Best Management Practices Guide for Control of Leafy Spurge (*Euphorbia esula*): An Integrated Pest Management Approach

Alberta Invasive Species Council (AISC)

This guide was created in 2021/2022 and adapted from the 'Integrated pest management leafy spurge prevention and control' by the Leafy Spurge Stakeholder Group in Manitoba.

Contents

Introduction

Leafy spurge is a non-native, invasive plant species, classified as a noxious weed in Alberta under the Alberta Weed Control Act. Plants listed in this category are considered too widely distributed to eradicate, thus the management objective for this species is containment. The Weed Control Act requires landowners who have leafy spurge on their property to control it from spreading.

Leafy spurge is commonly found in rangeland and riparian areas across Alberta, but primarily in the southern parts of the province. It has been identified as one of the world's worst invasive species (ISSG, 2005) due to its economic and ecological impacts; it spreads rapidly, creating dense monocultures which can displace native plants and harm livestock, primarily cattle and horses, from a milky sap that the entire plant produces.

Control of leafy spurge through chemical means is costly and requires reapplication over multiple years, repeated monitoring and often does not eradicate established infestations. Further, the tendency for leafy spurge to invade riparian area, restricts the use of herbicide and can be difficult to access.

Preventing an invasive species from establishing is the most efficient way to manage them. Controlling leafy spurge once it has been established can prove to be costly and difficult. There are several ways to prevent the introduction and spread of leafy spurge:

- Clean equipment, vehicles, and clothing thoroughly when leaving an infested area of leafy spurge.
- Remove flowering spurge plants from alongside frequently traveled trails or entrances to pastures.
- Avoid driving through or mowing areas where leafy spurge seeds are maturing and turning brown, to prevent the spread.
- Purchase and grow non-invasive or native plants in gardens or natural areas. Be sure to check scientific names and do your research before planting.
- Quarantine livestock that have come from an infested area to allow any seeds or plant parts they may have consumed to pass through their system. The effective quarantine time for sheep and goats is 5-6 days (USDA, 2014). Livestock such as cattle and horses should not be forced to ingest leafy spurge as they are susceptible to the toxins produced by this plant and can become ill (USDA, 2014).
- Purchase certified weed free forage. Visit the Alberta Invasive Species Council's website at www.abinvasives.ca/resources/certified-weed-free-forage/ for more information.
- Avoid using gravel, topsoil, or forage from areas with infestations or from unknown sources.

Identification

Leafy Spurge (*Euphorbia esula)* is an invasive, perennial plant that was introduced from Europe and Asia and is now widespread across North America. Leafy spurge has erect stems that can grow up to 1 meter tall, emerging from a woody crown of deep roots beneath the soil's surface. Multiple stems often emerge from the crown, giving the plant a shrubby appearance. The numerous, blue-green to greenish-grey narrow lance-shaped leaves are arranged alternately along the stem and are hairless and waxy with smooth margins. Leaves become reddish-orange in late summer as the plant senesces. The flowers of leafy spurge are arranged in clusters of flat-topped umbels at the tip of the stem and have showy bright green to yellow satellite-shaped bracts beneath inconspicuous green flowers that give the flower heads a yellowish-green appearance. The distinct yellow-green colour from the flowers and tendency to grow in dense patches allows for quick and easy identification from a great distance.

Leafy spurge reproduces primarily by resprouting from its extensive, creeping root system, as well as by seed. Roots of this plant can extend 4.5 m laterally and 9 m deep, allowing it to form dense stands. Large plants are able to produce up to 130,000 seeds which, when mature and seed pods are dry, can explode and distribute seeds as far as 5 m from the parent plant. All parts of this plant contain a milky latex sap that can poison livestock and cause skin irritation on humans – the sap is a key characteristic for leafy spurge identification.

Impacts of Leafy Spurge

Leafy spurge establishes readily in the sandy loam soils of prairies, especially along riparian areas and has become a costly problem in agriculture. It is toxic to most livestock, including cattle and horses, who will either partially or completely avoid areas infested with the invasive weed. This greatly reduces the carrying capacity of a pasture and can place additional grazing pressure on the surrounding, more palatable vegetation. In terms of the carrying capacity of grazing land for cattle, leafy spurge infestations can greatly reduce the amount of forage available to livestock as well as for wildlife in natural areas. For example, a 40% infestation decreases the carrying capacity of cattle by 50%, and an 80% infestation decreases the carrying capacity of cattle by 100%.

