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Leafy spurge – A nemesis of the Great Plains

RODNEY G. LYM and CALVIN G. MESSERSMITH

North Dakota State University, Fargo, ND.

Leafy spurge (*Euphorbia esula* L.) is a deep-rooted perennial weed of the *Euphorbiaceae* or spurge family, which has spread rapidly westward since introduction into Massachusetts from continental Europe in 1827. The weed was spread primarily as a contaminant in wheat seed and leafy spurge infestations now are concentrated in 2.3 million acres of the Intermountain and Northern Great Plains regions of the U.S. and in 125,000 acres of the Canadian Prairie Provinces of Manitoba, Saskatchewan, and Alberta. An active federal program of research and control for over 20 years probably has limited the spread of leafy spurge in Canada. Leafy spurge is a difficult weed to control. It is listed as a noxious weed and therefore must be controlled legally in at least 19 states.

Plant description

Leafy spurge is one of the first plants to emerge in the spring and commonly grows 16 to 32 inches in height (Fig. 1). The most colorful feature of leafy spurge is the yellowish-green bracts which are most visible throughout June and subtend the true flower (Fig. 2). The true flowers are borne on a terminal umbel or on lateral branches near the stem tip. Each pedicel of the umbel bears a cyathium, which is the special flower type of the spurge family that includes both staminate and pistillate flowers. Pollination is almost entirely by insects such as ants and bees. Seeds develop in a three-celled ovary and dehisce explosively during hot, dry days in mid-July. Each individual stalk can produce up to 150 seeds but generally only 20% of the seedlings survive.

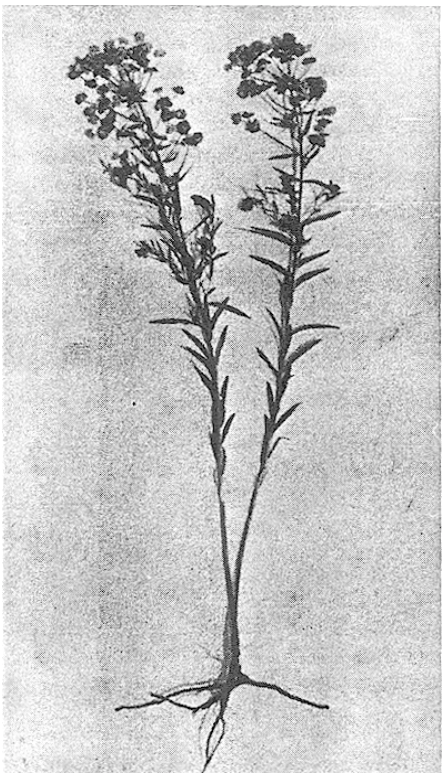

Fig. 1. Leafy spurge plant during pollination showing flowers, lateral branches and portion of root tissue.

Once infested, the rapid spread of leafy spurge is due primarily to shoots arising from the extensive root system of established plants rather than by seed production. Its roots are most abundant in the upper foot of soil but roots regularly penetrate 4 to 6 feet and can penetrate 15 feet or more (Fig. 3). Leafy spurge roots can produce vegetative shoots from all depths and have produced shoots for 5 successive years from a depth of 3 feet after the upper root system was removed by excavation. The average number of vegetative buds per single vertical root varies from 35 to 272. Upon removal of the top growth, root buds swell and begin growth until one or two new stems establish apical dominance. The remaining buds return to dormancy until the top growth is disturbed again. Thus, leafy spurge has nearly unlimited ability for regeneration and can withstand repeated control efforts.

Fig. 2. True flower of leafy spurge with staminate and pistillate flowers and three-celled seed capsule subtended by bracts.

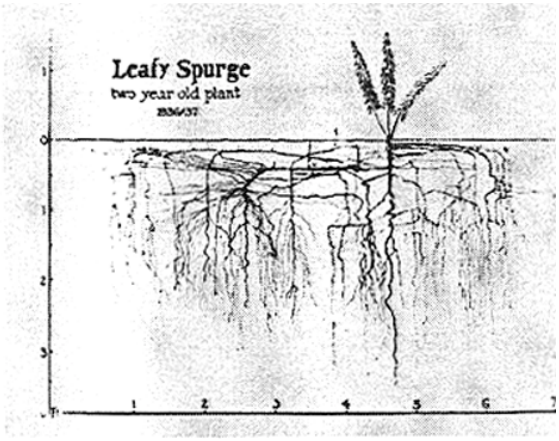

Fig. 3. Development of the root system for a two-year-old leafy spurge plant.

Latex is present throughout the plant and contains a toxic substance which is an irritant, emetic, and purgative for many animals when eaten. It causes scours and weakness in cattle, and may result in death. The toxin has produced inflamation and loss of hair on the hoofs of horses grazing in freshly mowed stubble. Sheep can graze leafy spurge without adverse effects on their health. Other animals will eat the dried plants in hay, but usually will not graze among growing plants.

Leafy spurge plants collected from many areas in the U.S. and Canada and then grown in a uniform environment have shown wide variation in leaf size and shape, chemical composition and thickness of the cuticle, seed protein composition and in root morphology. This indicates genetic differences among plants from different areas. Current investigations have suggested that plants previously identified as *E. esula* may be separated into as many as five different species depending upon the method of identification. Since leafy spurge is a prime candidate for biological control, this discrepancy must be resolved before large scale release of pathogens and/or insects can occur.

