Crop Profile for Ryegrass Seed in Oregon

(Annual and Perennial Ryegrass)

Prepared: July 2002

General Production Information

- Oregon ranks first nationally and accounts for 98% of U.S. ryegrass seed production. (For this crop profile, annual ryegrass (*Lolium multiflorum* Lam.) and perennial ryegrass (*Lolium perenne* L.) are treated as one crop unless otherwise noted.)
- In 2001, Oregon harvested 123,450 acres of annual ryegrass with a value of $39,862,000, and 171,530 acres of perennial ryegrass seed with a value of $98,205,000.
- Annual ryegrass averages 1,900 pounds of seed per acre; perennial ryegrass averages 1,450 pounds of seed per acre.
- Production cost for annual ryegrass is approximately $400 per acre; production cost for perennial ryegrass ranges from $600 to $700 per acre, depending on the area of production.
- Annual ryegrass seed is widely used in the southern U.S. for winter pasture, generally overseeding warm-season perennial grasses to extend the grazing season. Southerners also use it for overseeding lawns, golf courses, rice and cotton fields during winter. In other parts of the U.S., it is interseeded with row crops to absorb excess N, reduce erosion after row crop harvest, and provide winter feed. Annual ryegrass is also used throughout the world as a forage crop.
- Perennial ryegrass seed is used to establish permanent pasture (hay and forage) in the northern U.S and in temperate and semi-temperate areas throughout the world. Improved, turf-type varieties of perennial ryegrass are used for lawns and golf courses.

Production Regions

Nearly all ryegrass seed production in Oregon occurs in the Willamette Valley, which includes Benton, Clackamas, Lane, Linn, Marion, Polk, Washington and Yamhill counties. Almost 100% of the annual ryegrass production is in the Willamette Valley, with more than 73% occurring in Linn County, alone. More than 95% of perennial ryegrass production occurs in the Willamette Valley (Linn county and Marion county are the major areas, with 40% and 25%, respectively). Other areas of perennial ryegrass production include Morrow and Umatilla counties, in the north central part of the state.

The Willamette Valley's mild, wet winters and dry summers provide an ideal environment for ryegrass seed production. In addition, ryegrass grows well on the wet, poorly-drained soils that are found in much of this region, and survives the winter flooding that is common, while most other crops do not. The north
central part of Oregon is colder in winter, drier in summer, has low precipitation rates, and requires irrigation to produce a crop of perennial ryegrass for seed.

**Cultural Practices**

Growing and managing ryegrass for seed production is radically different than growing ryegrass for turf, lawn, pasture, or hay. Ryegrass grown for seed in the Willamette Valley is generally planted in early fall (September/October), prior to the onset of fall rains (the majority of the acreage is not irrigated). The crop is seeded in rows about 10 inches apart and fertilizer is sometimes incorporated at this time. Nearly all newly established fields are treated with a preemergence herbicide at time of planting. Once the grass has germinated, control of slugs is usually necessary, as they can cause extensive damage to the newly emerged crop.

Once established, additional herbicides are used during the winter to control both volunteer crop seedlings and weeds. Fungicides are routinely applied in spring as the weather warms up. Control of slugs is often necessary during the fall and winter in established fields of perennial ryegrass. Nitrogen is the major fertilizer used in grass seed production and applied in March and April at rates between 120 and 160 pounds per acre of actual nitrogen. In general, higher rates of nitrogen, phosphorus, and potassium are used in seed production than in grass hay or pasture production in the Willamette Valley.

Perennial ryegrass fields remain productive for about three to five years. On poorly drained soils, perennial ryegrass is again planted. On better drained soil, however, perennial ryegrass is used in rotation with mint, vegetables or wheat. Ground used for annual ryegrass is usually replanted to annual ryegrass year after year.

Harvest of the grass seed crop begins in late June or early July with swathing (cutting) and windrowing the crop. This is accomplished with self-propelled windrows, and is done while the seed is still somewhat green to prevent shattering. After the seed has dried in the windrow, the crop is combined and taken to a seed cleaning warehouse. It is critical to cut and combine in a timely and efficient manner to avoid rain damage. Seed is cleaned and bagged, and then sampled for germination and purity. Most of the seed is marketed by commercial seed companies, and many contract with growers to raise their proprietary varieties.

Open-field burning was developed as an inexpensive and effective solution to many ryegrass production problems and tasks, such as disease and weed control and a means for eliminating the straw and stubble that remained after harvest. However, due public concern over air pollution from smoke during field burning season, there are now legislative restrictions on field burning. Where once nearly all ryegrass acreage was burned after harvest, now only about 25% of the annual ryegrass acreage and less than 5%
of the perennial ryegrass acreage is field burned. Consequently, there has been an increase in use of herbicides and fungicides. Stubble is now either left in the field or cut and baled and sold as livestock feed in foreign markets.

**Insect Pests**

**Insect, Mite and Mollusk Pests (6)**

Cutworms are widespread, especially in newly planted fields. Chlorpyrifos is the most widely used insecticide for cutworms and other insect pests occurring in ryegrass fields. However, fields treated with chlorpyrifos (Lorsban 4E) cannot be grazed nor the hay, forage, seed, or screening used as livestock feed.

**European Crane flies**

*Tipula paludosa and Tipula oleracea*

**Pest description:** Adults are large (wing span of 1 to 1.5 inches), grayish-brown, and resemble large, long-legged mosquitoes. The wings of these two pest species are long, slightly milky-brown along the fore edges and folded in, roof-like, when the adult is at rest. Mature larvae are 1 to 1.5 inches long, legless, and earthy-gray in color. The body is cylindrical, squishy, but very tough and resilient (the larvae are called "leather jackets"). The body extends and retracts considerably, and the primitive head can retract, giving the larva a tightly packed and pudgy appearance. Eggs are black, narrow, rigid, and approximately 1 mm in length.