A 2010 economic assessment estimated the annual costs of leafy spurge in Manitoba to be $40 million per year (Ashton and Rempel 2010). This is double the amount researchers estimated this species cost in 1990 and the area infested increased 3.5 times in that same time period (Thompson et al.). These costs are attributed primarily to loss of grazing capacity for livestock and chemical control costs.

Leafy Spurge Life History and Competitive Advantage

Leafy spurge reproduces by seed, as well as vegetatively through its extensive creeping root system, giving it a significant advantage over desirable species. The depth and span of the leafy spurge root system can increase by up to 26 feet (7.9 m) and 15 feet (4.6 m) per year, respectively. What's more, the first shoots of new leafy spurge growth emerge as early as April, earlier than those of most native plants,

giving it a further advantage over other species in its ability to take advantage of available resources such as nutrients and water. The roots also give off a toxin in the surrounding soil, which can inhibit the growth of surrounding vegetation. The yellowish-green, showy bracts, often mistaken for the flowers, start to show around May-early June, with the inconspicuous green flowers appearing afterward in June - July. The round seed pods start green and fleshy then turn brown, with around 140 seeds per stem. The seed pods explode at maturity in late July – August with the higher temperatures and lower humidity, launching seeds up to 15 feet (4.6 m) away. This facilitates spread especially near waterways as the seeds, which can remain viable for 8 -10 years, can then easily be transported by water to new locations.

Due to its highly competitive life cycle, leafy spurge is extremely difficult to control successfully using just one method. For this reason, an integrated pest management approach is essential to controlling infestations. Ideally, several different control methods should be utilized depending on available resources, management goals, size, and location of the infestation. Aside from prevention, all control methods will come with an associated cost. This cost must be taken into account with both the long- and short-term benefits in mind when deciding on a management approach for leafy spurge that works best for your situation. There is no one way to control leafy spurge, and an integrated management approach is essential.

What is Integrated Pest Management?

Integrated Pest Management (IPM) is a multidisciplinary approach to invasive species management that emphasizes the importance of preventing invasive species from establishing; monitoring to determine invasive species presence and abundance; and the use of several management tools for control. The IPM approach will reflect time, funding, labor of participants, land use goals, and values of the community and landowners. IPM incorporates all available information and treatment methods to match the management requirements of a specific site whilst minimizing negative environmental, economic and socials impacts.

Control Options

Any strategy used for managing leafy spurge must involve careful planning as it is a very difficult species to control and is able to withstand various control methods (e.g., chemical, mechanical). In addition, the root system of leafy spurge is extremely well-developed and hardy, the habitat preference makes access and herbicide control near water systems difficult, and some livestock species tend to avoid the plant due to the toxicity of the sap. Regardless of the strategy used, the main components of a successful leafy spurge control strategy will include maintaining repetitive treatment over multiple and consecutive years, using effective grazing practices and periodic monitoring of controlled areas for native plant emergence and spot treatments. Management of leafy spurge will be long term, thus, before deciding which control measure or combination of strategies, there are a few factors to be considered when planning your control strategy:

- Where is the infested area?
- What is the size of the infested area?
- Which crops are grown in and around the infested area?
- What are the costs associated with each control measure?

