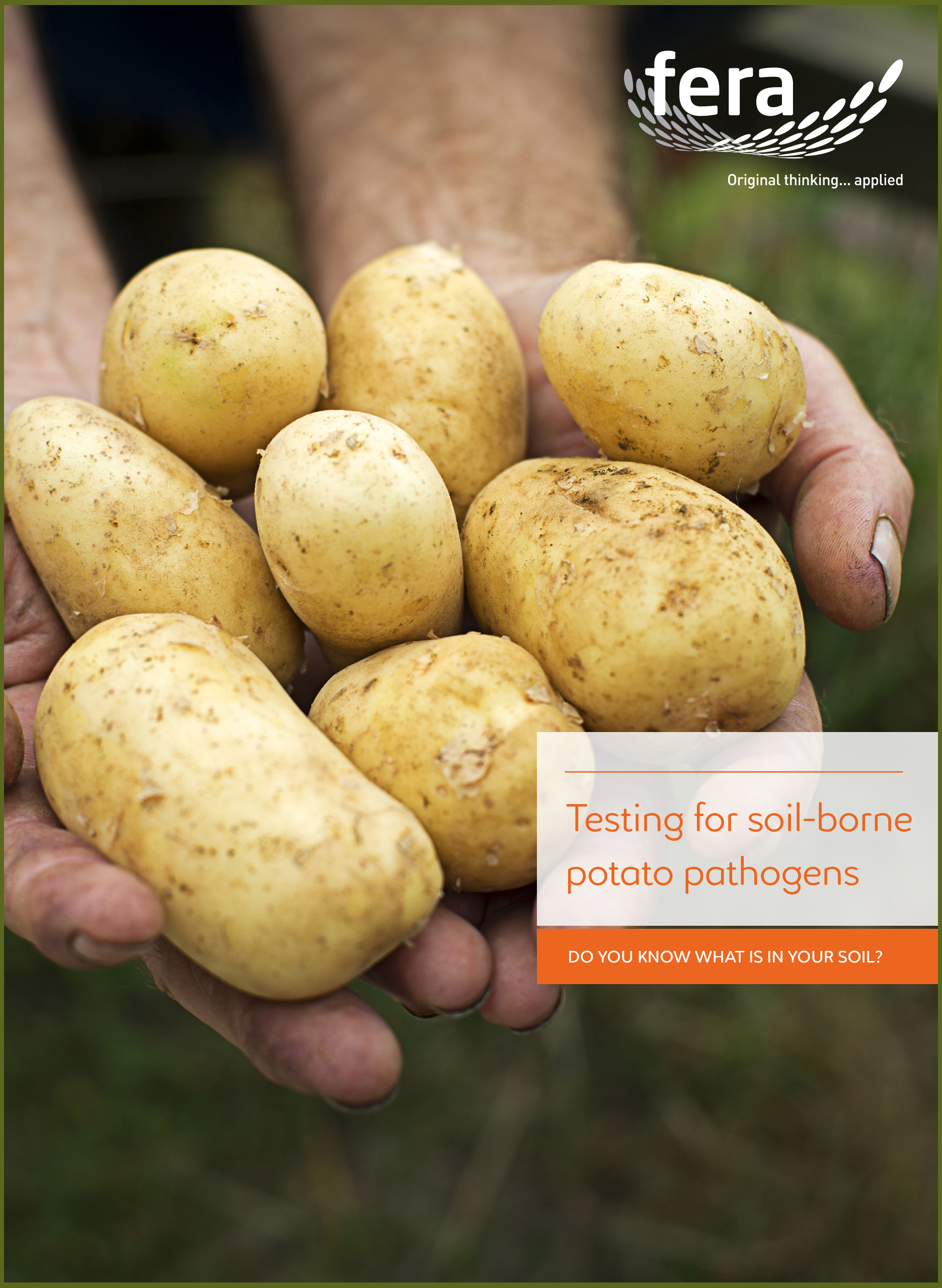


fera

Original thinking... applied

Testing for soil-borne potato pathogens

DO YOU KNOW WHAT IS IN YOUR SOIL?

