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MontGuide

Cheatgrass: Identification, Biology and Integrated Management

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This Montguide describes cheatgrass biological and ecological characteristics. It also provides mechanical, cultural and chemical management options to control this species in crop and non-crop situations.

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CHEATGRASS (*BROMUS TECTORUM* L.), ALSO known as downy brome, military grass, downy cheat and downy bromegrass, is one of the most problematic weeds throughout Montana. As a winter annual grass, cheatgrass is particularly troublesome in continuous winter wheat, winter wheat-fallow rotations, alfalfa, Conservation Reserve Program (CRP) lands, rangelands, fencerows, and railroad right-of-ways. Not only does cheatgrass reduce crop quality and yield, it creates serious fire hazards after it matures in late spring. Although cheatgrass is palatable as spring and fall forage before emergence of seed heads, mature plants decline in forage quality and can injure livestock by causing infection in the eyes or mouth.

Origin and Distribution

Cheatgrass, native to southwestern Asia, was accidentally introduced to North America in several independent events, often through contaminated crop seed and ship ballasts. The first introductions in North America are believed to have been from ship ballast dumps near St. Louis, Missouri. The first report of cheatgrass in western North America came from British Columbia in 1890. Early infestations were often found near wheat fields and railroads, because wheat seed was often contaminated with cheatgrass seed and straw infested with cheatgrass was used as packing material for goods transported via railroad. Cheatgrass now constitutes one of the most problematic weeds in the western U.S., Canada and northern Mexico.

FIGURE 1. A drawing of a cheatgrass plant, enlarged spikelet and seed. (Source USDA PLANTS database, USDA NRCS PLANTS Database)

Cheatgrass spread rapidly through the Intermountain West because it was pre-adapted to the environmental conditions of the region. Even though cheatgrass is known to invade intact native plant communities, improper livestock grazing in the late 1800s, which reduced the vigor of native vegetation, is also believed to have contributed to cheatgrass spread. In addition, cheatgrass colonized homesteads that were abandoned during the Great Depression. By 1950 cheatgrass was widespread and locally abundant in the Intermountain West. In Montana, cheatgrass was first reported in 1898 in Missoula County, and by 1980 every county in the state had reported its presence.

Cheatgrass Identification and Biology

Cheatgrass plants grow from 6 to 24 inches tall, depending on available soil moisture, fertility, and plant competition (Figure 1). At emergence, leaves are brownish-green. Mature plants are red-brown in color and have erect and slender stems. Leaf sheaths and flat, twisting blades are covered with soft hair. Leaves are approximately 1⁄32 inch wide and 2 to 6 inches long. Ligules are short. Panicles are 2 to 6 inches long with slender branches that droop to one side. It has numerous, five-to-eight-flowered spikelets with 3⁄8 to 5⁄8 inch awns that are slender, straight and purple at maturity. Each awn is attached to the lower lemma of a hairy, buff-brown, ½ inch long and narrow seed. The awns stick to the clothing of humans and the hair and fur of animals, which is one way cheatgrass disperses its seeds. Cheatgrass is a prolific seed producer. Seeds become germinable soon after maturation, but typically do not remain viable for more than two or three years. Roots are fibrous, relatively shallow, and grow many hairs which enable the plants to extract soil water very effectively.

Damage and Impacts

As a winter annual, cheatgrass gains a competitive advantage on crops and rangeland species that may not grow very much through the fall and winter and do not begin growth as early in the spring. Soil water depletion is one of the primary mechanisms by which cheatgrass competes with vegetation. This is especially problematic when attempting to revegetate land infested with cheatgrass. As spring precipitation diminishes and summer temperatures rise, perennial grass seedlings may not be big enough to survive, while cheatgrass plants are already producing seed to continue the next generation.

In rangeland, the most profound impact of cheatgrass is its influence on fire regimes. Cheatgrass increases the continuity of fine-textured fuel which promotes larger and more frequent fires. Because the fire return interval is shortened, perennial vegetation is unable to completely recover before the next fire. At the same time, cheatgrass continues to increase, promoting larger and more frequent fires. Perennial vegetation is eventually removed from the system, resulting in a near monoculture of cheatgrass.

In cropland, cheatgrass is particularly problematic in winter wheat-based cropping systems where heavy infestations have the potential to reduce crop yield and quality. It has been estimated that a cheatgrass abundance of 50 plants per square foot can remove soil water to the permanent wilting point to a depth of about 2½ feet, making this weed very competitive for soil water and nutrients. Several factors including a shift from spring wheat to winter wheat production, the widespread adoption of conservation tillage practices, and the use of selective herbicides for the control of wild oat (*Avena fatua* L.) and annual ryegrass (*Lolium multifloram* L.) in wheat have been cited as contributing to the increase in cheatgrass abundance.

How does cheatgrass grow?