Biological Control

Biological control, or biocontrol, is the suppression of populations of pests using living organisms. Researchers study invasive plant species in their native ranges to find insects (and other organisms) that rely exclusively on the invasive plant species of interest. Insects feeding on the invasive plant species cause damage and prohibit growth. Biocontrol releases are not always successful in establishing and do not usually eradicate the entire invasive species population, but rather reduces its populations to manageable levels so that native and desirable vegetation can establish**.**

Insects are commonly used as biocontrol agents due to their ability to establish and increase their population on their own once released at a site, making them a very low maintenance and cost-effective option. Prior to releasing new species of biocontrol agent in Alberta, candidate species are studied rigorously to ensure there will be no impacts to off target organisms such as native plants. Therefore, biocontrol is very safe to employ in invasive species management programs. **Please contact your local Agricultural Fieldman and/or the Alberta Invasive Species Council for more information on how to order a biocontrol release for your invasive plant infestation.**

Leafy Spurge Flea Beetle

Two species of leafy spurge beetle, *Aphthona lacertosa* (black leafy spurge beetle) and *A. nigriscutis* (brown leafy spurge beetle) are widely used as biocontrol agents for leafy spurge in Alberta. They are often referred to as flea beetles due to their tendency to jump when disturbed. Although similar in appearance, leafy spurge beetles are neither the same species nor genus as the flea beetles known to cause harm to canola crops. The three main species that attack canola in western Canada are the crucifer flea beetle (*Phyllotreta cruciferae*), the striped flea beetle (*P. striolata*), and the hop flea beetle (*Psylliodes punctulate*).

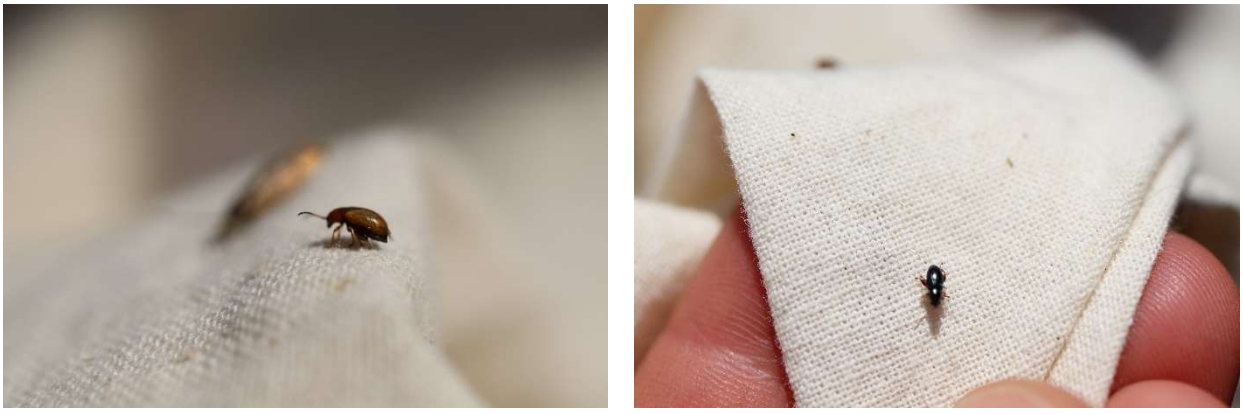

Figure 1. Brown and black leafy spurge beetles (*Apthona nigriscutis* and *A. lacertosa*, respectively).

Releasing leafy spurge beetles on your property: When preparing to release leafy spurge beetles on a patch of invasive leafy spurge, there are a few factors to consider to give your leafy spurge beetles the best change of establishing. Some tips for finding a good release site for leafy spurge beetle:

- **Patch size:** a patch of leafy spurge needs to be adequate in size, but there is no hard rule. Smaller patches may not be worth your time, we recommend a patch at 20m x 20m in size.
- **Shelter:** releasing spurge beetles in sites protected from prevalent winds, we recommend sizes on or at the bottom of east, south and southeast slopes. Beetles will move in the direction of the prevalent wind so prioritize releasing on northwest corners of leafy spurge patches.
- **Sunshine:** avoid tree canopy and release spurge beetles in full sun and/or south facing slopes.
- **Patch edge:** always release spurge beetles on the edge of a leafy spurge infestation to monitor the impact the beetles have and they are the most effective in moderate density patches.
- **Beetle presence**: have spurge beetles been previously released here? If so, it's not a bad idea to add to the existing population, however, are there other sites that would benefit from a release.
- **Avoid sprayed sites:** the spurge beetles need to eat spurge to survive, release beetles at least 10m away from any herbicide treatments or areas that have been treated.
- **Avoid floodplains and saturated soils:** floods will kill larvae who live underground. This can be difficult as many leafy spurge populations exist near water systems – find the highwater mark and try to release the beetle above that point.

