Crop Profile for Barley in Colorado

Prepared: September, 2000
Revised: September, 2002

Hordeum vulgare (Poaceae)

General Production Information

Colorado facts

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<tr>
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Data from 1997-2001 Colorado Agricultural Statistics Services

Description of Crop

Barley is a cool season grain crop used for feed, malting and seed. Malting barley has a higher economic value than barley grown for feed. Between 80-85% of the barley grown in Colorado is grown in south-central Colorado, in the San Luis Valley.

Cropping System

Barley should be planted as soon as the frost is off the ground to permit crop development prior to aphid flights, and to avoid other insects and diseases. In the San Luis Valley, the last frost is usually in June and precipitation starts in April. Barley is planted in the fall from Sept. 1 to Oct. 15 and in the spring from Mar.15 to Apr. 30. Optimal seed germination temperatures are 55 - 70 F. Barley requires a minimum soil temperature of 40 F, with optimal growth rates occurring at 70 F. Temperatures above 90 F impede barley growth. Barley is planted into a firm seed bed (for consistent drill depths) 0.5 - 1.5" deep with 6 - 10" row widths. Planting depth for cold, spring soils is 0.5 - 0.75". Eighty to one hundred
pounds of seed, or 700,000 - 1,000,000 plants per acre, is the average planting density. Minimum to conventional tillage is used during planting.

It is not recommended to rotate barley (malting, spring or feed) directly with other small grains because of the possibility of disease and pest problems. Instead, rotate barley with alfalfa, sugarbeets, corn, beans, or potatoes. Barley usually follows sugarbeets, corn or potatoes.

A general fertilizer recommendation is 110-80-80. Fertilizer is placed in the top 6" of the soil for early season availability. Late season nitrogen is less beneficial to the crop and causes lodging, reduces the plumpness of the grain and increases the protein content of the grain. Nitrogen management in malting barley is critical to avoid excess grain protein. A higher carbohydrate/protein ratio is desired in malting barley. Barley grown for feed may not need large amounts of nitrogen. Nitrogen is only needed to balance the soil. Phosphorous is a key addition to increase yields.

Although barley grown for feed is primarily a dryland crop, in the San Luis Valley both malting barley and barley grown for feed are irrigated (sprinkler). To increase the potential yields of malting barley, irrigation is important prior to critical growth stages such as tillering, stem elongation and grain fill.

Optimal harvest is between July 20 and August 1 for fall-sown barley and between August 1 and Sept. 20 for spring sown in the Front Range area, whereas it is early to late August in the San Luis Valley. Harvest must occur before the head shatters or sprouts, and when the moisture level of the plant is below 13%. Barley can be directly combined, but if the crop has matured unevenly, it must be windrowed, then combined. A slower cylinder speed must be used for malting barley to reduce kernel damage.

There are many pest problems when barley is stored. It is important to spray barley storage bins when previous stored grain was infested with insects. When producing barley for beer, an approved pesticide should be applied five or more days before storage of new grain to avoid pesticide residue that might inhibit yeast production. When storage is planned for long time intervals, aeration is important as it evens out the moisture, cools the grain and helps to reduce hot spots. If an infestation occurs and treatment is warranted, fumigation may be necessary. Buyers must be checked with before use of any storage pesticides or additives for preservation that may prohibit the use of the grain. Storage construction and management practices such as sanitation are the most important aspects of post harvest protection.

Barley will tolerate higher levels of soil salinity than most crops.

**Location of production**

Northwest

Boulder, Garfield,
Larimer, Moffat, Rio Blanco, Routt

**Northeast**

Adams, Kit Carson, Logan, Morgan, Phillips, Sedgwick, Washington, Yuma, Weld

**Southeast**

Arapahoe, Baca, Prowers, Pueblo

**Southwest**

Alamosa, Conejos, Costilla, La Plata, Mesa, Montrose

Rio Grande, Saguache

**Note:** Shaded boxes indicate counties where the crop is grown. Regions have been delineated by Interstate I-70 and I-25.

### Insect Pests

#### Key Insects

**Army Cutworm, *Euxoa auxiliaris***

Army cutworm is one of several species of caterpillars that attack small grains in Colorado. Adult moths are brown with light brown or black markings on the forewings and have a wingspan of about 2". Larvae vary in color from dull green to brown with faint stripes on the back and have brown heads. Army cutworms produce one generation per year. Eggs hatch in the fall with sufficient moisture. Army cutworm larvae spend the winter as partially grown caterpillars. They feed only on warm days in the winter; feeding is more frequent in the spring. Army cutworms always feed above ground during the night and/or on cloudy days. They are found under soil clods and other debris during the day. Cutworm larvae build small pupation chambers several inches below the soil surface. Moths emerge in May and
June and migrate to higher elevations in the Rocky Mountains to escape high summertime temperatures. During May and June, the adults can be a major nuisance in households and are referred to as Miller moths. In late summer and early fall the moths return to the plains to lay their eggs in wheat fields and in other cultivated areas. With adequate moisture, eggs hatch and larvae of the next generation begin feeding as weather conditions permit. Army cutworm caterpillars feed on plant foliage. Their feeding has the most effect on yield only when there is relatively little foliage for them to feed on, increasing the likelihood of damage to the crown.

**Armyworm, Pseudaletia unipuncta**

In Colorado, the armyworm is mainly a pest of spring grains. Armyworms occur in all production areas of the state. Mature larvae are about 1.5" long, smooth-bodied, and dark gray to greenish-black. They are characterized by five stripes running the length of the body, three on the back and two on the sides. Stripes on the back vary in color, whereas the stripes on the sides are pale orange with a white outline. The head capsule is remarkable for its "honeycomb" of black markings. The armyworm is unable to survive Colorado winters. Instead, armyworm moths migrate into Colorado in early summer. They lay their eggs in rows or clusters on the lower leaves of various grass crops. Dense grassy vegetation is preferred for oviposition (egg laying). Newly hatched larvae move with a looping (inchworm) action. Larvae feed at night and on cloudy days, and hide under crop debris during sunny periods. One or more generations may occur each year. Armyworms feed on leaves, kernels, and beards of barley heads. Their most important and obvious damage to barley is by clipping the heads.

**Cereal Leaf Beetle, Oulema melanopus**

Adult cereal leaf beetles are about 3/16" long, with a metallic blue head and wing covers, a red pronotum (neck) and orange-yellow legs. *Colops* spp. is the most common beetle confused with the cereal leaf beetle. However, it is a dull dark blue rather than a bright metallic blue and is about 1.5 times larger than the cereal leaf beetle. Adult cereal leaf beetles are very active during the cool parts of the day, and evening, but may disappear during the heat of the day. They fall off the plant when disturbed. Adult beetles prefer to feed on actively growing leaves. They chew completely through the leaf, between the veins, resulting in a linear streaking of the leaf. Larvae feed only on the upper surfaces of the leaf. Larvae feeding is distinguished from adult feeding because it is wider and limited to the upper part of the leaf. Beetles become active when temperatures are above 50F. Females mate in spring and lay eggs about two weeks later. One female lays over 300 eggs over a six week period. Eggs hatch in 4-23 days and the larvae feed for 10-21 days before crawling down the plant to pupate in the top two inches of soil. Cereal leaf beetles have been controlled biologically in many states, but strains adapted to western conditions have only recently been identified. Biological control will be an important management tool for cereal leaf beetle in Colorado.

