



## RUSTS OF TURFGRASSES

All commonly grown turfgrasses in the Midwest—bluegrasses, fescues, ryegrasses, zoysiagrasses, and bermudagrass—are attacked by one or more rust fungi in the genus *Puccinia* (Table 1). Other rust genera (*Uromyces* and *Physopella*) attack turfgrasses outside of the Midwest. Bentgrasses are usually not affected. Rust fungi are obligate parasites and infect only living grass plants. Two or more rusts may attack the same grass plant at the same time. Grass plants are most easily infected under stressful growing conditions.

Rusts are most severe when water and fertility are less than adequate for good growth. Most rust problems occur on Kentucky bluegrass, perennial ryegrass, tall fescue, and zoysiagrass. These diseases occur throughout the United States wherever susceptible grasses are grown.

Most rusts do not usually become a growth-limiting problem until mid to late summer during extended, warm to hot, humid, but dry periods when grass grows slowly or not at all and nights are cool with heavy dews. Some cultivars of Kentucky bluegrass (such as Birka, Campus, Delft, Eclipse, Lovegreen, Merion, Mystic, Prato, Touchdown, and Windsor), several of the newer perennial ryegrasses (Derby, Manhattan, Pennfine, and Regal), zoysiagrasses, Pennlawn creeping fescue, and Sunturf bermudagrass are particularly susceptible.

Severe rust infection causes many grass blades to turn yellow to brown, wither, and die. Such turf may be thinned and weakened and also be more susceptible to winter-kill, drought, weed invasion, and other diseases. Like powdery mildew, rusts are often more serious in the shade.

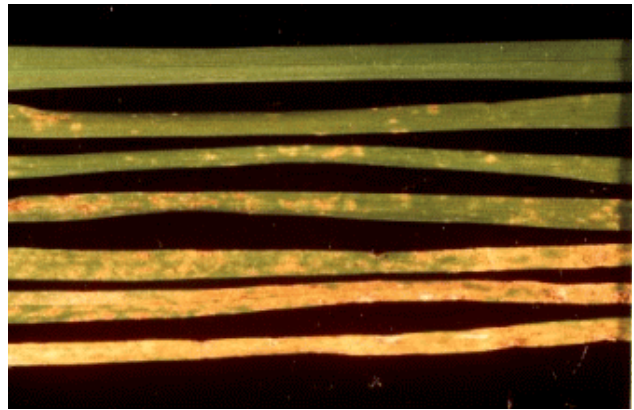


Figure 1. Leaf rust on bluegrass showing advancing stages of infection.



Figure 2. Bluegrass attacked by rust.

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Further information concerning Turfgrass Diseases is available at your nearest Extension Office or a Turf Specialist at the University of Illinois, Urbana-Champaign.

## SYMPTOMS

Shortly after infection, a close examination of the grass blades and leaf sheaths will show small light yellow flecks. These soon enlarge. In several days, the epidermis ruptures and tears away to expose the round, oval, or elongated powdery, spore-filled pustules, which may be reddish to chestnut brown, brownish yellow, bright orange, or lemon yellow (Figures 1 and 2). The powdery material rubs off easily on hands, shoes, clothing, and animals. Where severe, rust-affected leaves or even entire plants may turn yellow (orange on zoysiagrasses), wither, and die. Severely rust-infected turf soon takes on a reddish brown to yellowish or orange appearance, depending on the rust involved. Affected turf becomes weakened, chlorotic, thin, and unsightly.

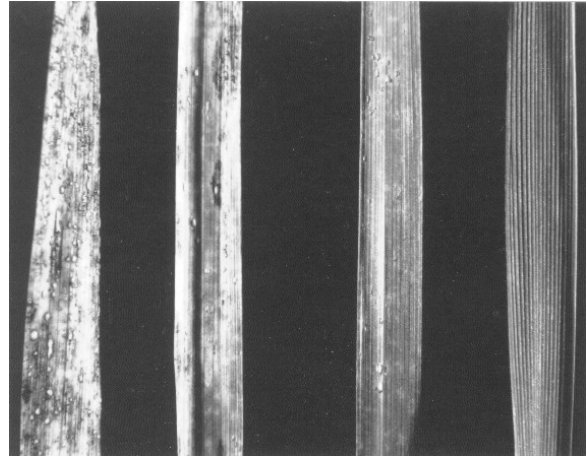


Figure 3. Leaf rust infecting tall fescue leaves; the leaf to the right is healthy (courtesy L.T. Lucas).

