HERBICIDE DISSIPATION FROM LOW DENSITY POLYETHYLENE MULCH UTILIZING ANALYTICAL TECHNIQUES

Timothy L. Grey*, (tgrey@uga.edu) A. Stanley Culpepper and Nehru Mantri
University of Georgia, Tifton, GA 31794
Theodore M. Webster
USDA/ARS, Tifton, GA 31794

In Georgia, most of the low density polyethylene mulch (LDPM) is laid for spring vegetable production followed by a second crop in the autumn and potentially a third crop the following spring. Between these vegetable plantings, farmers often use contact and residual herbicides to control weeds that will hamper these second and third crops. A major issue confronted by producers is the crop phytotoxicity of the herbicide residues remaining on the LDPM. Transplanted vegetables into LDPM that have herbicide residues present, can exhibit significant injury and even death. In order to quantify the amount of residues remaining on the surface of LDPM following topical applications, field studies were established to evaluate the herbicide dissipation from LDPM.

Herbicide dissipation was measured quantitatively using analytical techniques for two scenarios: under dry conditions and following an irrigation event. Halosulfuron, paraquat, carfentrazone, glyphosate, oxyfluorfen, ethalfluralin, and flumioxazin were applied to black 1.25-mil LDPM at their registered use-rates. A 929 cm^2 portion of the LDPM was harvested 1 hour after treatment (HAT) then sampled up to 5 consecutive rain-free days after treatment (DAT) to determine the level of herbicide remaining on the LDPM. In separate experiments, treated LDPM was harvested 1 HAT, then washed off with sprinkler irrigation (1 cm), sampled 3 HAT, with the same wash and sampling procedure repeated for 5 consecutive DAT. A Waters Alliance 2690 system coupled to a Micromass Quatro was used to analyze all of the samples using electrospray ionization using standard curves generated from technical materials for each herbicide.

Halosulfuron initial concentration for the rain-free studies was 3.8 mg/m^2 at 1 HAT. At 1 DAT, 86% of halosulfuron remained on the LDPM for the rain-free study. Subsequently, 69, 63, 68, and 65% was detected at 2, 3, 4, and 5 DAT, respectively. Halosulfuron initial concentration for the wash-off studies was 4.7 mg/ m^2 at 1 HAT. After a single wash-off event, 36% of the halosulfuron remained. Then 20, 14, 11, and 6% was detected 2, 3, 4, and 5 DAT. Halosulfuron remained on the LDPM even after 5 cm of irrigation. Paraquat initial concentration for the rain-free studies was 118 mg/m^2 at 1 HAT. At 1 DAT, 52% of paraquat remained on the LDPM. The concentration continued to drop to 31, 21, 14, and 9% at 2, 3, 4, and 5 DAT for the rain-free studies. Conversely, paraquat initial concentration for the wash-off studies was 150 mg/m^2 but was 0% after the initial wash-off event. Glyphosate initial concentration for the rain-free and wash-off studies was 115 mg/m^2 at 1 HAT. At 1 DAT for the

rain-free experiments, greater than 80% of glyphosate was still present, dropping to 50% at 2 DAT and remaining constant to 5 DAT. In contrast, glyphosate concentration for the wash-off studies was less than 3% after 1 wash-off event. This indicates that paraquat and glyphosate can be removed by washing off the LDPM with water. Carfentrazone initial concentration for the rain-free and wash-off studies was 8 mg/ m^2. Ten to 40% remained on the mulch at 1 HAT to 4 DAT for both the rain-free and wash-off studies. These data indicated that carfentrazone adsorption to LDPM was occurring and that there was subsequent release with each wash-off event. Oxyfluorfen and ethalfluralin initial concentration for the rain-free and wash-off studies was 40 and 38 mg/ m^2, respectively. After a single wash-off event with 1 cm of irrigation, 98% of oxyfluorfen remained on LDPM. Oxyfluorfen recovery for rain-free and wash off studies linearly declined from 50 to 6% by 4 DAT indicating adsorption to the LDPM. Ethalfluralin dissipation was rapid with less than 2% of the initial concentration detected for rain-free and wash-off studies 2 DAT. Flumioxazin recovery was erratic and requires further investigation.

Growers need to be aware of the potential for herbicide residues to persist on mulch, even after rainfall/irrigation events. Glyphosate and paraquat are both very water soluble and readily removed from the mulch with irrigation. Ethalfluralin was rapidly dissipated with or without irrigation. Residues of carfentrazone and oxyfluorfen were persistent on the mulch, even with irrigation events.