

# Management of Corky Ringspot Disease of Potatoes in the Pacific Northwest

*by Saad L. Hafez and P. Sundararaj*

Corky ringspot (CRS) is a serious disease of potatoes that occurs in limited geographical areas in the Pacific Northwest, predominantly in areas with coarse-textured, sandy soils. CRS can cause 6% to 55% of potatoes to be unmarketable.

CRS is caused by the tobacco rattle virus (TRV), which was named after the noise made by the leaves of infected tobacco plants when blowing in the wind. CRS is widespread in Europe, where it is considered one of the more important virus diseases of potato, especially in seed production areas. It was first observed in the USA at Hastings, Florida in April 1946. It has also been reported in California, Colorado, Idaho, Indiana, Michigan, Oregon, and Washington.

CRS is found in nature only in association with the stubby-root nematode, although this disease is not caused by the nematodes. The nematodes transmit the virus as they feed on healthy plants. The nematodes do little damage to crops and cause no visible injury symptoms and little or no yield loss in potato. They are a serious threat only as vectors of TRV.

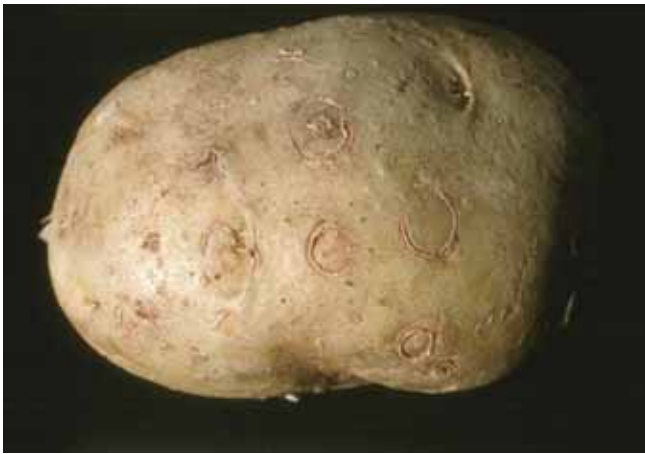
Although the disease does not seem to move rapidly from field to field, its erratic occurrence from year to year makes it difficult to ascertain its means of spread and distribution. The disease generally does not occur uniformly within a field. A single infected plant may produce tubers

both with and without symptoms. Infected tubers will not always show symptoms. Symptoms in stored tubers will tend to become more severe with time.

Problems with stubby-root nematodes have now been consistently documented in eastern Idaho for several years. Stubby-root nematodes apparently have a wide host range that includes cereal crops and potato. Since most of the weeds present in a potato field act as hosts for the nematodes, they feed and multiply on the weeds in the absence of the potato crop. Furthermore, the stubby-root nematode is not picky about what it eats, so it is difficult to control with crop rotation. Alfalfa is one crop that the stubby-root nematode does not like, so if you can eliminate the weeds from alfalfa, it would make a good crop for rotation.

## Symptoms of Corky Ringspot

Symptoms of CRS disease may differ due to potato cultivar and virus strain. Typically, concentric lesions on the surface of tubers (figure 1) and the ring-shaped pattern of corky tissues in the flesh of tubers (figures 2 and 3) are the distinguishing characteristics of CRS. These typical symptoms led to the name “corky ringspot” as well as the lesser-known names “spraing” or “sprain.” Cracking of the skin in the lesions is common.



**Figure 1.** External symptoms on potato tuber caused by tobacco rattle virus



**Figure 2.** Internal symptoms on potato tuber caused by tobacco rattle virus



**Figure 3.** Internal symptoms on potato tuber caused by tobacco rattle virus



**Figure 4.** Tuber deformation caused by tobacco rattle virus

The flesh beneath the spots also is brown and corky and the lesions may be shaped like those on the surface. In due course, tubers exhibit deep cracks and shallow corky depressions on their surface, which render them unmarketable. Usually the flesh shows much more corking and discoloration than appears on the skin of affected tubers. Severely affected tubers may be malformed and the skin roughened (figure 4).

Tubers with symptoms of corky ringspot should be discarded when the crop is graded and packed, since buyers discriminate against crops affected with the disease based on tuber symptoms.

Foliar symptoms of tobacco rattle virus have been documented in the Pacific Northwest, although foliar symptoms are less common than tuber symptoms. In other words, you generally cannot diagnose this disease by looking at the leaves of the plants. Leaf symptoms develop early in the season. In some cases, leaves of affected plants were dwarfed, malformed and slightly rolled. Yellowish, blotchy areas occur irregularly in affected leaves.

## About Stubby-Root Nematodes

Since corky ringspot is spread by nematodes, it can be helpful to understand the life cycle of these creatures.

Nematodes are a group of microscopic worm-like organisms that vary in their shape from thin and cylindrical, to sack-like, to kidney shaped (figure 5). “Stubby-root” is the common name of a group of nematodes that include two genera (*Trichodorus* and *Paratrichodorus*) and several species (figure 6). Not all of these transmit TRV or feed on potatoes, however. The nematodes were named for their feeding behavior, which causes damaged roots to cease growing, resulting in “stubby roots” (figure 7).

