SECOND SESSION

STERILIZATION OF OUTDOOR SEEDBEDS

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In many spheres of horticulture the use of chemical soil sterilants is well established. They are widely used for glasshouse crop production and, to a lesser extent, for vegetable crops in the open ground against a wide range of soil-borne pests and diseases. Comparatively recently they have been used on a field scale for the control of certain soil-borne virus vecting nematodes (eelworms) affecting strawberries and the "Specific Replant Disorder" of cherries and apples. This broad spectrum of activity has stimulated the interest of many nursery stock producers and, in the wake of increasing costs, seedling plant raisers are looking towards sterilants for an answer to problems associated with pest, disease and weed control, soil "sickness", and general growth improvement.

During recent years the materials which can be broadly termed soil sterilants have increased in number and some of the more representative types are described below.

CLASSIFICATION AND USE OF MATERIALS

Halogenated hydrocarbons:

(a) DBCP — Dibromochloropropane (Nemagon)
Mainly active against nematodes.

(b) DD — Dichloropropane / dichloropropene mixture
Mainly active against nematodes.

(c) Dichloropropenes mixed with other hydrocarbons (Telone)
Mainly active against nematodes. One of the constituents of DD. An *'Approved' product under the *Agricultural*

**Editorial Note:* *The term 'Approved' throughout this article refers to a* product approved under the Agricultural Approval scheme, which is a voluntary scheme in Great Britain under which proprietary brands of crop protection chemicals can be officially approved. The purpose of the scheme is to enable users to select and advisers to recommend efficient and appropriate crop protection chemicals and to discourage the use of unsatisfactory products. Approval cannot be given to a product containing a new chemical until it has first been considered and cleared under a different voluntary scheme, the Pesticides Safety Precautions Scheme.

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Chemicals Approval Scheme, but not specifically for nursery stock.

(d) Methyl bromide
Active against nematodes, fungi, insects, other pests and weeds. High mammalian toxicity. May be applied only by authorised contractors in Great Britain.

Carbamates

(a) Aldicarb (Temik)
Active against nematodes but may have inhibitory effect on certain fungi. High mammalian toxicity. Systemic. Not currently 'Cleared' for general use under the Pesticides Safety Precautions Scheme.

(b) Dazomet (Basamid)
Active against nematodes, fungi, insect, other pests and weeds. Releases methyl isothiocyanate (MIT) as the active constituent. 'Approved' as a general soil sterilant.

(c) Metham sodium (Vapam, Sistan, etc.)
Active against nematodes, fungi, insects, other pests and weeds. Releases MIT as the active constituent. 'Approved' as a general soil sterilant.

(d) Nabam (Dithane A40, etc.)
Active against fungi. One of the dithiocarbamate fungicides. When mixed with zinc sulphate can also be applied as a foliar spray. 'Approved' as a soil applied fungicide but not specifically for nursery stock.

Organophosphates

(a) Thionazin (Nemafos)
Active against nematodes, insect and other pests. High mammalian toxicity. 'Approved' but not specifically for nursery stock.

Miscellaneous

(a) Allyl alcohol
Active against weeds, but partly fungicidal and nematicidal. High mammalian toxicity. Not marketed as a pesticide / sterilant and therefore not 'Cleared' or 'Approved'.

(b) Chloropicrin (Tear Gas)
Mainly active against fungi, but moderately effective for nematode, insect and weed control.

(c) Chloropicrin / DD / MIT (Di-Trapex CP)
Active against nematodes, fungi, insects, other pests and weeds. Combination product of 3 important materials. 'Approved' as a general soil sterilant.

(d) Cresylic Acid (Novo)
Active against miscellaneous pests and weeds but also mildly fungicidal.
(e) Formaldehyde (Steriform, Formasan)
Mainly active against fungi, but moderate pesticidal and herbicidal properties. 'Approved' as a general soil sterilant.

This brief summary is representative but not comprehensive. Several of the materials are not officially 'Approved' for nursery stock use in this country. A few do not even have 'Clearance' for use and are therefore not generally available or currently recommended. They all, however, fall within the broad category of soil sterilants and are potentially worthy of consideration.

Over the years soil sterilants have been used almost exclusively to combat existing or suspected pests or diseases but little attention has been paid to their effect on crops and weed growth in the absence of a noticeable problem. With this in mind, the effect on plant growth of chloropicrin and dazomet used on apparently "clean" land has recently been experimentally evaluated. These 2 sterilants were selected from the list of available materials because of their particular activity and relative ease of handling.

Chloropicrin is injected into the soil at 9 to 15 in centres and at normal application rates of 10 to 33 gal / acre; costs are comparatively low. At soil temperatures of 55-60° F planting can usually take place 4 to 8 weeks after treatment. It is mainly fungicidal with activity against the diseases verticillium and phytophthora. It also has moderate herbicidal action At East Malling Research Station soil injection at a rate of 10 to 25 gal / acre overcame the "Specific Replant Disorder" of cherries and apples. On sites where cherries followed cherries and chloropicrin was used to treat the soil before planting the new crop, growth increases approaching 300% were obtained in comparison with untreated areas The response where apples followed apples was significant but not so dramatic. Under field conditions in other parts of the country growth increases of 70% in the first year and 50% in the second year were obtained from young apple trees after chloropicrin treatment of old apple orchard sites

Dazomet is marketed as a granular prill for rotovation into the soil. It is a combined wide spectrum pesticide, fungicide and herbicide and when applied at the normally recommended rates of 320 to 340 lb / cp / acre cost is approximately £160 per acre for materials only. Lower rates may be acceptable under certain conditions. Soil temperature should be not less than 45° F at time of application and should remain above 40° F during the ensuing 4 weeks. Cropping normally begins 8 weeks after treatment but this period is variable depending on time of year when application is made. The weed control properties of dazomet can be extremely

valuable and accumulating evidence suggests that it stimulates crop growth Conflicting views exist concerning the best method of sealing the volatile fumigant in the soil after rotovation. Polythene sheeting over the treated area is normally recommended but further opinion suggests that a capped soil surface which can be created by heavy flooding on certain soils is equally satisfactory.