Testing for soil-borne potato pathogens

With increased restrictions on pesticides, the lack of new active ingredients coming onto the market and increased pesticide resistance, finding ways to reduce treatment applications can save time and money for farmers but also minimises selection pressure on the pathogens.

Fera has been working to develop a suite of direct soil tests that will allow farmers to understand the levels and distribution of pathogens in the field and anticipate the risk of disease before planting the next crop.

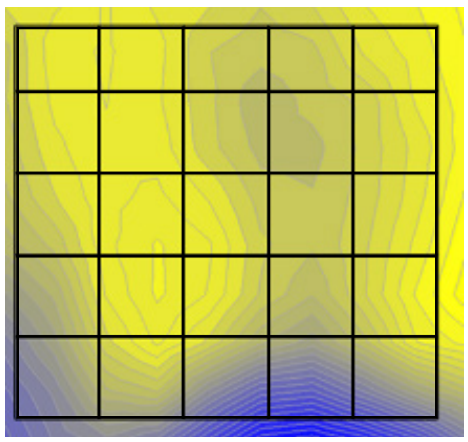
This can help with selection of the most suitable crop and variety for the available land and conditions as well as minimising the need for pesticides, potentially reducing costs and increasing yield.

Soil testing enables more precision farming practices to be delivered and it helps farmers and agronomists to understand the biological diversity of soils in relation to both plant health and productivity.

By using this approach farmers and growers can demonstrate to their communities their environmental responsibility in creating a sustainable environment.

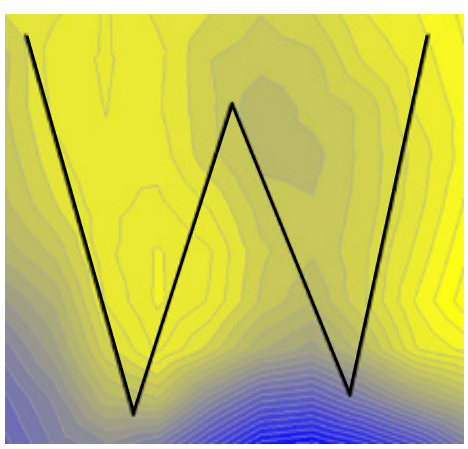
Larger samples = greater accuracy in the detection of pathogens

Improvements in our methods to extract DNA from the soil means we can now handle larger, more representative, sample volumes up to 500g. This increases the accuracy of detection of soilborne pathogens, many of which can be widely distributed in low populations in the soil prior to planting.



A SCALABLE SOIL EXTRACTION METHOD

Currently available direct soil tests are usually performed on small samples (<10g) or involve bioassays which are laborious and time consuming to perform. Improvements in our methods used to extract DNA from soil now allow us to significantly increase sample sizes to handle volumes of up to 500g. This allows us to pool representative samples from a given area to increase the accuracy of soil tests where a simple presence/absence answer is required, increasing the likelihood of detection from a single test when populations are in low numbers or clustered, yet still present a significant infection risk.



THE VARYING DISTRIBUTION OF DISEASE IN A FIELD

Sampling for soil-borne pathogens has historically employed a W-shape sampling pattern. This can be an effective sampling strategy when aiming to detect pathogens where the distribution is even across the field such as for black dot (*Colletotrichum coccodes*). However when the distribution is more clustered in the field such as is the case with *Verticium dahliae* or *Rhizoctonia solani*, employing a grid pattern for sampling and testing samples individually can be more effective to understand the risk of disease development in the field.

Are you sure you know what is in your field?

ATTRIBUTING RISK

AHDB–Potatoes estimate that avoidable waste results in an average annual post-harvest loss to the British potato industry of 1 million tonnes due to disease, damage, and failure to meet market specifications. This represents an estimated annual cost of £30m.