Stubby-root nematodes are migratory ectoparasites. That is, during each stage of their life cycle, stubby-root nematodes are mobile and feed on the outsides of roots. They often travel long, vertical distances. Eggs are laid in the soil, where all stages of the life cycle occur. The life cycle is relatively simple and all four larval stages outside the egg resemble the adult stage, except that the larvae are smaller.

Since several generations can be produced within a year, large populations of stubby-root nematodes can develop quickly. Their numbers can also decline rapidly after the crop is removed, so sampling at peak population times is critical to determine their population density more accurately. They may survive cold winters by migrating below the frost line and undergoing dormancy.

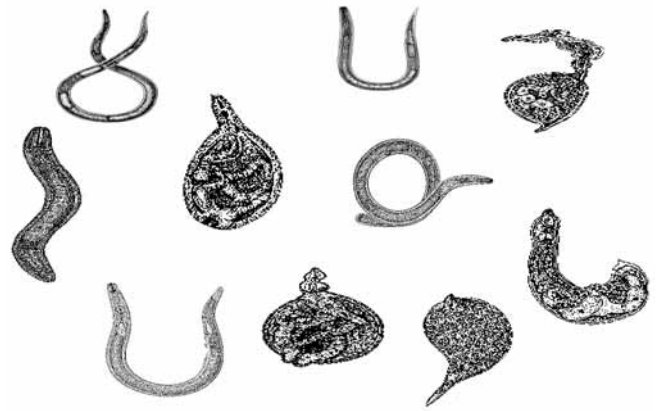


Figure 5. Different shapes of plant parasitic nematodes

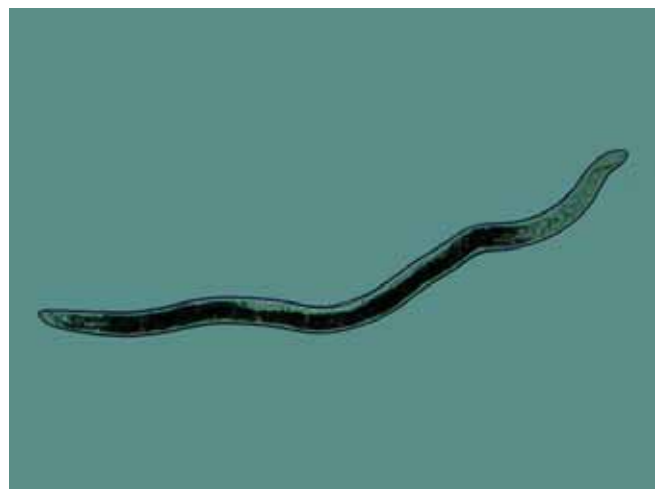
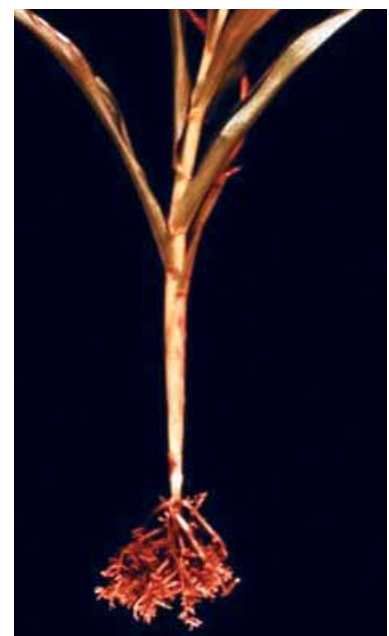


Figure 6. Light microscopic view of adult stubby-root nematode

Figure 7. Stubby root symptoms on corn caused by stubby-root nematode



## Causes and Spread of Corky Ringspot

Tobacco rattle virus is perpetuated in seed tubers and in infested soil from one season to the next. The virus is transmitted by two genera of stubby-root nematodes: *Trichodorus* and *Paratrichodorus*. These nematodes are found in sandy, moist, cool soils.

The nematodes acquire the virus by feeding on diseased plant tissue of potato or weed hosts. Corky ringspot may occur after TRV-carrying stubby-root nematodes feed directly on the tubers of potato plants.

Many common weeds found in the Pacific Northwest are good hosts and serve as symptomless reservoirs for TRV. Among them are hairy nightshade, redroot pigweed, green foxtail, broadleaved cocklebur, creeping buttercup, purslane, wild buckwheat, broadleaf plantain, wild lettuce, sunflower, winterfat, and beggarticks. The presence of any of these weed hosts in a field may increase the incidence of disease “hot spots” and serve to spread the disease within the field.