## DISEASE CYCLE

The cycle of development for these rust fungi is very complex because of the many species involved (about 30 in the United States; see Table 1 and Figures 3 and 4 and the numerous alternate hosts, mostly woody shrubs and herbaceous ornamentals. The alternate hosts are not believed to play an important role in the disease development of the rust fungi that attack turfgrasses.

The yellow-orange to rust-colored powdery material that rubs off is composed of tremendous numbers of microscopic spores (urediospores, uredospores, or urediniospores; Figures 3 and 4) the reproductive structures of the rust fungi (*Puccinia* species). A single pustule may contain 50,000 or more spores, each capable of producing a new infection. These spores are readily disseminated by air currents, water, shoes, turf equipment, infected sod, plugs, or sprigs. Some spores land on susceptible leaf tissue, where, in the presence of moisture, they germinate by developing germ tubes that penetrate the grass leaves and sheaths through open pores (stomates) and cause infection. Most spores do not successfully reach a turf plant. A new generation of rust pustules and urediospores appear 7 to 15 days later, depending largely on the temperature. Urediospores constitute the repeating stage of the rust fungus. This cycle of spore production, release, penetration, and infection may be repeated a number of times during the summer and fall, or until environmental conditions become unfavorable for the growth and reproduction of the rust fungus.

In mild climates, the rust fungi overwinter as dormant mycelium and as urediospores in or on infected turfgrass foliage and equipment. In Illinois, rust fungi usually overwinter as dormant mycelium within living grass leaves and crowns. When the temperature (usually between 60° and 90°F or 15° to 32°C) and moisture conditions are conducive to regrowth of the mycelium and germination of the urediospores, the leaves and leaf sheaths become infected and a new generation of radial pustules and their urediospores are formed. These spores are readily transported over long distances by air currents, and those from southern regions of the United States may serve as sources of windblown inoculum for northern regions, where mycelium and urediospores cannot survive the winter.

