WEEDICIDES*

STRENGTHS OF APPLICATION

ENQUIRIES are frequently received with regard to the concentrations of various chemicals when used for the destruction of weeds, and this article serves to summarise information concerning the more commonly used weedicides.

Owing to the expense of both material and labour, chemical sprays for the eradication of weeds are not generally recommended. Under certain circumstances, however, where cultural methods are not practicable, they serve a useful purpose. Sprays are used mainly for the control of such vigorous perennial weeds as Canada Thistle (*Cirsium arvense*) and Skeleton Weed (*Chondrilla juncea*) which have underground stems capable of producing new plants from small severed sections. Cultivation under these circumstances, unless repeated very frequently, would merely serve to spread the weed. Again, railway tracks are frequently cleared of plant growth by means of a chemical spray applied from a moving locomotive. Gravel paths and tennis courts are often difficult to keep free from weeds and as the disturbing of the surface, particularly in the case of a gravel tennis court, is not desirable, the use of a spray is very convenient. Such selective weedicides as arsenic pentoxide and sulphate of ammonia may be employed for the destruction of annual clovers and other weeds in lawns.

In the following section information is given concerning the more commonly used chemical weed-killers.

Sodium chlorate.—Sodium chlorate is probably the most successful weedicide in use at the present time. A 2½ per cent. solution (*i.e.*, 1 lb. to four gallons of water) is sufficiently strong to kill comparatively weak annual weeds such as chickweed (*Stellaria media*) and nightshade (*Solanum nigrum*). For general purposes a 10 per cent. solution (1 lb. to 1 gallon of water) is recommended, while in exceptional cases, such as when dealing with Blackberries (*Rubus fruticosus*), a 15 per cent. solution can be used at times with advantage. Improved results have been obtained by adding glue to sodium chlorate prior to application. Experiments carried out recently at the Wagga Experimental Farm indicated that the maximum destructive results with Skeleton Weed (*Chondrilla juncea*) were secured by the application of a 10 per cent. solution, containing two ounces of glue per gallon at the rate of 150—200 gallons per acre. Acidification of the spray by the addition of

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* G. R. W. Meadly, B.Sc., Botanical Branch in *Journal of the Department of Agriculture*, Vol. 12, No. 4, December, 1935.

¼ tea-spoonful of sulphuric acid per gallon is reported by Sampson and Parker to increase the efficiency of sodium chlorate spray used against St. John's Wort (*Hypericum perforatum*) (1).

Full particulars regarding method of application, dangerous properties, etc., are contained in Leaflet 330 (2) of this Department.

Calcium chlorate.—This is available usually as a proprietary line mixed with calcium chloride, such as "Weedex." The chloride content absorbs moisture from the atmosphere and thus considerably reduces the fire risk compared with sodium chlorate. Under local conditions, pound for pound, sodium chlorate has proved more effective than commercial chlorate, but by increasing the concentration of the latter in order to make the chlorate contents comparable, the calcium compound has given encouraging results. Concentrations recommended according to the type of weed range from 5 per cent. to 30 per cent. (½ to 3 lbs. per gallon). As with sodium chlorate, the solution should be applied to the foliage in the form of a fine spray, according to instructions contained in leaflet 330 (2).

Sodium arsenite.—White arsenic, arseneous oxide, is not readily soluble in water, but when boiled along with equivalent quantities of washing soda or caustic soda, soluble sodium arsenite is formed. This substance is not inflammable, but is dangerously poisonous to all classes of animals. Details concerning the preparation of this substance and methods of application are contained in Leaflet No. 442 (3).

A solution made up from 1 pound white arsenic, 1 pound washing soda and thirty gallons of water, is suitable for killing weak growing weeds such as chickweed (*Stellaria media*), while a 1-1-4 solution is suitable for strong growing perennial weeds such as Nut Grass (*Cyperus rotundus*). Improved results are reported by adding sulphuric acid in order to produce the acidity necessary for penetration (1). Just prior to use, the addition of 5 per cent. by weight of concentrated sulphuric acid is recommended. Sodium arsenite is usually used on gravel paths and hard tennis courts where there is no chance of stock gaining access to the poison. The 1-1-4 solution along with ½ lb. of whiting for marking purposes is also used for pouring into the frills of green timber which has been frill ringbarked. This hastens the killing action of the ringing and also reduces suckering.