**Russian Wheat Aphid, Diuraphis noxia**

Russian wheat aphid (RWA) is one of the most destructive insect pests in Colorado. RWA damages
barley by injecting saliva into and sucking sap from plants. Yield losses due to Russian wheat aphid damage are 50% or more if economic infestations are left untreated. RWA are yellow-green or gray-green and are often covered with wax. RWA are small, less than 0.09" in length, and are convex and elongate. The two forms of RWA are found in Colorado during the year are wingless and winged females. In Colorado, most severe spring infestations are caused by wingless aphids. Winged aphids begin to appear in Colorado in April and May and flights peak in July. At this time winged aphids include both local aphids and immigrants from the south. Winged aphids infest late maturing winter wheat and spring grains. Grasses serve as alternate hosts for RWA during the period between grain harvest. Weather conditions that favor cool season grasses and volunteers will increase the number of aphid infestations. Aphid feeding prevents young leaves from unrolling. RWA colonies are found within the tubes formed by these tightly curled leaves. This not only makes it difficult to achieve good insecticide coverage, but also interferes with the ability of predaceous and parasitic insects to reach and attack aphids. Leaves infested by RWA have long white, purple or yellowish streaks. Heavily infested plants are stunted and some may appear prostrate or flattened. Cultural controls used to reduce RWA include: control of volunteer wheat and barley, adjusting planting dates, and maintaining healthy, stress-free crops. Applications of carbofuran, chloropyrifos, dimethoate, disulfoton, imidacloprid, lambda-cyhalothrin, methyl parathion, phorate, and thiamethoxam can all control RWA, but should not be applied until the economic threshold has been surpassed.

### Say's Stink Bug, *Chlorochroa sayi*

Say's stink bugs are large insects with a triangular-shaped thorax (body). Adults are green during the summer and fade to brown or gray in the fall. Females lay small, cylindrical eggs in groups on plant surfaces which later hatch into nymphs. Nymphs appear as small, underdeveloped adults and go through metamorphosis (gradual transformation) for three to four weeks as they turn into adults. Stink bugs overwinter as adults underneath plant debris. Generally, there is only one generation per year in the northern areas. Both nymphs and adults have piercing mouthparts which they insert into plant tissue and suck out juices. They prefer developing grains of barley, wheat, and other grasses. Shriveled and deformed grains result from this feeding. Stem damage can result in sterile, sun-bleached heads. Three to four adult stink bugs per 100 sweeps with a standard insect sweep net (diameter of 15") may warrant an insecticide treatment such as Warrior (lambda cyhalothrin).

### Additional Insects

#### Aphids, Family: *Aphididae*

Aphid life cycles vary with species. Aphids are small, soft-bodied insects found singly or in clusters on stems or on the undersides of leaves. Aphids overwinter as eggs and adults. The tiny aphids hatch in the spring, mature rapidly and give birth - without mating - to living young. Mature aphids fly to cultivated crops during the spring and summer where they form new colonies. Only females are produced during the summer and with their rapid rate of reproduction, it is possible for large numbers to develop in a short period of time. They may be a problem throughout the season. As cool weather approaches in the
fall, both males and females are produced. They mate and lay fertile eggs that overwinter. Aphids attack the leaves, blossoms, pods, and other parts of their host plants, sucking plant juices through their tiny needle-like beaks. Heavily infested plants become stunted and do not produce normal crops. Migrating aphids also transmit several important plant diseases such as barley yellow dwarf. Bird cherry oat aphids vector barley yellow dwarf. Bird cherry-oat aphids, *Rhopalosiphum padi*, are olive-green with a reddish-orange area on their rear end. They are medium sized aphids, 0.05 - 0.10" with long antennae, long dark tube-shaped cornicles, and dark colored legs. The aphids feed on wheat by sucking plant sap.

**Grasshoppers**

Grasshoppers follow roughly a 22-year cycle in Colorado, with the last major outbreak occurring in the late 1970s and early 1980s. Grasshoppers vary considerably depending on the species. Grasshopper nymphs have a similar appearance to adults but are smaller in size. Grasshoppers lay eggs in undisturbed areas, usually in late summer and early fall. Small nymphs or "hoppers" hatch the following spring. Winged adults appear 5 - 6 weeks after eggs hatch. A few Colorado grasshopper species have eggs that hatch in late summer and overwinter as nymphs. Winged adults of these species usually appear early in the following summer, often causing undue alarm about unusually early grasshopper activity. Some of these species are important on rangeland, but none are considered a threat to field crops. The usual pattern of grasshopper damage in field crops is for early development to occur in weedy areas of roadsides, fence rows, irrigation ditches, and other non-crop areas. As these food sources are exhausted or begin to dry down, the grasshoppers leave in search of other food - often an irrigated crop. Here they first feed in the field margins and subsequently spread throughout the field. Most field crop damage is caused by the clearwing, differential, red-legged, two-striped, and migratory grasshoppers.

**Stink Bugs, Nezara viridula**

All adult stink bugs are shield-shaped. Stink bugs are bright green and are 0.55 -0.74" long. The major body regions of the green stink bug are bordered by a narrow, orange-yellow line. When first laid, the barrel-shaped green stink bug eggs are yellow to green, later turning pink to gray. Stink bugs inflict mechanical injury to the seed as well as transmit yeast spot disease. The degree of damage caused by this pest depends to some extent on the developmental stage of the seed when it is pierced by the stink bug's needle-like mouthparts. The younger the seed when damaged, the greater the yield reduction. Stink bugs overwinter as adults and become active in spring when temperatures are above 70F. Each female deposits up to several hundred eggs, usually in mid to late June. These eggs are laid in clusters (averaging 36 eggs) primarily on leaves and stems but also on pods. Nymphs hatch from these eggs and pass through five instars before becoming adults. Approximately five weeks elapse between egg hatch and adult emergence. Stink bugs generally reach high population levels in late September or early October.

**Storage Pests, various**

Weevils, borers, beetles, and moths make up the majority of insect stored-grain pests. In North America,
summer temperatures are relatively low and winters are harsh which reduces the incidence of storage pest problems. The granary weevil, *Sitophilus granarius*, or the rice weevil, *Sitophilus oryzae*, can be major pests in warmer weather. The lesser grain borer, *Rhyzopertha dominica*, is also a common pest and readily distinguished from other pests by its cylindrical shape and small size. There are many types of grain beetles that can infest stored grain. The rusty grain beetle, *Cryptolestes ferrugineus*, is similar to the commonly occurring flat grain beetle, *C. pusillus*, but is more resistant to cold. Some beetles are able to burrow into wooden storage bins and infect new grain when the bins are refilled. The most common moth is the Angoumois grain moth, *Sitotroga cerealella*. Also commonly found are European grain moths, *Nemapogon granella*, are similar to the Angoumois grain moth only not nearly as destructive as the Angoumois grain moth. Additional common storage pests are Indian Meal Moth (*Plodia interpunctella*), Confused flour beetles (*Tribolium confusum*), Long-headed Flour Beetle (*Latheticus oryzae*), and Sawtoothed Grain Beetle (*Oryzaephilus surinamensis*).

