BASIC PHILOSOPHIES AND APPROACHES IN THE DEVELOPMENT OF NEW CHEMICALS AND NEW USES FOR HERBICIDES

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Fungicides and insecticides were the chemicals first used for crop protection, herbicides were the last to be introduced on a large scale. The beginning with herbicides was very slow and only during the last two to three decades has the speed of development increased. The last 15 years especially have been marked by an explosive expansion of herbicide use in agriculture.

Robinson (1964) reported for example that in 1953, the British Weed Control Council recommended five herbicides for use in vegetables; by 1964 this number had grown to 30.

The application of herbicides not only gave rise to enormous yield increases, due to the herbicidal effect, but also allowed farmers to follow cropping systems without any mechanical soil treatment and to space their crops more narrowly using chemical treatments.

These examples illustrate some of the most obvious positive consequences of chemical treatments which were important and decisive for the finally rapid and spectacular break-through of herbicides in agricultural practice.

However, the negative side-effects of herbicides must not be overlooked and must also be considered in scientific and development work. The continuous use of herbicides identical or similar in action over long periods may lead to a selection of weed species that 'escape' the herbicidal effect of the chemicals in use. A typical example is the development of 'mono-weed-vegetations of grasses' in cereals, because of the continuous use of hormone-type weed killers or the selection of perennials in fruit orchards.

Another point which must be considered is the question of the ideal period of activity of a herbicide for agricultural use. It is beyond question that the introduction of triazine- and urea-type herbicides, offering for the first time, when correctly applied, a season-long weed control in crops (e.g. triazines in maize, triazines and ureas in orchards), opened up completely new possibilities for the farmer and, therefore, they are closely linked with the rapid increase of the chemically treated agricultural area. However, under certain conditions, such herbicides may persist longer in the soil than usual and thus damage a subsequent crop.

These examples should demonstrate sufficiently that herbicide research and development today is different from the testing procedures followed 20 years ago. The introduction and expanding use of herbicides has changed the agricultural environment. Consequently, the research targets have to be adapted to new requirements.

A major consideration in selective weed control is sufficient crop tolerance, but it is difficult to give a limit for a general selectivity factor. In the course of herbicide development farmers have learned to apply relatively risky chemicals in crops with a small margin of tolerance. (Tolerance may be interpreted in the economic sense as well: the economic importance of tolerance depends to a great degree on the acreage treated and the value of the crop.)

In the past, screening procedures were mainly based on performance, i.e. on phytotoxic effects on model plants. It was only in the course of the development period that the behaviour of a compound in a soil and other factors of a more basic character were included in the complex of considerations. In the future, much more basic research must be included in early phases of the screening period; performance and tolerance are no longer the dominating arguments for the choice of new chemicals. Adsorption and leaching properties, metabolism problems, carry-over, etc., may become decisive questions.

In order for scientists to be able to grasp the high complexity and implications of the problems, specialized studies and training of personnel in charge of herbicide research and development will be a necessity. Weed science, as a new science, has ramifications in a wide range of other sciences, including soil science, agronomy, weed biology, and plant physiology. In the classical ways of studies in natural sciences, it was nearly impossible to find programmes of studies that complied with these new requirements. Besides some isolated starts in Europe, it will be one of the main tasks of the European Weed Research Council to promote education and training in weed science not only for the benefit of the users of herbicides today, but also for the benefit of our environment tomorrow.