Seed treatments to control charcoal rot in soya bean

Soya bean plants are susceptible to root and stem base rot caused by soil pathogens at all growth stages. One of these diseases is charcoal rot, caused by the polyphagous fungus *Macrophomina phaseolina* (Mp).

This pathogen infects a wide host range of nearly 500 species in more than 100 families around the world, including other important crops such as cotton, chickpea, maize and common beans. Morphologically, physiologically, genetically and pathogenically, the fungus varies widely, enabling it to adapt to different environmental conditions and hence become widely distributed geographically.

Soya bean seedlings affected by Mp develop reddish brown lesions on the hypocotyl, which becomes ash-grey and then turns black. The presence of small, black sclerotia in the cortical tissue confers the charcoal appearance that gives the disease its name. In addition to these symptoms and signs, mature plants develop chlorotic lesions on their leaves, which then die but remain attached to the stem, and finally the plants die prematurely. A combination of water stress and high temperatures favours disease development.

**Alternative control**

Biological agents can provide an alternative to control certain plant diseases, especially when other methods such as chemicals are difficult to use. *Sclerotium rolfsii*, *Rhizoctonia solani*, and *Pythium* spp. were successfully controlled by using antagonistic microorganisms such as *Trichoderma* spp., *Penicillium* spp., *Aspergillus* spp. and some bacteria.

A talc-based formulation of *Trichoderma viride*, produced on a commercial scale, was widely used by farmers to treat seeds of sesame, groundnut, sunflower, chickpea and mung bean for the biocontrol of root rot disease caused by Mp.

Treating the seeds with *Trichoderma* spp. and *Gliocladium virens* and storing them was more advantageous than storing the formulation and treating the seeds just before planting. *Trichoderma harzianum* inhibited the in vitro linear growth and microsclerotia production of Mp.

To control fungal pathogens, chemical products are available for application of soil, seeds and/or foliage. Fungicide seed treatments are intended to control diseases that cause seed rot and damping-off before and after emergence. Thiram, fludioxonil and captan/pentachloronitrobenzene/thiabendazole, that were used to control *Sclerotinia sclerotiorum* in field trials, managed to reduce sclerotia formation in infected soya bean seed by 98%. Moreover, treatment of soya bean seeds with thiram reduced the incidence of *Phomopsis sojae* and increased seed germination.

**No chemicals available**

Currently, no chemicals are available to control charcoal rot in soya bean. Seed treatments may be helpful if soya bean seeds are infected with Mp, but there is no information on specific active ingredients effective against this pathogen. Among fungicides tested against Mp in infected cotton seeds, carbenazim, quintozene and bentomyl enhanced plant emergence (PE) and disease control. Monoceren®, pencycuron, carboxin 200, tolclofos-methyl, and Maximum AP also increased the percentage of surviving seedlings.
from Mp-infected seeds.

The efficacy of seed treatments with two biological products (Trichoderma viride or Bacillus subtilis) or one chemical treatment with thiophanatemethyl/pyraclostrobin with regard to PE, disease severity, Mp colony-forming units (CFUs), crop yield and 1000-seed weight in two soybean cultivars maturity group (MG) VIII were evaluated in the field to control Mp on two soybean cultivars, NA8000 RG and Munasqa RR, in Tucumán, north-western Argentina.

Biological and chemical seed treatments have been shown to be effective to control Mp on various crops. For cotton, several fungicides were tested as seed treatments to determine their efficacy in controllingMp infection. Monercen 250 FS and tolclofos-methyl were the best-performing fungicides in controlling Mp on cotton in the greenhouse. A reduction in the percentage of dead sesame plants affected by Mp was found when seeds were treated with biological antagonists such as Trichoderma sp. and Aspergillus sp.

**Lower disease severity**

In NA8000 RG and Munasqa RR, treatments had a similar performance trend: the highest crop yield values were obtained with the pyraclostrobin/thiophanate-methyl mixture, followed by those obtained with T. viride and B. subtilis.

Similar yield increases were also observed: an increment of 100kg was obtained when applying chemical seed treatments (propineb and dicarboximide) in sesame to control Mp, as compared with yield values obtained with the untreated control. Mp did infect Munasqa RR and NA8000 RG, but severity levels and CFU/g were higher in NA8000 RG in both seasons. The chemical and biological treatments resulted in lower disease severity and CFU/g values than in the inoculated control.

These results go along with lower disease incidence in eggplants treated with different Trichoderma sp. strains. Results from this study of chemical and biological seed treatments of soybean to control charcoal rot will be useful to develop more efficient management strategies for this important disease.

References and the full article are available from the authors. Contact the Estación Experimental Agroindustrial Obispo Colombes (EEAOC) at email dt@eeaoc.org.ar for more information.