### Tarnished Plant Bugs, *Lygus lineolaris*

Tarnished plant bugs have 2 - 5 generations per year, depending on location. It is a true bug with piercing-sucking mouthparts. Adults are 0.23 - 0.25" long, oval and somewhat flattened. They are greenish brown with reddish brown markings on the wings. A distinguishing characteristic is a small but distinct yellow-tipped triangle in the center of the back. They overwinter as adults under leaf litter, stones, and tree bark as well as in other protected places. They become active at the end of April and begin laying eggs on barley. The eggs are about 0.04" long, cream colored and flask shaped. They are laid in plant tissues in such a way that only the small anterior end is visible. Eggs hatch into nymphs about seven days after being laid. Young nymphs are pale green and resemble aphids, except their legs are more robust, their movements are more rapid and they have no abdominal cornicles. Nymphs resemble adults without wings. The damage is caused by the toxin excreted from feeding on the plants, producing yellowing symptoms.

### Key Insect Management Strategies

#### Cultural Controls

Minimal stress during the growing season will encourage healthy barley and reduce the risks of insect infestation. Earlier planted barley will have a chance to establish before aphid populations are at damaging levels. Storage construction (preferably airtight), sanitation, use of clean grain, well-dried seed, and good ventilation are used to ensure stored seed does not have problems with insects. Cultural controls used to reduce Russian wheat aphid (RWA) include: control of volunteer wheat and barley, adjusting planting dates, and maintaining healthy, stress-free crops.

#### Insecticides - (For Storage Pests in Grain)

Target Pests: See storage pests in additional insects section
Pesticide: *bacillus thuringiensis* (Dipel DF)

- Recommended rate for seed: 2.9 oz ai/100 bu (0.37 lb product/100 bu)
- Comments: Apply immediately after harvest unless temperatures are cool, then wait for moth activity

Pesticide: *chlorpyrifos-methyl* (Reldan 4E)

- Recommended rate for seed: 4 fl oz ai/1000 bu (9.2 fl oz product/1000 bu)
- Recommended rate for machinery/facilities: 0.17 pt product/650-1250 sq ft (1.15 fl oz ai/650-1250 sq ft)
- Comments: Manufacturer will cancel as of 2003, Not accepted by European standards

Pesticide: *methoprene* (Diacon II)

- Recommended rate for seed: 1.0-2.0 fl oz ai/1000 bu (3.0-6.1 fl oz product/1000 bu)
- Recommended rate for machinery/facilities: 0.34 fl oz ai/10 cu ft (1 mL/10 cu ft)
- Comments: Concentration of ai 2.5-5.0 ppm on seed application, more than 1 ppm due to resistance in some pests; Not for use with soybeans

Pesticide: *silicon dioxide* (Dryacide Diatomaceous Earth)

- Recommended rate for seed: 870 oz ai/1000 bu (56 lb product/1000 bu)
- Recommended rate for machinery/facilities: 6.2 oz ai/10 cu ft (0.4 lb product/10 cu ft)

**Insecticides - (General)**

Pesticide: *carbofuran* (Furadan 4F)

- Target Pests: Russian wheat aphid, grasshoppers
- Recommended rate: 0.11-0.22 oz ai/1000 row ft (0.25-0.5 oz product/1000 row ft)
- Comments: **24c registration** for grasshoppers, Russian wheat aphid, Wheat curl mite

Pesticide: *disulfoton* (Di-Syston 15G)

- Target Pests: Russian wheat aphid, Bird cherry oat aphid, Corn leaf aphid, English grain aphid, Greenbug
- Recommended rate: 0.25 oz ai/1000 row ft (1.67 oz product/1000 row ft)

Pesticide: *disulfoton* (Di-Syston 8E)
Target Pests: Russian wheat aphid, Bird cherry oat aphid, Corn leaf aphid, English grain aphid, Greenbug
Recommended rate: 6.8-13.6 oz ai/A (8-16 oz product/A)
Comments: Preharvest Interval 30 days (Coors requires 45 days)
Use Data: 1992= rate used- 0.75 lb ai/A
1% of total acres treated
1997= rate used- 0.78 lb ai/A
4% of total acres treated

Pesticide: ethyl parathion (Parathion 8EC)

Target Pests: armyworms, aphids, grasshoppers, stink bugs, cutworms, brown wheat mite
Recommended rate: 3.2-8.5 fl oz ai/A (0.25 to 0.66 pt product/A)
Comments: Preharvest Interval 15 days.
Use Data: 1992= rate used- 0.56 lb ai/A
3% of total acres treated
1997= rate used- 0.75 lb ai/A
2% of total acres treated

Pesticide: imidacloprid (Gaucho 480S)

Target Pests: Russian wheat aphid, Aphids other than Russian wheat aphid, Hessian fly, Wireworms
Recommended rate: 0.4-1.2 oz ai/ 100 lb seed (1-3 oz product/100 lb seed)
Comments: 45 days to graze and feed, May not perform well in dry soil

Pesticide: lambda cyhalothrin (Warrior)

Target Pests: Russian wheat aphid, Cereal leaf beetle, Say's stink bug
Recommended rate: 0.29-0.44 oz ai/A (2.56 - 3.84 oz product/A)
Comments: Preharvest Interval 30 days. Section 18 exemption

Pesticide: malathion (Malathion ULV)

Target Pests: Grasshoppers
Recommended rate: 7.7 fl oz ai/A (8 fl oz product/A)

Pesticide: methyl parathion (Penncap-M)

Target Pests: Stink bugs, aphids, grasshoppers, armyworm
Recommended rate: 3.4-10.0 fl oz ai/A (1-3 pt product/A)
Target Pests: Russian wheat aphid
Recommended rate: 6.7-10.0 oz ai/A (2-3 pt product/A)
Comments: Preharvest Interval 15 days.
Use Data: 1992= rate used- 0.56 lb ai/A
3% of total acres treated
1997= rate used- 0.71 lb ai/A
1% of total acres treated

Pesticide: thiamethoxam (Cruiser 5FS)

- Target Pests: Russian wheat aphid, Aphids other than Russian wheat aphid, Hesssian fly, and Wireworms
- Recommended rate: 0.36-0.63 oz ai/100 lb seed (0.75-1.33 oz product/100 lb seed)
- Comments: Rotation crop restrictions

Weeds

Key Weeds

Black Nightshade, Solanum ptycanthum

Black nightshade, a member of the Nightshade family, is an annual that grows 6 - 24" tall with glabrous, appressed-hairy stems. Black nightshade is a Colorado noxious weed and varies greatly in form and color. Seed leaves of black nightshade are elongate-oval and pointed; the first true leaves are spade-shaped with smooth edges. Lower leaf surfaces are often purple. Berries turn from green to black when mature and the calyx covers only a small part of the fruit surface. Petioles, stems and leaves have some hairs but are not densely hairy or sticky. Leaves are ovate, smooth to wavy-edged and have a tapered tip. Flowers are white to pale blue, 0.25 - 0.4" wide borne in clusters. Flowering occurs from May to October. Seed are the only source of reproduction.