£30m

Annual cost of avoidable waste per year

Using DNA-based monitoring of soil borne pathogens and the latest predictive modelling, the levels of DNA found in fields can be related to the risk of disease development, enabling farmers to more selectively choose the crops and varieties they plant.

An increasing range of pathogens that can be identified directly from soil DNA will help with selection of the best management practices to minimise disease risk by helping us help farmers understand the biological diversity of soils in relation to plant health and productivity.

Tuber skin blemish diseases are a major cause of wastage in washed ware potatoes due to the high quality requirements of the pre-pack market. Soil-borne diseases can also directly reduce yield in the field. Additional losses result from failure to meet disease tolerances during seed potato certification, influencing demand in national and overseas markets.

Potato disease

Powdery scab

Verticillium wilt
Desiccated stems due to Verticillium wilt

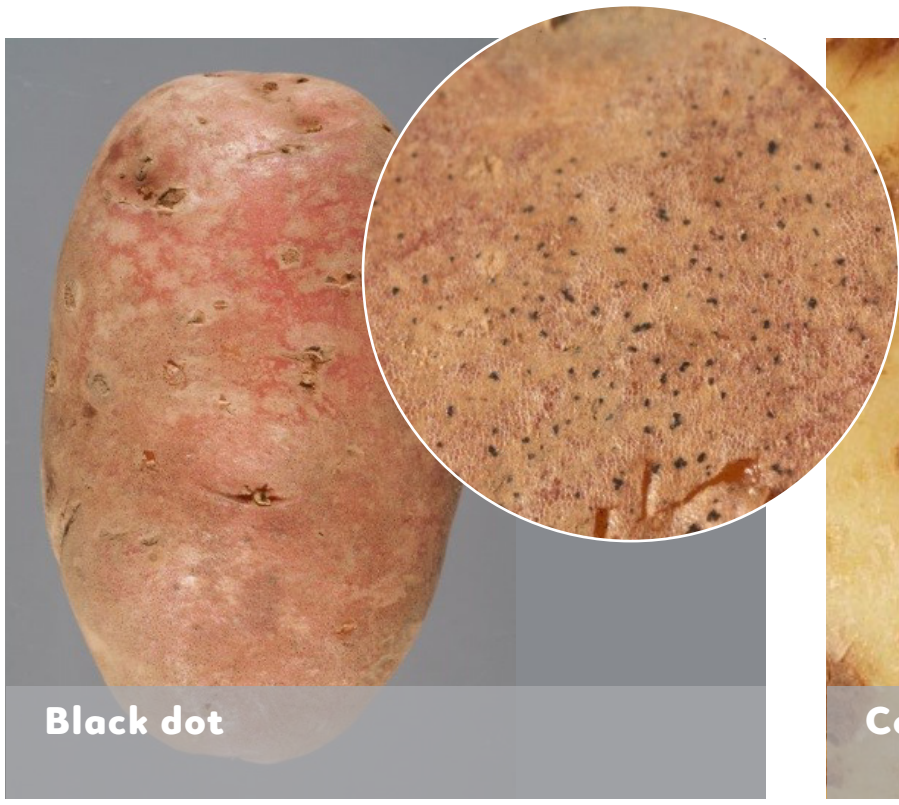
Powdery scab (*Spongospora subterranea*) is a soil-borne fungal blemish disease of potatoes characterised by raised pustules containing a powdery mass of spores. The fungus is also able to transmit the potato mop top virus (PMTV), which itself causes a disease known as spraing. There are no above ground symptoms of powdery scab but tuber infections in seed potatoes lead to downgrading or rejection.

Cultivar resistance and long rotations are the most effective ways to combat infected land. Clean land should be planted with clean seed. Testing will enable you to understand if the land you are intending to use is infected. Annual losses due to powdery scab in ware potatoes have been estimated at £1 million.