CRS spreads to previously uncontaminated fields when virus-infected nematodes are introduced. This occurs through the movement of soil, plant residues, or water from contaminated to uncontaminated fields, and by planting infected potato seed. If non-infected stubby-root nematodes are present in a field, introduction of the virus alone can result in the spread of the corky ringspot disease. The virus can be carried in plant residues, in the seed of several weeds (nightshade, cocklebur, and purslane), and in manures from animals fed on infected plants.

The severity of the disease varies depending on the population density of the stubby-root nematodes in the soil. In seasons when CRS is mild, it is probable that there were low populations of the stubby-root nematodes in the soil. In other seasons when the disease is severe, the vector is probably present in much greater numbers. Populations of stubby-root nematodes may vary throughout the year, with highest populations in the fall. Compared to many other nematode species, stubby-root nematodes are not present at high population levels. Unfortunately, only a few nematodes are necessary to cause a high incidence of disease.

## Factors Affecting Disease Severity

Expression of CRS symptoms in potatoes is influenced by such factors as potato variety, nematode population, environmental conditions, and time of infection. Infection early in the growing season, for example, usually increases the severity of tuber symptoms.

The Russet Burbank variety is susceptible to the CRS disease. Some other russet varieties including Nooksack and Lemhi Russet are slightly more resistant, but no russet variety has sufficient resistance to prevent symptom expression. Merrimack, an old U.S. variety, and many European varieties, are resistant to CRS.

Several factors influence the survival of nematodes in potato fields, including soil type and soil moisture. In general, stubby-root nematodes are unable to penetrate densely packed soils containing large quantities of clay, silt or very fine sand particles of less than fifty microns. An abundance of soil moisture favors stubby-root nematode activity and leads to rapidly increasing population levels.

## Testing Your Soil for Stubby-root Nematodes

Soil samples can be collected any time of the year if soil is not dry, or too wet or frozen. To make the most appropriate management decisions, samples should be collected in the fall following harvest and irrigation.

From the plant root zone, the top 2 inches of soil should be removed and the sample should be taken at 15-20" depth. Bulk the soil cores in a clean bucket, mix thoroughly, and submit one quart of the mixture for nematode analysis. Each sample should contain at least 30 individual cores, or if representing less than five acres, at least 2-3 cores per acre. One composite sample may represent up to 25 acres of a field. Keep the sample cool, ideally at 50 to 55° F.

Include name, location, soil type, texture, observable symptoms, cropping history, and date of last treatment with a nematicide. Place the sample in a sturdy, moisture-retaining bag and clearly identify with a tag attached to the outside of the bag. Deliver or mail by express delivery to the University of Idaho Nematology lab, Parma Research and Extension Center,



29603 U of I Lane, Parma, ID 83660-6699.  
Telephone: (208) 722-6701.

Fields should be treated when the nematode population is at a detectable level.

## Management Options for Corky Ringspot Disease

Stubby-root nematodes are difficult to control with fumigants because of their mobility in the soil. These nematodes are highly sensitive to change in soil moisture and temperature.

Fluctuation in these two factors causes the nematode to move up and down in the soil profile. Stubby-root nematodes can reside at soil depths of more than 40 inches.

While soil fumigation can effectively reduce the initial population in the fumigation zone, it may fail to control CRS simply because the nematodes moved up from deeper soil after the fumigant had dissipated. Metam sodium does not effectively control stubby-root nematodes and Telone II must be applied at high rates to treat deeper soil profile.

The disease has been controlled effectively with non-fumigant nematicides in different parts of the world. We recommend non-fumigant, systemic, carbamate nematicide. When applied at planting, these kinds of nematicides remained active for 8-12 weeks after application. Certain non-fumigant nematicides such as aldicarb (Temik) and oxamyl (Vydate) are the product of choice for controlling stubby-root nematode in Idaho. Temik moves up and down in the potato hill with the waterfront, reaching nematodes as they move in the soil. Temik or Vydate's systemic activity also affect nematodes as they feed on the root system of potato plants.

Temik applied as in-furrow at planting, modified in-furrow at planting or in-furrow at planting in combination with foliar applications of oxamyl (Vydate) resulted in the lowest incidence of corky ring spot disease and had the highest total and marketable yields.

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## To Prevent Spread of Corky Ringspot:

1. Plant certified virus-free seed.
2. Wash or steam-clean machinery after working in nematode- and virus-infested fields.
3. Avoid moving plant material from infested to noninfested fields. Infested material could include weed residues and manures from animals fed on plants from contaminated fields.
4. Eliminate cull potato piles without contaminating non-infested fields.
5. Prevent water movement from infested to non-infested areas. Do not use irrigation water that may contain runoff from contaminated fields.
6. Practice good weed control. Controlling nightshade is especially important because of its suitability as a host for the TRV.

ALWAYS read and follow the instructions printed on the pesticide label. The pesticide recommendations in this UI publication do not substitute for instructions on the label. Due to constantly changing pesticide laws and labels, some pesticides may have been cancelled or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless both the pest and the plant, animal, or other application site are specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock. Trade names are used to simplify the information; no endorsement or discrimination is intended.

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