Canada Thistle, Cirsium arvense

Canada thistle, a member of the Sunflower family, was introduced from Europe. It is a creeping perennial which reproduces by seed and fleshy, horizontal roots. Canada thistle is on the Colorado noxious weed list and designated as one of the top ten most widespread weeds causing the greatest economic impact to the State of Colorado. Stems are erect, hollow, smooth and slightly hairy, 1 - 5' tall, simple, and branched at the top. The leaves are set close on the stem, slightly clasping, and dark green. Leaf shape varies widely from oblong to lance-shaped. There are numerous sharp spines on the outer edges of the leaves, branches and main stem. The flowers are small and compact, about 0.75" or less in diameter, and light pink to rose-purple in color, occasionally white. Seed are oblong, flattened, dark brown, and approximately 0.125" long. Canada thistle emerges in April or May in most parts of
Colorado. Infestations are found in cultivated fields, riparian areas, pastures, rangeland, forests, lawns, gardens, roadsides, and waste areas. Because of its seeding habits, vigorous growth, and extensive underground root system, control or eradication is difficult. It is distributed across Colorado in elevations ranging from 4,000 - 9,500'.

**Hairy Nightshade, *Solanum sarrachoides***

Hairy nightshade, a member of the Nightshade family, is an annual. Hairy nightshade is on the Colorado noxious weed list. Leaves have wavy edges, prominent veins and numerous fine, short hairs, especially along the underside of the main vein. Berries are green or yellowish brown when mature, never black. The calyx covers the entire upper surface of the fruit. The pedicels, like stems and leaves, are usually hairy. Mature plants reach about 2' in height.

**Kochia, *Kochia scoparia***

Kochia, a member of the Goosefoot family, is native of Eurasia. It is an annual, reproducing solely by seed. Kochia is also on the Colorado noxious weed list. Flowering occurs from July to October. Stems are erect, round, slender, pale green, branched, and 1 - 6' tall. Leaves are narrow, bright green, hairy, numerous and are attached directly to the stem. Upper leaves are more narrow than lower leaves. Flowers are inconspicuous in the upper leaf axils. Seed are about 0.063" long, wedge-shaped, dull brown, and slightly ribbed. Kochia can be found throughout Colorado up to 8,500' in elevation. It has become a major problem on roadsides, waste areas, and fields that are not cultivated. In the fall, plants become red, later turning brown and breaking away from the root, causing them to tumble over the ground scattering large amounts of seed. Many kochia populations in Colorado are resistant to sulfonylurea, imidazilinone, triazine and benzoic acid herbicides, representing three very different modes of action. Therefore, care should be taken when using herbicides to control kochia. Some alternative herbicides include: fluroxypyr, bromoxynil, MCPA ester, isoxaflutole, pyridate, flufenacet, fomesafen, glyphosate, lactofen and clomazone. It is important to rotate herbicide modes of action to prevent future cases of herbicide resistance.

**Redroot Pigweed, *Amaranthus retroflexus***

Redroot pigweed, a member of the Amaranth family, was introduced from Europe and tropical America. It is an annual that reproduces by seed. The stem is light green, erect, stout, tough, rough-hairy, branched and 1 - 6" tall. The taproot is long, red and somewhat fleshy. Lower leaves are alternate, ovate, about 3 - 6" long, pointed at the tip, dull green, rough-hairy, with prominent ribs and veins. Upper leaves are smaller, narrower, and more lance-shaped. Flowers are small, green, and densely crowded in large, bristly, simple, or branched, terminal or axillary clusters. Redroot pigweed grows in cultivated fields, pastures, roadsides, and waste places in Colorado in elevations up to 8,500'. It is one of the most prominent, nonnative annual plants found in cultivated fields in eastern Colorado. ALS herbicide resistant redroot pigweed is most common in barley produced in corn growing counties. Since spring of 2003, pigweeds have developed dual resistance to triazines and ALS-inhibitors.
**Sunflower, Helianthus annuus**

Sunflower, a member of the Sunflower family, is a native weed. It is an annual, 1 - 10' tall. Stems are erect, simple to branched and rough. Leaves are alternate, simple, rough, and hairy. Ray flowers are yellow to orange-yellow and disk flowers are brown. Flowering is from July to September. Seed are the only source of reproduction.

**Wild Oat, Avena fatua**

Wild oat, a member of the Grass family, is an annual weed, 1- 4' tall with erect, hollow stems. Although oats are grown in Colorado as a crop, the wild species is very different and is on the Colorado noxious weed list. Leaf blades are 0.125 - 0.625" wide with open sheaths and membranous ligules. Seedling leaves twist counterclockwise. The inflorescence is an open panicle, 4 - 18" long, drooping, spikelets contain 2 - 3 florets which disarticulate above the glumes. Seed are yellow to black, narrowly oval, 0.25 - 0.5" long. This species is distinguished from domestic oats by the twisted awn which bends at right angles and a horseshoe-shaped scar at its seed base. Resistance to diclofop-methyl (Hoelon) has been shown in Wild oat populations in barley.

**Additional Weeds**

**Common Lambsquarters, Chenopodium album**

Common lambsquarters, a member of the Goosefoot family, was introduced from Europe. It reproduces by seed. The stem is erect, stout, smooth, grooved, often striped with pink or purple, branched and grows 1 - 6' high. Lower leaves are alternate and ovate. Upper leaves are also alternate, but are more narrow. The flowers are small, green, and crowded in the axils and at the tips of the stems and branches. Common lambsquarters is a succulent, fast-growing plant which rapidly removes moisture from the soil.

**Field Bindweed, Convolvulus arvensis**

Field bindweed, a member of the Morningglory family, is a creeping perennial introduced from Europe. It reproduces by seed and horizontal roots. Field bindweed is on the Colorado noxious weed list as well and is designated one of the top ten most widespread weeds causing the greatest economic impact to the State of Colorado. The stems are smooth, slender, slightly angled, 1 - 4' long and spread thickly over the ground or wind around erect plants and other objects. Leaves are alternate, 1 - 2" long, with great variation in shape. They are somewhat arrow-shaped with spreading, pointed, or blunt lobes at the base. Flowers are bell or trumpet-shaped, white, pink, or variegated, and about 0.75 - 1" in diameter. Flowering is from June to September. Field bindweed is one of the most competitive perennial weeds. A two or three-year food supply is stored in the extensive underground root system. This makes it difficult to kill by cultivation because roots will live as long as their food reserve lasts. Seed remain viable in the soil for up to 40 years. Field bindweed is widespread in cultivated and uncultivated areas, pastures,
lawns, gardens, roadsides, and waste areas throughout Colorado from 4,000 - 8,000' in elevation.

