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Ecology and Management of Common St. Johnswort (*Hypericum perforatum* L.)

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Figure 1. Common St. Johnswort flowers bloom around mid-summer.

Abstract

Common St. Johnswort is a perennial weed accidentally and intentionally introduced to North America from Europe. It is a member of the Clusiaceae family and also bares the common names St. John's wort, goatweed, and Klamath weed. Common St. Johnswort is perennial, relatively long-lived, and reproduces by short rhizomes that initiate from the stem base and by seed. Seeds can survive in the soil for ten years.

Herbarium records indicate that populations of common St. Johnswort in Montana were first reported from Gallatin County in 1905 and as of 2007 have been reported from 26 of Montana's 56 counties infesting an estimated 68,065 acres. It is recognized as an economically important pest in temperate regions world wide and has a long and storied history as a medicinal plant. It invades foothill rangeland, pastures, and open forest sites where it reduces available forage to livestock and wildlife and poses a threat of poisoning. It also occurs in riparian areas, along roadsides, and along railroad rights-of-way.

Common St. Johnswort can be controlled using picloram (one to two quarts Tordon® per acre) or metsulfuron (one ounce Escort® or Cimarron® per acre) applied to actively growing plants before bloom. Grazing management of common St. Johnswort with all species of livestock is risky because it contains hypericin which causes blistering of skin of grazing animals that consume it and are exposed to the sun. In extreme cases, affected parts of the mouth may prevent animals from drinking and foraging. Five insects are available for biological control of common St. Johnswort. The release of two foliar feeding beetles in 1945 and 1946, *Chrysolina hyperici* and *C. quadrigemina,* were the first attempt at biological control using insects in the United States and were very successful in reducing St. Johnswort populations in California.

PLANT BIOLOGY

Taxonomy

Common St. Johnswort is in the Clusiaceae family, formerly called the Hypericaceae. The name *Hypericum perforatum* was applied by Linnaeus in 1753 in his publication *Species Plantarum*. The genus name *Hypericum* is derived from the old Greek, *Hyperikon,* recorded by Dioscorides meaning "a plant from the heath." Supposedly this is because it grew in heath habitats. The species name p*erforatum* refers to the translucent glands on the leaves that appear as minute perforations. There are no varieties or sub-species recognized in the North American Pacific Northwest. However, two sub-species have been recognized by European taxonomists. Plants from populations of common St. Johnswort in western North America and Australia where it is a more serious problem are taller than in Britain and eastern Canada where they are not as weedy. Two types of common St. Johnswort have been indicated in eastern Canada, one growing on acidic soils and one growing on calcareous soils. There are three native *Hypericum* species found in Montana that can be distinguished from *H. perforatum* during flowering. Hybrids of *H. perforatum* with other *Hypericum* species have been named in Europe but no hybridization is known to occur in North America.

Identification

Common St. Johnswort is an erect herb that grows from one up to three feet (0.3-1.0 m) tall. Individual plants can produce many stems and the stems can have many branches. Stems are two-sided with black glands along the ridges, hairless (glabrous), and there are distinct dark rings located at the lower nodes. The stems dry to a rusty red color in the fall, can remain upright throughout the winter, and can accumulate over time (see Figure 2).

Figure 2. An infestation of common St. Johnswort on a south-facing slope as seen in early spring is indicated by the rust colored stems from the previous years' growth.

The leaves are small (less than one-half inch long), hairless, oblong in shape, and bright green in color. They are simple, with entire or with weakly-wavy margins or rounded teeth. They are oppositely arranged on the stem, and they attach directly to the stem without a petiole (sessile, see Figures 3 and 4). There are glands throughout the leaves that appear as translucent dots when viewed as the leaf is held up to light. There can also be black glands on the ventral leaf surface.

Figure 3. Stems, leaves and flowers of common St. Johnswort.

The flowers are bright yellow and showy (see Figures 1 and 5). There are five green, linear-lanceolate sepals 5 by 1 mm, and five 14 by 8 mm irregularly-shaped yellow petals. The petals have black glandular dots along the margins. There are many stamens and one pistil with a three-parted style. The ovary is three celled. The flowers are heliotropic, tracking the sun from east to west as it crosses the sky. The flowers are arranged in short, broad and somewhat flat-topped cymes at the branch ends. The fruit is a capsule that contains many small (1.1 by 0.5 mm) cylindrical, black, seeds that are pitted in longitudinal rows. Seeds have a gelatinous seed coat that may aid in dispersal by animals.