**Crop damage:** The larvae of these two pest species feed on many plant species and are found occasionally in perennial ryegrass, especially when there is heavy rainfall and excessive soil moisture. They are rarely found in annual ryegrass. As larvae mature, they come to the soil surface at night and feed above ground on crowns of grasses. Craneflies are common but full effects of larval feeding on grass seed crops has yet to be determined.

**Chemical control:** Insecticides are not labeled for control of this pest in grass seed fields at this time. Chlorpyrifos (Lorsban 4E) at 0.5 to 1 lb ai/a, when applied to control a pest listed on the label, has given
excellent control of crane flies infesting grasses grown for seed. Best application timing is in late October or through mid-November. Best results have been when it is applied in the rain and to fields with minimal straw load or charcoal residue.

**Black cutworm**

*Agrotis ipsilon*

**Pest description:** Black cutworm larvae are 30 to 40 mm long when mature. They can be gray, brown, and black and have lighter brown stripes running the length of the body. The head capsule is dark brown or black. By day, they hide in the soil or under plant debris on the soil surface. The adults of this moth are brownish-gray with a spot and a light silvery band on the front wings. The wingspan is about 35 mm.

**Crop damage:** Very few larvae in an area can cause substantial clipping and defoliation. Stand loss can occur if seedlings are repeatedly clipped off or if the growing points are destroyed. Most damage occurs June through November. Damage usually occurs in irregular patches of less than an acre to many contiguous acres. Black cutworm is a pest mainly in perennial ryegrass.

**Cultural control:** Plowing and diskimg usually reduce in-field larval populations below damaging levels, which explains why this pest is not a problem in annual ryegrass.

**Chemical control:**

- Chlorpyrifos (Lorsban 4E) at 1 lb ai/a is applied broadcast as a foliar treatment. 24c registration.

**Glassy cutworm**

*Crymodes devastator*

**Pest description:** Adults are heavy grayish moths with a wingspan of about 1.25 inches. Larvae are a translucent (glassy), dirty gray with a red-brown head. They can be 1.5 inches long when mature (late spring). They are true subterranean cutworms, spending nearly their entire larval life in the crown or in and among the roots.
**Crop damage:** Larvae bore into the crown and through roots. Crop injury may develop at infestations of as few as 1 or 2 per crown on grasses of poor vigor. Healthy stands may not show seed yield reduction with as many as 4 per crown. Injury is enhanced by extremely cold winters. Damage occurs from fall through the following spring. In western Oregon, the larvae feed through the winter.

**Chemical control:**

- Chlorpyrifos (Lorsban 4 E) at 1 lb ai/a applied broadcast as a foliar treatment. Effective control usually results from October or November applications when larvae are small (0.25 inch or less) and very close to the soil surface. Organic matter, heavy straw loads, and carbon residues from field burning catch and hold this insecticide, often resulting in control failures—even if the product was applied in rain. 24c registration.

**True Armyworms**

*Pseudoletia unipuncta* and others

**Pest description:** Moths have gray or brown forewings with slate or buff colored markings. Hind wings are silvery-gray. Average wingspan is 35 to 40 mm. The mature larvae are about 40 mm long, tan to brown, with a faint white or red mid-line stripe on the top of the body. There are black, triangular marks on both sides of the mid-line of each segment except the prothorax. These are bordered below by a white stripe on each side. There is a prominent black stripe along each side, bordered below by an orange-brown stripe. Larvae have an inverted white "Y" on the front of the head. The pupae are brown and found in the ground, commonly near the crowns of host plants.

**Crop damage:** The true armyworm causes damage infrequently (1 season in 10) in perennial ryegrass only. Outbreaks are associated with unusually high rainfall that extends into late spring or early summer. Late summer flights of moths lay eggs in established grass seed fields. The larvae feed within crowns of plants on new fall regrowth as it emerges from crown. Extensive but localized damage may result if the population is not treated.

**Biological control:** Most armyworm damage occurs during the fall in western Oregon. As the larvae grow and mature during the winter and early spring, they are parasitized heavily by wasps and Tachinid
flies. This generally eliminates the population by late spring.

**Chemical control:**

- Chlorpyrifos (Lorsban 4E) at 1 lb ai/a applied broadcast as a foliar treatment. For satisfactory results, grass and soil should be moist at time of treatment and the insecticide washed into the underlying thatch with irrigation or rain immediately after application. Organic matter and carbon residues from field burning prevent penetration and may reduce control. 24c registration.

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**Leafminers**

*Phytomyza nigra*

**Pest description:** Larvae are small, white maggots that mine between the epidermal layers of grass blades. A pest in perennial ryegrass only.

**Crop damage:** This pest most commonly is seen in young stands. Very localized damage within a field may result in some seedling die-out. Moisture stress, coupled with the chlorotic symptoms produced by the miner, can kill seedling grasses.

**Biological control:** The larvae of leafminers often are preyed upon heavily by parasitic wasps. As a result, leafminer populations literally crash. This results in good biological control that suppresses quite a few future generations of the fly.

**Chemical control:** Chemical control usually is not recommended. Dimethoate applied to control other pests on the grass seed label has been observed to give good control.

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**March fly**

*Bibio xanthopus*

**Pest description:** Small, light brown to gray larvae (0.5 inch long when mature in February or March) are quite common in western Oregon perennial ryegrass fields high in organic matter.
**Crop damage:** The larvae actually do not feed on live plants, except incidentally; they feed primarily on decaying organic matter. Heavy fall and winter rains that cause water to puddle force the larvae to the soil surface. Large numbers of these wiggling, squirming larvae roll into seed furrows resulting in "heaving" of the seedling plants. If freezing conditions follow soon afterwards, seedling mortality can be high.

**Cultural control:**

The following cultural practices may help in reducing damage.

1. Prepare a fine seedbed and pack well.
2. Close seed row at planting.
3. Plant early. Well established seedlings tolerate more injury than smaller ones.

