What is New with Rhizomania and Curly Top Management and Effects of These Viruses on Storage

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Rhizomania is a serious yield limiting viral disease in sugarbeet first identified in California, USA in 1984. The disease has since spread to all major production areas in the United States. Rhizomania is caused by *Beet necrotic yellow vein virus* (BNYVV) and vectored by the plasmodiophorid (a fungal-like organism), *Polymyxa betae*. The virus survives inside the thick-walled resting spore of the vector in the soil, which can remain viable for many years. As a result, once a field is infested, using crop rotation and non-host crops will not be effective for controlling the disease. In the spring with near saturated soil conditions, the resting spore will germinate to release zoospores when in close proximity to sugarbeet roots. The zoospores will attach to the root and transmit the virus to the sugarbeet root. Therefore, the primary control measure will be to grow a sugarbeet cultivar with high resistance to BNYVV. Cultivars with the *Rz1* resistance gene are available, but resistance breaking strains of the virus have been found in CA, CO, ID, MN, and OR. In the disease screening nursery in Kimberly, ID, check cultivars with just the *Rz2* gene for resistance frequently exhibit symptoms on 10 to 40% of the plants, while cultivars with just the *Rz1* gene tend to have just occasional blinking plants (plants with yellow narrow upright leaves). In the nursery and commercial fields, the *Rz1* gene seems to be necessary to maintain an acceptable level of resistance, even if the cultivars contain other sources of resistance. Since resistance breaking strains are known to occur and resistance genes only allow for partial resistance to this disease, it would be wise to grow cultivars with additional sources of resistance to help protect *Rz1*. If inoculum levels are quite high, resistance in the cultivars may breakdown. Another control measure to consider would be to reduce irrigation frequency, so the soil surface dries between irrigations. Genetic engineering approaches have been studied for rhizomania, so hopefully in the near future cultivars with resistance based on transgenic strategies will become available.

Curly top is another serious yield limiting viral disease for sugarbeet grown in semiarid production areas in the United States. Curly top is vectored by the beet leafhopper and can be caused by a number of *Curtovirus* species: *Beet severe curly top virus* (BSCTV; formerly CFH strain), *Beet mild curly top virus* (BMCTV; formerly Worland strain), and *Beet curly top virus* (BCTV; formerly Cal/Logan strain). Other *Curtovirus* species have been documented or at least proposed in recent years and some have been shown to occur on sugarbeet in other countries. A survey of the western United States showed BSCTV, BMCTV, and BCTV were present in sugarbeet (6). However, samples in this survey along with some collected in 2012 in Idaho show a virus different from these three was also present in sugarbeet. This "unknown" virus amplifies with the coat protein primers, but does not amplify with the species specific primers. This "unknown" virus is currently being investigated further at the USDA-ARS laboratory in Kimberly, ID. The curly top virus species are carried between growing seasons by adult female beet leafhoppers that overwinter on weeds in desert areas and poorly managed residential areas. The females lay eggs in the spring, leading to the start of approximately three generations under Idaho conditions. When the winter host plants desiccate in the spring, the beet leafhoppers move into crop areas carrying the curly top viruses. Most commercial sugarbeet cultivars in the western United States carry partial resistance to the curly top viruses, but the low to intermediate resistance carried by the cultivars tends not to be as protective prior to the eight-leaf growth stage. Thus, the earlier plants become infected the higher the yield loss. In-furrow, foliar, and seed-treatment insecticides have been used to supplement this host resistance. Based on studies by the USDA-ARS Kimberly sugarbeet program (1,9), the neonicotinoid seed treatments (Poncho, Cruiser, and NipsIt) were established as being effective at reducing curly top through early season control of the beet leafhopper vector. Root yield increases of 17% or more have been observed for Idaho (based on USDA-NASS statistics) and other states with semiarid production areas through the use of these neonicotinoid seed treatments (1,9). These seed treatments provide at least 59 days of beet leafhopper protection after planting along with early season control of leafminer and aphids (1,3,4,7,9). In 2012, research indicated that some labeled foliar insecticides (Asana® and Mustang®) may be used to potentially extend this coverage period. However, foliar insecticides would not be recommended to replace the seed treatments, because of their short efficacy period. Currently genetic engineering approaches are being developed for curly top, so in the future cultivars with resistance based on transgenic strategies may become available.

In storage, sugarbeet roots have been shown to lose an average of 0.2 to 0.3 pounds of sucrose per ton of roots per day when stored under ambient conditions, but losses can be as high as 0.5 pounds depending on cultivar. Thus, cultivar selection for storage could improve storability and reduce sucrose losses in storage (5). However, pathogen (2,5,7,8), pest (3), and environmental influences (over or under watering, frost, etc.) during the growing season can also negatively impact root storability. In particular, rhizomania (5,8) and curly top (7) have been documented to negatively influence root storability. Also, placing roots infested with *Rhizoctonia solani* and bacteria such as *Leuconostoc* into storage piles has been shown to reduce sucrose in neighboring healthy roots (2). Thus, keeping sugarbeet plants healthy and as stress free as possible during the growing season will also reduce losses in storage.

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