Annual plants such as cheatgrass, grow from a seed, then flower, set seed and die every year. Cheatgrass is considered a winter annual plant because it usually germinates in the fall and grows rapidly until cold temperatures arrive. Germination may occur in spring, as well, depending on conditions. Growth may continue through the winter, especially in the root system. In early spring, cheatgrass seedlings resume growth, produce seeds and die sometime between mid-July and early August. Other winter annual weeds include common chickweed (*Stellaria media* (L.) *Vill*.), field pennycress (*Thlaspi arvense* L.), jointed goatgrass (*Aegilops cyclindrica* Host), and shepherd's purse (*Capsella bursa-pastoris* (L.) Medic). Winter annual weeds are particularly problematic in winter annual crops.

Integrated Management of Cheatgrass

Once established, cheatgrass is very persistent. In general, the integration of chemical management tools with cultural practices is recommended for successful control. Because the majority of cheatgrass seeds usually do not remain viable in the seedbank for more than a couple years, preventing seed production in the spring reduces the number of seeds in the soil which may improve the outcome of integrated management. As with other weeds, preventing and minimizing invasion is critical. Practices like prescribed grazing, irrigation management, and nutrient management can help maintain the vigor of desirable species and prevent an increase of cheatgrass.

Integrated Management in Range, Pasture and CRP Systems

Disking and other mechanical control treatments alone are typically not recommended because disturbed soil and a fluffy seedbed usually favor cheatgrass. If mechanical control is used, multiple treatments are required to bury cheatgrass seeds at least four to six inches deep to suppress their germination. Mechanical control followed by chemical application may help to reduce the abundance of cheatgrass seeds in the seedbank.

Roundup® (glyphosate) can be applied at low rates in early spring to suppress competitive growth and seed production of cheatgrass. Care should be taken to only apply glyphosate when desirable vegetation is dormant to avoid risk of injury to those species. Journey® (imazapic + glyphosate) provides pre- and post-emergence control of cheatgrass. Journey is best used in the late summer or fall before or right after cheatgrass emergence and prior to planting desirable species. Plateau® (imazapic) provides control of cheatgrass and its selective activity allows many desirable native grasses and forbs to re-establish after treatment. For the most effective control of cheatgrass, late summer or fall applications of Plateau® herbicide, preemergent to early post-emergent, are recommended. Matrix (rimsulfuron) and Landmark (sulfosulfuron + chlorsulfuron) can be applied in the fall followed by seeding in the spring or applied in the spring following by seeding in the fall. See Table 1 for more details on chemical control.

Prescribed livestock grazing in the spring may be effective in localized areas. Grazing should occur when cheatgrass is tall enough to be accessible to the livestock, but prior to plants turning purplish-red so as to prevent seed production. At least two defoliations each spring are required to keep cheatgrass from producing seed, and grazing is required for a minimum of two consecutive years. Grazing should be carefully monitored to prevent damage to perennial vegetation.

TABLE 1. Examples of herbicides that can be used to manage cheatgrass. Consult herbicide labels for additional rate, application, and safety information. Additional herbicide information can be found at http://www.greenbook.net.

Herbicide Active Ingredient **Trade Name**	**Mode of Action**	**Product per ACRE**	**Application Time or Growth Stage**
Range, Pasture and CRP Systems			
Glyphosate Roundup Pro	Inhibition of EPSP synthase	6 to 12 ounces	Apply early spring prior to seed production and prior to growth of desired perennial grasses
Imazapic + glyphosate Journey	Inhibition of acetolacetate synthase (ALS) and EPSP synthase	16 to 32 ounces	Apply late summer to early fall before or shortly after cheatgrass emergence and prior to planting desirable species
Imazapic Plateau	Inhibition of acetolacetate synthase (ALS)	2 to 12 ounces	Apply late summer to early fall before or shortly after cheatgrass emergence and prior to planting desirable species
Rimsulfuron Matrix	Inhibition of acetolacetate synthase (ALS)	2 to 3 ounces	Apply late summer to early fall before cheatgrass emergence; if planting desirable species, wait until spring
Sulfometuron methyl + chlorsulfuron Landmark	Inhibition of acetolacetate synthase (ALS)	0.75 ounces	Apply late summer to early fall before cheatgrass emergence; if planting desirable species, wait until spring
Cropping Systems			
Alfalfa			
Clethodin Select Max	Inhibition of acetyl CoA carboxylase (ACCase)	9 to 16 ounces	Apply when grasses are 2 to 6 inches tall
Ammonium salt of imazamox Raptor	Inhibition of acetolacetate synthase (ALS)	4 to 6 ounces	Apply before cheatgrass is 3 inches tall
Clearfield® Wheat			
Ammonium salt of imazamox Beyond	Inhibition of acetolacetate synthase (ALS)	4 to 6 ounces	Apply when cheatgrass has 1 to 5 leaves and no more than 2 tillers
Imazamox + MCPA ClearMax	Inhibition of acetolacetate synthase (ALS) + Auxin Growth Regulator	4 + 8 fl oz Winter wheat: Up to 18 fl oz.	Wheat: 4-leaf to prior to jointing. Weeds: 1 to 3 inches tall.
Winter Wheat			
Propoxycarbazone-sodium + mesosulfuron-methyl Olympus Flex	Inhibition of acetolacetate synthase (ALS)	3½ ounces	Apply from wheat emergence up to jointing
Sulfosulfuron Maverick	Inhibition of acetolacetate synthase (ALS)	⅔ ounces – Fall or ⅜ ounces – Fall + ⅜ ounces – Spring	Crop stage: apply from 2 leaf up to jointing
Pyroxsulam Power Flex	Inhibition of acetolacetate synthase (ALS)	3½ ounces	Crop stage: apply from 3 leaf up to jointing
Spring Wheat			
Pyroxsulam + florasulam + fluroxypyr GoldSky	Inhibition of acetolacetate synthase (ALS) + Inhibition of acetolacetate synthase (ALS) + Synthetic Auxin	1 pt (0.21 oz + 0.04 oz + 1.42 oz)	Wheat: Up to jointing. Cheatgrass: Up to 2 tillers
Fallow			
Dicamba and *Glyphosate* Fallow Master Broad Spectrum	Action like indole acetic acid (synthetic auxins) and inhibition of EPSP synthase	32 ounces	Apply before cheatgrass is 6 inches tall
Peas and Lentils			
Imazamox ammonium salt Raptor	Inhibition of acetolacetate synthase ALS (acetohydroxyacid synthase AHAS)	4 ounces	Apply before cheatgrass is 3 inches tall

