-September; silt soil. Lower Hunt. (See Salinger's paper.)

Substituted urea compounds: The two materials widely used are monuron and diuron, with an increasing use of diuron, both at a rate not exceeding 1.6 lb a.i. per acre. Monuron at this rate is used by some narcissus growers in late autumn and provides long term residual weed control in these plants. It is also used by gladiolus growers both before and after the emergence of the shoots. Both materials can be safely used on established nursery stock in spring or summer, except among plants of the *Ericaceae* and possibly the conifer *Cryptomeria japonica elegans*. Many plants may show a slight marginal chlorosis after application, but this damage seldom checks growth, or affects the subsequent development of the plants. Diuron is now the preferred material due to its lower solubility. On light soils such as in Taranaki, rates lower than 1.6 lb a.i. per acre may prove satisfactory. Neburon has so far been used only experimentally and at a rate of 0.74 lb a.i. per acre unsatisfactory weed control was obtained, and higher rates would prove uneconomic.

Weeds not controlled by urea compounds at these rates included plantain (*Plantago* spp.), possibly speedwell (*Veronica* spp.) and perennial weeds.

Simazine: Simazine has given satisfactory weed control at a rate of 1 and 2 lb a.i. per acre and is probably safe on the majority of plants at these rates. At the moment we do not recommend it for use among rose stock cuttings or in *Ericaceae*. Weed control in summer is generally good, though it will not control *Portulaca* spp. and possibly also *Amaranthus hybridus*.

2,4-DES has given variable results and is too unreliable to be recommended generally.

Mineral Oils: To date mineral oils are the main materials used for weed control in forestry nurseries, being applied before and after the emergence of conifer seedlings. As these oils have a desiccant effect only, it has been necessary in some areas to make up to four applications annually and I understand that at the Forest Research Institute excellent results are being obtained with the use of residuals such as simazine. Chemical weed control in forestry nurseries provides a tremendous saving in labour.

Apart from mineral oils used on conifer seedbeds, all these materials are best applied when the plants or cuttings have been set out in the nursery and cultivated once or twice to consolidate the soil and to obtain a good tilth. Nurserymen prefer to make band applications along the rows to prevent panning and scouring of the soil. In taller, thick-growing nursery stock such as fruit trees or large ornamentals the plants themselves often suppress the growth of weeds between the rows due to shading effects. The choice of the most efficient and persistent weedkiller will depend to a great extent on the expected weed population.

A factor which requires further investigation is the control of a mixed population of perennial and annual weeds. Experiments are being carried out combining amitrole with residual weedkillers. Possibly a combination of dalapon, amitrole, and a residual or paraquat and a residual will prove satisfactory. More important than the selection of the material is the necessity to teach nurserymen how to use residual weedkillers. These materials are something new to nurserymen, they are used in a different manner from therapeutants, and their application must be understood before they are used. Operators must be trained, sprayers calibrated, and plant, soil, and weather conditions must be correct before the materials are applied. Despite these reservations residual weed control will prove to be a major factor in nursery production, but even after five years of experiments and growers' tentative trials we cannot lay down hard and fast recommendations. An observation experiment on the nurseryman's property is well justified in the first instance before recommendations are given for the overall use of these materials.

TABLE 2—SEED GERMINANT HERBICIDES IN NURSERY STOCK

Material	Rate per acre	Weed growth	Effects	Soil	Weather	Persistence	Weed controlled	Plant damage
Chlorpropham	4 lb a.i.	bare soil	germinating seeds	moist	cool	3-6 months	grasses, broadleaf not portulaca	Root cuttings?
Simazine	1 lb a.i.	bare soil	germinating seeds checks young weeds	—	—	+ 6 months	most, not portulaca, amaranthus?	Ericaceae? Rose stock cuttings?
Monuron	1.6 lb a.i.	bare soil	germinating seeds	—	—	6 months	grasses, broadleaf, incl. portulaca, not plantain, veronica	Cryptomeria. Marginal chlorosis. Some plants Ericaceae?
Diuron	1.6 lb a.i.	bare soil	germinating seeds	—	—	6 months	most so far	marginal chlorosis on light soils on pieris
Neburon	.74 lb a.i.	bare soil	germinating seeds	—	—	very poor at .74 lb rates	—?	slight damage cryptomeria
2,4-DES (Crag No. 1)	6 lb (commercial formulation)	bare soil	germinating seeds	moist	warm	very variable results	variable	—
Mineral oils, 18% aromatic oil	25-40 gallons (commercial formulation)	young weeds	kills young plants	moist	warm	1-2 months	most weeds, ineffective on large clumps of grass	Germinating conifer seedlings; non coniferous plants.

DISCUSSION ON SOIL FUMIGANT SESSION

Mr Matthews—Am I correct in assuming from both speakers that oxalis is controlled with either SMDC or DMTT?

Mr McNeur—I have used SMDC, DMTT, and MB on oxalis and have had a 99 per cent control with it. Also, on onion weed (*Allium* spp.).

Mr Fitzgerald—Mr McNeur makes the inference that half rates of the materials would be as effective as the full rates to gain complete weed control or other plant pathogenic control for which they are applied in many cases. Secondly have these results been confirmed?

Mr McNeur—I was referring to weed seed kill only. For fungi the rate of MB would have to be increased and for virus a rate of 3 to 4 lb of MB would be required.

Comment:

Mr Taylor—The question of *Senecio vulgaris* being resistant to SMDC has been raised. I consider it would be resistant, as it shows high resistance to chlorpropham.

Mr Meeklah—Overseas work indicates that the rate of SMDC may be reduced if a plastic seal is employed.

Mr Hooper—If soil temperatures are in the range of 40 degrees the rate should be increased.

Mr McNeur—All rates used were as recommended by the manufacturers and good results have been obtained at temperatures of 40 to 42 degrees F.

Mr Isaacs—Under high temperatures, the materials will dissipate more quickly in the soil. At lower temperatures the materials linger in the soil and can cause damage to plants set out too soon after application.

Mr McNeur—That is one thing that we are worried about. With MB and other materials there should be sufficient time lag after application before planting. In all instances I think one should always plant out a few plants before the main crop is planted. For violets and carnations there is often bromine toxicity and an interval may need to be left for up to a month.