Note that if your location does not have all of these characteristics, release and establishment of the beetles is still possible.

Adult leafy spurge beetles emerge when the spurge is flowering and feed on the leaves and flowers limiting the plant's ability to photosynthesize and grow. The *Aphthona* beetles will mate and lay eggs in late summer at the base of leafy spurge plants. The eggs mature into larvae that burrow into the soil to feed on the roots during the winter and emerge as adults in the spring. Adult leafy spurge beetles feed on new leafy spurge foliage and are most active during the hot summer months between mid-June to late July when they reproduce. Since a large portion of the damage to leafy spurge is done by the larvae on the root system, oftentimes the effect this biocontrol agent has above ground is not as obvious until 1-3 years after the release and can be mistaken for ineffectiveness.

Monitoring for establishment of leafy spurge beetles

Damage from leafy spurge beetles may appear above ground as a "halo" of stunted (smaller, non-flowering, or reduced flowering plants) around the original release point, with plants growing back smaller and smaller each season until there is very sparse regrowth in the area. Damage from adult feeding appears early in the season with characteristic pockmarks on leaves and stems, as well as purplish bruising and deformation of stems and foliage. Later in the summer when beetles have been actively feeding, the decimation of new growth on leafy spurge plants as well as clusters of adult beetles on individual plants are visible in well-established populations. Monitoring for leafy spurge beetles can also be done by 'sweeping' leafy spurge plants with a sweep net to collect beetles on warm, sunny days in early July. Note that if initial 'sweeps' result in the collection of no beetles, continue to try over a two-to-three-week period.

a)  b) 

Figure 2a. Damage caused by leafy spurge flea beetle foraging. 2b, An image of the halo around a leafy spurge beetle release site where no leafy spurge is growing. Photo courtesy of Tim Skuse.

Moving leafy spurge beetles to other patches on your property

When a leafy spurge beetle population has established and is actively decreasing their food source, it is advisable to collect and move them to a new location of leafy spurge.

- Beetles are ready to re-locate to a new leafy spurge patch if:
    - you can see many beetles on individual sparse spurge plants, or
    - you can collect at least 5 beetles in one sweep of a net (500 beetles in 5 minutes).
- Either transport the beetles inside a sweep net for short distances or transfer them to a container or bag, ideally not plastic to avoid condensation. If plastic is your only option, please create some holes and tape them over from the inside of the container or bag so it is breathable for the insects – masking tape works well and is still breathable.
- Release the beetles in the new location by inverting the net or container onto spurge plants at the edge of a patch. Do not scatter throughout the patch, as *Aphthona* beetles require a group of individuals in close proximity to establish a population.

Please visit www.abinvasives.ca/biocontrol-release-program/ for a more comprehensive guide on collecting and moving leafy spurge beetles.

Spurge hawk-moth and hornworm

The spurge hawk-moth, *Hyles euphorbiae*, was the most common biocontrol agent for leafy spurge infestations since it was released in the late 1960s in southern Alberta. This biocontrol agent continues to be self-sustaining as populations can still be found. The larval stage or caterpillar is very large and can grow up to 10 cm long, is brightly coloured, starting as green in colour and as it matures, the body turns red-orange, and has a distinct red horn on its back end. Although its effectiveness as a biocontrol agent has proven to be minor, hence the discontinuation of its release, know that it is still having an impact on leafy spurge infestations as it feeds on the foliage and flowers of the plant and remains a good insect to have around when managing leafy spurge.

Figure 3. Spurge hawk-moth, *Hyles euphorbiae,* caterpillar and adult.

