SOIL STERILANTS

by B.D. Robinson.

Soil sterilisation is an important consideration where the maintenance of railway tracks, storeyards, sports grounds, right of ways, irrigation systems, fire-breaks and powerlines are concerned.

In selecting a chemical for sterilising an area of soil the following aspects should be taken into consideration:

I. The type of vegetation to be controlled.

2. Rainfall.

3. Soil type and fertility.

4. Duration of sterilisation required.

The chemicals most widely used for soil sterilisation are:
Sodium arsenite, Arsenic trioxide, sodium chlorate and either sodium tetra borate or sodium penta borate. Where salt or brine is readily available it makes quite a good, cheap sterilant.

W/3/Rob/1

ARSENICALS

Arsenicals have been found to be one of the most toxic chemicals to plant life, but they are readily adsorbed by clay particles and their efficiency is decreased by increased clay content of the soil. In lighter soils, leaching plays an important part in sterilisation and the insoluble arsenic trioxide is more persistent than the sodium arsenite. Where a quick kill of existing vegetation is required sodium arsenite is more effective. Generally arsenicals give better kills of annuals than perennials and this applies particularly to arsenic trioxide. Because of the slow penetration of arsenic trioxide into the soil applications are most effective in the Autumn: Arsenic trioxide applied as a powder at 6-16 lbs per square rod has given good control of annuals for up to five years. Sodium arsenite is more effective on perennials than arsenic trioxide but is not as persistant.

CHLORATES

Sodium chlorate is very soluble and gives a shorter period of soil sterilisation, but is more effective on deep rooted perennials at 4-10 lbs. per square rod than arsenicals. The best results are obtained when there is over 5 inches of rainfall to leach the chlorate down to the deeper roots of the perennials. Sodium chlorate is best applied in the Spring when most weeds seeds have germinated. Chlorates are not affected by clay content but their efficiency is decreased by increased nitrate content of the soil.

BORATES

The efficiency of borates parallels in general that of arsenic trioxide. The main differences between borate formulations are due to the relative solubilities of the penta borate and the tetra borate. Borates and chlorates have the advantage that they are non-toxic. Crafts et al have reported that the lime content (I) of soils affects the toxicity of borates, possibly by fixation as the calcium borate. Borates take a considerable time to show effects and like arsenic trioxide are most effective if applied in the Autumn. For a rapid initial kill the borates are mixed with sodium chlorate. For spray application the more soluble penta borate is used, but this reduces the period of soil sterility.

The borates are not as efficient as either sodium chlorate or sodium arsenite on annuals or perennials but have a longer period of soil sterilisation. Many species of grasses show a high tolerance to boron.

W/3/R.1/2

MIXED WEEDICIDES

Where the use of arsenic is not a hazard, mixtures of sodium chlorate and arsenic trioxide give superior results to mixtures of sodium chlorate and borates. (Note mixtures of sodium chlorate and arsenic trioxide should not be left in storage). A mixture of sodium chlorate and sodium arsenite is an effective combination and has the advantage that it can be applied as a spray. It is not, however as persistent as the combinations of borates and arsenic trioxide. Mixtures of arsenic trioxide and borates have the disadvantage of not giving a quick kill of vegetation but are preferred where sodium chlorate cannot be used because of fire risks.

Crafts et al have reported (2) that with mixed

weedicides the total effects were usually less than the sum of individual treatments and antagonism occurred to greater degree between arsenic-borate mixtures and borate-chlorate mixtures, than with arsenic-chlorate mixtures.

NEW SOIL STERILANTS

Two new weedicides C.M.U. (3-(p-chlorophenyl) -1,1-dimethyl urea) and P.D.U.. (phenyl dimethyl urea) appear to have excellent futures as soil sterilants.

They are both very insoluble, non-toxic and can be applied as sprays which gives them an advantage over dry powder forms of soil sterilants.

C.M.U.

McCall (1952) states that it is non-corrosive and non-inflammable. Solubility in water and hydrocarbons is very low, it is sparingly soluble in polar organic solvents (in water at 25'C it is 230 ppm.) Toxicity, either when taken internally, or as askin irritant is considerably less than that of 2,4-D. C.M.U. is marketed as a wettable powder.

W/3/Rod/3

C.M.U. is absorbed by the plant mainly through the roots but it appears to undergo slight downward translocation. Thus under dry conditions its action is slow (McCall, 1952). Otis (1951) reports that C.M.U. is strongly adsorbed by the soil colloids, nearly all being adsorbed by the first inch of the soil.

Initial C.M.U. symptoms usually appear as die back of leaf tips and burn of leaf edges, beginning with the older leaves; this is followed by progressive chlorosis and retardation of growth culminating in death of the plant.

C.M.U. may be applied with 2,4-D; it is claimed that the action is synergistic. C.M.U. has been tested as a selective herbicide but is more usually used for the complete destruction of vegetation.(3)

C.M.U. is formulated as a dispersible powder (80% active ingredient) and for most soil sterilisation work is used at between 20-60 lbs. per acre. Trials on nut grass (4) and other plants indicate that C.M.U. does not penetrate in lethal doses, beyond 2 inches in soil even when up to 80 lbs/acre were used. On the other hand

cultivation followed by two sprayings at 20 lbs. per acre prov-ed effective on nut grass.

At 80 lbs. per acre C.M.U. gave excellent results on Para grass (Panicum barbinode). This method may be improved by weakening the grasses first by spraying with a contact herbicide and treating the para grass with weaker rates of C.M.U. (5).

Generally, C.M.U. has shown excellent control of grasses (6) and other vegetation, but on heavy compacted soils it is not effective on deep rooted perennials.

It is becoming evident that C.M.U. is not as effective in light rainfall as heavy rainfall areas and is not particularly effective on rushes. C.M.U. at 35-60 lbs./acre has given good control of most weeds including convolvulus arvensis (7). After two years 50-60% of the area treated remained bare. Bracken is resistant to C.M.U.

P.D.U.

This new chemical is showing promise as a soil sterilant, a weedicide for deep rooted perennials and a weedicide in crops (8). Its properties parallel C.M.U. but in some directions may be more versatile in its uses, because of its increased solubility and decreased persistance.

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