

Chapter IX

Summary

1. Field and laboratory investigations of sulfentrazone in potato.

In field experiments, potato injury from sulfentrazone PRE at rates up to 0.21 kg/ha was generally similar to injury from metribuzin, metolachlor, or metribuzin plus metolachlor PRE. However, AT EMERG applications resulted in excessive injury that ranged from 60 to 86%. AT EMERG applications also caused decreased potato height and alterations in potato flowering patterns. Sulfentrazone at either application timing controlled common lambsquarters at least 98% even at the lowest rates and was more effective than metribuzin or metolachlor alone. Highest rates of sulfentrazone (0.28 kg/ha) were effective on annual grass species but no rate was effective on common ragweed. Total yield and grade from sulfentrazone PRE applications was similar to potato treated with metribuzin, metolachlor, or metribuzin plus metolachlor in both years. Potato injury from AT EMERG applications of sulfentrazone plus metolachlor decreased total potato yield and caused changes in grade distribution in 2000.

In laboratory experiments, common lambsquarters and jimsonweed absorption of [¹⁴C] sulfentrazone per g fresh weight was more than two-fold that in potato after 24 h root exposure. After 48 h exposure, sulfentrazone absorption by common lambsquarters was nearly two-fold that in jimsonweed and three-fold that in potato. Sulfentrazone movement from roots to shoots was also greater in common lambsquarters than in jimsonweed and potato after 6 h exposure. Both weed species exhibited nearly a two-fold increase in sulfentrazone translocation from roots to shoots compared to potato after 12, 24, and 48 h exposure. Since the site of action of sulfentrazone, protoporphyrinogen oxidase, is located in shoot tissue, translocation to

shoot tissue is essential for sulfentrazone toxicity. Therefore, differential root absorption as well as differential translocation of sulfentrazone from root to shoot tissue are the proposed primary mechanisms of differential sulfentrazone tolerance between potato, common lambsquarters, and jimsonweed.

2. Laboratory, greenhouse, and field investigations of the experimental herbicide AE F130060 03 for Italian ryegrass management in winter wheat.

In laboratory experiments, foliar absorption of [¹⁴C] AE F130060 00 was not influenced by herbicide safener or Italian ryegrass biotype; however, both diclofop-sensitive and -resistant biotypes absorbed at least three times more AE F130060 00 than wheat at 12, 36, and 72 h after treatment (HAT). Since at least 91% of the herbicide remained in the treated leaf during the course of these experiments, herbicide translocation did not appear to be a contributing factor in differential tolerance between species. Differential metabolism, however, was noted between winter wheat and Italian ryegrass. Greatest overall metabolism occurred in winter wheat treated with the safener AE F107892. At 72 HAT, relative amounts of parent AE F130060 00 in Italian ryegrass biotypes were nearly 1.8 times greater than in wheat that received AE F107892 and nearly 1.5 times greater than that in unsafened wheat. However, obvious differences in herbicide metabolism between diclofop-sensitive and -resistant Italian ryegrass biotypes were not evident.

In field experiments, AE F130060 03 was as effective as diclofop-methyl and more effective than chlorsulfuron plus metsulfuron, chlorsulfuron plus metribuzin, MON 375600, ICIA 0604, and CGA 184927 for control of diclofop-sensitive Italian ryegrass. AE F130060 03 also controlled diclofop-resistant Italian ryegrass better than diclofop-methyl and all other herbicides applied. AE F130060 03 also reduced late-season emergence inflorescence emergence of diclofop-sensitive and -resistant Italian ryegrass by 91 to

100%. Although wheat injury from AE F130060 03 was greater than that from other herbicides, wheat recovered and injury did not influence grain yield. Grain yield from wheat treated with AE F130060 03 was similar to or greater than yield from wheat treated with the other herbicides. Italian ryegrass control, inflorescence emergence, and grain yield was not influenced by AE F130060 03 rate or the addition of methylated seed oil (MSO).

In other field experiments investigating the influence of AE F130060 03 application timing, rate, and MSO, Italian ryegrass control was generally not influenced by application rate or MSO addition. However, application timing did impact late-season Italian ryegrass control and inflorescence emergence. Applications made to two- to three-leaf Italian ryegrass resulted in greater Italian ryegrass emergence following application, thereby resulting in lesser apparent late-season control and greater Italian ryegrass inflorescence emergence compared to applications made to two- to three-tiller or four- to five-tiller Italian ryegrass.

In greenhouse and field experiments investigating wheat cultivar tolerance to AE F130060 03, herbicide treatment by cultivar interactions occurred for wheat yield in field experiments but did not occur for biomass production in greenhouse experiments. In the field, AE F130060 03 injured wheat 11 to 32%, reduced tiller number of all cultivars except Roane, Coker 9663, and VA98W-593, and reduced height of all cultivars except USG 3209 and VA98W-593 at 3 WAT. By 9 WAT, tiller number and height of treated wheat was similar to nontreated wheat. AE F130060 03 did not influence moisture content or kernel weight of any cultivar. Although yields of treated wheat were at least 81% of yields of nontreated wheat in either year, reductions in grain yield due to AE F130060 03 application occurred in FFR 518 and Coker 9663 in 2000 and AgriPro Patton and VA98W-593 in 2001. It is proposed here that winter wheat cultivar tolerance could be improved by increasing the amount of safener used in AE F130060 03 applications.

3. Field, greenhouse, and growth chamber investigations of growth and reproductive ability of imidazolinone-susceptible and -resistant smooth pigweed.

Under noncompetitive conditions in the greenhouse, rates of height increase in imidazolinone-susceptible (S) smooth pigweed were similar to those in R1, R2, R3, and R5. However, growth rate at 3 to 5 wk after planting (WAP) was greatest in the R4 biotype. In both noncompetitive conditions in the greenhouse and in noncompetitive and competitive conditions in the field, R4 had a more rapid rate of height increase at 3 to 5 WAP. However, height of S and R4 biotypes were similar by 8 to 9 WAP. In the greenhouse, S produced more total biomass than all R biotypes, although a greater relative proportion of total biomass was attributed to reproductive biomass in R4. Seed production in the greenhouse was similar between S and R4 biotypes, and greater than seed production of R1, R2, R3, or R5 biotypes. Similar to patterns of rapid initial height increase in R4, seed of R4 also displayed a more rapid initial rate of germination than S, although final germination after 12 d imbibition was similar between S and R4. Vegetative and reproductive biomass accumulation in the field was density-dependent but was similar for all biotypes. Collectively, these results suggest that not all imidazolinone-resistant smooth pigweed biotypes suffer fitness penalties compared to imidazolinone-susceptible smooth pigweed, particularly under competitive conditions in the field.