EFFECT OF APPLICATION DROPLET SIZE AND PHOTOPERIOD ON THE ABSORPTION AND TRANSLOCATION OF ^{14}C-GLYPHOSATE IN TERRESTRIAL ALLIGATOR WEED

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Abstract.. Alligator weed (*Alternanthera philoxeroides*) is an aquatic plant native to South America. It was first sighted in Australia in 1946 and while it is found in various areas of the central NSW coast, its main area of infestation is the lower reaches of the Hunter Valley. Alligator weed is considered a perennial aquatic plant but it may also invade channel banks and agricultural land. In open water, the plant forms large mats of hollow stem material with adventitious roots originating from stem nodes, but in the terrestrial habit the weed forms a large underground network of rhizomes.

Generally, herbicides have been unable to control the expansion and propagation of new tissue from the underground portion of alligator weed because they are unable to translocate into this tissue. Also, while glyphosate has been successfully used to control many perennial weeds as it is translocated rapidly to the underground parts, it has not controlled terrestrial alligator weed successfully. We investigated the influence of glyphosate (isopropylamine salt) application droplet size on uptake and translocation to see if efficacy could be improved by careful choice of spray technology. Also, the influence of seasonal timing was investigated by growing the plants under different photoperiods before applying the glyphosate.

The internal concentration of ^{14}C-glyphosate necessary to kill rhizome tissue was established by shaking rhizome segments in solutions of the herbicide for 24 hours. On a plant dry weight basis, rhizomes were able to propagate at concentrations below about 5 µg/g of plant tissue and were killed at above 39 µg/g.

Ten week old field-grown alligator weed plants were treated with a solution of carbon-14 radiolabelled glyphosate (27.4 µg a.i./plant) in either 1.0 or 0.2µL droplets. One leaf pair per plant was treated with 26 droplets. The application of ^{14}C-glyphosate to the plants in 0.2 µL droplets enhanced herbicide uptake into the treated leaf relative to plants treated with 1 µL droplets. Droplet size did not affect the total amount of glyphosate remaining in the treated region of the plant or translocation of the herbicide from the treated zone. Accumulation of the translocated radiolabel in the root hairs of plants treated with 0.2µL droplets was significantly greater than in plants treated with larger droplets but there was no significant difference in accumulation of the radiolabel in other plant tissues. The concentration of radiolabel in the rhizome tissue of the plants from either droplet treatment was 0.4-0.5 µg/g, much lower than the lethal quantity previously determined.

The same 1µL droplet treatment was applied to plants grown under either a 10 hour (short-day) or a 16 hour (long-day) photoperiod. More ^{14}C-glyphosate was absorbed and retained in the leaf tissue by short-day plants. The accumulation of radiolabel in the above ground and underground tissue was similar in short and long-day plants. However, a greater concentration of radiolabel (w/w) accumulated in the new rhizome tissue of short-day plants harvested 7 and 14 days after herbicide treatment. The concentration of radiolabel in the new rhizomes of plants harvested 7 days after treatment was only 1.7 µg/g (long-day) and 6.5 µg/g (short-day) and was insufficient to prevent vegetative propagation of this tissue. We conclude that the performance of glyphosate can be improved by changes in timing of application, but not by the use of different droplet sizes.