BUL 1040

Diagnosing and Managing *Rhizoctonia* in Idaho Beans Crops

James Woodhall
Parma Research and Extension Center, University of Idaho

Lara Brown
Parma Research and Extension Center, University of Idaho

Mack Murdock
Parma Research and Extension Center, University of Idaho

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University of Idaho Extension

Introduction

RHIZOCTONIA ROOT ROT is an important disease of bean crops in southern Idaho that infects the lower stem and roots. Yield losses of up to 30% from the disease have been reported, although infection rates can be as high as 100% in severely affected fields. It is caused by the soilborne fungus *Rhizoctonia*, which exists as a species complex comprised of multiple Anastomosis groups (AGs) of either *Rhizoctonia solani* (designated AG 1–13) or Binucleate *Rhizoctonia* species (also called BNR or *Ceratobasidium* with AGs designated A–W). Individual AGs can be further divided into subgroups such as AG 2-1 to AG 2-4 and AG 4 HG-I to AG 4 HG-III. The various AGs and their subgroups differ considerably in their aggressiveness to cause disease, host preference, response to environmental conditions, and sensitivity to fungicides. In Idaho, *R. solani* AGs 1–5 and 11 as well as BNR AGs A, E, F, and K have been associated with disease in beans (Table 1), with the *R. solani* subgroups AG 2-2 and AG 4 HG-II the most frequently encountered. *R. solani* AG 2-2 and AG 4 HG-II are also the most important groups associated with severe disease in sugar beets.

Symptoms

The pathogen attacks the plant at any age, causing seed rot, damping off, stunting, root and stem lesions, and even plant death, although seedlings are considerably more susceptible to infection than mature plants. Lesions (Figure 1) can occur on the stems and roots before or after emergence. On the stems, lesions can have a brown or reddish-brown discoloration. Older lesions can be sunken and coalesce on the stems, leading to a lesion that completely encompasses (girdles) the stem. In younger plants, girdled hypocotyls result in preemergence and postemergence damping off. In older plants, severe girdling can cause the plant to fall over.

Table 1. Anastomosis groups (AG) of *Rhizoctonia solani* and Binucleate *Rhizoctonia* associated with common bean in Idaho and other hosts.

AG	Host
1-IB	Adzuki bean, lettuce, soybean, bent grass
2-1	Potato, pepper, wheat, sugar beet, strawberry, pea, barley, tomato, brassica
2-2	Onion, sugar beet, rice, corn, soybean, common bean, wheat
3-PT	Potato
4 HG-I	Soybean, onion, sugar beet, potato
4 HG-II	Potato, snow pea, barley, sugar beet, cereals
4 HG-III	Soybean, onion, potato
5	Pea, potato, barley, wheat, turfgrass, soybean
11	Soybean, lupine, wheat, rice, lily, bean
A	Potato, pea, strawberry, sugar beet
E	Onion, kale, sugar beet, soybean, tomato, radish
F	Common bean, kale, corn, sugar beet, onion
K	Pea, kale, strawberry, tomato, carrot, radish, wheat, chickpea

Figure 1. Stem lesions and girdling caused by infection from *Rhizoctonia solani* AG 4 HG-I.

Figure 2. Sclerotia at the stem base associated with a *Rhizoctonia solani* AG 1-IB infection.

Occasionally, sclerotia of the fungus can be observed in the lesions (Figure 2). These are small brown or black and hardened survival structures of the fungus. Lesions also occur on pods in contact with a moist soil surface, resulting in the rotting of pods and seed discoloration. As with many soilborne diseases, infection distribution tends to be scattered and irregular within a field rather than uniform.

A less frequently encountered symptom in Idaho beans is web blight. Mild cases of web blight caused by AG 1-IB and AG 4 HG-I have been observed in southwest Idaho. Web blight refers to an aboveground symptom that affects all aerial parts of beans. Infection initially appears as necrotic spots that coalesce. Typically, web blight is associated with humid, tropical, and subtropical regions and with the various subgroups of AGs 1 and 2, although AG 4 isolates have also been associated with the symptom.