When cheatgrass forms extensive stands that are nearly monospecific, revegetation of infested stands in combination with control measures is imperative. Prescribed livestock grazing may be used to reduce the vigor of cheatgrass plants and seed bank populations. Disking the soil to stimulate cheatgrass germination, then disking or spraying to kill new seedlings, followed by soil firming and drill or broadcast seeding of desired species can also help restore invaded sites. Pasture and CRP seedings should be preceded with an appropriate cover crop to allow cheatgrass control prior to seeding the permanent vegetation. Integrating seeding along with a herbicide application may streamline the revegetation process, but care must be taken to seed species that are tolerant to any herbicide.

Prescribed fire is typically not recommended for controlling cheatgrass as fire will most likely increase cheatgrass populations. However, some success has been observed when burning cheatgrass or Japanese brome before seed set and/or seed rain. No biological control agents currently exist for control of cheatgrass, but researchers continue to investigate soil fungi and bacteria as potential agents.

Integrated Management in Small Cereals Systems

Preventing the production of cheatgrass seeds is one of the best approaches to reduce its abundance in subsequent winter wheat crops. Other approaches include diversifying crop rotation and enhancing crop competitiveness by increasing seeding rate and decreasing row spacing. Finally, banding N fertilization enhances crop competitiveness, thus decreasing cheatgrass growth.

There are several chemical management options to reduce the abundance and impact of cheatgrass. Among them Maverick® (sulfosulfuron), Beyond® (imazamox), Olympus™ 70WDG (propoxycarbazone), Olympus Flex™ (propoxycarbazone), and PowerFlex™ (pyroxsulam) are registered for selective herbicides that provide suppression or control of cheatgrass in winter wheat (Table 1).

To be effective, herbicides should be applied to actively growing cheatgrass seedlings. Products that have soil activity (Maverick®, Olympus™ and PowerFlex™) require moisture after application to act properly. Beyond® and ClearMax® herbicides must be used with cultivars that contain the gene that confers tolerance to imazamox as part of the Clearfield® Production System. Tolerance to imazamox means that the crop with the gene is able to withstand a recommended rate of Beyond® or ClearMax® with minimal risk of crop injury. Varieties that do not contain this gene are either killed or seriously injured by these herbicides.

Preventing Herbicide Resistance

Herbicide resistance is the innate ability of a weed biotype to survive and reproduce after treatment with a herbicide dose that would normally be lethal. In Montana, no herbicide resistant cheatgrass biotypes have been found. However, biotypes resistant to ALS herbicides (inhibitors of the acetolactate synthase enzyme) have been selected in Oregon. Other cases of herbicide resistance in cheatgrass include Ureas and Amides (Spain), and Photosystem II inhibitors (Spain and France). To reduce the risk of selecting herbicide resistant biotypes, producers should rotate among herbicides with different sites of action. Also, producers should rotate management practices, such as the incorporation of timely cultivation. Finally, crop rotation is an excellent tool to reduce the selective pressure on herbicide resistant weeds. More information can be found in Montguide MT200506AG, *Preventing and Managing Herbicide-resistant Weeds in Montana*.

Note: Information in this document is provided for educational purposes only. Reference to commercial products or trade names does not imply an endorsement of them by MSU Extension. Common chemical and trade names are used in this publication for clarity by the reader. Inclusion of a common chemical or trade name does not imply endorsement of that particular product or brand of herbicide and exclusion does not imply non-approval. This publication is not intended to replace the product label.

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