**Chemical control:** None are registered.

**Sawflies**

*Dolerus nitens* and *Pachynematus setator*

**Pest description:** The adults are predominantly black with brownish legs and markings on the body. The female’s abdomen is distended greatly at emergence, and the intersegmental membrane is translucent greenish-blue. The eggs are small and green at first. After about one week, the eggs turn yellow, and the plant tissue around them turns dark reddish-brown. The larvae are similar in appearance to "many legged" armyworms, except that the sawflies have abdominal prolegs on almost every segment of the abdomen. (Armyworms, cutworms, and most caterpillars have prolegs only on abdominal segments 3, 4, 5, and 6.) Early larval instars are pale yellowish-green but turn gradually to a vivid green (around 2 cm long at final instar).

**Crop damage:** The larvae feed on leaves and chews through stems, resulting in the loss of the entire seed head. If the stem is not entirely severed, harvested seeds are usually sterile.
Chemical control:

No products are labeled for this use.

"Silver top"

Pest description and crop damage: "Silver top" is a condition in grasses in which the seed head turns white and dries off before some or all of the seeds have developed. "Silver top" is not generally seen in perennial ryegrass but is most noticeable in annual ryegrass. It can be caused by plant bugs or thrips but, in annual ryegrass, is most often caused by the larva of the cereal stem moth (*Ochsenheimeria vaculella*) which bores into and damages the conductive tissues transporting nutrients to the seed head. Larvae are about 5 mm long, whitish in color, and difficult to see. Larvae balloon into grass fields on wind currents from late winter through early spring. Larvae mine leaves initially and tunnel into stems as they get larger. When mature (usually in June) they bore out of stems, already having done damage to the seed head. This insect does not occur every year, and even in outbreak years, it is a minor pest.

Chemical control:

- Dimethoate at 0.25 to 0.33 lb ai/a is applied when the majority of plants begin to approach boot stage if large numbers of cereal stem moth larvae are present. However, very few fields are treated with dimethoate because larval populations are generally controlled by naturally occurring parasitic wasps.

Sod webworm (cranberry girdler)

*Chrysoteuchia topiaria* and other species

Pest description: The moths have protruded snouts projecting from the head. The moths are about 0.33 inch long and marked with colorful iridescent scales on the wings and body. The eggs are scattered on crowns of plants and the soil surface. The larvae of these moths are creamy-white or pinkish with a light brown head. Small hooks on the abdominal prolegs are arranged in circles or ovals. This distinguishes them from armyworms or cutworms whose hooks are arranged in a line.
Crop damage: Larvae feed on and in crowns and roots of most grasses and can cause serious injury to established stands wherever grass is grown for seed. Two to six larvae per crown can result in damage. Larvae feed on crowns from late June through late October, early November. Most commonly seen in perennial ryegrass; rarely a problem in annual ryegrass.

Biological control: Diseases and bird predation significantly reduce larval populations from October through March. Unfortunately, these natural controls usually occur after most damage has been done. Endophyte-containing turf varieties of grasses may help reduce populations.

Chemical control:

- **Adult control:** Diazinon 500 AG at 1 lb ai/a. Apply when adults begin their flight period (usually late June). Do not graze livestock within 2 days or cut for hay within 10 days following treatment.
- **Larval control:** Chlorpyrifos (Lorsban 4E) used in early September to control cutworms also controls sod webworm if rainfall or irrigation is used to wash insecticide through the crown during application. In the Willamette Valley, attempts to control larvae with Lorsban applied as a broadcast spray without irrigation into crowns immediately after application (before spray deposit has dried) have not been successful. Heavy carbon residues from field burning and heavy post-harvest straw loads may reduce the insecticide’s effectiveness.

**Slugs**

- Gray garden slug (*Deroceras reticulatum*)
- Marsh field slug (*Deroceras laeve*)
- and others

Pest description: Slugs are are closely related to snails but have no external shell. Color ranges from grey to brown to black; mature slugs are about 0.5 to 0.75 inches in length.

Crop Damage: Damage to foliage is typified by removal of plant tissue between the veins but can be seen also on the edges of leaves. Slug damage can be distinguished easily from damage caused by cutworms or other pests by the presence of slime trials on the plant parts or on the soil surface.

Cultural control: Slug populations will be high in grass seed fields that follow a legume in rotation or in fields that are no-till and direct-seeded. Tillage prior to seeding a new field reduces in-field slug populations by crushing or burying slugs, disrupting their pathways, and removing volunteer plant food. Removal of plant residues from prior year’s grass seed crop, which can provide shade and moisture,
creates an unfavorable environment for slugs.

**Biological control:** Certain ground beetles and spiders prey on slugs, as well as birds; however, their activity is usually not enough to prevent slug damage when slug populations are high.

**Chemical control:** Cereal-based baits, treated with either metaldehyde or iron phosphate, are the primary means of control. Iron phosphate baits are considered environmentally friendly and are not toxic to mammals but are relatively new; their efficacy in grass seed fields has not been determined. Metaldehyde baits have been used for many years with satisfactory results and, due to metaldehyde’s specific mode of action, beneficial organisms, such as earthworms and predatory insects, are not adversely affected. Baits are broadcast in the fall after the first few rain showers initiate slug activity. Baiting may be necessary throughout the fall and winter but early fall baiting is best because it kills a large population of the field slugs before they lay eggs. New fields are seeded in the fall prior the onset of rains and slug control is usually necessary after planting.

**Garden Symphylan**

*Scutigerella immaculata*

**Pest description:** Adult symphyllans are 3 to 7 mm long, with prominent rapidly vibrating antennae, and 12 pairs of legs. (Newly hatched symphyllans have 6 pairs of legs.) Their bodies are creamy white. They resemble centipedes, but centipedes are usually larger, yellowish to brown, and when mature have more than 12 pairs of legs.

**Crop damage:** Symphyllans are an occasional pest in perennial ryegrass. They eat fine root hairs and can weaken plants. They also eat germinating seeds, resulting in poor stand establishment in spots.

