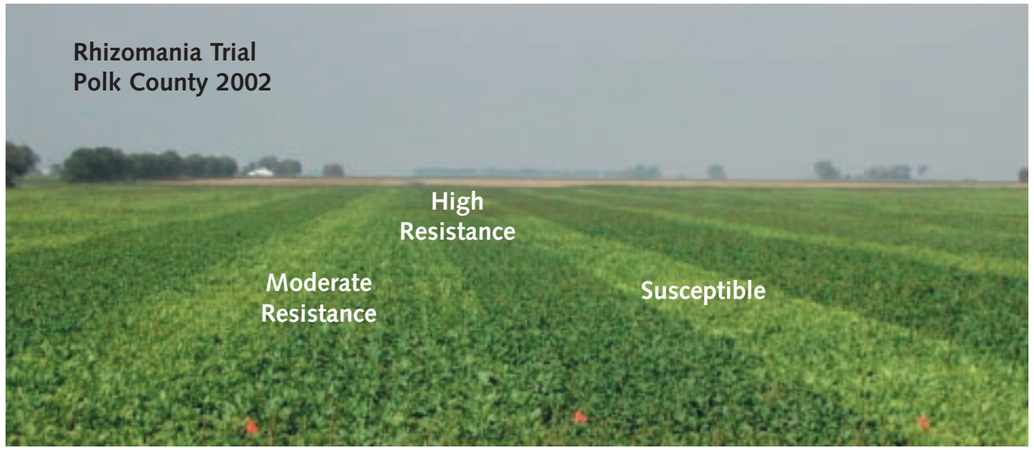

Figure 7. Polk County variety strip trial in 2002.

Varieties

Rhizomania resistant varieties

All the control methods mentioned earlier may slow the introduction of rhizomania, but ultimately the disease will spread.

Once a field or adjacent fields have been infected with rhizomania, those fields should be planted with rhizomania resistant varieties, which offer high disease resistance coupled with good performance under rhizomania pressure.

In 2001 and 2002, American Crystal conducted strip trials with rhizomania resistant varieties throughout the Red River Valley. The selected fields for the trials were known to have moderate-to-heavy rhizomania pressure. The susceptible variety (Fig. 7) shows severe foliar symptoms, while the rhizomania resistant varieties are still green with no obvious foliar symptoms.

The results of the trials demonstrate that under severe rhizomania pressure, resistant varieties outperform susceptible varieties by $200 to more than $300 per acre.

On the Horizon

Considering how easily rhizomania moves and how much of the American Crystal growing region is already infected, it is clear that this disease will continue to spread and be a major concern in the Red River Valley. Because we cannot control rhizomania with chemical or cultural practices, resistance breeding is essential to the longer-term viability of sugarbeet production in many areas. Recent trial data suggests that resistant varieties will offer significant rhizomania control.

For additional information, contact your agriculturist or ACSC beet seed specialists. See the annual Sugarbeet Research and Extension Reports from 1999 to the present. Also see the Pest Alert section at www.crystalsugar.com.

Web site:
www.sbreb.org
www.crystalsugar.com

American Crystal Sugar Company

Limiting A Serious Economic Threat

Rhizomania is considered one of the most destructive sugarbeet diseases today.

Rhizomania attacks the plant's root and can severely reduce tonnage and sugar content, resulting in losses up to $300 an acre or more. It can survive and remain viable in the soil for at least 20 years.

Figure 1. Rhizomania is easily detected by scouting fields in mid-August. Note the fluorescent yellow patches throughout the field—these areas can start out small and quickly infest whole fields in high-pressure areas.

Caused by Beet Necrotic Yellow Vein Virus, which is spread by the soil fungus vector *Polymyxa betae*, rhizomania was first detected in the Red River Valley in 1997. Since that time, the Agricultural Department at American Crystal Sugar Company has been actively scouting fields for the disease and educating sugarbeet growers on its seriousness and economic impact.

Rhizomania On The Move

First reported in Italy in 1952, rhizomania spread throughout Europe and Asia in the 1970s. It was originally diagnosed in the United States in California in 1983, then slowly moved through the country, spreading to Texas in 1986. In the early 1990s, rhizomania was first detected in southern Minnesota. American Crystal discovered the disease in 1997, and in 1998, verified rhizomania in numerous fields in the southern Red River Valley. Since then, it has rapidly moved into the northern end of the Red River Valley.

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The Disease Cycle

Warm, wet soil aids development

In the multiplication phase of the disease (Fig. 2), zoospores infect the root cells of the sugarbeet plant. Plasmodium is developed within these cells, sporangium is formed, and the zoospores are released back into the soil, where they can continue to infect more root material.

These spores can survive in the soil 20 years or longer until favorable conditions occur to allow them to germinate, triggering the release of zoospores to produce new infections. These favorable conditions are wet, warm soils and the presence of a host crop.

