

Testing soil for legume fatigue

Problem

Several legume crops can show severe symptoms of legume fatigue. This is due to often conjoint infestations of *Didymella*, *Fusarium*, *Aphanomyces* and other root rot pathogens that can accumulate in the soil in crop rotations that include pea, faba bean, vetch, red clover or lucerne. A heavy infestation may lead to a total loss of the legume.

Solution

With the help of a simple legume fatigue test, the soil can be examined for legume-fatigue symptoms prior to cultivation.

Benefits

The test offers reference points regarding the soil contamination with the pathogens mentioned above and can, thus, reveal the need for a cultivation break. Refraining from cultivating on contaminated soils helps to avoid high yield losses due to legume fatigue.

Applicability box

Theme

Nutrient supply, soil quality and soil fertility

Geographical focus

Generally, and especially in clayey and shallow soils

Application time

3 months prior to cultivating the field with concerned legumes

Required time

About 4 hours (baking time not included)

Period of impact

Entire crop rotation

Equipment

Baking oven, aluminium trays, flower pots, seed, balance

Best in

Crop rotations with a high share of legumes; prior to cultivating peas or beans

Practical recommendation



1. Extract 10 litres of humid soil from the field plot you wish to examine and sieve it down to a grain size of 10 mm.
2. Moisten dry samples and mix them evenly.
3. Fill four aluminium trays with the humid soil and store the remaining soil.
4. Cover the trays filled with soil with tinfoil and place them in the baking oven. Sterilise the samples for at least 12 hours at 70-100 °C in the oven.



5. Let the aluminium trays cool for 12 hours after sterilisation.
6. Mark four flowerpots with "R" (for untreated reference) and another four with "H" (for heat-treated soil).
7. Fill the four H-flowerpots with the heat-treated soil and fill the four R-flowerpots with the untreated soil.



8. Place 5-10 legume seeds (depending on seed size) in each pot and cover them with 0.5 cm of the same type of soil.
9. Place the H and R pots randomly in a tray with some water and keep them in a sheltered place with at least 18 °C and daylight.
10. Keep the pots humid during about 6 weeks by pouring water into the trays.

Practical testing

- After about 6 weeks, the test can be evaluated. If the reference plants have germination problems and/or are growing poorly and turning yellow due to heavy infestation, the evaluation can take place earlier.
- For evaluation, cut all plant shoots at the stem 2 cm above the soil, and weigh the shoots of each pot separately. Make a note of the shoots' weight.
- Dividing the weight of the untreated reference plants by the weight of the plants from the heat-treated soil gives a ratio which can be used as an indicator for legume fatigue.
- For example, if the weight of the plants in the untreated soil is 180 g and the weight of the plants with the heat-treated soil is 200 g, then; $180 \text{ g} / 200 \text{ g} =$ a ratio of 0.9.

Evaluating the results

- If the ratio is above 0.80, we would not expect any yield losses due to biologically-caused legume fatigue.
- If the ratio falls between 0.80 and 0.20, there is a risk of the legume showing symptoms of legume fatigue during or after humid and cool weather. The lower the ratio, the higher the risk of yield losses during unfavourable weather conditions. In such a case, we need to determine, based on the testing results and farm-specific experience, if the risk of cultivating on the sampled land should be taken. Refraining from cultivating the tested legume for several years would reduce future cultivation risks. It is then also advisable to use this test for any other legume species that might be cultivated on the sampled land.
- If the ratio falls under 0.20, we advise strongly against growing the tested legume or any other legume sp (including legume-based green manure) on the sampled land for the next 7-8 years, regardless of weather conditions, in order to restore the land.

Use the comment section on the [DiverIMPACTS discussion forum](#) to share your experiences with other farmers, advisors and scientists! If you have any questions concerning the method, please contact the author of the practice abstract by e-mail.



About this practice abstract, DiverIMPACTS, ReMIX and LIVESEED

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This practice abstract was originally elaborated in the Organic Knowledge Network Arable project (OK-Net Arable) and was adapted for the DiverIMPACTS, ReMIX and LIVESEED projects, based on the EIP AGRI practice abstract format.

DiverIMPACTS: The project is running from June 2017 to May 2022. The overall goal of DiverIMPACTS - Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability - is to achieve the full potential of di-

versification of cropping systems for improved productivity, delivery of ecosystem services and resource-efficient and sustainable value chains.

LIVESEED: The project is running from June 2017 to May 2021. The overall goal of LIVESEED is to improve performance of the organic sector by boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that healthy seed and large portfolio of species and cultivars adapted to organic systems are key for realising the full potential of organic agriculture and climate change adaptation.

ReMIX: The project is running from May 2017 to April 2021. ReMIX will exploit the benefits of species mixtures to design more diversified and resilient agro-ecological arable cropping systems. Based on a multi-actor approach, ReMIX will produce new knowledge that is both scientifically credible and socially valuable in conventional and organic agriculture. Overall, ReMIX will contribute to the adoption of productive and resilient agricultural systems.

Project websites: www.diverimpacts.net, www.liveseed.eu, www.remix-intercrops.eu © 2021