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Integration of herbicides with flea beetles, *Aphthona nigriscutis*, for leafy spurge control

RODNEY G. LYM[1], ROBERT B. CARLSON[2], CALVIN G. MESSERSMITH[1], and DON A. MUNDAL[1]

[1]Plant Sciences Department, North Dakota State University, Fargo 58105, USA; [2]Department of Entomology, North Dakota State University, Fargo 58105, USA

Leafy spurge (*Euphorbia esula* L.) is one of the most difficult perennial weeds to control in North America and currently infests nearly 1 million ha. Herbicides alone have not controlled the weed. Biocontrol insects have been introduced but have been slow to establish and spread. The effect of herbicide treatments on survival and establishment of the flea beetle, *Aphthona nigriscutis*, on leafy spurge, was evaluated. *Aphthona nigriscutis* was established in 1989 and herbicide treatments were initiated in June 1992. The treatments included picloram plus 2,4-D at 0.28 plus 1.1 kg/ha spring-applied, picloram plus 2,4-D at 0.56 plus 1.1 kg/ha fall-applied, and *A. nigriscutis* alone. Stem-density was annually evaluated in the spring, and adult sweep-counts were conducted throughout each summer. Stem-density in the insect-only treatment declined by 95% from May 1992 to May 1995. However, control was reduced to only 30% by September 1995 once the larvae stopped feeding and pupated to adults in early summer. The greatest leafy spurge stem-density reduction was 99% by the insect plus fall-applied herbicide treatment, which occurred after the first application in 1992. The spring-applied herbicide plus insect treatment reduced leafy spurge populations less than the insects alone. The *A. nigriscutis* population in the nonherbicide treatments increased from seven beetles/M^2 in 1992 to 130 beetles/M^2 in 1994. The *A. nigriscutis* population declined to less than one beetle/M^2 when herbicides were spring-applied, but increased to 30 beetles/M^2 when herbicides were fall-applied. Beetle populations declined in 1995 compared to 1994 regardless of treatment as leafy spurge stem-density decreased. Fall-applied herbicide treatments combined with *A. nigriscutis* provided better long-term leafy spurge control than either control method used alone.