**Cultural control:** Tillage reduces populations but usually not enough to achieve control where they are a problem.

**Chemical control:** Effective insecticides are not labeled for use in grass seed.

**Thrips**

*Anaphothrips obscurus* and others
**Pest description:** Thrips are an occasional pest in perennial ryegrass. They are very small, narrow insects about 0.0625 inch long. They can have wings or be wingless. If winged, the insect has four wings with a characteristic "hair" fringe margin.

**Crop damage:** Thrips feed by rasping the surface of the leaves with their mouthparts and sucking up the exuding plant juices. This damage causes whitening, yellowing, or stippling of leaves.

**Chemical control:**

- Dimethoate at 0.25 to 0.33 lb ai/a.

**Winter grain mite**

*Penthaleus major*

**Pest description:** Adults of this mite are dark blue to black in color with orange-red legs. Found in about 10% of perennial ryegrass fields.

**Crop damage:** Infested fields have a grayish or silvery appearance caused by the removal of plant sap and chlorophyll from the plants. Damage occurs from large populations of mites in the fall and again in the spring. Seedling grasses can be stunted or die if large populations infest seedling stands in the fall and the winter is exceptionally cold.

**Chemical control:**

- Dimethoate at 0.25 to 0.33 lb ai/a.

**Wireworms**

*Limonius canus, Limonius californicus, Ctenicera pruinina*

**Pest description:** Adults are hard-shelled, slender beetles called click beetles. They range in color from tan to very dark brown and are 0.33 to 0.5 inch long. They appear in the spring and summer months.
Larvae are yellow-brown and up to 0.5 inch long. Larvae have three pairs of legs. The last segment of the body is usually pronged or forked at the end.

**Crop damage:** The larvae are the damaging stage of this insect and are found in perennial ryegrass. They feed on the roots and into the crowns of plants, killing them or severely stunting growth. These symptoms are apparent in the fall. Occasionally, summer-seeded grass seed is damaged before emergence; there will be long lines of empty seed furrows.

**Chemical control:** Effective soil applied insecticides are not labeled for use on grasses grown for seed. Preplant soil fumigation is used in high value crops and suitable soils.

**Diseases**

Conditions that make the Willamette Valley ideal for grass seed production are also ideal for disease development caused by various fungi. Stem rust is the most serious disease found in perennial ryegrass and nearly 100% of the acreage is treated with fungicides one to five times during the growing season with products like azoxystrobin (Quadris) and propiconazole (Tilt). This disease is not as problematic in annual ryegrass, which may be treated only once on about 10% of the acreage. Many of the diseases that plague the ryegrass seed crop have their biggest impact on seed yield, and are not a problem in turf or hay crops.

**Stem rust**

*Puccinia graminis*, subsp. *Graminicola*

A fungus that over-winters as slow-growing mycelium. In spring, the fungus resumes more vigorous growth and produces primary inoculum (urediniospores) that are windborne. Urediniospores from these sources produce secondary inoculum which infects the same or other plants, and the disease spreads. Epidemics result from repeated sporulation cycles (production and spread of urediniospores). After seed harvest and as plants continue to grow, black teliospores are produced within the pustules formerly occupied by reddish brown urediniospores.

**Symptoms:** Pustules hold masses of dark reddish brown urediniospores that form on both sides of the
leaves, on leaf sheaths, and on spikes or panicles. In early-season or light infections, pustules often are scattered and separate. In late-season or heavy infections, pustules often coalesce. As pustules develop, bubble-like blisters form on the surface; they feel rough to the touch. After pustules break through the epidermis, surface tissues look ragged and torn.

**Chemical control:**

Fungicides are applied when pustules first appear; repeat every 7 to 10 days for contact fungicides or every 14 to 21 days for systemic fungicides. Application at flag leaf emergence, even if rust is not visible, can help in a year when rust does not develop fully due to low temperatures.

- Chlorothalonil

Do not allow livestock to graze in treated areas or feed treated plant parts to livestock. 14 day PHI. 12 hour REI.

1. Bravo Ultrex at 0.9 to 1.4 lb/A on 14 day intervals.

2. Echo 720 at 1 to 1.5 pints/A on 14 day intervals.

- Tebuconazole: Folicur 3.6 F at 4 to 8 fl oz/A. Has systemic activity. A maximum of 16 fl oz /A per season may be applied. Chaff, screenings, and straw may be used for feed, but do not forage, cut green crop, or use seed for feed. Regrowth may be grazed starting 17 days after harvest. 4 day PHI. 12-hour REI.

- JMS Stylet-Oil at 1-2 gal/A. Slightly effective when used alone but most effective when tank mixed with Tilt at 4-6 oz/A. Do not spray if temperature is below 50 °F, above 90 °F or when plants are under heat or moisture stress. Do not spray when foliage is wet. Good coverage is essential. 4 hour REI.

- Myclobutanil: Laredo EC at 8 to 12 fl oz/A. Has systemic activity. A maximum of 48 fl oz/A per season may be applied. Do not graze treated fields for one year following application. 24 hour REI. 24c registration.

- Azoxystrobin: Quadris Flowble at 6 to 12 fl oz/A. Has systemic activity. A maximum of 1.15quarts/A per season may be applied. Treated fields may not be grazed or harvested for foliage until after harvesting grass seed crop. 8 days PHI. 4 hour REI.

- Propiconazole: Tilt at 4 fl oz/A. Has systemic activity. Do not apply more than 32 fl oz/A per season. Using grass seed crop waste, hay, and seed screenings is permitted if the final treatment is at least 20 days before harvest. Regrowth may be grazed 140 days after the last treatment. 24 hour REI.
**Blind seed**

*Gloeotinia temulenta*

This disease is most common in perennial ryegrass but can also occur in annual ryegrass. In spring, ascospores are ejected from the apothecia into the air, landing on flowers of the ryegrass plant. Within 2 weeks, secondary spores (conidia) may form on the surface of developing seed. Seed may be shrunken, rust colored, or may have a pink coating. Infected seed is very difficult to identify visually; microscopic examination is required to verify presence of conidia. Conidia can be disseminated during rain.

