



## Fusarium Fact Sheet

In general fusarium damping-off hosts include; peas, beans, potatoes and weeds fathen, shepherd's-purse, chickweed, thistle, field pansy, alfalfa, and volunteer OSR, cereals and linseed can all be infected by different Fusarium species. Fusarium in linseed is usually only seen in spring linseed.

### Fusarium Wilt

Fusarium wilt in linseed, *Fusarium oxysporum f. sp. Lini*, is limited to a host range of linseed and Flax. Fusarium wilt is a soil fungus, but it can also be seed borne. Fusarium wilt can infect linseed at any growth stage and invades through the roots and develops in the water-conducting tissues which impairs water transport (Figure 1), resulting in characteristic wilting and plant death.

Fusarium can survive in soil for 5-10 years, surviving as saprophytes (lives on dead/decaying organic matter) in plant debris in soil indefinitely and producing dormant and tough resting spores.

Disease infection is most likely when temperature in the soil reach 24 - 28°C, although it can survive over a wide range (14 - 38 °C). Dry soils also increase incidence of Fusarium wilt.

### Symptoms

Early infection can result in severe disease and mortality, in older seedlings leaves may turn brown and the top bends down to form a 'shepherd's crook.' Later infections cause plant yellowing, premature ripening and reduced yields. Foliar symptoms seen are; yellowing of leaves, brown spot on leaves, wilting, necrosis and root browning. In the UK Fusarium is only seen in spring linseed, which are tolerant. Typically, in a field there will be yellow 1-2m circular-ish patches of linseed, starting with yellow plants or brown spots on leaves, with dead or dying plants seen in the middle of the disease foci (Figure 2). Root browning (brown-ashy appearance, as seen in rot) is another symptoms of infection.



Figure 2– Fusarium symptoms. Left - brown spotting on leaves. Middle– Shepherd's crook wilting symptoms. Right- circular patch of diseases.

### Control

There is no chemical control options. The best control method is an integrated control consisting of; rotation, tolerant varieties and crop nutrition.

Fusarium wilt is soil borne, farmers should use a minimum rotation of three years, ideally five. Weather stresses can allow disease in, there is little that can be done with these. However, in other countries where fusarium wilt has infected crops fertilisers (N, P, K) have helped reduce incidence. As in other crops, helping to reduce crop stresses will help the plant imitate defence against the disease. Acidic and sandy soils are more conducive to disease infection—so check soil pH. Fusarium can be seed borne, as part of the damping off complex. Start clean, use certified seed where the level of disease is tightly controlled.

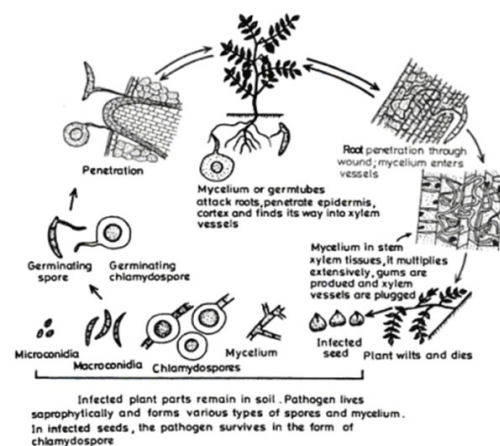


Figure 1 life-cycle (Ahmad et al., 2016)

## *Fusarium Solani*

*Fusarium solani* is part of a species complex, thought to consist of 50-60 different species and can therefore infect many different plant species. *F. Solani* makes up the range of pathogens that cause damping off.

*F. Solani* is mainly infected crop residues and seed borne, which can survive in the soil for many years. *F. Solani* spore germination is triggered by root exudates from host plant seeds. Fungal hyphae infect the developing hypocotyl (the stem of the emerging cotyledons, from seed). Hyphae can also produce asexual spores (macroconidia) that can directly infect developing roots. Infection spreads to the xylem (water carrying vessels) which causes above ground wilting. At end of the season resilient fungal spores are produced in infected plant tissue.

Disease infection is most likely in warm soils and when crops are stressed i.e. drought conditions.

## Symptoms

Patches of wilted or dying plants will be seen in the field. Foliar symptoms vary with the strain of *F. Solani*, but can include; wilting, stunting and chlorosis. Root rot symptoms produced are similar between most of the *Fusarium* species.

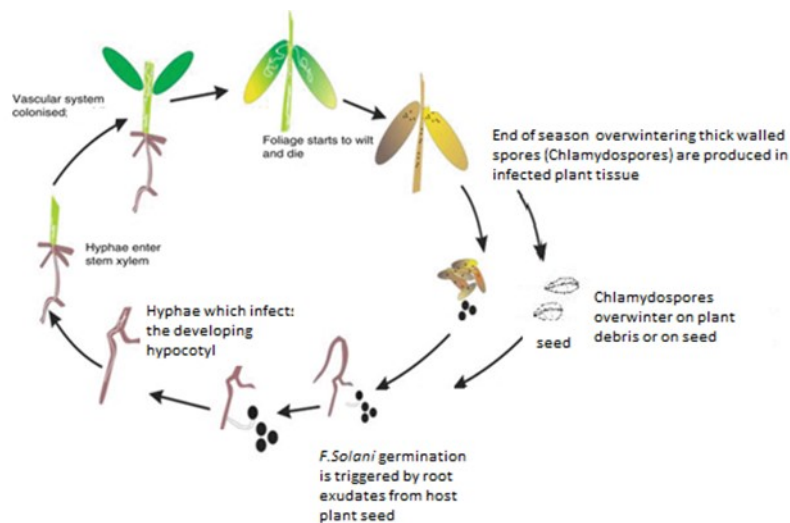


Figure 3 *Fusarium Solani* lifecycle,, Gajera et al., 2016



Figure 4 *Fusarium* symptoms LHS, and middle. RHS *Fusarium* root rot symptoms in peas and lentils resulting from infected seed (ROOT ROT IN PEAS AND LENTILS in Western Canada, n.d.)

## Control

There are no chemical control options, the best control method is an integrated control consisting of; clean seed and sowing conditions. *F. Solani* is an opportunistic disease and will infect stressed crops. To reduce stress sufficient soil moisture at sowing is important, if conditions are dry consider delaying drilling. Good seedbeds will give good seed to soil and aid plant establishment and improve plant resilience to weather and disease stresses.

Use certified seed, which has been tested for damping-off disease levels. If a field history is known do not farm save seed or get seed tested. Currently there are no fungicidal seed treatments approved against damping-off in linseed. Seed treatments generally only provide 2-3 weeks protection, after which seedlings will be susceptible.

Due to the broad host range of *F. solani* there is no evidence extending the rotation will reduce levels in the soil. The majority of inoculum is from infected crop residues. Delayed drilling and ploughing down infected crop residues has a lower impact on disease levels, than environmental conducive conditions of the season on disease levels.