A description of some preliminary work may help to illustrate the growth amendment and other effects obtainable from using soil sterilants on outdoor seedbeds.

Experiment. Replicated plots were prepared on land which had been summer fallowed. The site was apparently free of pest, disease and weed problems. Treatments applied during autumn were as follows:

(a) Chloropicrin at 25 gal / acre (plots immediately covered for a minimum period of one week with plastic sheeting to restrict loss of sterilant vapour).
(b) Dazomet at 320 lb / acre (plots covered as above).
(c) Dazomet at 320 lb / acre (plots heavily watered to seal the soil surface and restrict loss of sterilant vapour).
(d) Nil(untreated).

During the spring following treatments, stratified seed of *Acer platanoides* and *Rosa corymbifera* 'Laxa' *(R. dumetorum)* were sown in equal amounts on all plots. Crop and weed seedling emergence and growth was recorded. Results are shown in Tables 1 and 2:

Table 1. Crop emergence and yield (emergence in untreated plots designated 100. All other data are relative to this base).

	Untreated		Chloropicrin		Dazomet (plastic seal)		Dazomet (water seal)	
Crop	Emergence	Saleable size plants	Emergence	Saleable size plants	Emergence	Saleable size plants	Emergence	Saleable size plants
A platanoides	100	68	126	106	120	93	149	137
R c 'Laxa'	100	91	133	118	170	150	167	145

Table 2. Weed growth 5 and 10 weeks after sowing. [1]

	Untreated		Chloropicrin		Dazomet (plastic seal)		Dazomet (water seal)	
Date	Weeds psy	% soil cover	Weeds psy	% soil cover	Weeds psy	% soil cover	Weeds psy	% soil cover
27 May	170	—	79	—	7	—	5	—
30 June	134	33	93	18	14	4	11	4

[1]Plots were hand weeded immediately after the first weed count.

In order to try to explain growth amendment effects, all plots were examined before sterilants were applied and during the subsequent growing season for free living eelworms (particularly *Xiphinema, Longidorus* and *Pratylenchus* spp), nutrient levels, and nitrifying and de-nitrifying bacteria. Although treatments greatly reduced the number of free living eelworms there was no obvious correlation between number or type of eelworm and crop growth. It was interesting to note, however, that eelworm recovery was slowest on the dazomet / plastic sealed plots. In this particular trial treatment had no obvious effect on nutrient status or the numbers of nitrifying and de-nitrifying bacteria. A supplementary trial one year later, on a different site, using the 2 dazomet treatments on an *Acer platanoides* seedbed produced similar results as shown in Tables 3 and 4.

Analysis of treated and untreated soil for free living eelworms again showed nothing significant, but in this second trial nutrient analysis indicated that the differential response may be connected with higher levels of ammonium in the treated soils. These combined results show that: (a) all 3 sterilant treatments increased crop seedling emergence and also the number of plants which attained saleable size, and (b) both Dazomet treatments made a very significant contribution towards weed control.

Table 3. Crop emergence (emergence in untreated plot designated 100. Other data are relative to this base).

Crop	Untreated	Dazomet (plastic seal)	Dazomet (water seal)
A. platanoides	100	181	180

Table 4. Weed growth 5 and 10 weeks after sowing. [1]

	Untreated		Dazomet (water seal)		Dazomet (plastic seal)	
Date	Weeds psy	% Soil cover	Weeds psy	% Soil cover	Weeds psy	% Soil cover
19 May	216	10	8	trace	17	1
27 June	75	5	18	1	25	2

[1]Plots were hand weeded immediately after the first weed count.

Conclusion: Many types of soil sterilants are available. In addition to pest, disease, and weed control, at least some of them offer considerable potential for improving seedling emergence and crop growth. The growth amendment effects are worthy of more detailed investigation for the nursery stock producer.

PROPAGATION OF DWARF PICEAS AT KINSEALY

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The suitability of dwarf spruces for the modern small garden, their unavailability in the general nursery trade and the ban on their importation into Britain and Ireland prompted preliminary work into their propagation and culture. Observational trials in 1969 indicated satisfactory rooting with the use of 0.8% IBA powder. There were also indications that mid-summer cuttings of current season's growth responded better than one year old shoots taken as cuttings in March. In 1970 further observational trials were carried out, in which 30 cuttings of 14 dwarf *Picea* cultivars were taken at two week intervals from July 21 to September 1. The rooting medium used was two parts peat moss to one part granitic sand. All cuttings were treated with a proprietary 0.8% IBA rooting powder and placed under mist, with a base temperature of 21-23° C.

Each batch of cuttings was lifted after three months. Table 1 shows the rooting percentages of the cultivars rooted on the dates indicated. Generally rooting in all types decreased after August 19, except in *Picea abies* 'Nidiformis'. All *Picea abies* cultivars except *P. a.* 'Repens' showed a marked increase in rooting up to mid-August. There was a sharp drop in rooting after August 5 with *P. a.* 'Juniperinus' and *P. glauca* 'Conica'. (*P. albertiana* 'Conica').