**Symptoms:**

Poor seed germination.

**Chemical Control:**

Fungicides are not used to control this disease.

**Cultural control:**

1. Plant disease-free seed. Infected seed stored dry for 24 months is considered safe to plant.

2. Prepare a good seed bed, and plant seed at least 0.5 inch deep.

3. Promote good soil drainage.

4. Apply optimum rates of nitrogen fertilizer, and maintain a healthy and vigorous stand.

5. Prevent heading in perennial ryegrass fields until after mid-July.

6. Harvest at the proper time to reduce seed shatter.

7. Remove as much seed as possible from the field during combining.

8. Destroy ryegrass screenings.

9. In severely infested fields, open field burning with full straw load may be required if the stand is to remain in production. Otherwise, plow the field.

10. Limit production to two seed crops, then plow.
**Crown rust**

*Puccinia coronata*

This fungal disease is a problem mainly in perennial ryegrass. (The term "crown" is associated with the teliospores, not with a location on a plant. The top of the teliospore is broad with a "crown" of fingerlike projections.) The alternate host is buckthorn (*Rhamnus* spp.) and its importance varies considerably with its proximity to the grass host. The fungus overwinters on infected plants.

**Symptoms:**

Pustules are bright orange-yellow and occur as small, scattered blisters on upper and lower surfaces of leaf blades, but they also may appear on leaf sheaths. The epidermis along the margin of the pustule is slightly raised but not ragged like stem rust pustules. Pustules sometimes develop in stripes, which causes confusion with stripe rust in field diagnosis. Microscopic examination of urediniospores and teliospores is needed for proper diagnosis.

**Cultural Control:**

Many turf-type cultivars with crown rust resistance are available.

**Chemical control:**

Fungicides are applied when pustules first appear; repeat every 7 to 10 days for contact fungicides or every 14 to 21 days for systemic fungicides. Application at flag leaf emergence, even if rust is not visible, can help in a year when rust does not develop fully due to low temperatures.

The products and rates listed for stem rust control are identical to those used for control of crown rust. See description of stem rust, above, for details.

**Drechslera leaf blights**

*Drechslera* spp. and *Bipolaris* spp

This fungal disease is one of the more common leaf spots on perennial and annual ryegrass and is also known as Helminthosporium Net Blotch. The fungi survive as conidia and dormant mycelia in infected plant tissue and debris. Conidia are spread by wind, rain, irrigation water, or machines. Cool, wet spring weather favors the disease.

**Symptoms:**
The lesions may lie parallel and perpendicular to the leaf axis, resulting in a netlike appearance; hence the name "net blotch". Lesions may coalesce to form dark brown, solid spots. Heavily infected plants progressively die back from the tips which can result in the entire leaf turning brown.

**Chemical control**

In most years, control is not necessary. Consider applying a fungicide if upper leaves, especially flag leaves, are heavily infected and if prolonged cool, rainy weather is forecast.

- Chlorothalonil

Do not allow livestock to graze in treated areas or feed treated plant parts to livestock. 14 day PHI. 12 hour REI.

1. Bravo Ultrex at 0.9 to 1.4 lb/A on 14 day intervals.

2. Echo 720 at 1 to 1.5 pints/A on 14 day intervals.

**Ergot**

*Claviceps purpurea*

Sclerotia of the fungus overwinter on or near the soil surface and germinate in spring, giving rise to stalked, spherical structures that eject ascospores. The flower is the only part susceptible to infection. Temperature, light, and other environmental conditions that affect the duration and uniformity of flower opening also determine the severity of infection. Infected florets exude a sticky, viscous combination of plant sap and conidia, commonly referred to as honeydew. Its high sugar content attracts insects, especially flies, which efficiently spread the disease (secondary spread). The disease cycle begins again when mature ergot fall to the ground.

**Symptoms:**

Hard, gray to purple-black, elongated bodies (sclerotia) replace seed. Sclerotia usually are two to three times longer than normal seeds. (The sclerotial stage is preceded by a "honeydew" stage in which a sticky mass of conidia oozes from infected florets.)

**Cultural control**

1. Plant ergot-free seed.

2. Promote good soil drainage.
3. Prevent heading in pastures or in field margins.

4. Remove as many ergot as possible from the field during harvest. Ergot can be removed later during seed cleaning.

5. Destroy screenings containing ergot. If buried, they must be more than 3 inches deep.

6. Use resistant cultivars or ones that flower only a short time.

7. Control annual bluegrass or other Poa species.

8. Open field burning will reduce but not eliminate ergot.

9. Rotate field out of susceptible grasses.

**Chemical control:**

- Propiconazole: Tilt at 4 to 8 fl oz/A just before anthesis. Do not apply more than 32 fl oz/A per season. Using grass seed crop waste, hay, and seed screenings is permitted if the final treatment is at least 20 days before harvest. Regrowth may be grazed 140 days after the last treatment. 24 hour REI.

**Rhynchosporium scald and leaf spot**

*Rhynchosporium orthosporum and Rhynchosporium secalis*

This fungal disease occurs mainly in perennial ryegrass and is only occasionally found in annual ryegrass. The pathogen survives as dormant mycelia in living plants or plant debris. During winter and spring, the fungi sporulate profusely when conditions are wet, releasing conidia that are splashed or blown to uninfected tissue. Symptoms do not appear for 10 to 14 days after infection.

**Symptoms:**

Irregular leaf spots that spread and join to form brown elongated lesions, giving the plant a "scalded" appearance. Lesions may eventually kill the entire leaf.

**Cultural control:**

Field burning has little effect on this disease.
Chemical control:

- Chlorothalonil: Bravo Ultrex at 0.9-1.4 lb/A. One or two well-timed applications are more cost-effective than three. There has been no advantage to tank-mixes of Bravo and Tilt (propiconazole) unless rust is also a problem. Do not allow livestock to graze in treated areas or feed treated plant parts to livestock. 14 day PHI. 48 hour REI.