Ammonia sulphate.—Sulphate of ammonia assumes a dual purpose as it may be used both as a weedicide and a fertiliser. Many annual clovers such as Hop Clover (*Trifolium procumbens*), Sucking Clover (*T. dubium*) and Woolly Clover (*T. tomentosum*) invade our lawns and provide a laborious task if they are to be hand weeded. The application of a 2½ per cent. (¼ lb. to 1 gallon) solution of ammonium sulphate does much to reduce the clover content of a lawn, at the same time acting as a tonic to the grass. The solution may be applied by means of a watering can at the rate of about 1 gallon per eight square yards.

The addition of one part of calcined sulphate of iron to every three parts of ammonium sulphate will improve the weed-killing properties and also produce a darker green colouration in the grass. There is an alternative dry mixture consisting of three parts of ammonium sulphate, one part of calcined iron sulphate and twenty parts of sand, used at the rate of four ounces per square yard. The number of applications depends on the weediness of the lawn, but the treatment should be continued at approximately fortnightly intervals (4). Watering or rain is not desirable after application.

Taprooted weeds such as Flat Weed (*Hypochoeris spp.*) may be eradicated by means of a mixture made up as follows :—

7 parts sulphate of ammonia,
3 parts calcined sulphate of iron,
10 parts of sand.

A pinch of this should be applied to the crowns of the weeds during fine weather. A second application after an interval of about ten days will generally result in the death of the weeds.

Arsenic pentoxide.—This substance has been used with considerable success as a selective weedicide on lawns, bowling greens, putting greens, etc., in New Zealand (5) and has also given satisfactory results under local conditions. The lawn should be mown prior to treatment and the foliage should be quite dry so that dilution of the solution does not occur. For general purposes a 1-80 solution, *i.e.*, 1 lb. of arsenic pentoxide to eight gallons of water, should be used, but for badly weed-infested lawns under wet conditions a 1-60 solution gives best results and is quite safe.

The required quantity of arsenic pentoxide should be dissolved in about 1 gallon of cold water and then diluted to the required strength. The solution should be applied in the form of a fine spray at the rate of about 240 gallons per acre. Plants killed by this treatment include Winter Grass (*Poa annua*), Flat Weed (*Hypochoeris spp.*) and the troublesome annual clovers. Arsenic pentoxide is poisonous and if the hands are wetted unduly during spraying operations, harmful burning occurs in the quick of the finger nails.

Sulphuric acid.—Sulphuric acid is used to an appreciable extent in Europe for the eradication of weeds, particularly Cruciferous weeds such as Charlock (*Brassica sinapistrum*) in crops. Spraying is done when the weed is in the seedling stage, a 5 per cent. solution being the usual strength applied at the rate of 100-200 gallons per acre. Experiments carried out in Arizona (6) showed that under the existing conditions a 5 per cent. solution killed most farm weeds including Dodder (*Cuscuta spp.*), but several applications of a 10-15 per cent. solution were required to kill Johnson Grass (*Sorghum halepense*) and Nut Grass (*Cyperus sp*). The acid does not readily adhere to the vertical leaves of cereals and has little effect on them apart from a temporary browning.

The commercial concentrated acid may also be used for killing Flat Weeds (*Hypochoeris spp.*) in lawns. A few drops from a pipette dropped into the heart of each weed is sufficient.

Sulphuric acid must be handled with extreme care owing to its damaging action on the skin and clothes as well as the corrosion of most metals, particularly when dilute.

Iron sulphate.—This is also used in Western Europe for the destruction of broad-leaved plants, particularly Charlock and Wild Mustard in cereal crops. The usual recommendation is a 20 per cent. solution applied at the rate of 50 gallons per acre when the weed seedling is in the four-leaf stage.

Copper sulphate.—This is used for the same purpose as iron sulphate, but is somewhat more expensive. Fifty gallons per acre of a three per cent. solution is the usual application.

Common salt.—Common salt should only be used under exceptional circumstances owing to the lasting detrimental effect on the soil. It is suitable for gravel paths, tennis courts and other places where no vegetation is desired. One to two pounds per square foot or twenty to thirty tons per acre applied in a dry state is the average requirement.

There are various other preparations undergoing trial, but not in general use, such as ethylene dioxide, ammonium sulphocyanate and certain chromates. Those listed above, however, are the chemical weedicides most in use at the present time.

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