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Unexplained nonconcurrent distribution of leafy spurge and alfalfa in noncropped areas of eastern North Dakota

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Association or nonassociation of plant species can indicate underlying effects of site, habitat, soil characteristics, common parasites, allelopathy or previous disturbance. Methods to quantify such associations are available (1). Leafy spurge (*Euphorbia esula* L.) is naturalized widely throughout eastern North Dakota, particularly in noncultivated areas, including grassy roadsides (2). Alfalfa (*Medicago sativa* L.) is also naturalized throughout the state, growing in similar sites. In casual observation in previous years, the authors noted that alfalfa and leafy spurge appeared not often found close to each other, even in areas where both were common. The present study was undertaken to see if this seeming nonassociation was real and to see if clues to its underlying cause might be evident.

During May and June 1987, three surveys were made in seven counties in eastern North Dakota where leafy spurge was abundant. At this time leafy spurge plants were in flower and were recognized easily. The areas sampled were noncultivated grassy roadsides along secondary roads. Environmental extremes which might affect occurrence of either plant species were avoided: low, wet or poorly drained areas, very dry hilltops, areas showing evidence of soil disturbance or cultivation and areas where present or past herbicide spraying was evident. On chosen sites, a series of 10 to 20 contiguous sample plots extending continuously for several kilometers were evaluated for presence of alfalfa and/or leafy spurge. In scoring individual plots, a single plant of alfalfa or leafy spurge anywhere within that plot was recorded as a positive occurrence, an extremely conservative measure. There were three sites: a) 299 plots about 8 by 90 m in adjacent parts of Cass, Ransom and Richland counties, observed May 8, 1987; b) 235 plots about 8 by 40 m in adjacent parts of Barnes and Griggs counties, observed June 3, 1987; and c) 210 plots about 8 by 8 m in adjacent parts of Dickey and Sargent counties, observed June 29, 1987. Alfalfa plants were found in 39% of plots and leafy spurge in 45%. Results were analyzed as contingency tables using the chi-square statistic and by Cole's coefficient of interspecific association (C7) (1).

Alfalfa and leafy spurge occurred together in only 8% of plots, significantly less than expected based on their overall frequencies (Table 1). Cole's C7 statistic also indicated negative association of the two plant species. Both analyses indicated that there was a

significant negative association between leafy spurge and alfalfa in each of the three surveys and in the totals (Table 1). Given the extensive sampling over a large area and the sampling pattern used, topographic or edaphic factors are not likely to be responsible for the observed results. Other explanations for the observed results may be allelopathy and common parasites. Although leafy spurge is allelopathic to some species, alfalfa is not reported among these (3). Alfalfa generally does not cause allelopathic effects although its effect on leafy spurge has not been tested adequately. A parasitic rust fungus, *Uromyces striatus* Schroet. infects both leafy spurge and alfalfa as alternating hosts (4). In North Dakota, *U. striatus* appears on alfalfa only late in the season and, while it is widespread, its severity is very low (Stack 1985, 1986, 1987, unpublished). *U. striatus* is destructive on leafy spurge. It becomes systemic and causes distortion on growing shoots, impairs flowering and often causes death of the plant (4). Naturally occurring biocontrol could prove an explanation for observed nonconcurrent distribution. The purpose of this survey was to document observations and suggest possible explanations. Any causal relationship needs to be determined by experimental studies.

Table 1. Co-occurrence of leafy spurge and alfalfa.

Site: counties	Leafy spurge	Alfalfa		Chi-square	C ⁷ *
		Absent	Present		
		(number of plots)			
A: Cass, Ransom, Richland	absent	105	125		
	present	49	20	13.7**	-0.402
B: Barnes, Griggs	absent	34	58		
	present	107	3	34.2**	-0.371
C: Dickey, Sargent	absent	43	44		
	present	116	7	55.3**	-0.766
All counties	absent	182	227		
	present	272	63	105.6**	-0.518

*C⁷ Cole's coefficient of interspecific association (1).

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