Nematodes

Nematodes are not a problem in ryegrass grown for seed (3).

Weeds

Weed competition in grass seed fields can reduce plant vigor and seed yield, making weed control a major concern in most grass seed fields. Grass weeds are especially troublesome because, if left uncontrolled, they can contaminate the seed harvest with undesirable seed. Glyphosate is often used along fence rows, ditch banks, and other borders to control grass weeds that have the potential to contaminate the ryegrass seed harvest. Between 75% and 100% of the ryegrass acreage is treated with an herbicide to control broadleaf weeds, grass weeds, or volunteer seedlings of the seed crop. A wide range of annual and perennial broadleaf and grass weeds are found throughout the production area. Many different types of herbicides are registered for use in ryegrass; the weed species complex, time of year of the application, grass crop cultivar, and age of the planting will determine which herbicide is used. Herbicide profiles used in grass seed production appear at the end of this weed section.

Newly Seeded Fields

All newly seeded fields of perennial and annual ryegrass are treated with an herbicide, although the method of application and type of herbicide used may differ. If needed, a broadcast application with a non-selective herbicide, such as paraquat (Gramoxone) or glyphosate (Roundup), is made prior to seed bed preparation. Then, in general, a preemergence or early postemergence herbicide is used at or after planting. Selective, postemergence herbicides to control broadleaf weeds can also be used after planting in the fall but are usually not needed until the following spring.
Preemergence Herbicides (newly seeded fields):

Perennial ryegrass:

A common practice in perennial ryegrass is to apply a slurry of activated carbon, about one inch wide, over the seeded row and then make a broadcast application of diuron + pronamide (Direx or Karmex + Kerb). The carbon adsorbs the herbicide and prevents damage to the emerging seedling. The diuron + pronamide mix provides preemergence weed control of many annual and perennial broadleaf and grass weeds. Oxyfluorfen (Goal or Galigan) is a preemergence and early postemergence herbicide that is sometimes used to control annual broadleaf weeds. Ethofumesate (Nortron) controls only grass weeds and is applied when weeds are still small (earlier than four-leaf stage) and the ryegrass crop has at least two leaves. A selective, postemergence herbicide may be applied if broadleaf weeds appear after the crop has germinated, but is usually not needed until the following spring.

Annual ryegrass:

Ethofumesate (Nortron) is used almost exclusively on nearly 100% of the acreage at time of planting annual ryegrass to control grass weeds (applied when weeds have less than four leaves and the ryegrass seedling has at least two leaves). No other preemergence herbicide is registered for use in newly seeded annual ryegrass. A selective, postemergence herbicide may be applied if broadleaf weeds appear after the crop has germinated, but is usually not needed until the following spring.

Postemergence Herbicides (newly seeded fields):

Annual and Perennial Ryegrass:

Selective, postemergence herbicides that can be used to control broadleaf weeds after the perennial or annual ryegrass seedlings have emerged include: 2,4-D (several brands), MCPA (several brands), bromoxynil (Buctril), dicamba (Banvel, Clarity), tribenuron-methyl (Express), carfentrazone (Aim), fluoroxypr-methyl (Starane) and quinclorac (Paramount). Glufosinate (Rely) controls grass weeds, such as annual and roughstalk bluegrass, mannagrass, and Bromus species, but is used only when other herbicide programs are deemed inadequate and is considered a "rescue" or "salvage" treatment because of high likelihood of crop injury.

Established Fields

The herbicide regime for annual ryegrass is fairly standard on most acreage, which includes an application of ethofumesate (Nortron) when weeds and the crop are young and, if needed, followed by a spring application of a selective, postemergence herbicide, usually 2,4-D or dicamba (Banvel or Clarity). The postemergence herbicides listed above in the "newly seeded fields" section are also allowed for use in the spring. In addition, Curtail (clopyralid + 2,4-D, Curtail M (clopyralid + MCPA) and Stinger (clopyralid) are registered for use in annual ryegrass if application is made in the spring following fall
Perennial ryegrass will stay in production for three to five years and a preemergence herbicide is commonly applied during fall or winter to the established crop. If needed, a postemergence herbicide to control broadleaf weeds is applied in the spring.

Preemergence herbicides registered for use in established perennial ryegrass include: pendimethalin (Prowl), s-metolachlor (Dual Magnum), s-dimethenamid (Frontier or Outlook), flufenacet + metribuzin (Axiom) and oxyfluorfen (Goal or Galigan). Herbicides that have preemergence and early postemergence activity include: diuron (Karmex or Direx), metribuzin (Sencor), ethofumesate (Nortron), and pronamide (Kerb). The postemergence herbicides registered for use in perennial ryegrass, in addition to ethofumesate, are the same as those for annual ryegrass.

**Herbicide Profiles**

**Preemergence Activity:**

**S-Dimethenamid**

**Formulation:** Frontier 6.0 or Outlook 6.0

**Crop:** Perennial ryegrass, established stand

**Weeds Controlled:** Annual ryegrass, rattrail fescue, seedling brome, volunteer crop seedlings and some annual broadleaf weeds.

**Application rate:** 1.13 to 1.5 lb ai/A (24 to 32 fl oz/A Frontier 6.0 or Outlook 6.0)

**Timing:** In fall prior to rain before targeted weeds emerge.

**PHI:**

**REI:** 12 hours

**Efficacy Issues:** Less effective control of annual bluegrass.

**Remarks:** Do not graze treated fields or feed straw or seed screenings to livestock.

**Flufenacet + Metribuzin**
**Formulation**: Axiom DF

**Crop**: Perennial ryegrass, established stand

**Weeds Controlled**: Annual bluegrass, annual ryegrass, rattail fescue, seedling brome, volunteer crop seedlings

**Application Rate**: 0.3 to 0.4 lb ai/A flufenacet + 0.075 to 0.113 lb ai/A metrabuzin (9 to 13 oz/A Axiom DF)

**Timing**: Apply before weeds emerge or no later than the two-leaf stage of volunteer grasses. Apply before November 15.