Control

Leafy spurge is difficult to eradicate, but topgrowth control and a gradual reduction in the underground root system are possible if a persistent management program is followed. Most herbicides have been tested on leafy spurge since the introduction of 2 4-D in the 1940s. Few herbicides affect leafy spurge growth and no promising new herbicides are presently in development. Herbicides commonly used to control leafy spurge include 2, 4-D Banvel (dicamba), Roundup (glyphosate) and Tordon (picloram).

The timing of herbicide application on leafy spurge is important for optimum control and is based on the morphological and physiological development of the plant. Leafy spurge control with 2,4-D, Banvel or Tordon is best either when flowers and seed are developing during early summer growth (mid-June to mid-July) or when fall regrowth has developed but before a killing frost. The plant begins a dormant period after seed dispersal in mid-July and most leaves fall from the stem. The dormant stage usually coincides with hot dry weather of mid-summer and continues until new fall growth is stimulated by cooler weather and rainfall in August and early September. Fall growth is characterized by a leafless main stem with two or more branches developing below the original flowering branches. The branches usually are 4 to 6 inches long with small leaves, and the leaves often turn red or yellow as the fall progresses. The plants may appear in poor vigor in late fall, but carbohydrates are being transported to the roots for winter storage.

Leafy spurge control with herbicides generally follows the morphological and physiological development of the plant as described, but plant response to herbicides can vary almost day-by-day with growing conditions. In particular, control declines with low soil moisture and unseasonably high or low temperatures.

Tordon is the most effective herbicide for leafy spurge control. Tordon at 2 pounds per acre applied during seed set in the spring generally gives 90% or better leafy spurge control when evaluated one year following treatment. Control decreases gradually with time following treatment and retreatment will be necessary in two to three years. Forage production in heavy infested pastures can double in the year following treatment.

Tordon at 0.25 to 0.5 pound per acre alone or tank mixed with 2,4-D at 1 pound per acre applied annually will gradually reduce a leafy spurge stand and is less expensive than Tordon at 1 pound per acre or more. Leafy spurge control is generally 50 to 60% after one year. Additional leafy spurge density reductions should be expected from the annual applications until only small infestations remain after three to five years. This treatment program can result in a nearly threefold increase in forage production after the first application and is less injurious to native grass species than Tordon at 2 pounds per acre. The increase in forage production is great enough to provide a positive net income over treatment costs.

Banvel is an alternative to Tordon for leafy spurge control in pasture and rangeland. Banvel at 6 to 8 pounds per acre will give fair to good leafy spurge control for one year but control usually decreases rapidly during the second year. An annual retreatment program is necessary to maintain leafy spurge control. Banvel is less likely to injure grass but has a shorter soil residual than Tordon.

The 2,4-D low volatile ester, oil soluble amine, or water soluble amine at 1 to 2 pounds per acre applied annually will give short term topgrowth control of leafy spurge. Applications of 2,4-D both spring and fall have prevented the spread of leafy spurge but generally have provided only small reductions of stand density. The 2,4-D treatments can result in a 50 to 100% increase in forage production in areas densely infested with leafy spurge, and will provide a positive net income.

Roundup is most effective for leafy spurge control when applied either after seed development in midsummer or after fall regrowth has begun and until a killing frost. Roundup applied during spring growth generally provides less long-term control than 2,4-D, Banvel and Tordon. Roundup is non-selective and generally is applied only in wooded areas where residual herbicides such as Banvel and Tordon cannot be used.

Potential for Biological Control

Leafy spurge is a prime candidate for biological control because several insects and disease pathogens have been found on leafy spurge in Europe which keep the plant in check (Fig. 4). However, leafy spurge is hardy and can spread either by seed or root, so a series of insects and/or diseases that attack the plants roots and shoots at various times during the growing season probably will be needed to control leafy spurge. Research in this area is progressing, but biological control is several years away and will require a large economic input.

The extensive underground root system of leafy spurge and the large number of dormant buds makes this plant difficult to control. However, previously unproductive land can be returned to a productive state if a persistent, well planned leafy spurge management program is followed.

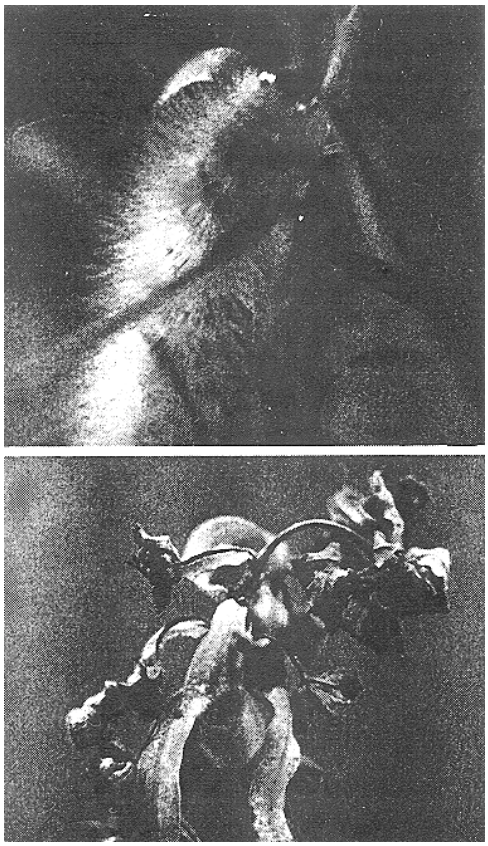

Fig. 4. Biological control of leafy spurge by insects (top) or disease pathogens (bottom) are currently being developed.