Figure 4. Leaves of common St. Johnswort.

Common St. Johnswort can be distinguished from the native *Hypericum* species by the flower characteristics. *Hypericum majus* found in wet places in the northwest part of Montana and *H. anagalloides* reported from Missoula and Ravalli Counties, both have shorter petals (2 to 7 mm long) than *H. perforatum*, the petals lack black glandular dots, and the ovary is one celled. *Hypericum formosum* found in moist areas in west and central Montana has sepals that are triangular in shape compared to the linear-lanceolate sepals of *H. perforatum*, and seeds that are more or less striated lengthwise.

Figure 5. The population of common St. Johnswort pictured in Figure 2 blooming in mid-July.

Life History

Common St. Johnswort is a perennial. It has been listed as a hemicryptophyte, which means that the over-wintering buds are at the soil surface. The buds can form rosettes in the spring and also rhizomes that originate from the stem base in response to defoliation and mechanical disturbance. Its root system is capable of penetrating deeply into the soil enabling it to be invasive in rangeland with dry summers. Rhizomes develop under poor growing conditions.

Vegetative growth begins early in the spring and gives common St. Johnswort a competitive advantage over later emerging plants (see Figure 6). Vegetative growth is completed by mid-summer when soil moisture is limited. Common St. Johnswort populations form a dense canopy up to three feet (1 m) tall. Vegetative reproduction is stimulated by grazing, fire, and defoliation.

Figure 6. Vegetative growth of common St. Johnswort in late May

Flowering typically begins in late June and continues into August. Historically, bloom is associated with Mid-Summer Day, June 24. Flowers are pollinated by bees, self-pollinated, or embryos can develop without pollination (apomixis). Seeds mature by the end of August. Stems die and turn a rusty-red color in late summer or early fall when soil moisture becomes limited or after a hard frost. Fall re-growth can be significant when there is fall precipitation.

Common St. Johnswort is a prolific seed producer. Capsules of plants collected in Nova Scotia averaged 73 seeds per capsule and as many as 500 seeds per capsule have been counted. Populations in Idaho averaged 23,350 seeds per plant. Some seeds are capable of germination upon maturity, but percent germination increases with time after maturity. Exposure of seeds to short periods of 212° to 221° F. (100° to 105° C.) increases germination which may facilitate seedling establishment after fire. Germination of seeds was not reduced after burial in the soil for three years, and seeds stored at room temperature for 15 years maintained a 50% germination rate.

Seedlings are characterized by slow growth and are poor competitors with established native perennial grasses and other plants. Seedling flushes have been observed after rainfall, herbicide application, and fire. Seedling mortality of 96-99% where moisture was lacking was reported in Idaho. Garden competition studies showed high seedling mortality of common St. Johnswort when growing with other plant species.

Habitat

Common St. Johnswort grows in open forests, dry rangeland, pastures, along streams and rivers, along roadsides and railroads, and in waste places (see Figures 2 and 5). In Montana, it is commonly found on well-drained gravelly or sandy soils where annual precipitation is between

15 and 30 inches. It is commonly found on sunny hillsides. Disturbance favors its invasion and maintenance of competitive plant communities reduces invasion. In North America it can be found throughout Canada except the far north and in all but the most southern U.S. states. Calcium has been found to reduce seed germination and common St. Johnswort is not common on soils with moderate levels of calcium.

Spread

Historically, common St. Johnswort spreads by escaping garden cultivation. As early as 1696, European settlers brought common St. Johnswort seeds to North America for their gardens because it was valued for its medicinal, spiritual, and magical powers. It had escaped cultivation and spread along roadsides from Maine to Florida by the Revolutionary War. It was brought to California around 1900 and rapidly spread throughout the drier rangelands.

Common St. Johnswort is also believed to be spread by animals. The gelatinous seed coat enables seeds to adhere to fur, and initial infestations reflect animal movement. It is also spread along roadways, railroads, rivers and streams. Rhizome fragments can be spread by tillage.