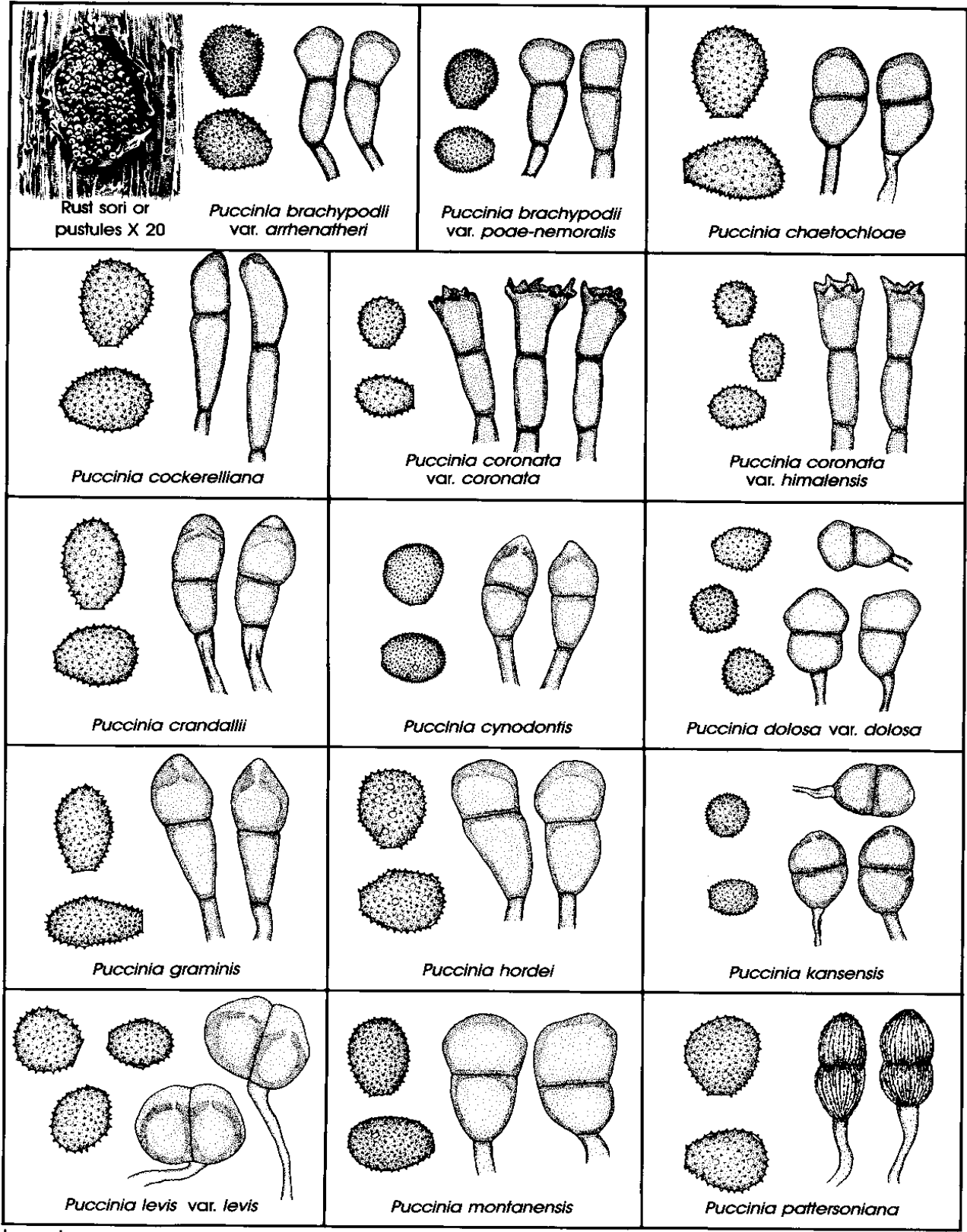
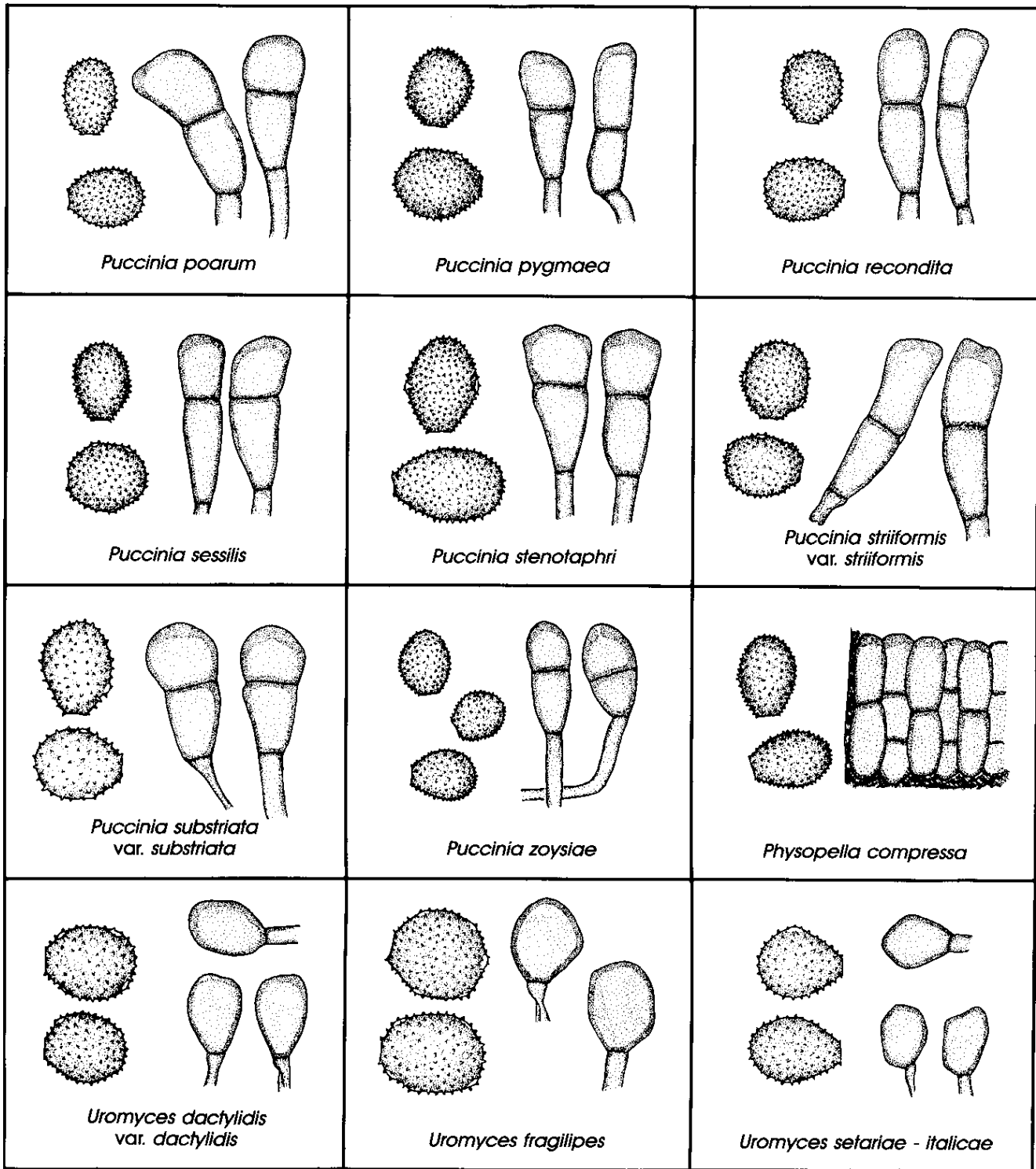


