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# CGA-362622 REDUCES GROWTH AND PHOTOSYNTHESIS OF GOOSEGRASS

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## Abstract

Laboratory and greenhouse studies were conducted to determine the effect of CGA-362622 on absorption, translocation, and metabolism of clethodim (Select) in goosegrass [*Eleusine indica* (L.) Gaertn.], and to examine the effect of CGA-362622 on fresh weight accumulation and photosynthetic rate of actively growing goosegrass. For the absorption and translocation study, herbicide treatments were main plots, harvest timings were subplots, and plant portions were subsubplots in a split plot treatment arrangement. The metabolism study had an identical treatment arrangement. All studies were repeated in time. When plants reached the four leaf stage, the second fully expanded leaf was covered. The plants were sprayed with two non-radiolabeled mixtures, either clethodim (8.1 fl. oz/A) alone or a mixture of clethodim and CGA-362622 (0.05 oz ai/A). Immediately after application, 5 1-µL droplets of $^{14}$C-clethodim solution containing $^{14}$C-clethodim (1.7 kBq of radioactivity), Select™ 2EC, deionized water, crop oil concentrate, and/or CGA-362622 were placed on the adaxial surface of the second fully expanded leaf. Plants were harvested at 0.5, 1, 4, 8, 24, or 96 h after treatment (HAT) and then divided into the treated leaf, roots, shoot above and shoot below the treated leaf. For absorption and translocation, plant parts were oxidized to recover $^{14}$C. For metabolism, plants were harvested at 4, 8, 24, or 96 HAT, and only the treated leaf contained sufficient $^{14}$C for detection. The $^{14}$C was extracted, concentrated, and fractionated using high performance liquid chromatography. For the growth analysis and photosynthetic rate experiments, treatments were non-treated and CGA-362622 (0.05 oz ai/A) treated plants. Treatments were replicated four times and the experiments were repeated in time. For growth analysis, plants were harvested immediately and at 2, 4, 6, or 8 days after treatment (DAT) and above ground fresh weights were recorded. For photosynthetic rate measurements, single leaf photosynthetic rates were measured with a portable photosynthesis system, which included a 0.25 L chamber used to enclose the middle portion of the second uppermost fully expanded leaf. To ensure light saturation, measurements were made between 1100 and 1300 EST. Measurements were made just before herbicide treatment and 1, 2, 6, and 8 DAT.

Absorption was 28% of applied $^{14}$C-clethodim at 0.5 h, and 87% of applied $^{14}$C-clethodim at 96 h, regardless of the presence of CGA-362622. Clethodim exhibited a biphasic mode of absorption, with 60% of the $^{14}$C-clethodim absorbed in the first 8 h. Absorption was improved a further 20 percentage points over the remaining 88 h of the study. Translocation of clethodim was similar when clethodim was applied alone or in the presence of CGA-362622. While absorption increased over time, little herbicide moved from the treated leaf to other plant portions at any harvest interval. By 96 h after treatment, only 0.8 % of applied $^{14}$C had moved into the portion of the shoot below the treated leaf, the location of the intercalary meristem (active site). These data suggest that CGA-362622 does not affect translocation of clethodim out of the treated leaf. Metabolism of clethodim was similar when clethodim was applied alone or in the presence of CGA-362622. Three major metabolites of clethodim were detected in treated tissue at all harvest intervals, while no $^{14}$C-clethodim (retention time of 35.5 min) was recovered at any harvest interval. Over time, $^{14}$C extracted from treated leaves became relatively more polar than clethodim. CGA-362622 reduced goosegrass biomass accumulation compared to non-treated goosegrass from 0 to 4 DAT. Thereafter, the increase of biomass was similar for both CGA-362622 treated and non-treated goosegrass. Immediately before an application of CGA-362622, rates of photosynthesis were similar for all plants in the experiments. One day after treatment (DAT), the photosynthetic rate in plants treated with CGA-362622 had decreased, and remained lower at the 2, 6 and 8 d sampling times. CGA-362622 appears to affect overall growth rate of goosegrass, reducing it considerably. The reduction in growth caused by CGA-362622 could have implications for ACCase activity, perhaps causing negative feedback inhibition or reduced expression of the enzyme complex.

Graminicides evidently require actively growing meristematic regions for inhibition of ACCase. The data presented herein show that the growth and photosynthetic rate of goosegrass is reduced with CGA-362622 treatment. Clethodim was absorbed and translocated similarly to other graminicides, and absorption, translocation, and metabolism of clethodim was not affected by the presence of CGA-362622. The rapid metabolism of clethodim, which was unaffected by the presence of CGA-362622, resulted in detoxification of clethodim to nontoxic metabolites. By the time goosegrass resumed growth and photosynthesis, clethodim was no longer present to inhibit reactivated ACCase. Together, these data suggest that the antagonism of clethodim by CGA-362622 may be influenced by CGA-362622 altering the growth and photosynthetic rate of goosegrass and therefore the sensitivity of the plant to ACCase inhibition.