THE SEARCH FOR WEEDICIDES.

by B. D. Robinson

It is appropriate at this our first meeting on weed control, to consider how weedicides are developed from their beginning in the laboratory to their accepted use in everyday life.

The basic research on auxins which led to the development of the host of growth regulators and the various homologues of MCPA, 2,4-D and 2,4,5-T has given a great impetus to the search for new weedkillers. In seeking new biologically active chemicals, the procedure has been to prepare literally thousands of substances and test their activity in the laboratory. This work has given the scientist valuable information as to which chemical structures are effective on plant growth. By preparing various homologues of these structures, by adding various side chains or by substitution with various groups of chemicals, further information on biological activity has been gained.

The selection, preparation and screening of chemicals for use as weedicides now constitutes a major portion of the research programme of many of the larger industrial organizations. The selection of chemicals for testing depends on the following considerations:

1. A general study of the structure in the light of recent knowledge of chemical structure and activity.

2. A literature survey of basic research in the related fields of science.

3. The resources - both technical and financial - of various organizations to prepare and screen selected chemicals. The synthesis of selected chemicals is an expensive procedure, requiring substantial resources of chemical research. Further, the chemicals must be formulated in such a manner that they can be applied to a plant for testing. This often imposes a serious problem with insoluble chemicals which may only be soluble in a phytotoxic solvent, or may have to be converted to another slightly different chemical form for application. Many solvents, for example, acetone and lanoline have been shown to exert some

influence on plants, and factors such as this must be allowed for in measuring the activity of chemicals.

The next step is to test the chemical for its activity on plants. The test must be simple, bear a relation to practical conditions, and require a small amount of chemical. This is important where large numbers of expensive chemicals are being treated. To detect biological activity, the chemical must be screened on a cross section of plants which are physiologically different.

This has been illustrated quite clearly by past laboratory and field testing of weedicides and growth regulators. Most laboratory tests, such as the Avena test, the Kidney bean test, and the cucumber seedling test are suitable for determining relative activity but are not suitable for determining activity as potential foliar sprays, soil sterilants and pre or post emergence treatments. The selection of indicator plants is guided by agricultural and economic considerations and a reasonable cross section of indicator plants can be chosen from crops, weeds and grasses.

Plants which have been used in screening tests include wheat, mustard, rape, sugar beet, tomato, cotton, maize, cress, ryegrass, clovers, and various weeds of economic importance.

Unfortunately, there are serious limitations as to what plants may be used for test purposes. In general, the plants should produce some easily measurable or obvious reaction to chemicals such as stem curvature, root inhibition, or loss or dry weight. The indicator plants may be grown from seeds placed on agar moulds into which has been incorporated the chemical under test, or the chemical may be applied to the growing plants as sprays. The application of sprays incurs a waste of chemical and in some tests use is made of the micrometer syringe (1) to place small amounts of test chemical on indicator plants.

In order to detect potential soil sterilants, screening tests must be carried out on plants growing in soil. In screening for pre and post emergent weedicides, the chemicals are applied at varying intervals both before

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and after germination of the test plants. The test plants, which are usually a mixture of crop plants and selected weeds, are grown in rows in small boxes in potting soil. For some tests the soil may be varied to include three different soil types.

The accurate spraying of large numbers of small boxes of indicator plants has been solved (2) by using a mass production technique whereby the boxes are placed on a continuous belt and move under a calibrated spray boom. This method gives accurate control of the variables in spraying and has the advantage that it duplicates field and low volume spraying.

From all of these screening tests between 1% and 10% of the total number of chemicals tested may emerge as potential weedicides. The next step is to undertake small scale field tests and, quite probably, investigate the activity of various homologues of a particular chemical that shows promise.

If a chemical passes all these tests then come the more familiar, but nevertheless substantial, problems of formulation, production and marketing.

In the search for weedicides only a few chemicals in every thousand screened emerge as marketable products.

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