Figure 3. Fifteen species of *Puccinia* that cause rust diseases of turfgrasses; for each species the urediospores are on the left and the teliospores are on the right (after Cummins). Drawing by Lenore Gray.



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Figure 4. Twelve species of rust fungi that cause rust diseases of turfgrasses; for each species the urediospores are on the left and the teliospores are on the right (after Cummins). Drawing by Lenore Gray.

Most rust fungi also produce another spore type, teliospores (Figures 3 and 4), when the leaves senesce or dry slowly. The brown to black telial stage is minor on mowed turfgrasses grown under a good cultural management program. The teliospores, if produced, may serve as overwintering structures in the north, germinating in the spring to produce a third spore type, basidiospores. Basidiospores are transported by air currents to the leaves of nearby, alternate hosts (mostly woody shrubs and herbaceous ornamentals), where they may germinate and infect resulting in two more spore types, pycniospores, and later, the aeciospores. Cluster cups or aecial form on the alternate hosts and release aeciospores which are then capable of infecting grass plants giving rise to urediospores, thus completing the disease or life cycle. The urediospores are most important in infection of mowed turfgrasses.

Infection for most rusts is favored by 4 to 8 hours of low light intensity, temperatures of 70° to 75°F (21° to 24°C), and high humidity, heavy dews, or light rains followed by 8 to 16 hours of high light intensity, temperatures of 80° to 95°F (27° to 35°C), and slow drying of leaf surfaces. Stripe or yellow rust is active in northern states in early spring and fall. Along the Pacific Coast it is active during the winter months.

## Control

1. Plant rust-resistant grasses, blends, or mixtures locally adapted for your area. Check with your area Extension office or Extension turf specialist for suggested grass species and cultivars to grow. Kentucky bluegrass cultivars with moderate to good resistance to one or more rust include A-20 and A-34 (Bensun), Adelphi, Admiral, America, Apart, Aquila, Argyle, Aspen, Banff, Bayside, Bonnieblue, Bono, Bristol, Brunswick, Challenger, Charlotte, Classic, Columbia, Enmundi, Enoble, Escort, Fylking, Geronimo, Glade, Harmony, Holiday, Majestic, Midnight, Mona, Monopoly, Mosa, Mystic, Nassau, Nugget, Parade, Park, Piedmont, Plush, Ram I, Rugby, Sasta, Sydsport, Trenton, Vantage, Victa, Wabash, and Welcome (see Table 2).