**Flixweed, Descurainia sophia**

Flixweed, a member of the Mustard family, is very similar to, and often confused with tansy mustard, *D. pinnata*. Most of the *Decurainia* in Colorado is flixweed. Flixweed is on the Colorado noxious weed list. It is an introduced annual or winter annual which reproduces by seed. Stems are erect, branched, and 4 - 30" high. Leaves are alternate, 2 - 4" long, dissected to give a lacy appearance. The stem and leaves are covered with fine hairs. Flowers are small, pale yellow, and grow in small clusters at the tips of elongated racemes. Seed pods are 0.25 - 0.75" long and on a stalk. Flixweed is widely distributed and is one of the first weeds to appear in spring. It is scattered across Colorado up to 8,000' in elevation.

**Green Foxtail, Setaria viridis**

Green foxtail is a member of the Grass family and is on the Colorado noxious weed list. Characteristics distinguishing it from other foxtail species include: shorter than other foxtails, roughened leaf sheaths, lack of hairs, and smaller seed than other foxtails. Seed are broadly oval, green and found in spike-like panicles that are 1 - 4" long. Green foxtail is native to Eurasia, but common throughout most of North America. Green foxtail is responsible for reductions in yields, increased seed cleaning costs, and expensive control measures. Flowering and seed production occur in July, August and September.

**Quackgrass, Elytrigia repens**

Quackgrass, a member of the Grass family, is an aggressive perennial reproducing by seed or spreading by a shallow mass of long, slender, branching rhizomes. Quackgrass is on the Colorado noxious weed list. Rhizomes are usually yellowish-white, sharp-pointed, somewhat fleshy. These rhizomes are effectively spread by tillage, increasing the distribution of the population in a field. They are able to penetrate hard soil or even tubers and roots of other plants. Stems are erect and usually 1 - 3' tall. Leaf blades are 0.25 - 0.5" wide, flat pointed and have small auricles at the junction of blade and sheath. Leaf sheaths and upper leaf blade surfaces are thinly covered with soft hairs. Spikelets are arranged in two long rows, flat wise to the stem. Florets either are awnless or have short, straight awns. Tillage is an effective control by depleting food reserves and bringing rhizomes to the surface.

**Redstem Filaree, Erodium cicutarium**

Redstem filaree, a member of the Geranium family, is a winter annual or biennial with stems that are 1" - 2' long, spreading or erect, generally originating from a rosette. Leaves are divided into narrow feather-like lobed or toothed segments. Both leaves and stems are hairy. Flowers are purplish-pink and generally borne in clusters of two or more. The fruit has five lobes and is long-beaked, with each lobe splitting away at maturity. Redstem filaree is on the Colorado noxious weed list.

**Russian Thistle, Salsola iberica and S. collina**
Russian thistle, a member of the Goosefoot family, was introduced from Russia. It is an annual and reproduces by seed. It is on the Colorado noxious weed list. It is a round, bushy, branched plant growing 1 - 3.5' high. The branches are slender, succulent when young, and woody when mature. The first leaves to develop are alternate, dark green, soft, slender, and 1 - 2.5" long. These senesce early and new leaves form which are alternate, short, stiff, spiny, and not over 0.5" long, with two sharp-pointed bracts at the base. The flowers are small, inconspicuous, green-white or pink, and are usually solitary in the leaf axils. Seed are conical and 0.063" in diameter. Russian thistle grows in dry plains, cultivated fields, roadsides, and waste areas, primarily in grain-growing areas of the state. At maturity, the plant breaks off at the base. Its round shape allows it to tumble, scattering seed for long distances. It is widespread over Colorado in elevations up to 8,500'.

Key Weed Management Strategies

Cultural Controls

It is optimal to maintain moderate amounts of crop residue. However, avoid planting barley into infested stubble or weedy grasses. Deep banding nitrogen fertilizer between paired barley rows can increase barley yield and reduce wild oat competition compared with broadcasting.

Herbicides -

It is important to rotate not only herbicides when controlling weeds, but also herbicide modes of action to prevent future cases of herbicide resistance.

Pesticide: 2,4-D (Weedar 64)

- Target Pests: Common lambquarters, Sunflower, Russian thistle; High doses for Canada thistle and Field bindweed
- Recommended rate: 3.7-14.9 fl oz ai/A (0.5-2.0 pt product/A)

Pesticide: 2,4-D (Hi-Dep)

- Target Pests: Common lambquarters, Sunflower, Russian thistle; High doses for Canada thistle and Field bindweed
- Recommended rate: 6-16 fl oz ai/A (0.75-2.0 pt product/A)

Pesticide: 2,4-D (Savage)

- Target Pests: Common lambquarters, Sunflower, Russian thistle; High doses for Canada thistle and Field bindweed
- Recommended rate: 11.4-22.4 oz ai/A (0.75-1.5 lb product/A)

**Pesticide: 2,4-D (Salvo)**

- Target Pests: Common lambquarters; Partial control of Russian thistle, Canada thistle and Field bindweed
- Recommended rate: 5.2-7.8 oz ai/A (6.4-9.6 oz product/A)
- Use Data: 1992= rate used- 0.54 lb ai/A
  - 30% of total acres treated
- 1997= rate used- 0.60 lb ai/A
  - 25% of total acres treated

**Pesticide: 2,4-D + 2,4-DB (Weedone LV4)**

- Target Pests: Common lambquarters, Sunflower, Russian thistle, Canada thistle, Field bindweed, Flixweed, Kochia
- Recommended rate: 5.4-21.5 fl oz ai/A (0.5-2.0 pt product/A)
- Comments: Crop damage may result if not applied at correct stage of growth.

**Pesticide: 2,4-D + glyphosate (Landmaster BW)**

- Target Pests: Suppression of weeds before planting or emergence of crop
- Recommended rate: 2,4-D- 8.2-13.2 oz ai/A; glyphosate- 5.2-8.3 oz ai/A (40-64 oz product/A)
- Comments: Pre planting application; Do not till for 7 days

**Pesticide: bromoxynil + MCPA (Bronate)**

- Target Pests: winter annual weeds including tansy and blue mustard; it will also control sunflowers and wild buckwheat.
- Recommended rate: bromoxynil- 5-10 fl oz ai/A; MCPA- 5.4-10.8 fl oz ai/A (1-2 pt product/A)

**Pesticide: bromoxynil (Buctril; Broclean)**

- Target Pests: winter annual weeds including tansy and blue mustard; it will also control sunflowers and wild buckwheat.
- Recommended rate: 5.3-10.7 fl oz ai/A (1-2 pt product/A)
- Use Data: 1992= rate used- 0.42 lb ai/A
  - 32% of total acres treated
- 1997= rate used- 0.40 lb ai/A
  - 12% of total acres treated
Pesticide: **carfentrazone-ethyl** (Aim)