**PHI**: 120 days

**REI**: 12 hours

**Efficacy Issues**: Excellent control of annual bluegrass.

**Remarks**: Crop injury may occur if applied after November 15 or if used after second harvest; 9 to 11 oz/A product rate reduces likelihood of injury. Do not graze treated fields. 24c registration.

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**S-Metolachlor**

**Formulation**: Dual Magnum

**Crop**: Perennial ryegrass, established stand

**Weeds Controlled**: Annual ryegrass, rattail fescue, seedling brome, volunteer seedlings

**Application Rate**: 0.95 lb ai/A (1 pint/A Dual Magnum)

**Timing**: In fall prior to rain before targeted weeds emerge. Apply before November 15.

**PHI**: Unavailable

**REI**: 24 hours
**Efficacy Issues:** Less effective control of annual bluegrass.

**Remarks:** Crop injury may occur if applied after November 15. Do not graze fields within 250 days of application. 24c registration.

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**Pendimethalin**

**Formulation:** Prowl 3.3 EC

**Crop:** Perennial ryegrass, established stand

**Pests Controlled:** Most annual grasses and many broadleaf weeds; volunteer crop seedlings.

**Application Rate:** 1.98 to 2.97 lb ai/A (4.8 to 7.2 pints/A Prowl)

**Timing:** In fall prior to rain before targeted weeds emerge.

**PHI:** Unavailable

**REI:** 24 hours

**Efficacy Issues:** Good control of annual bluegrass.

**Remarks:** Crop injury may occur if applied after November 15. Do not graze treated fields. May temporarily injure grass stands. 24c registration.

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**Preemergence and Early Postemergence Activity:**

**Oxyfluorfen**

**Formulation:** Goal 2XL or Galigan 2E

**Crop:** Perennial ryegrass, new or established stands

**Weeds Controlled:** Many grass and broadleaf weeds

**Application Rate:**
New plantings: 0.025 to 0.0375 lb ai/A (2 to 3 oz/A Goal or Galigan)

Established stands: 0.125 to 0.375 lb ai/A (8 to 24 oz/A Goal or Galigan)

**Timing:** In fall prior to rain before targeted weeds emerge or when they are still small, usually prior to December 15. Grass seed crop should have at least one tiller per plant (newly seeded fields) or at least six tillers per plant (established fields).

**PHI:** 150 days

**REI:** 24 hours

**Efficacy Issues:**

**Remarks:** Do not graze fields within 150 days of application. 24c registration.

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**Diuron**

**Formulation:** Karmex DF or Direx DF

**Crop:** Perennial ryegrass, new or established stands

**Weeds Controlled:** Many grass and broadleaf weeds

**Application Rate:**

Carbon-seeding: 2.0 to 2.4 lb ai/A (2.2 to 3.0 lb/A Karmex or Direx)

Established stands: 0.8 to 1.6 lb ai/A (1.0 to 2.0 lb/A Karmex of Direx)

**Timing:**

New stands: apply in fall after carbon application and planting but before rains.

Established fields: apply at the onset of fall rains and before weeds reach the two- to four- leaf stage.

**PHI:** Unavailable
REI: 12 hours

**Efficacy Issues:** Does not control downy brome, wild oats or volunteer winter cereals

**Remarks:** Two year crop rotation restriction.

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**Metribuzin**

**Formulation:** Sencor DF or Sencor 4F

**Crop:** Perennial ryegrass, established stands

**Weeds Controlled:** Many grass and broadleaf weeds, volunteer crop seedlings

**Application Rate:** 0.24 to 0.56 lb ai/A (0.33 to 0.75 lb/A Sencor DF or 7.7 to 17.9 oz/A Sencor 4F)

**Timing:** In fall or prior to new spring growth; prior to when volunteer crop seedlings are at the two-leaf stage

**PHI:** 120 days

**REI:** 12 hours

**Efficacy Issues:** Effective control of diuron-resistant weeds and most *Bromus* species

**Remarks:** Marginal and variable crop tolerance. Do not graze treated fields or feed straw or seed screenings to livestock until 28 days after application. 24c registration.

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**Ethofumesate**

**Formulation:** Nortron SC

**Crop:** Annual ryegrass, new stands; Perennial ryegrass, new or established stands

**Weeds Controlled:** Many annual grass weeds and volunteer crop seedlings

**Application Rate:** 0.75 to 1.9 lb ai/A (24 to 60 oz/A Nortron)
Timing: In fall before weeds are at the two-leaf stage

PHI: Unavailable

REI: 12 hours

Efficacy Issues: Especially effective in controlling annual bluegrass.

Remarks: Most effective when applied preemergence. Do not graze treated fields. Do not rotate with any crop other than ryegrass for 12 months after application.

Postemergence Activity:

2,4-D

Formulation: Amine, oil-soluble amine, or ester. Several brands.

Crop: Annual and perennial ryegrass, new and established stands

Weeds Controlled: Many broadleaf weeds

Application Rate: 0.36 to 0.75 lb ae/A

Timing:

New stands: In fall, use 0.5 lb ae/A, after crop seedlings have reached the two-leaf stage stage, or in spring before boot stage.

Established stands: In fall or spring. Make spring applications before crop reaches boot stage.

PHI: Unavailable

REI: 48 hours

Efficacy Issues:
MCPA

**Formulation:** Amine, ester or sodium salt. Several brands.

**Crop:** Annual and perennial ryegrass, new and established stands

**Weeds Controlled:** Many broadleaf weeds

**Application Rate:** 0.5 to 1.0 lb ae/A

**Timing:**

New stands: In fall, use 0.5 lb ae/A, after crop seedlings have reached the two-leaf stage, or in spring before boot stage.

Established stands: In fall or spring. Make spring applications before crop reaches boot stage.