Grazing

Grazing is the practice of using livestock species to feed on the invasive plant species instead of their desired vegetation as a form of biological control. Although grazing does not kill the plant itself, it prevents seed production and if grazed intensely, will lead to a depletion of root reserves and plant biomass. Leafy spurge is toxic to most livestock including cattle and horses. However, sheep and goats will readily graze leafy spurge when trained to do so. This can provide effective control of leafy spurge top-growth and seed bank reduction, providing an effective, sustainable, and flexible method of control. Sheep overlap the diet of cattle by 20-40%, and goats overlap it by 5-20% (Leafy Spurge Stakeholder Group, 2007). This means that sheep or goats can be added to a pasture with other livestock without greatly impacting cattle or horse stocking rates. This also means that although sheep and goats readily consume the spurge and can develop a preference for it, a diet of 100% leafy spurge will result in digestive issues a significant decline in performance. A sheep's diet can consist of up to 50% leafy spurge, and a goat's up to 80% before digestive upsets occur. The animals need to be allowed to self-regulate and supplement their diet with other forage species, and therefore should not be restricted to areas with only leafy spurge present as forage.

In 3-5 years, leafy spurge infestations can be reduced by up to 90% by sheep or goats. Goats tend to have a quicker preference for the plant and will consume it more readily than sheep. Sheep often initially show an aversion to leafy spurge, however, if they are "trained" to consume leafy spurge they soon become accustomed to its taste. It is worth noting that mixing flocks of sheep, or bringing in new sheep to control leafy spurge who have not previously been exposed to the taste is often ineffective as sheep usually learn to consume leafy spurge from example by their mothers and peers, and also how to consume amounts that do not cause digestive upset. Additionally, animals brought in from a separate flock or source will tend to graze away from the main flock and therefore have less success in adopting spurge-eating behavior.

The Leafy Spurge Stakeholders Group suggest that continuous grazing has the quickest effect in reducing leafy spurge patches, however, rotational grazing is also a viable option if this works better for your particular operation and management practices. The act of repeated grazing is what eventually kills off the plant, and it has also been shown that repeated grazing at lower stocking rates is far more effective than stocking high numbers of goats or sheep over a shorter period. Your multi-species stocking rates will depend on several factors including:

- How much you are willing to reduce your stocking rates for cattle and/or horses.
- Length of your grazing season.
- Size and density of the leafy spurge infestation in your pasture (ie. it will take more animals to effectively graze 300 stems/m^2 than 30 stems/m^2).
- Amount of brush and shrubs in the pasture – Sheep and especially goats will make up a large portion of their diet in woody browse if available, meaning less of their diet will consist of leafy spurge.

Consider one sheep or goat per one to three acres of leafy spurge, early in the spring to provide an immediate attack on spurge seedlings. If possible, animals should be introduced to heavily infested areas to allow for time to acquire a taste for the plant as there may be an adjustment period of 2-3 weeks before they readily prefer to consume leafy spurge. As the spurge patch decreases, your stocking rate will also need to decrease otherwise there will be overlap with the diet of other livestock. **Grazing is the only control method that can be revenue-neutral or even revenue-generating.** Check with your local Agricultural Fieldman or local sheep and goat grazing associations for more details on how to bring this method to your pastures.

Table 1. Comparison of goat and sheep grazing for control of leafy spurge.

Sheep	Goats
• More aversive to leafy spurge until taste for it is developed • Need to be taught by experienced sheep how to consume leafy spurge • Overlap diet of cattle by 20-40% • Diet can consist of up to 50% spurge before digestive upset • More complex social structure • Require less intensive herding and containment than goats	• More readily develop a taste for leafy spurge • More readily consume leafy spurge • Overlap diet of cattle by 5-20% • Diet can consist of up to 80% spurge before digestive upset • Will consume more brush than spurge if available • Escape artists - require higher and tighter fencing or more intensive shepherding than sheep

Cultivation

Leafy spurge can reproduce through root fragments and so cultivation should be implemented with caution. Cultivation should only be considered in areas where it is a common agronomic practice.

Cultivation is most effective when used repeatedly throughout the season (see intensive cultivation method), or once or twice in the fall (see fall-only cultivation method). Both methods will need to be carried out consistently for at least 3-4 consecutive years to be effective, and if done improperly or if care is not taken to prevent the spreading of seed or plant fragments, cultivation can facilitate further spread of the leafy spurge infestation. Cultivation should be at least 4 inches deep.