- Target Pests: Broadleaf weeds
- Recommended rate: 0.50 oz ai/A (1.24 oz product/A)
- Comments: Pre Harvest Interval of 7 days

Pesticide: **chlorsulfuron + metsulfuron** (Finesse)

- Target Pests: Blue mustard and Lambsquarters can be controlled
- Recommended rate: chlorsulfuron- 0.13-0.31 oz ai/A; metsulfuron- 0.03-0.06 oz ai/A (0.2-0.5 oz product/A)
- Comments: Resistance has been noted in some key weeds
  - **chlorsulfuron** (Glean) use
- Use Data: 1997= rate used- 0.010 lb ai/A
  - 7% of total acres treated

Pesticide: **clopyralid + 2,4-D** (Curtail)

- Target Pests: Most broadleaf weeds (< 3 inches tall)
- Recommended rate: 0.5-0.67 lb ai/A
- Comments: Rotation interval of 30 days, apply between 4-leaf stage up to jointing stage
  - **clopyralid** (Stinger) use
- Use Data: 1992= rate used- 0.12 lb ai/A
  - 2% of total acres treated
  - 1997= rate used- 0.10 lb ai/A
  - 3% of total acres treated

Pesticide: **dicamba** (Clarity)

- Target Pests: wild buckwheat, kochia, nightshade species
- Recommended rate: 4.5 fl oz ai/A (8 fl oz product/A)
- Use Data: 1992= rate used- 0.12 lb ai/A
  - 2% of total acres treated
  - 1997= rate used- 0.10 lb ai/A
  - 3% of total acres treated

Pesticide: **dicamba + glyphosate** (Fallow Master)

- Target Pests: Suppression of weeds before planting or emergence of crop
- Recommended rate: dicamba- 1.3-2.1 oz ai/A; glyphosate- 7.5-12 oz ai/A (32-52 oz product/A)
- Comments: Pre-Planting application 15 days before planting barley seed
Pesticide: **diclofop methyl** (Hoelon)

- Target Pests: wild oats, downy brome
- Recommended rate: 11.1-14.4 fl oz ai/A (2.0-2.6 pt product/A)
- Comments: Resistance has been identified in Wild Oats; Pre planting application
- Use Data: 1992= rate used- 1.0 lb ai/A
  2% of total acres treated
  1997= rate used- 1.0 lb ai/A
  1% of total acres treated

Pesticide: **difenoquat** (Avenge)

- Target Pests: Wild oats
- Recommended rate: 12.5-20 fl oz ai/A (2.5-4.0 pt product/A)
- Use Data: 1992= rate used- 0.81 lb ai/A
  1% of total acres treated

Pesticide: **fenoxaprop-p-ethyl** (Puma)

- Target Pests: Wild Oats
- Recommended rate: 1.2 fl oz ai/A (10.6 fl oz product/A)

Pesticide: **glyphosate + 2,4-D** (RT Master)

- Target Pests: All weedy species
- Recommended rate: glyphosate- 26 fl oz ai/A; 2,4-D- 2.7 fl oz ai/A (0 - 2 qt product/A maximum)
- Use Data: 1992= rate used- 0.41 lb ai/A
  4% of total acres treated
  Comments: Pre Planting and Post Harvest applications; Lower rates for barley grown for seed

Pesticide: **imazamethabenz methyl** (Assert; Assert SG)

- Target Pests: mustards and wild oats
- Recommended rate: 4.3-6.5 fl oz ai/A (1.0-1.5 pt product/A)
- Use Data: 1992= rate used- 0.40 lb ai/A
  3% of total acres treated
  1997= rate used- 0.50 lb ai/A
  3% of total acres treated

Pesticide: **MCPA** (Rhomene)
- **Target Pests:** Annual and Biennial Weeds
  - Recommended rate: 4.2-16.7 fl oz ai/A (0.5-2.0 pt product/A)
  - Use Data: 1992= rate used- 0.40 lb ai/A
    23% of total acres treated
  - 1997= rate used- 0.67 lb ai/A
    3% of total acres treated

**Pesticide:** metsulfuron (Ally)

- **Target Pests:** broadleaf weeds
  - Recommended rate: 0.06 oz ai/A (0.1 oz product/A)

**Pesticide:** paraquat (Gramoxone Max)

- **Target Pests:** Suppression of weeds before planting or emergence of crop
  - Recommended rate: 5.2-10.8 oz ai/A (1.3-2.7 pt product/A)

**Pesticide:** thifensulfuron + tribenuron (Harmony Extra)

- **Target Pests:** general broadleaf
  - Recommended rate: thifensulfuron- 0.15-0.30 oz ai/A; tribenuron- 0.08-0.15 oz ai/A (0.3-0.6 oz product/A)
    - **thifensulfuron** use
      - Use Data: 1992= rate used- 0.02 lb ai/A
        3% of total acres treated
      - 1997= rate used- 0.05 lb ai/A
        6% of total acres treated
    - **tribenuron** use
      - Use Data: 1992= rate used- 0.01 lb ai/A
        3% of total acres treated
      - 1997= rate used- 0.02 lb ai/A
        1% of total acres treated

**Pesticide:** triallate (Far-Go)

- **Target Pests:** Wild Oats
  - Recommended rate: 14.8-18.5 fl oz ai/A (2.0-2.5 pt product/A)
  - Use Data: 1992= rate used- 1.25 lb ai/A
    3% of total acres treated
  - 1997= rate used- 1.20 lb ai/A
    1% of total acres treated
Pesticide: **tribenuron methyl** (Express)

- Target Pests: Canada thistle and other broadleaf weeds
- Recommended rate: 0.13-0.25 oz ai/A (0.17-0.33 oz product/A)
- Use Data: 1992= rate used- 0.01 lb ai/A
  3% of total acres treated
  1997= rate used- 0.02 lb ai/A
  1% of total acres treated

Pesticide: **trifluralin** (Treflan HFP)

- Target Pests: Annual grasses and Broadleaf weeds
- Recommended rate: 6.9 fl oz ai/A (1.0 pt product/A)

Pesticide: **trifluralin + triallate** (Buckle)

- Target Pests: Wild Oats
- Recommended rate: trifluralin- 4.8-6.0 oz ai/A; triallate- 16-20 oz ai/A (10.0-12.5 lb product/A)

Pesticide: **trisulfuron** (Amber)

- Target Pests: Flixweed, Redroot Pigweed, Sunflower (Kochia and Russian thistle require herbicide mixing to control)
- Recommended rate: 0.21-0.35 oz ai/A (0.28-0.47 oz product/A)
- Comments: Resistance has been noted in some key weeds

**Critical Pest Management Issues**

The most critical insect problem in the San Luis Valley is armyworms. It clips the barley heads just prior to harvest. Pyrethroids would be very effective on armyworm and army cutworm in an infestation situation. There are very few insect pests in Northern Colorado due to the practice of crop rotation, but Russian wheat aphid remains a critical management issue. Russian wheat aphid resistant barley will be needed in the future. Russian wheat aphid and cereal leaf beetle do not have sufficient registered products. Cereal leaf beetle is an emerging issue of unknown importance.

