Survey '67:

New Herbicides for Noncrop Areas

Dr. F. L. Timmons, noted weed authority, discusses herbicides recently made available for noncrop applications, and offers some suggestions for their use.

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AT LEAST 16 new herbicides and herbicide uses have been registered for weed control on noncrop, turf, and aquatic areas in recent years. Also, at least six new spray surfactants and systems of increasing droplet size in spray applications have improved the effectiveness of herbicides, or reduced the hazards of spray drift onto desirable vegetation, in or adjacent to the treated noncrop areas.

A number of restrictions have been made on uses of herbicides in noncrop areas, especially with regard to contamination of water for irrigation or domestic use. Many labels have been clarified and made more complete with regard to method, rate, time of application, and precautions for use.

The new developments I shall discuss have all occurred during the 4 years since completion of the manuscript for Agricultural Handbook 269 "Herbicide Manual for Noncropland Areas," published in March 1965. It can be ordered from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20250. Information on earlier herbicide developments can be obtained from this handbook. More recent developments, discussed here, will be included in a new agricultural handbook now ready for press.

Revised by the author from a paper presented on program of Division A-2, Land Use and Management, of the American Society of Agronomy meeting, Stillwater, Oklahoma, August 21-26, 1966. A brief abstract was published in Agronomy Abstracts 1966.

Inverts Cut Spray Drift

At least four formulations of invert emulsions of 2,4-D, silvex, and other phenoxy herbicides are now available. These formulations provide a more viscous spray, having smaller percentage of fine droplets. Usually not more than 1% of them are less than 800 to 1000 microns in diameter, and few are less than 200 microns. This greatly reduces the amount of spray drift, consequently reducing the chances of harming desirable vegetation in neighboring areas.

Two of the invert emulsions are applied by patented bifluid nozzle systems, in which the water from one tank and the herbicide from another tank are mixed at the nozzle. Other invert formulations are premixed with water and applied with conventional aerial spraying equipment, or by special devices such as a whirling disc.

A water-swellable polymer has been developed as a particulating agent for greatly reducing the drift of water soluble herbicide sprays. Special instructions given on the label for mixing the compound with water containing herbicides must be followed for successful use. Spray applications of this material can be made by conventional equipment from which line and nozzle screens have been removed.

The chief advantage of invert emulsion (water-in-oil) and water-swellable polymer formulations is reduction of spray drift. Also, the large droplets dry less rapidly on the foliage and may aid absorption into plants. However, there have been no consistent increases in effectiveness as compared to standard (oil-in-water) emulsions of water sprays. There is a tendency for the more viscous emulsions and particulated sprays to give less complete or uniform coverage of sprayed vegetation. This sometimes results in less effective control.

New polyethylene glycol surfactants have been developed especially for use with wettable powder formulations. These surfactants also improve the effectiveness of some water soluble herbicides and some oil soluble herbicides applied in oil-water emulsions.

New Herbicides Offer Promise

At least eight new herbicides have been registered during the past 4 years for weed control in noncrop areas such as ditchbanks, rights-of-way, fence rows, industrial sites, and tank yards.

Bromacil (5-bromo-3-*sec*-butyl-6-methyluracil) is a highly effective nonselective herbicide for control of a broad spectrum of annual and perennial weeds, at rates ranging from 3 to 6 lb/A* for annuals, 7 to 12 lb/A for most perennials, and from 15 to 30 lb/A for resistant perennial grasses and broad-leaved species. These rates are considerably less than those required of most older nonselective herbicides.

Picloram (4-amino-3,5,6--trichloropicolinic acid) is an extremely potent and versatile new herbicide, available in liquid and pelleted formulations and in several mixtures with other herbicides. It controls such stubborn deep-rooted perennial weeds as Canada thistle, field bindweed, and Russian knapweed, at rates as low as 1 or 2 lb/A active ingredient (a.i.), applied on foliage in summer or on the soil in fall.

Picloram controls most broad-leaved annual weeds at rates as low as ½ lb/A a.i. or less. It is highly effective on many woody plants, but is no more effective on some herbaceous and woody species than are 2,4-D and other phenoxy herbicides. Picloram does not cause serious injury to grasses and grass-like plants except at high rates.

Picloram has a very low order of acute toxicity to animal life. However, because of its high potency on plants and its long persistence in soil, it must be used with extreme care to avoid spray drift onto desirable vegetation, contamination of water to be used for irrigation, or contamination of soil to be used for growing broad-leaved crops or ornamentals.

Prometone (2-methoxy-4,6-bis (isopropylamino)-*s*-triazine), a new industrial herbicide, is available in emulsifiable and pelleted formulations. Suggested rates are 10 to 15 lb/A for annuals and susceptible perennials, and 20 to 60 lb/A for resistant species.

DSMA and MSMA (disodium and monosodium methanearsonates) are recent additions to the arsenal of herbicides for control of perennial and annual weed grasses, nutsedge, cocklebur, and puncturevine at 4 to 9 lb/A.

Paraquat (1,1'dimethyl-4,4'-bipyridinium salt), at 1 to 2 qt/A, rapidly kills annual weeds and top growth of perennials. It is often used in combination with or preceding other herbicides that have a slower but more lasting effect on perennial weeds.

