

New Herbicides for Weed Control in PNW Potato Production

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Weeds cause tremendous losses in potato production and more potato acres in the United States are treated with the herbicide metribuzin (Lexone or Sencor) than any other pesticide (Guenther et al. 1999). The annual value of metribuzin to U.S. potato growers is estimated to be \$81 million (Guenther et al. 1999). Although metribuzin is still the main weed control tool used in potato production, several weed species are not consistently controlled by metribuzin and metribuzin resistant weed biotypes have increased. In addition, several potato varieties are sensitive to metribuzin, limiting its use to tolerant varieties.

Several new herbicides with modes of action different than metribuzin are being tested for weed control in potato production. Sulfentrazone (Spartan), flumioxazin (Valor) and azafenidin (Milestone) are new herbicides that inhibit protoporphyrinogen oxidase, an enzyme in plants important in the synthesis of chlorophyll. All three herbicides control hairy and black nightshade and since the mode of action is different than herbicides currently labeled in potatoes, may provide growers with new herbicide resistance management tools.

Sulfentrazone and flumioxazin were tested in Russet Burbank potatoes for crop tolerance and weed control at three locations in 2000 representing major potato growing regions in Idaho, Oregon, and Washington State. Trials were conducted under sprinkler irrigation on a Delco silt loam soil with 1.4 % organic matter, pH 8.1 in Aberdeen, ID, Owyhee silt loam soil, 1.5 % organic matter, pH 7 in Ontario, OR, and on a Quincy sand soil, 0.5 % organic matter, pH 7 near Paterson, WA. In all three trials herbicides were applied after the final hilling and prior to potato and weed emergence.

Flumioxazin applied at rates ranging from 0.05 to 0.13 lb ai/a controlled hairy nightshade and common lambsquarters in late June from 85 to 91% and redroot pigweed from 63 to 80% in Idaho trials. Common lambsquarters and redroot pigweed control were lower in July, but hairy nightshade control remained above 85% with flumioxazin at 0.09 and 0.13 lb/a. Flumioxazin did not control tame oats.

In Oregon, flumioxazin controlled redroot pigweed in early June from 56 to 85% and control increased as flumioxazin rate increased from 0.05 to 0.13 lb/a. Early season common lambsquarters and hairy nightshade control ranged from 75 to 100%. Flumioxazin failed to control barnyardgrass.

In Washington, flumioxazin controlled redroot pigweed, common lambsquarters, and hairy nightshade for the entire season at rates from 0.05 to 0.13 lb/a. Flumioxazin failed to control large crabgrass, which was controlled well by a postemergence application of clethodim. Little or no potato injury was observed when treating with flumioxazin in Idaho and Oregon trials. Flumioxazin at the 0.13 lb/a slightly visually injured potatoes in Washington, but potato yield was not reduced compared to a hand weeded check or potatoes treated with a herbicide standard.

Combining flumioxazin with dimethenamid-P (Outlook) or *S*-metolachlor (Dual Magnum) improved control of redroot pigweed, barnyardgrass, and large crabgrass and did not injure potatoes or reduce potato tuber yield at all three locations. Tank mixes of flumioxazin with EPTC (Eptam) or pendimethalin (Prowl) in Oregon did not improve control of redroot pigweed, but did improve control of barnyardgrass compared to flumioxazin applied alone. Combining flumioxazin with pendimethalin in Idaho slightly improved control of redroot pigweed and tame oats, but control was not commercially acceptable. Flumioxazin combined with metribuzin in Idaho controlled all annual weeds well.

In Idaho, sulfentrazone applied alone from 0.06 to 0.13 lb/a controlled common lambsquarters, redroot pigweed, and hairy nightshade greater than 95%. Tame oats were not controlled well by sulfentrazone. In Oregon trials, sulfentrazone applied alone from 0.09 to 0.25 lb/a controlled common lambsquarters, redroot pigweed, and hairy nightshade greater than 90%. Sulfentrazone controlled barnyardgrass greater than 90% at 0.188 and 0.25 lb/a. In Washington, sulfentrazone controlled hairy nightshade and sparse populations of common lambsquarters, and redroot pigweed greater than 99% at rates ranging from 0.09 to 0.25 lb/a but failed to control large crabgrass.

Sulfentrazone tank mixed with metribuzin, *S*-metolachlor, or pendimethalin visually injured potatoes in early June in Idaho trials, but injury was transient and potato tuber yield was equal to hand weeded checks. Sulfentrazone visually injured potatoes in June at rates of 0.19 lb/a or more in Oregon and Washington, but potato tuber yield was not reduced compared to potatoes treated with herbicide standards or hand weeded checks. Tank mixes of sulfentrazone at 0.09 or 0.19 lb/a with *S*-metolachlor, dimethenamid-P, EPTC, or pendimethalin, controlled annual broadleaf and grass weeds well and did not reduce potato tuber yield at all three locations compared to hand weeded checks or potatoes treated with standard herbicide treatments.

In Washington trials azafenidin was tested at 0.125 and 0.25 lb ai/a. Azafenidin controlled early season hairy and black nightshade, redroot pigweed, common lambsquarters, and large crabgrass nearly 100% at both rates tested. However, azafenidin severely injured potatoes, stunted potato growth, and reduced potato yield compared to weed free checks.

Both sulfentrazone and flumioxazin controlled hairy and black nightshade, a common weed in potato without appreciable crop injury. These two herbicides may also control triazine resistant weed biotypes in potato rotations and provide growers new options for weed control in metribuzin susceptible potato varieties. IR-4 residue trials with sulfentrazone were conducted at three locations in Washington by Prosser USDA-ARS personnel in 2000. Similar trials are planned for flumioxazin in 2001.

Dimethenamid-P (Outlook), fluthiamide + metribuzin (Axiom), and ethalfluralin (Sonalan) registrations are also being pursued in potatoes. These three preemergence herbicides could be labeled in potatoes in the next 1 to 2 years. All three herbicides are applied PRE to weeds and control many annual grasses and small seeded broadleaf weeds.

Literature Cited

Guenthner, J. F., M. V. Wiese, A. D. Pavlista, J. B. Sieczka, and J. Wyman. Assessment of Pesticide Use in the U. S. Potato Industry. *Amer. J. of Potato Res.* 76:25-29.