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Symposium

Are many little hammers effective? Velvetleaf (*Abitilon theophrasti*) population dynamics in two- and four-year crop rotation systems

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To improve understanding of relationships between crop diversity, weed management practices, and weed population dynamics, we used data from a field experiment and matrix models to examine how contrasting crop rotations affect velvetleaf. We compared a 2-yr rotation system (corn–soybean) managed with conventional rates of herbicides with a 4-yr rotation (corn–soybean–triticale 1 alfalfa–alfalfa) that received 82% less herbicide. In November 2002, a pulse of velvetleaf seeds (500 seeds m²) was added to 7- by 7-m areas within replicate plots of each crop phase–rotation system combination. Velvetleaf seed, seedling, and reproductive adult population densities, seed production, and seed losses to predators were measured during the next year. Velvetleaf seed production was greater in the 4-yr rotation than in the 2-yr rotation (460 vs. 16 seeds m²). Averaged over 12 sampling periods from late May to mid-November 2003, loss of velvetleaf seeds to predators also was greater in the 4-yr rotation than in the 2-yr rotation (32 vs. 17% per 2 d). Modeling analyses indicated that velvetleaf density in the 4-yr rotation should decline if cumulative losses of seeds produced in the soybean phase exceeded 40%. Achieving such a level of predation appears possible, given the observed rates of velvetleaf seed predation. In addition, no tillage occurs in the 4-yr rotation for 26 mo after soybean harvest, thus favoring seed exposure on the soil surface to predators. Models that included estimates of seed predation indicated that to prevent increases in velvetleaf density, weed control efficacy in soybean must be \geq 93% in the 2-yr rotation, but could drop to 86% in the 4-yr rotation. These results support the hypothesis that diverse rotations that exploit multiple stress and mortality factors, including weed seed predation, can contribute to effective weed suppression with less reliance on herbicides.