**PHI:** Unavailable

**REI:** 12 to 48 hours

**Efficacy Issues:**

**Remarks:** Often used in a tank-mix with other herbicides. Do not graze treated fields for 14 days after application.

Bromoxynil

**Formulation:** Buctril or Bronate

**Crop:** Annual and perennial ryegrass, new and established stands

**Weeds Controlled:** Broadleaf weeds
**Application Rate**: 0.25 to 0.5 lb ai/A (1 to 2 pints/A Buctril or Bronate)

**Timing**:

New stands: In fall, after crop seedlings have reached the two-leaf stage, or in spring before boot stage.

Established stands: In fall or spring. Make spring applications before crop reaches boot stage.

**PHI**: Unavailable

**REI**: 12 hours

**Efficacy Issues**:

**Remarks**: Do not graze treated fields or feed straw or seed screenings to livestock.

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**Dicamba**

**Formulation**: Banvel or Clarity

**Crop**: Annual and perennial ryegrass, new and established stands

**Weeds Controlled**: Broadleaf weeds

**Application Rate**:

New stands: 0.25 to 0.5 lb ae/A (0.5 to 1 pint/A Banvel or Clarit)

Established stands: 0.25 to 1.0 lb ae/A (0.5 to 2 pints/A Banvel or Clarity)

**Timing**:

New stands: In fall, after crop seedlings have reached the three-leaf stage but before jointing.

Established stands: In fall or spring before jointing.

**PHI**: 37 to 70 days (dependent upon rate used)

**REI**: 24 hours
**Efficacy Issues:** Good control of curly dock, smartweeds, knotweed and sorrels. Poor control of many mustards.

**Remarks:** Often tank-mixed with other postemergence herbicides. Grazing restrictions range from 7 to 21 days (dependent upon rate used).

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**Clopyralid**

**Formulation:** Stinger

**Crop:** Annual and perennial ryegrass, established stands

**Weeds Controlled:** Many broadleaf weeds

**Application Rate:** 0.094 to 0.25 lb ae/A (0.25 to 0.66 pints/A Stinger)

**Timing:** In spring before crop reaches boot stage and/or as a postharvest fall treatment in perennial ryegrass. A preharvest treatment to control late-emerging Canada thistle can be made after grass seed is fully developed.

**PHI:** Unavailable

**REI:** 12 hours

**Efficacy Issues:** Especially effective in controlling Canada thistle.

**Remarks:** Often tank-mixed with other postemergence herbicides, such as MCPA and 2.4-D. Crop rotation restrictions of 12 to 18 months apply to certain crops.

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**Fluroxypyr-methyl**

**Formulation:** Starane

**Crop:** Perennial ryegrass, new and established stands
**Weeds Controlled:** Bedstraw  

**Application Rate:** 0.12 lb ai/A (0.66 pints/A Starane)  

**Timing:**  
New stands: Apply after crop seedlings have reached two-leaf stage but before boot stage.  
Established stands: Apply in spring between tiller stage and early boot stage.  

**PHI:** Unavailable  

**REI:** 12 hours  

**Efficacy Issues:** Fair to good control of bedstraw  

**Remarks:** Do not apply during boot, flower or seed development stage of growth. Do not graze treated fields or feed straw or seed screenings to livestock. 24c registration  

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**Carfentrazone-ethyl**  

**Formulation:** Aim  

**Crop:** Annual and perennial ryegrass, new and established stands  

**Weeds Controlled:** Many broadleaf weeds.  

**Application Rate:** 0.13 to 0.5 lb ai/A (0.33 to 1.24 oz/A Aim)  

**Timing:** May be applied before seeding and up to jointing stage of crop.  

**PHI:** Unavailable  

**REI:** 12 hours
**Quinclorac**

**Formulation:** Paramount

**Crop:** Annual and perennial ryegrass, new and established stands

**Weeds Controlled:** Field bindweed

**Application Rate:** 0.25 to 0.38 lb ai/A (0.33 to 0.5 lb/A Paramount)

**Timing:** Apply in fall after harvest but before first frost. Field bindweed should be actively growing and at least four inches long.

**PHI:** Unavailable

**REI:** 12 hours

**Efficacy Issues:** Very good control of field bindweed.

**Remarks:** A supplement label allows use in ryegrass for control of bindweed. Do not graze treated fields or feed straw or seed screenings to livestock.

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**Tribenuron-methyl**

**Formulation:** Express 75 DF

**Crop:** Annual and perennial ryegrass, new and established stands

**Weeds Controlled:** Broadleaf weeds

**Application Rate:**
New stands: 0.125 oz ai/A (0.167 oz/A Express)

Established stands: 0.125 to 0.25 oz ai/A (0.167 to 0.33 oz/A Express)

**Timing:**

New stands: Apply after crop is in four-leaf stage.

Established stands: Apply prior to jointing.

**PHI:** 60 days

**REI:** 12 hours

**Efficacy Issues:** Fair to good control of wild carrot.

**Remarks:** Perennial ryegrass is very sensitive to Express. To minimize crop injury, always tank mix with either 2,4-D or Banvel, and liquid nitrogen fertilizer. For perennial ryegrass, use the 0.125 oz ai/A rate on seedling fields; apply after jointing to established fields. A supplement label allows use in annual and perennial ryegrass. Do not graze treated fields for 60 days after application.

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**Glufosinate**

**Formulation:** Rely

**Crop:** Annual and perennial ryegrass, new and established stands

**Weeds Controlled:** Annual and roughstalk bluegrass, mannagrass, *Bromus* species

**Application Rate:**

Broadcast: 0.313 to 0.375 lb ai/A (2.5 to 3 pints/A Rely)

Directed, shielded spray: 1.0m to 1.5 lb ai/A (4 to 6 quarts/A Rely)

**Timing:** For best weed control and crop safety, apply when crop initiates spring growth.

For newly seeded fields, apply after crop reaches third tiller stage.
PHI: Unavailable

REI: 12 hours

Efficacy Issues:

Remarks: Use of Rely is considered a "rescue" or "salvage" treatment because of high likelihood of crop injury. Do not graze treated fields for 365 days after application. 24c registration.

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