Intensive Cultivation programs should begin two to four weeks after leafy spurge emerges in the spring. Till at least four inches deep every three weeks until the soil freezes for one or two years.

Fall-only cultivation should be done when the re-growth of leafy spurge is three to six inches tall and should be repeated for three years. Growing crops that are competitive with leafy spurge such as perennial forages that are well adapted to your area, will help keep the growth of infestation down. There is evidence that fertilizing established grasses in the spring or fall may help to combat spurge as well because the shallower roots of the grasses will be able to access the nutrients before the deeper roots of the leafy spurge.

Hand pulling/digging

This method can be effective in reducing the seed output but will not affect the extensive root system. It is only useful on very small, new infestations and with consistent, repeated use. Wear gloves and wash hands to avoid skin irritation from the latex sap exuded by the plant.

Mowing

Mowing can be effective in reducing seed output if done regularly and with correct timing, however, mowing alone is ineffective for control of leafy spurge as the plant will continue to spread through its creeping root system. Mowing should be done every 2 to 4 weeks, ensuring it is only done during the early flowering stage, before seeds turn brown as mowing past this stage will lead to seed spread. It is also critical that all mowing equipment is thoroughly cleaned before being transported to avoid spreading the infestation.

Chemical Control

For chemical control of leafy spurge to be effective, timing and regularly repeated treatments are critical otherwise the plant will rapidly re-infest. It is important to note that ***no single herbicide treatment will work to fully control leafy spurge.*** Caught early enough and with proper application, herbicides can be used to eliminate or greatly reduce small patches of leafy spurge. Spraying at least 15 feet further than the visible perimeter of an infestation (if the location allows) will help to control any smaller plants growing near the edge. 2,4-D, Amitrol, Dicamba, Imazapyr, MCPA, and Picloram are all registered for use on leafy spurge. Always check product labels to ensure the herbicide is registered for use on the target plant in Canada by the Pest Management Regulatory Agency. Always read and follow label directions.

Although chemical control has traditionally been used as a reliable and integral part of weed control, this has not necessarily proven true in the case of leafy spurge. With continued use, resistance to certain herbicides can develop within infestations leading to a higher cost for control and generally decreased effectiveness over time. Utilizing herbicides from different groups can be a way to combat this issue and can help to cut costs as well as increase the efficiency in controlling leafy spurge while decreasing

potentially harmful side effects. Consult your local Agricultural Fieldman or Certified Pesticide Dispenser for more information. Like all control methods, herbicides are most effective when used in combination with other control methods as part of an Integrated Pest Management approach.

Integrated Pest Management (IPM) Strategies

As a multidisciplinary approach to invasive species management, IPM emphasizes the importance of using several management tools for control. Combining two or more of the above control methods (biological, mechanical, physical, chemical and cultural) will provide the best chance of success for controlling leafy spurge and minimize adverse impacts on non-target species, however, this will be based on your own preferences, size of the problem and accessibility of the leafy spurge.

Always remember: Managing invasive plants is an ongoing process – results are not immediate and take time and commitment. Once you decide on a management plan, it is important to stick with it. **Do not give up!**

Management of leafy spurge can be a long-term commitment, requires control measures to be implemented consistently and may not show immediate results - creating a management plan will allow you to set goals, objectives and actions for effective management of leafy spurge. Elements to consider for your management plan may include the following:

- Prevention of invasive species on your property
- Identifying the invasive species on your property and establish management goals
- Identify and prioritize species that may interfere with management goals
- Assess control techniques
- Develop and implement management plan
- Monitor and assess impacts of management options and actions
- Review management goals, control priorities and techniques to determine success

Below are some combinations that may work for your operation; however, flexibility should also be built into your management plan to allow for unanticipated field conditions or barriers that may arise. Consult your local Agricultural Fieldman to create a plan that works best for you and your property.

Table 2. Overview of control options for leafy spurge.