Occasionally, signs of the fungus can be observed at the stem base just above the soil line (Figure 3). These consist of the filamentous strands of the fungus itself that house the tiny sexual spores (basidiospores), which are only observable under a microscope. Researchers spotted them in August 2021 in a southwest Idaho field of black beans infected with AG 11. The field was under overhead irrigation. The sexual phase is not always present and requires relatively high humidity, usually from row closure and canopy cover, to allow its formation.

Several other soilborne fungi present in Idaho cause symptoms similar to *Rhizoctonia*. These include species of *Fusarium, Pythium* (both causing stem and root infections) and, in some instances, *Sclerotinia sclerotiorum* (white mold). Since disease management options vary considerably for these different pathogens, please consult a diagnostic lab or Extension specialist if you are uncertain of the disease present.

Disease Cycle

Soilborne inoculum is considered the primary source of inoculum. The pathogen can survive long periods as sclerotia or mycelia in soil or infested plant debris. Several AGs also infect crops grown in rotation with beans in Idaho, including AG 2-2 (onions, sugar beet, potatoes, and cereals), AG4 HG-II (sugar beet and potatoes), AG 5, and AG 11 (cereals). It can be carried on or within bean seeds, too, although this is considered rare. The usual means of dissemination is via contaminated soil carried by wind, rain, irrigation water, and equipment.

Soil compaction is thought to increase disease incidence and severity. The role of soil moisture is less understood. Irrigation water may spread propagules of *Rhizoctonia*; reports of moderate to high soil moisture at low soil temperatures favoring seedling disease exist. However, watering may disrupt the infection process and hyphal web formation. It is more likely that the presence of cold water early in the season reduces soil temperatures, which increases the time required for sprouts to emerge, therefore increasing the exposure time of the young and highly susceptible plants to the pathogen.

Disease Management

Cultural Control

Soilborne diseases can be difficult to manage. As a result, implementing multiple approaches is necessary to optimize the chance of successful disease management and to minimize the gradual buildup of inoculum in the soil. Although some resistant varieties have been reported, due to the wide variety of AGs present in Idaho reported resistance values may not be accurate in all instances.

The best practice for reducing *Rhizoctonia* disease is to establish fast-growing seedlings that reach maturity sooner, reducing susceptibility to the disease. This can be achieved by planting beans when soil temperatures are warmer, maintaining optimum soil fertility, and planting at a shallow depth. The use of healthy, vigorous certified seed can reduce infection, since poor quality seed germinates slowly, favoring infection.

Figure 3. White mycelia at the stem base, containing sexual spores of *Rhizoctonia solani* AG 11.

Other suggestions: Avoid high seeding rates if planting into compacted soils. If possible, avoid planting beans in fields near previous outbreak sites, since wind and irrigation can move soil containing the pathogen into nearby fields. Practice crop rotation, although with so many AGs with host preferences for currently used rotation crops, this may not be totally effective. However, avoid planting beans immediately after growing a sugar beet crop infected with crown rot or damping off. Since plant debris can harbor pathogens, practices that encourage the decomposition of plant residue, such as discing the plants into the soil, are encouraged.

Chemical Control

Soil fumigation is rarely used in bean production because it is typically not economically viable. Fungicides applied in-furrow at planting can effectively reduce the pathogens, particularly for fields with a known history of *Rhizoctonia*. A soil test can determine whether or not *Rhizoctonia* is present prior to planting, although tests do not yet exist for all AGs of the fungus and can be expensive. In trials at Parma, in both the greenhouse and field, a range of fungicides applied at planting reduced root and stem disease. Quadris appeared to have better disease control applied in-furrow at planting, rather than applied several weeks after emergence (Figure 4). A fungicidal seed treatment should be used wherever possible.