Impacts

Common St. Johnswort reduces available forage for wildlife and livestock. Its dense canopy and rhizomatous growth reduces the number of forage species and plant diversity, and the amount of forage mass produced. It is toxic at all stages of growth and although livestock usually avoid common St. Johnswort, animals may readily graze young plants when other forage is not available. Livestock poisoning has been reported from Australia, New Zealand, North Africa, and Europe. Common St. Johnswort produces the photodynamic pigment hypericin in the dark glands on the stem, leaves, and flowers. Hypericin is activated by oxygen and visible light. Animals that consume enough hypericin (10^{-7}M, or 1% - 4% of body weight) show symptoms of blistering after exposure to sun light. Areas of light hair or un-pigmented skin are most susceptible and animals with affected areas of the mouth may refuse to feed. Symptoms also include fever, rapid pulse, diarrhea, dermatitis, and excessive salivation. Hypericin remains chemically intact through ingestion, digestion, absorption into the blood, and passage through the liver. It is poisonous only through ingestion. Contaminated hay poses a poisoning threat because hypericin is stable during drying and resistant to heat destruction. Native *Hypericum* species do not produce hypericin.

Common St. Johnswort is a valued medicinal plant species. It was used as a treatment for wounds and was known in England as “balm of the warrior’s wound.” The oil from North American *Hypericum* species was used by Native Americans to heal wounds and to treat consumption. In Europe, common St. Johnswort was used as an astringent, diuretic and sedative. It was used to treat hysteria and many other affections. Recently, hypericin was found to inhibit human immunodeficiency virus.

MANAGEMENT

Biological Control

Currently there are five insect species available for control of common St. Johnswort (see Table 1). This weed has the distinction of being the first target weed species in 1945 and 1946 for control using biological control insects. The Klamath weed beetles, *Chrysoloina hyperici* and *C. quadrigemina,* were very successful in reducing populations of common St. Johnswort in Australia and California. Adult beetles lay eggs on the leaves in the fall or spring. The eggs hatch in six to seven days and the larvae feed on the leaves and flowers, and can completely defoliate plants. Heavy larval feeding in the fall reduces winter survival of common St. Johnswort. Both insects do well in mountainous, open, sunny and warm areas, but *C. hyperici* prefers more moist conditions than *C. quadrigemina*. Neither insect does well in shaded barren or excessively rocky locations.

The St. Johnswort root borer, *Agrilus hyperici*, is a beetle that deposits eggs on the stems from the soil level up to about eight inches (20 cm) in July and August. The larvae feed in the roots from July to May of the following year. They consume the root tissues resulting in stunted plants and reduced flower production. They establish best in dry, mountainous areas. On damp sites, larvae are susceptible to fungal attack. They will attack common St. Johnswort plants growing in the shade.

The St. Johnswort moth, *Aplocera plagiata* (also known as *Anaitis plagiata*) deposits eggs on the foliage in July and the inchworm-like larvae feed on the leaves and flowers through September. Large populations of this insect can defoliate plants and inhibit flower and seed formation. They do well in dry, open areas with sandy, rocky soils, and soils with limestone parent material. They do not thrive in areas receiving high rainfall.

Table 1. Biological control insects for management of common St. Johnswort, the site of attack on the plant, insect life stage for collection, and the collection method for re-distribution.

Insect	Type	Site of Attack	Collection	Collection Method
Agrilus hyperici	beetle	larvae feed in roots	adult	sweep net in July and August
Aplocera plagiata (plagiata)	moth	leaves and flowers	larval	sweep net
Chrysolinia hyperici	beetle	leaves and flowers	adult	sweep net or hand pick
Chrysolinia quadrigemina	beetle	leaves and flowers	adult	Sweep net
Zeuxidiplosis giardi	gall midge	leaf buds	larvae	galled plants

Herbicidal Control [1/]

On pastures and rangeland, common St. Johnswort can be temporarily suppressed by aminopyralid, metsulfuron, picloram, or 2,4-D (see Table 2). Metsulfuron should be applied to actively growing plants in the spring, summer or fall at a rate of 1 ounce product (Escort® or Cimarron®) per acre. A non-ionic surfactant is needed in the spray solution at 0.5% by volume for metsulfuron to be effective. Picloram should be applied at 1 to 2 quarts product (Tordon®) per acre to actively growing plants before bloom. The higher rate should be used to eradicate small populations. To reduce large populations, 1 quart picloram combined with 1 quart 2,4-D (4EC) per acre applied to actively growing plants before bloom is recommended. Pre-bloom foliar applications of 2,4-D at 2 quarts per acre with repeated applications to re-growth can also be used. The ester formulations of 2,4-D are more effective than amine formulations. Aminopyralid should be applied at a rate of 5 to 7 ounces (Milestone®) per acre to plants before bloom. Glyphosate applied at 1 to 2 quarts per acre will kill common St. Johnswort on cropland or where revegetation is planned.