Control	Timing	Size of Infestation	Target location on patch	Special considerations	Impacts to the plant
Biocontrol	Releases and monitoring in early to mid-July.	Established infestations at least 20 m by 20 m.	Release beetles on the upwind side of the patch.	Consider a buffer of at least 10 m from an establishing	Leafy spurge flea beetles feed on the roots as larvae and the plants foliage as

				population of beetles and an area intended for herbicide use.	adults, weakening the plant by reducing its ability to photosynthesize.
Herbicide	Spray before June 15 or after August 15th when the beetles are not active.	Any.	Do not spray leafy spurge at the side of a biocontrol release. Herbicide applications can be conducted to control leafy spurge on the outer edge of the non-release side of the patch.	Herbicide use on the outer edge of a leafy spurge infestation. Grazing will leave infestations susceptible to a late-season treatment with herbicides such as 2,4-D + Picloram.	Herbicide can impact the entire plant.
Mowing	Every two to four weeks throughout the growing season to weaken the plant by reducing its ability to photosynthesize.	Small, isolated patches.	Do not mow leafy spurge at the site of a biocontrol release. The leafy spurge flea beetles need to have leafy spurge to eat to maintain their populations.		Mowing can prevent seed production when timed properly and can weaken the plant by reducing its ability to photosynthesize.
Hand-pulling	Continuous throughout the growing season.	Small, isolated patches.			Hand-pulling can prevent seed production when timed properly and will weaken the plant by preventing its ability to photosynthesize.
Cultivation	Intense – continuous	Any.	All.	Use this control	Cultivation may prevent seed

	throughout the growing season; or fall only.			method with caution; best for use in cultivated fields; till four inches deep. Herbicide use at least 7 days before fall cultivation will reduce intensity of cultivation required.	production when timed properly and will weaken the plant by reducing its ability to photosynthesize.
Grazing	Continuous or rotational.	Stocking rate of one sheep or goat per one to three acres of leafy spurge.	All.	Goat and sheep can be trained to forage on leafy spurge. Horses and cattle tend to avoid feeding on the plant due to the toxic latex substance found in leafy spurge.	Grazing will weaken the plant by reducing its ability to photosynthesize.

No one method is going to eradicate leafy spurge, but combing and taking an integrated management approach will reduce and prevent it from spreading on your property and further. Management of leafy spurge is a long-term battle and requires monitoring and review to adapt and modify your plans as the population of leafy spurge changes.

Case Study: Integrated Pest Management of Leafy Spurge on the Waldron Ranch in Southwestern Alberta

Success is possible for management of leafy spurge as displayed in the case of the Waldron Ranch in Southwestern Alberta. The Waldron Ranch is a grazing cooperative encompassing 65,000 acres in southwestern Alberta. The ranch is exclusively for cattle grazing.

Mike Roberts was hired as Manager of the Waldron Ranch in 2008. At that time, the leafy spurge infestations were out of control. The plant was taking over parts of the ranch and reducing the available forage for cattle as leafy spurge is unpalatable and can be toxic to cattle and horses. The ranch had been dealing with leafy spurge for over 40 years and was spending $13,000 to $15,000 per year for herbicide applications that were largely ineffective.

In 2009 and 2010 the Municipal District of Ranchland and Pincher Creek pitched in and sent Mike and the Chairman of the Waldron Grazing Co-op Board to a weed symposium in Montana to learn about controlling leafy spurge with sheep grazing: an integrated pest management strategy.

Upon their return, a plan was devised to work with the local Hutterite Colony that needed pasture for their sheep. The Waldron Ranch is paid $0.20/day per ewe for three months out of the growing season and they use the revenue generated to pay for herders and materials to move the sheep around. The Waldron Ranch usually profits between $1,500 and $1,800 per year from this arrangement.

Additionally, leafy spurge flea beetles were released on the Waldron Ranch. Flea beetles exhibit jumping behaviour (similar to fleas) and it's believed that they jump onto the sheep and are distributed throughout the Ranch by hitching a ride on them, thereby effectively and at no cost, spreading beetle populations to new patches on the property.

The leafy spurge infestations are still present on the ranch but have decreased considerably and are no longer growing. Ultimately, the Waldron Ranch turned a liability (leafy spurge infestation, annual control costs) into an asset (net profits from the sheep grazing partnership with the Hutterites). The approach of using insect biocontrol agents in combination with the grazing of leafy spurge has been proven very effective.

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