Other resistant grasses include Ensylva, Flyer, and Shadow fine-leaved fescues; All-Star, Birdie II, Blazer, CBS II, Citation II, Cowboy, Dasher, Delray, Elka, Fiesta, Gator, Loretta, Manhattan II, Omega II, Palmer, Pennant, Prelude, Premier, Repell, Tara, and Yorktown perennial ryegrasses. Emerald and Meyer zoysiagrasses are very susceptible; Belair has some resistance. Bermudagrass, Italian or annual bluegrass, and tall fescue cultivars also differ in resistance. Common and many hybrid bermudagrasses are tolerant or resistant while the hybrid Sunturf is very susceptible.

Tall fescue cultivars with improved crown rust resistance include Adventure, Apache, Falcon, Jaquar, Mustang, and Olympic. Resistance to rusts is limited by the presence of numerous physiological races of the rust fungi. A cultivar in one location may be resistant whereas it appears susceptible in another turfgrass area.

2. Fertilize to keep grass growing at a steady rate, about an inch a week, during summer or early fall droughts. The growth of grass blades pushes the rust-infected leaves outward, where they can be mowed off and removed. To increase vigor, maintain a proper balance of nitrogen, phosphorus, and potassium (N-P-K), according to local recommendations and a soil test report. These recommendations will vary with the grasses grown and their use. **Do not overfertilize**, especially with a readily available high-nitrogen source. Keep the phosphorus and potassium levels high.

3. During summer or early fall droughts, water established turf thoroughly early in the day so that the grass can dry before night. Water infrequently and deeply, moisten in the soil at each watering to a depth of 6 inches or more. Avoid frequent light sprinklings, especially in the late afternoon or evening. Free water on the leaf surface for several hours enhances development of rusts and many other diseases.
4. Increase light penetration, air movement, and rapid drying of the grass surface by pruning or selectively removing dense trees and shrubs bordering the turf. Space landscape plants properly to allow adequate air movement and to avoid excessive shade.
5. Remove thatch in early spring or early fall during cool weather when it has accumulated to half an inch. Use a "vertical mower", "power rake", "aerifier", or similar equipment. This equipment can be rented at most large garden supply or tool rental stores.
6. Mow frequently at the weight recommended for your area and for the grasses grown. Mow upright grasses, such as Kentucky bluegrass, ryegrasses, and fescues, at 1½ to 3 ½ inches (somewhat higher in the summer). Creeping grasses like bentgrasses, bermudagrass, and zoysias may be mowed to one-half inch or less. Remove no more than a third of the leaf surface at one cutting. Collect the clippings where feasible. This eliminates a potential source of inoculum.
7. Follow suggested weed-control programs for the area and for the grasses grown.
8. The cultural practices outlined above (1 through 7) should provide for a steady, vigorous growth of grass during extended, warm to hot, dry periods when rust attacks are most severe. If rusts are serious year after year, these practices may need to be supplemented by a preventive fungicide spray program. The initial application should be made when rust is first evident on the grass blades. Repeat applications are needed at 7- to 14-day intervals as long as rust is prevalent. Sterol-inhibiting fungicides such as Bayleton, will provide several weeks of protection with a single application. For best results, apply the fungicide soon after mowing and removal of the clipping. Good coverage of the leaf surface is necessary for control. The addition of about a half teaspoonful of commercial "spreader-sticker" or surfactant (about ½ to 1 teaspoonful per gal or 1 pint to 1 quart per 100 gal) such as Plyac Non Ionic Spreader-Sticker, De-pesther Spreader-Activator, Ortho Spreader-Sticker, Triton B-1956, Bio-Film Spreader-Sticker, Chevron Spray Sticker, Miller NuFilm-17 and NuFilm P, or X-77. Always follow the manufacturer's directions. For the most effective control of rusts, uniformly spray 1000 sq ft of turf with 2 to 3 gal of water containing **one** of the suggested fungicides listed in the current edition of Illinois Commercial Landscape and Turfgrass Pest Management Handbook.

Use the lower fungicide rates in a routine **preventive** program; use the higher rates for a **curative** program, after the appearance of numerous infections (light yellow flecks).