Table 2. Chemical and product name, recommended application rate, soil residual half life, and eco-toxicity of herbicides commonly used to control common St. Johnswort. The eco-toxicity is the lethal concentration of the herbicide when applied in a single dose kills 50 percent of the tested organism (the lower the number the more toxic the herbicide). Follow label guidelines for rangeland use and all other label requirements when applying herbicides to avoid damage to desirable plant species.

Chemical name	Product name	Rate per Acre	Half life (days)	Eco-toxicity (LC_{50}/EC_{50})
2,4-D	Many names	1 to 2 qts.	7	1-10 mg/L
Aminopyralid	Milestone	5 to 7 oz.	30	>100 mg/L
Glyphosate	many names	1 to 2 qts.	32	8.2 mg/L
Metsulfuron	Escort/Cimarron	1 oz.	14-180	>150 mg/L
Picloram	Tordon	1 qt.	90	10-100 mg/L

Hand Pulling

Hand pulling, grubbing, and hoeing may be effective on small populations of common St. Johnswort if it is applied persistently. Hand pulling that removes the short rhizomes will be most effective. Follow-up treatments will be necessary where a persistent seed bank exists.

Mowing

Mowing if applied before bloom will reduce flowering and seed production. Mowing will promote increased vegetative production and will not reduce populations.

[1/] Any mention of products in this publication does not constitute a recommendation by the NRCS. It is a violation of Federal law to use herbicides in a manner inconsistent with their labeling.

Tilling

Common St. Johnswort is not normally a problem in cultivated crop fields because it is controlled by tillage procedures that clean crop fields of weeds. However, because it produces short rhizomes, it is possible to spread common St. Johnswort within a crop field and between fields. An application of glyphosate to common St. Johnswort plants that regenerate from rhizomes or seeds following tillage will reduce it on tilled fields. Cleaning tillage equipment of soil that may contain seeds or rhizomes is recommended after use on fields where common St. Johnswort has been growing and before use on weed-free fields.

Prescribed Burning

Fire favors seed germination and vegetative growth and by itself will not control common St. Johnswort. Prescribed fire on land infested with common St. Johnswort should be combined with other control treatments such as herbicides or biological control.

Grazing Control

Grazing to control common St. Johnswort is not recommended because of the potential for livestock poisoning. Prescribed grazing to maintain the health and competitiveness of pasture and rangeland plant communities is important in preventing and retarding invasion, and to increase the effectiveness of other control treatments.

Cultural Control

Common St. Johnswort seedlings are not strong establishers in healthy productive plant communities. Also, plant competition reduces the invasiveness of common St. Johnswort and increases the effectiveness of control applications. Therefore, practices that increase the competitiveness of desirable plant species such as conservation crop rotation and conservation cover will make the environment less hospitable for common St. Johnswort survival.

Revegetation

Species selected for revegetating disturbed sites and common St. Johnswort infestations should be appropriate for management objectives, adapted to site conditions, and competitive with the weed. Management objectives will determine if introduced or native species are seeded and the combination of species in the seed mix. The environmental conditions of the site including precipitation, soil texture and depth, slope and aspect, will affect species establishment. Refer to Montana Plant Materials Technical Note 46, 'Seeding Rates and Recommended Cultivars,' and Extension Bulletin EB19 'Dryland Pasture Species for Montana and Wyoming' for seeding rate guidance and revegetation species selection. State and area resource specialists can help determine the most appropriate, site-specific species mix and timing of seeding.

In most cases, herbicidal suppression of common St. Johnswort is needed for revegetation of infested lands. The herbicides listed in Table 2 will control common St. Johnswort and reduce competition during the establishment period with little or no injury to emerging grass seedlings. This is especially important for species that are slow to establish like many of the native grasses. However, where herbicides have been applied, chemical carryover should be assessed prior to planting permanent vegetation.

Integrated Pest Management

Integrated pest management is the application of two or more management alternatives so they are complimentary in weed suppression, increase the longevity of control procedures, and improve crop production, or conservation of resources. On small common St. Johnswort populations, aggressive herbicidal control should be combined with cultural practices that strengthen the competitiveness of the plant community. In areas with large scale infestations, herbicides should be used to eradicate small satellite populations and to reduce spread along the invasion front of the parent population. Biological control insects can be used to reduce the parent population and reduce invasiveness. On crop and hay land in rotation, tillage followed by herbicide treatment will be more effective than either treatment applied alone. On disturbed sites, pastures, and rangeland where competitive plants have been lost, revegetation following control of common St. Johnswort will improve the longevity of the control application.

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