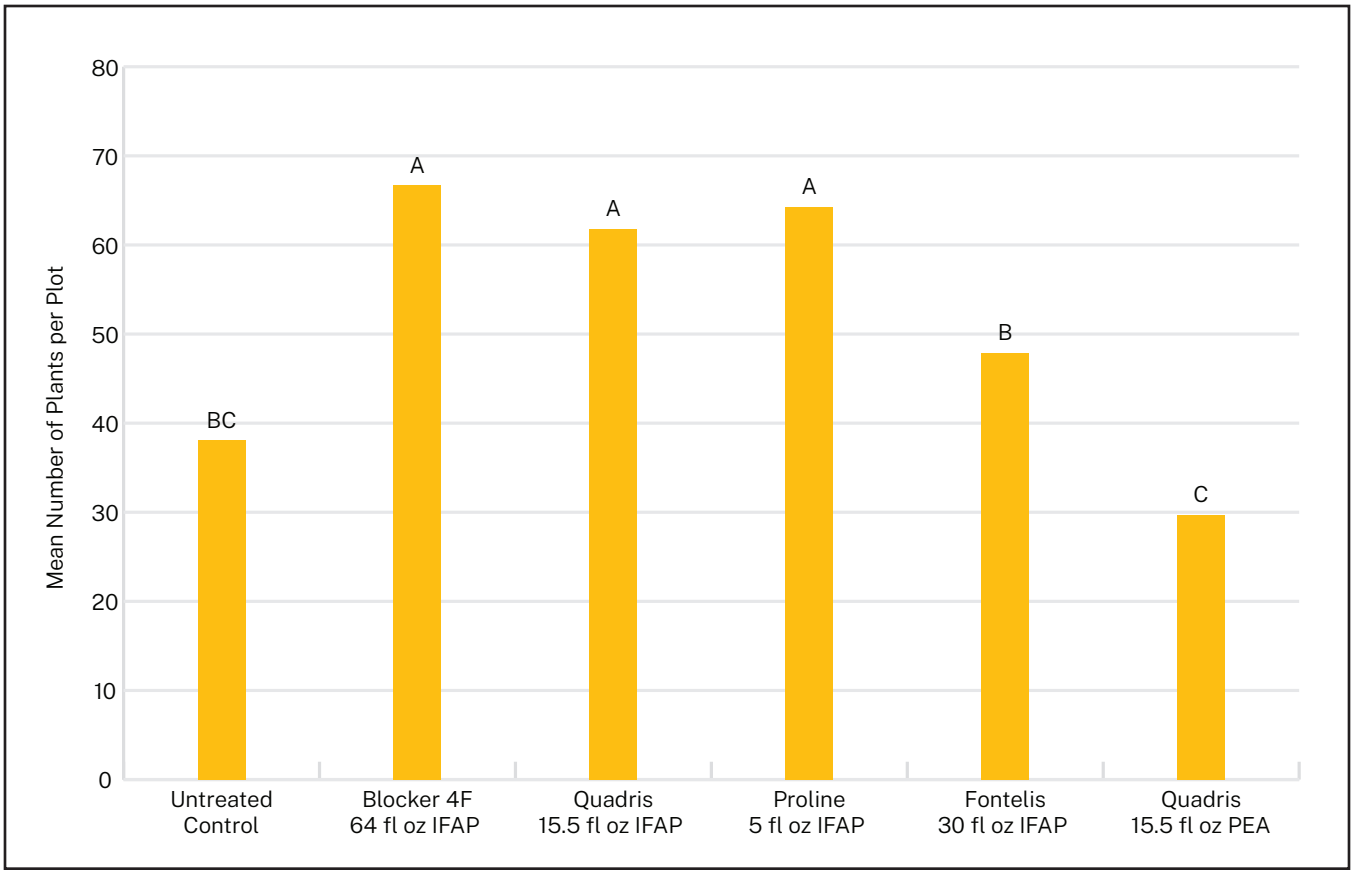

Figure 4. Mean stand count of plants inoculated with *Rhizoctonia solani* AG 11 and treated with various fungicides. IFAP = in-furrow at planting, PEA = postemergent application four weeks after planting. Stand counts were taken five weeks after planting. Diffferent letters denote statistically different mean number of plants per plot.

Further Reading

Schwartz, H. F., J. R. Steadman, R. Hall, and L. R. Forster, eds. 2005. *Compendium of Bean Diseases.* 2nd ed. St. Paul, MN: APS Press.

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