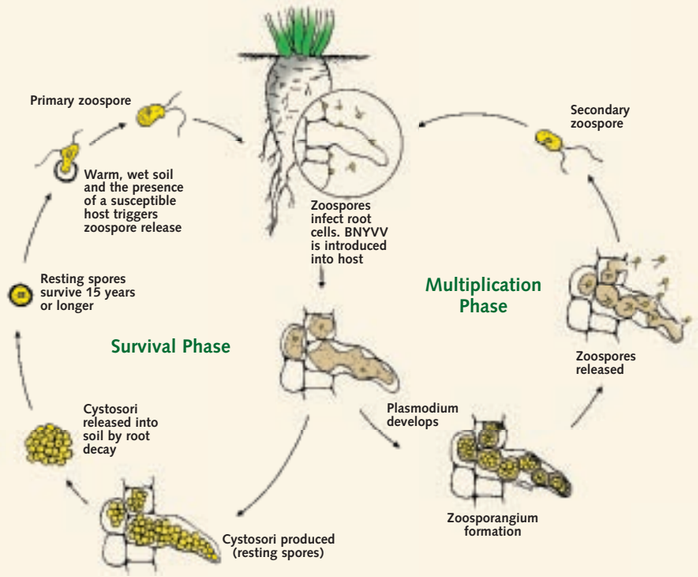

Figure 2. Life cycle of rhizomania.

Symptoms

Expression varies greatly

Rhizomania can infect both young and adult sugarbeet plants. Typically, rhizomania-infected beets show both root and foliar symptoms. However, it's important to note that not all infected beets will show severe symptoms. In fact, some sugarbeet plants may not show any of the classic rhizomania signs.

The severity of the infection varies greatly, depending on the time of the infection. Early infections are most likely to cause severe stunting and classic symptoms, while late infections may go undetected with very little economic impact.

Typical rhizomania foliar symptoms can show up as early as mid-July and stretch out into late August and September. Foliar symptoms of rhizomania generally first occur in patches or in small areas of a field (Fig. 3). These patches have a fluorescent yellow leaf color. They often may be confused with nitrogen-deficient or water-stressed sugarbeets. These similarities, along with a tendency for rhizomania to occur in lower portions of fields with poor drainage, compound the difficulties in identifying the disease.

Figure 3. Foliar symptoms of rhizomania.

Infected plants usually have upright foliage with narrow leaves and elongated petioles (Fig. 4).

Rhizomania root symptoms also vary, depending on the time of infection. Beets infected early show stunted or constricted taproots with masses of hairy roots giving them a bearded appearance (Fig. 5). Severely infected roots often will be low in quality and pose a storage problem with the increased tare associated with the massive bearding.

Figure 4. Note fluorescent yellow color & elongated petioles.

Roots often constrict two to three inches below the soil surface, producing a wineglass-shaped sugarbeet (Fig. 6). A vertical cross section of the sugarbeet also reveals specific symptoms associated with rhizomania—internal darkening and discoloration of the vascular bundle rings is quite evident in infected sugarbeets.

Controlling Rhizomania

Limit movement of infected soil

The best control practice for rhizomania is to limit the amount of soil movement among fields. This disease can be spread by soil movement on machinery, wind, water, and by human or animal traffic. The introduction of very small amounts of rhizomania-infected soil can cause severe rhizomania disease problems only a few sugarbeet crops later.

With that in mind, all necessary steps should be taken to limit soil movement to reduce the risk of spreading contaminated soil.

Machinery should be cleaned of dirt between fields, especially when bringing equipment in from an infected area.

The use of cover crops is another tool that can help prevent soil movement by limiting wind erosion.

Planting early, when soils are too cold for infection of rhizomania, is another practice that can reduce the impact of the disease. Early planting won't prevent rhizomania, but it will allow sugarbeet roots to get established before the infection can occur, resulting in less yield reduction.

Because rhizomania development is favored by wet-saturated soils, proper water management is essential. Deep tillage helps improve soil structure for increased water penetration, but excessive tillage may spread rhizomania-infected soil across fields. Improving soil drainage by utilizing proper ditching techniques that prevent saturated soils will also reduce disease development.

Limiting tare dirt movement between fields will help prevent the introduction of rhizomania into non-diseased fields. Increasing sugarbeet rotation length will have little impact on disease development, but longer rotations will slow the build-up of inoculum.

Soil fumigation is another tool that has been used in other parts of the U.S. At this time, it's not clear that soil fumigation would be beneficial in the Red River Valley. The cost of fumigation may prohibit its use.

Figure 5. Bearded appearance of severely-infected roots.

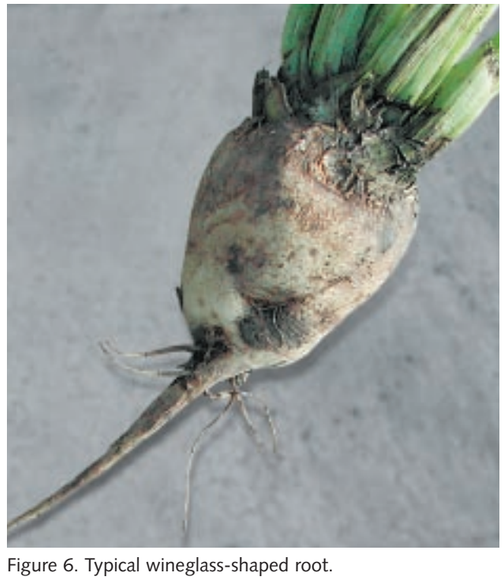

Figure 6. Typical wineglass-shaped root.