Symposium on Metabolism of Herbicides

INTRODUCTION

In recent years there has been a rising tide of interest in the metabolism of pesticide chemicals by various organisms. The strength of that interest is evidenced in this symposium by both the number of papers and the breadth of subject matter covered. Interest in this area of investigation has stemmed in part from concern with the role of metabolism in selective toxicity, partly from studies on mode of action of these chemicals, and in part from concern with the relationship of metabolism to the residue problem.

Earlier investigations on metabolism of exogenous chemicals were concerned principally with mammals. However, the rapidly expanding horizons of comparative biochemistry soon suggested that parallel metabolic and detoxication processes should occur in plants and other organisms as well. This was soon demonstrated to be the case.

With the development of the powerful tools of radioactivity, paper chromatography, and gas chromatography, much more sophisticated investigations could be carried on. These studies have abundantly demonstrated the wide variety of metabolic and detoxication reactions to which the exogenous compound is subjected in any organism. The papers in this symposium demonstrate that a compound may be complexed with any one of the innumerable cellular constituents or it may, through metabolic processes, be converted into a complex; or the parent substance may undergo a variety of reactions ranging from hydrolysis to oxidation. Although any given investigation tends to limit observations to a narrow range of reactions, it is undoubtedly true that these foreign molecules are subjected to a veritable host of reactions all occurring simultaneously. In this manner, then, does the machinery of the cell overcome the disturbance of its dynamic equilibria by a foreign molecule.

Investigation of metabolism of herbicides received particular impetus from the discovery of the role of β oxidation in converting phenoxybutyric acids to biologically active phenoxy acetic acids. Studies prior to this time had demonstrated herbicides were metabolized by plants and microorganisms and by animals. Discovery of the β oxidation of phenoxybutyric acids was one of the early examples of how metabolism of a foreign molecule could be important in determining herbicidal activity. Subsequently, studies have shown that metabolism can and does play a key role in determining the resistance of a given plant species to a chemical. Conversely, the lack of a sufficient rate of metabolism may result in the molecule's being highly toxic to the plant.

The role of metabolism as a factor in reducing residues of herbicides either in plants or soils cannot be overlooked. Present information already permits us to point to several instances in which metabolism appears to be an important factor in eliminating herbicides as a residue in a particular crop plant. Unquestionably as our knowledge of this field matures, we shall be seeking molecules that may be selectively metabolized by the crop we wish to protect, thus virtually eliminating residue problems. Such an accomplishment is without doubt well into the future, but the goal is certainly one toward which we are moving.

The contribution of this symposium to stimulating additional research on metabolism of herbicides and plant growth regulators should be considerable. The reader perusing these papers will note that, despite the excellent research that has been done, in no case is the complete metabolic picture worked out for even one chemical. Such a situation can be looked upon only as a challenge to the scientific community. This challenge, we should hope, will spur many scientists to direct their activities to this interesting and important field of study.

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