ENVIRONMENTAL EFFECTS OF HERBICIDES COMMONLY USED IN CONSERVATION CROPPING, PERSISTENCE IN SOIL, AND EFFECTS ON SOIL MICROORGANISMS

A.V. Jolley, A.J. Wardrop and P.K. Johnstone
State Chemistry Laboratory
Department of Agriculture and Rural Affairs
5 Macarthur Street, East Melbourne, Vic. 3002

Abstract. A recent review (1) on this topic is used as the basis for this poster presentation. The major herbicides used in minimum tillage systems in Australia are considered. How long a particular herbicide persists in the soil is influenced by the chemical and physical properties of the herbicide, soil moisture, soil temperature, microbial activity, and the physical and chemical properties of the soil such as pH, organic matter content and particle size distribution.

Alachlor, diclofop-methyl, amitrole, glyphosate, and dicamba all show relatively short persistence. Trifluralin, atrazine, chlorsulfuron, paraquat, and diquat are reported to carry-over into the subsequent cropping season under certain environmental conditions. Although paraquat and diquat exhibit considerable persistence, they do not remain herbicidally active because they are strongly bound to soil particles. Persistence is dependent on soil properties which vary from site to site and season to season. Whilst increased herbicide usage is unlikely to have adverse effects on target crops, further studies into phytotoxic effects on sensitive crop species need to be carried out for trifluralin, atrazine, and chlorsulfuron due to their potential to persist into the subsequent season and thereby possibly affect more sensitive species in a rotation.

Since soil micro-organisms are involved in critical processes such as recycling of nutrients, the effects of herbicides on soil micro-organisms may result in a loss in soil fertility. Although there is a large amount of information relating to herbicide effects on soil microbiological processes the precise manner in which they influence soil fertility is still unclear. The most appropriate experiments to monitor herbicide effects on soil microflora are those which include the entire crop, soil, herbicide and micro-organism system, and may include the measurement of soil respiration, ammonification, nitrification and nitrogen fixation.

Several processes are affected by the herbicides listed. These include the nitrogen cycle by atrazine; cellulose decomposition by paraquat; algal growth by alachlor; bacteria legume symbiosis by trifluralin; and stimulation of cellulose decomposition by glyphosate. There is no information available on the effects of chlorsulfuron and diclofop-methyl on soil micro-organisms. Further studies are needed to investigate the effects of these two herbicides on soil micro-organisms.

It is concluded that to fully understand the effects of herbicide persistence, tests need to be developed which include crop, soil, herbicide and micro-organism interactions.

REFERENCES

1. Wardrop, A.J., 1986. Victorian Department of Agriculture and Rural Affairs, Technical Report Series No. 129 pp. 45-74.