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Esters of quinclorac as possible leafy spurge herbicides: Absorption, translocation, metabolism, and toxicity

GERALD L. LAMOUREUX and DONALD G. RUSNESS

USDA, Agricultural Research Service, Biosciences Research Laboratory, P.O. Box 5674, State University Station, Fargo, ND 58105

Quinclorac is one of the more effective herbicides that has been tested for the control of leafy spurge, but it is not registered for this use. Its efficacy is limited by metabolic detoxification, rapid efflux from the roots and sequestration. In an effort to overcome these deficiencies, the following quinclorac esters were synthesized and are being evaluated in the greenhouse and the laboratory: the methyl, ethyl, *n*-propyl, *iso*-propyl, *n*-butyl, *sec*-butyl, *n*-pentyl, *n*-hexyl, *n*-heptyl, *n*-octyl, *iso*-octyl, hexadecyl, butoxy-ethanol, and the 1,3-propanediol esters.

The [^{14}C]quinclorac esters were readily absorbed by the leaves of leafy spurge where they were metabolized at varying rates. The *n*-pentyl, *n*-hexyl and *n*-octyl esters were metabolized more rapidly than the short-chain or branched-chain esters. Metabolism did not proceed by simple hydrolysis and only low levels of free quinclorac were produced. Limited translocation was observed with some of the esters. The esters were generally less toxic than quinclorac when applied to the foliage, but additional dose response studies must be conducted.

The [^{14}C]quinclorac esters were absorbed by the roots when leafy spurge was grown and treated in hydroponic culture. Following treatment, much of the radioactivity was effluxed from the roots back into the nutrient solution. The 4-hydroxybutyric acid ester of quinclorac was the major product detected in the nutrient solution following treatment with the *n*-hexyl ester. The 4-hydroxybutyric acid ester was produced by microorganisms in the nutrient solution, the potting material, and the soil, but it was not produced by leafy spurge. It was produced by elimination of a 2-carbon fragment following omega- and beta-oxidation. The short chain esters were not metabolized by the nutrient solution, the n-heptyl and n-octyl esters were metabolized at the highest rate and a long chain ester (hexadecyl) was metabolized at an intermediate rate. No metabolism of the esters was observed in filter-sterilized nutrient solution. Free quinclorac was liberated from the odd chain-length esters (*n*-pentyl, *n*-heptyl and 1,3-propanediol) while the 4-hydroxybutyric acid ester and another metabolite, probably the 2-hydroxyacetic acid ester, were liberated from the even chain-length esters (*n*-hexyl, *n*-octyl, and hexadecyl). Non-sterile soil from the Red River Valley metabolized the *n*-pentyl and 1,3-propanediol esters to quinclorac

and the, *n*-hexyl ester to the 4-hydroxybutyric acid ester. Soil-applied *n*-pentyl and 1,3-propanediol esters of quinclorac appeared to be more toxic to leafy spurge than quinclorac; however, the *n*-heptyl ester would be predicted to be the most effective of these esters when-soil applied.