Head molds are currently a major issue for barley growers in Colorado.

ALS herbicide resistance can be selected for very quickly, even after two applications. More commonly, population pressure due to consecutive applications or continuous production of the same crop year after year using only ALS herbicides selects for resistance. In many situations, resistance is selected for along
right-of-ways and then resistant biotypes move into agricultural fields. It is important to rotate not only herbicides when controlling weeds, but also herbicide modes of action to prevent future cases of herbicide resistance.

Weeds, diseases, and insects can all develop resistance over time to pesticides. When the same pesticide is used consecutively over a period of time, the target pest can become resistant to that pesticide and render the pesticide obsolete.

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**Diseases**

**Key Diseases**

**Bacterial Blight, Xanthomonas campestris pv. translucens**

Bacterial blight occurs in poorly drained wet areas. The bacterium is easily spread in the field by tillage equipment, surface water and animal life in the soil. Bacterial leaf blight usually only occurs on the upper leaves. Small, water-soaked lesions form that eventually coalesce into larger lesions that may cover the entire leaf. These spots can advance rapidly to cause blight and are generally associated with sprinkler irrigation in cool wet weather. The bacteria overwinter on and in seed and in debris. Management practices for bacterial diseases include use of pathogen-free seed, pre-treated seed, crop rotation, field sanitation, and use of copper-based bactericides.

**Barley Yellow Dwarf**

Barley yellow dwarf is caused by a group of barley yellow dwarf viruses that infect many crops including barley, corn, oats, and wheat. The vectors are a group of aphids, including greenbugs, bird cherry-oat aphids, corn leaf aphids and English grain aphids. Plants are stunted and have a stiff, crumpled appearance. Tillering is reduced and heads do not fill. Individual leaves turn yellow from the tips in a chevron with edges advancing toward the tiller. The virus survives in aphids, grassy weeds, volunteer plants and fall-planted cereals. Infected plants are located at random in a field where winged adults have landed. These plants develop into foci of disease. The disease is favored by cool, wet weather in the spring and early summer. Barley yellow dwarf can cause losses of 5-30% in barley. Barley yellow dwarf depends on late planting of winter cereals that will serve as a bridge to the fall infection of early planted spring cereals. Planting barley later in the spring or earlier in the fall to avoid infection in spring-planted barley can be a useful management tool. Use of insecticides is seldom economical.

**Black Point, Helminthosporium, Alternaria, and Fusarium sp.**

Black point, or Black Tip Fungus, reduces germination and lowers grain grade. Rain events that occur
after the barley has matured encourage the development of these fungi. The embryo end of kernel becomes black and the kernel may become shriveled. There are other fungi that can cause black point, but the three mentioned above are the most common. Infection leads to discounted prices of discolored grain and viability of the seed also may be reduced. Management practices include the use of clean, pathogen-free seed.

**Loose Smut, Ustilago nuda**

The fungus *Ustilago nuda* is the causal agent of loose smut. Yield loss is directly related to the percentage of infected heads. Losses can range from the typical 1% to an entire field. Loose smut occurs throughout the San Luis Valley, but typically has a limited impact. High severity cases can occur within individual fields. Disease severity depends on the infection level of the planted seed. Black spore masses replace heads. Infected heads emerge from the boot slightly earlier than normal and are darker than healthy heads. The darkening is due to spore masses, which replace the kernels. Spore masses are covered by a thin membrane that ruptures easily after head emergence, permitting the spores to be dispersed by wind and water. After a short time only the naked rachis is left. These fungi survive in debris, soil, seed, and transplants. Best management practices include using resistant cultivars, seed treatment with systemic fungicides such as carboxin and crop rotation.

**Net Blotch, Pyrenophora teres**

Net blotch affects barley by reducing the carbohydrate content and the malt extract for brewing. Serious infections reduce yield and quality. Light infections occur throughout the San Luis Valley. Serious infections are rare. Net blotch lesions first appear as light brown patches with a pattern of dark-brown inside them. The dark brown pattern of net blotch takes on a net-like pattern characteristic of the disease. Surrounding areas become yellow. Net blotch can spread over the entire leaf and kill it. The fungus overwinters on seed or on plant residue in the soil. Cool, moist conditions provide favorable conditions for disease development. Spots develop on leaves and leaf sheaths at all stages of plant growth. Sizes vary from very small to large, but are uniformly brown and frequently have a yellow halo. It is associated with cool wet weather. The imperfect state is *Drechslera teres* (*Helminthosporium teres*) also known as Helminthosporium leaf blotch. Rotation and genetic resistance are common controls. Foliar fungicides such as Quadris® (azoxystrobin), Tilt® (propiconazole), and Headline® (pyraclostrobin) are also sometimes used to control this disease. Sanitation by tilling in the crop residue before planting can reduce the incidence of net blotch.

**Stripe Rust, Puccinia striiformis**

Stripe rust infection usually appears as small, yellow pustules on the leaves and heads, often arranged in conspicuous stripes. Individual pustules are small, but a series of pustules can form in a line between vascular bundles and progress the length of the blade. On seedlings, the pustules appear individually, not in a line. Near the end of the season, the fungus produces a black spore stage (teliospores) in and around the yellow pustules (urediniospores). The fungus is assumed to overwinter in southern production areas,
and then the yellow spores are blown northward in the spring. Stripe rust infects barley as well as wheat and numerous grasses. Controls include crop rotation, planting resistant varieties, and timely application of labeled fungicides such as: mancozeb, propiconazole, pyraclostrobin and azoxystrobin.

Additional Diseases

**Common Root Rot,** *Fusarium* sp., *Pythium* spp., *Rhizoctonia solani*, and *Bipolaris sorokiniana*, *Helminthosporium sativum*

Rots of roots and other plant parts are the most common and economically damaging diseases of field crops in Colorado. Soilborne fungi such as *Pythium, Fusarium, Rhizoctonia solani*, and *Bipolaris sorokiniana* are the major causal agents of root rots in barley. Symptoms of root and crown rots are seen first in the above ground parts of the plant as chlorosis, wilting, stunting, necrosis, collapse, reduced yield, and plant death. The affected roots, crown or stem will have darkened lesions and cankers.

**Covered Smut, Ustilago hordei**

Tillers infected with covered smut are slightly more stunted than those infected with dwarf bunt. It is also slightly less smelly as dwarf bunt. Harvesting heads containing covered smut with healthy grain produces "smutty" grain and is discounted in price by grain buyers. Control by seed treatments such as Vitavax (carboxin) or Vitavax-Captan (carboxin-captan) have been very successful as well as sowing resistant cultivars.