Any one of these fungicides may be alternated with another fungicide, such as Chipco 26019, Dyrene or Dymec, Vorlan, Cleary's 3336, Fungo 50, Kromad, or Tersan 1991.

If Pythium blight is also a problem, alternate one of the fungicides suggested to control rusts, with a fungicide to control Pythium.

When mixing or applying any fungicide, follow the manufacturer's directions and precautions carefully.

Mention of a trade name or proprietary product does not constitute warranty of the product and does not imply approval of this material to the exclusion of comparable products that may be equally suitable.

Table 1. Rust Fungi That Infect Cultivated Turfgrasses in the Midwest

Rust fungus	Turfgrasses infected
<i>Puccinia</i>	
<i>brachypodii</i> var. <i>arrhenatheri</i>	Blugrasses, fescues, wheatgrasses
<i>brachypodii</i> var. <i>poae-nemoralis</i>	Bentgrasses, bluegrasses, fescues, perennial ryegrass, turf timothy
<i>cockerelliana</i>	Fescues
<i>coronata</i> var. <i>coronata</i>	Bahiagrass bentgrasses, bluegrasses, fescues, perennial ryegrass, turf timothy, weeping alkaligrass, wheatgrasses
<i>coronata</i> var. <i>himalensis</i>	Kentucky bluegrass
<i>crandallii</i>	Bermudagrasses, fescues
<i>cynodontis</i>	Bermudagrasses
<i>graminis</i> subsp. <i>graminicola</i>	Bentgrasses, bluegrasses, perennial ryegrass, turf timothy, wheatgrasses
<i>graminis</i> subsp. <i>graminis</i>	Bermudagrasses, wheatgrasses
<i>hordei</i>	Perennial ryegrass
<i>kansensis</i>	Buffalograss
<i>montanensis</i>	Wheatgrasses
<i>pattersoniana</i>	Wheatgrasses
<i>poarum</i>	Bentgrasses, bluegrasses, fescues, turf timothy
<i>recondita</i>	Bentgrasses, bluegrasses, fescues, perennial ryegrass, wheatgrasses
<i>sessilis</i>	Fescues
<i>striiformis</i>	Bluegrasses, fescues, perennial ryegrass, turf timothy, weeping alkali grass, wheatgrasses
<i>zoysiae</i>	Manilagrass ( <i>Zoysia matrella</i> )

Source: Adapted from Cummins (1971) and Smiley (1983). For illustrations of the urediospores and teliospores of these fungi, see Figures 3 and 4.



Table 2. Modern Kentucky Bluegrass Cultivars Adapted to Illinois and Reported to be Moderately to Highly Resistant (R)<sup>a</sup> to one or More Diseases

Kentucky Bluegrass Cultivars	"Helminthosporium" diseases	Leaf smuts	Leaf and stem rust	"Fusarium blight"	Sclerotinia dollar spot	Typhula blight	Septoria leaf spot	Red thread
A-20	R	R	R	R	R		(b)	R
A-34 (Bensun)	R	R	R	R				
Adelphi	R	R	R	R	R	R	R	R
Baron	R	R	R	R	R	R		R
Bonnieblue	R	R	R	R	R	R		R
Brunswick	R	R	R	R	R			
Cheri	R	R	R	R	R		R	
Enmundi	R		R	R	R			R
Enoble	R							
Fylking	R	R	R				R	
Geronimo	R				R			R
Glade		R	R	R		R		
Majestic	R	R	R	R	R		R	R
Monopoly	R	R		R		R		R
Nugget	R	R	R			R	R	R
Parade	R	R	R	R	R		R	
Plush	R	R	R		R			R
Rugby	R	R	R	R	R			
Sydsport	R	R	R		R		R	
Touchdown	R	R		R			R	R
Vantage		R		R	R			
Victa	R	R	R	R				R

- a A resistant (R) rating does not mean that a particular cultivar will be resistant in all locations every year. Due to the presence of physiological races or strains of the various fungi that cause these diseases, a cultivar may be susceptible in one locality and highly resistant in another. This is especially true of powdery mildew and is the reason we omitted this disease from our ratings.
- b A blank under a given disease does not necessarily indicate susceptibility. In some cases it means that no data are available on which to evaluate the relative susceptibility or resistance to a particular disease.