Ethylene glycol bis (trichloroacetate) is registered for use at 10 to 20 lb/A, to control annual and perennial grasses and certain broad-leaved weeds. Two,3,6-trichlorobenzyloxypropanol is registered for use at 4 to 9 lb/A for control of deep-rooted perennial weeds.

*Rates of application are of commercial formulations unless specified as active ingredient (a.i.).

Herbicides for Annual Weeds

Several new herbicides are available for control of crabgrass and other annual weeds in turf. One is siduron (1-(2-methylcyclohexyl)-3-phenylurea), at suggested rates of 4 to 12 lb/A, in new spring seedings, and 16 to 24 lb/A in new fall seedings and established turf. Another is terbutol (2,6-di-tert-butyl-p-tolylmethylcarbamate) for preemergence application at 12½ lb/A for control of crabgrass in established turf.

Bromoxynil (3,5-dibromo-4-hydroxy benzonitrile) has shown promise for control of annual broad-leaved weeds in seedling grasses, at ½ to 1 lb/A. One,1-dimethyl-4,6-diisopropyl-5-indanyl ethyl ketone has shown promise for control of crabgrass and goosegrass in established turf. Neither herbicide is registered for use at this time.

Neburon (1-butyl-3-(3,4-dichlorophenyl)-1-methylurea) at 8 lb/A, norea (3-(hexahydro-4,7-methanoindan-5-yl)-1,1-dimethylurea) at 4 to 6 lb/A, and dichlobenil (2,6-dichlorobenzonitrile) at 4 to 6 lb/A a.i. have recently been registered for preemergence control of annual weeds in woody ornamental, shelter-belt, and nursery plantings. Dichlobenil at 4 to 6 lb/A a.i. applied as a granule formulation in midwinter is also recommended for control of quackgrass, nutsedge, and mugwort in

EDITOR'S NOTE: The following list of trade names of herbicides and adjuvants mentioned in the accompanying article is presented for the convenience of readers who are more familiar with trade names than with common or chemical names.

Common or chemical name	Trade name
ammonium sulfamate	Ammate X-NI
bromacil	Hyvar X
bromoxynil	Brominil
dichlobenil	Casoron
dimethylamine salts of endothall	Hydrothol 191, 47
DSMA	Ansar 184
ethylene glycol bis(trichloroacetate)	Glytac
fenac	Fenac
invert emulsions (examples)	
applied with bifluid nozzles	Instemul, Visko-Rhap
applied with conventional nozzles	Envert, Verton
MSMA	Ansar 529, 170
neburon	Kloben
norea	Herban
1,1-dimethyl-4-6-diisopropyl-5-indanyl ethyl ketone	Sindone
paraquat	Paraquat
picloram	Tordon
polyethylene glycol surfactants (examples)	Plyac, WK Surfactant
prometone	Pramitol
siduron	Tupersan
terbutol	Azak
2,3,6-trichlorobenzyloxypropanol	Tritac
water-swellable polymer (example)	Norbak

shrub and tree plantings.

A granular formulation of dichlobenil is registered for control of certain submersed aquatic weeds. Applications of 7 to 10 lb/A a.i. are recommended on exposed bottoms or shorelines of ponds or lakes. Rates of 10 to 15 lb/A a.i. are recommended for applications made over the water surface in early spring before the weeds begin rapid growth.

A liquid formulation of fenac (2,3,6-trichlorophenylacetic acid) is registered for control of submersed aquatic weeds in ponds and lakes from which water is not used for irrigation. Applications of 10 to 13 gals. of fenac per acre in 50 to 100 gals. of water are recommended on exposed bottoms or shorelines of ponds and lakes. Water should be kept off of treated areas for at least 3 weeks (or longer in regions of low precipitation) to allow time for the slowly soluble herbicide to become thoroughly fixed in the surface soil by rain or snow.

Two new dimethylalkylamine salts of endothall (7-oxabicyclo (2.2.1) -heptane-2,3-dicarboxylic acid) are now available for control of submersed aquatic weeds and algae. They are effective on weeds at much lower concentrations than are the potassium and sodium salts of endothall that have been in use much longer. However, the amine salts are not safe for fish, whereas the potassium and sodium salts do not injure fish.

Aquatic Herbicides Restricted

The most important recent development affecting control of aquatic and bank weeds has been the restricted use of herbicides in or near canals, ponds, lakes, and streams. Most herbicides approved for control of aquatic or bank weeds include on the label the warning: *"Do not contaminate water to be used for irrigation or domestic purposes."* These restrictions are imposed, not because the herbicides are known to be toxic to warmblooded animals, but because not enough information is available to make certain that they are not toxic. One notable exception is a formulation of ammonium sulfamate which is registered for weed and brush control around domestic water supplies, lakes, and other bodies of water. Copper sulfate, the herbicide used extensively since 1904 to control algae, is still permitted in domestic water supplies at concentrations up to 4 ppmw of copper sulfate pentahydrate, equivalent to 1 ppmw of copper ion.

Some research has been initiated to determine the fate of certain herbicides in irrigation water, bottom soil, aquatic plants, and in certain crops and soils irrigated with treated water. Probably much more such research will be necessary before adequate use of effective and safe herbicides will be permitted for control of aquatic and bank weeds.

Illinois Turf Course Set

The University of Illinois will conduct its Third Turf Short Course from Jan. 30 to Mar. 10 at the University. Contact Short Course Supervisor, 104 Mumford Hall, University of Illinois, Urbana, Ill., for more information.