**Damping off and Seedling Blight, Fusarium spp., Bipolaris sorokiniana, Helminthosporium sativum**

Pre and post emergence damping-off and seedling blights can be caused by many different pathogens. Soil-inhabiting fungi such as *Fusarium* spp., *Pythium* spp., and *Rhizoctonia solani* commonly cause these diseases. In barley, seedling blight can also produce seedling blight symptoms. When pre emergence damping-off occurs, seedlings fail to break the soil surface. The germinating seed rots while still in the ground. With post emergence damping-off, seedlings still in the cotyledon stage will rot at the soil line. The stem appears pinched and plants fall over. Seedling blights occur after true leaves emerge. The developing root system rots and plants collapse. Seedling diseases are problems when soils are cold and wet at or immediately following planting. These conditions can delay germination or stress developing seedlings, which allows pathogens to attack. Crusting caused by poor soil preparation or hard rain, or excessive trash on the surface also contributes to disease. Fungicide seed treatment such as captan, mancozeb, metalaxyl, PCNB, and thiram combined with avoiding cold wet soils and good soil preparation will best manage these diseases.

**Dwarf Bunt, Tilletia controversa**
Tillers infected with dwarf bunt are severely stunted, anywhere from half to a quarter normal height. Small smut balls are formed that are very black and have a "fishy" odor, especially when moist. All barley cultivars are highly resistant or immune to infection, so no further control measures are currently needed.

**Powdery Mildew, Erysiphe graminis f. sp. hordei**

Powdery mildew affects barley when humidity is high. The white web-like covering on the top and bottom of leaves identifies powdery mildew. It can occur under wet or dry conditions and does not require a film of water on the leaf surface for infection to take place. Spores are produced continuously day and night throughout the summer. Fungi overwinter as mycelium on buds, twigs and fallen debris. They also produce a sexual structure (cleistothecium) which produces ascospores in the spring. Management of powdery mildew is primarily through use of resistant cultivars. Cultural practices that increase airflow and enhance leaf drying are useful management tools. Protectant and systemic fungicides such as Quadris® (azoxystrobin), Tilt® (propiconazole), and Headline® (pyraclostrobin) can be used when necessary. Crop rotation and destruction of crop tissue through tillage reduce disease risk. Chemical controls are sulfur fungicide sprays at early boot to protect the flag leaf. Tilt® (propiconazole) is labeled for use as the flag leaf is emerging, but not after this growth stage.

**Spot Blotch, Cochliobolus sativus (Bipolaris sorokiniana, Helminthosporium sativum)**

Also known as Helminthosporium leaf blotch, the imperfect state of spot blotch is Cochliobolus sativus. Lesions caused by this fungal pathogen are oval in shape and generally have a dark brown color. As the lesion grows, the center becomes light tan in color. Primary infections tend to start on lower leaves. Spot blotch is favored by humidity and can lead to the death of affected leaves and leaf sheaths. This disease has become more of a problem since the practice of no till or minimum till agronomic practices which leave crop debris behind. Maintaining healthy plants and proper fertilization while avoiding high levels of nitrogen can be effective in reducing the incidence of this disease. Foliar fungicides such as mancozeb, Tilt® (propiconazole), and Headline® (pyraclostrobin) are available to protect barley from infection. Tilt® (propiconazole) is labeled for use as the flag leaf is emerging, but not after this growth stage.

**Key Disease Management Strategies**

For disease management in center pivot irrigation systems, water the crop early in the day and allow the field to dry. To avoid root rot, barley should be planted where the groundwater is consistently within three feet of the soil surface. Maintain adequate nitrogen and phosphorous levels to encourage vigorous root and shoot growth, enabling plants to resist or tolerate infection.

Fungicides are not commonly used on barley in Colorado. Although in the San Luis Valley, fungicide seed treatments are used to control head molds.
**Fungicides**

Pesticide: *azoxystrobin* (Quadris)

- Target Pests: net blotch, powdery mildew, stripe rust
- Recommended rate: 0.15-0.20 oz ai/A (9.2-12.3 fl oz product/A)

Pesticide: *captan* (Captan 30DD; Captan 400)

- Target Pests: damping off, seedling blights
- Recommended rate: rate per 100 lb seed, 0.5-0.9 oz ai (1.8-3.0 oz)
- Comments: Seed Treatment

Pesticide: *carboxin* (Vitavax 200)

- Target Pests: smut
- Recommended rate: rate per 100 lb seed, 0.6-0.8 oz ai (3-4 fl oz)
- Comments: Seed Treatment

Pesticide: *mancozeb* (Penncozeb 75DF)

- Seed Treatment
- Target Pests: damping off, root rot, stripe rust
- Recommended rate: rate per 100 lb seed; 2.3 oz ai (3 oz product)
- Foliar Treatment
- Target Pests: spot blotch
- Recommended rate: rate per 100 lb seed, 24 oz ai (1.0-2.0 lb product)

Pesticide: *mancozeb* (Dithane M-45)

- Seed Treatment
- Target Pests: damping off, root rot, stripe rust
- Recommended rate: rate per 100 lb seed; 2.2 oz ai (4.0 oz product)
- Foliar Treatment
- Target Pests: spot blotch
- Recommended rate: rate per 100 lb seed, 24 oz ai (32 oz product)
- Comments: Dithane is a broad spectrum, protectant fungicide and should only be applied after scouting and at the exact rates noted on the label.

Pesticide: *metalaxyl* (Apron Flowable)
• Target Pests: damping off (*Pythium* spp.)
• Recommended rate: rate per 100 lb seed, 0.26-0.46 fl oz ai (0.82-1.64 fl oz)
• Comments: Seed Treatment

Pesticide: **metalaxyl + PCNB+ Bacillus subtilis** (System 3: Allegiance, Terraclor, and Kodiak)

  • Target Pests: damping off
  • Recommended rate: rate per 100 lb seed- metalaxyl: 0.17-0.35 oz ai; PCNB: 6.83-1.38 oz ai; *B. subtilis*: 0.004-0.008 oz ai (4.1-8.3 oz product)

Pesticide: **PCNB** (PCNB Flowable)

  • Target Pests: damping off (*Rhizoctonia, Fusarium* spp.)
  • Recommended rate: rate per 100 lb seed, 1-2 fl oz ai (5-10 fl oz)

Pesticide: **propiconazole** (Tilt)

  • Target Pests: net blotch, spot blotch, powdery mildew, stripe rust
  • Recommended rate: 1.67 fl oz ai/A (4 fl oz product/A)
  • Comments: Tilt is labeled for use as flagging leaf is emerging, but not after this growth stage to avoid possible illegal residues.

Pesticide: **pyraclostrobin** (Headline)

  • Target Pests: black point, net blotch, spot blotch, powdery mildew, stripe rust
  • Recommended rate: 2.12 fl oz ai/A (9 fl oz product/A)
  • Comments: Pre Harvest interval of 14 days

Pesticide: **thiram** (Thiram 42S)

  • Target Pests: Damping off
  • Recommended rate: rate per 100 lb seed, 0.2 oz ai (3 oz)

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**Contacts**

**Expert contacts**

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