Verticillium wilt is a fungal disease of the vascular tissue of potato and most commercial cultivars are susceptible. There are two species causing disease in potato; *V. albo-atrum* and *V. dahliae.* They can persist as saprotrophic soil organisms for up to 25 years. *Verticillium wilt* affects a wide range of plant species and accounts for significant crop losses globally as it causes dieback of the plant and the leaves to wilt, curl or discolour. It thrives in temperate climates and it's distribution can be sporadic within fields. Before planting your crop it is important to understand the risk of this soil borne fungal disease as an early infection can significantly damage crop yield.

Fera has established the Soil Health Unit to improve understanding of soil management and its effects on crop health and threat control. Our work involves investigating the interactions between soil condition, crops, water and biotic stress – and the environmental factors that influence them. This includes testing for the presence of *Verticillium dahliae* in soil which causes *Verticillium* wilt in many plant species, as well as a range of other soil pathogen tests. Contact us about our testing services at: **sales@fera.co.uk**

Potato disease tests



Black dot

Common Scab

£3m

Estimated annual losses by common scab

Black dot is caused by the geographically widespread fungus *Colletotrichum coccodes*, which can survive freely in soil for up to 8 years. Black dot symptoms appear as a dark brownish-grey blemish of potato tubers, progressing to lesions covered with minute black dots of resting spores (sclerotia). At present, most widely grown cultivars of potato are susceptible to the pathogen. Combined annual losses due to the blemish diseases black dot and silver scurf *(Helminthosporium solani)* in ware potatoes have been estimated at up to £5 million.

£5m

Estimated annual losses by black dot and silver scuff

Common Scab can be caused by many different soil-borne *Streptomyces* species of which the most important is *Streptomyces scabies*. Depending on the virulence of the *Streptomyces* species, cultivar susceptibility and the prevailing environmental conditions, a variety of scab symptoms such as erumpent, pitted or superficial lesions can develop on potato tubers and several root crops, including carrot, radish, beet, parsnip and turnip. Annual losses in ware potatoes due to common scab have been estimated at £3 million.

Fera's tests target all of the pathogenic *Streptomyces* species in one test but can also identify individual pathogenic species if required. Please get in touch to tell us about your requirements.

Contact us about our testing services at: sales@fera.co.uk

Fera is committed to helping agronomists, farmers and growers use sustainable testing methods to improve soil health for the present and the future. Soil testing helps to provide a holistic view of soil health so that effective integrated crop and soil management can be implemented.

Integrated Crop Management

Fera has introduced a new Integrated Crop Management Service that not only includes soil testing but expands a full package of services, including Insect Monitoring, Nematode Testing and Crop Health.

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"Informed agronomy decisions can boost a grower's profitability through reducing the costs and/or increasing the overall output. Influencers and decision makers must be able to access the best information about their crops and that starts with Integrated Crop Management. Fera Science Ltd offers a unique service to growers and advisors which targets soil and crop health, as well as nematode and insect monitoring. Understanding the health of the crop and the environment impacting it can mean the difference between success and failure e.g. changing the rotation, correct varietal choice, efficient pesticide application. The ICM can be tailored to suit a grower and advisor requirements so get in touch for further information."

Toby Reich, Business Development Manager, Fera

Find out more about our Integrated Crop Management service, contact us at: sales@fera.co.uk

Did you know?

AHDB and BBRO Project Partnership
"Soil Biology and Soil Health Partnership"
Jan 2017 – Dec 2021.

Fera is leading projects within this new research partnership entitled "Measuring and optimising the long-term impacts of soil management on soil biology and health". One of a number of connected projects within the Partnership specifically aims to develop and demonstrate robust DNA-based measures for routine monitoring of soil borne disease and identification of the best management practices to minimise disease risk.

Funded by AHDB and BBRO

Overall Coordination by NIAB

Scientific partners: Fera Science, ADAS, GWCT, ORC, SRUC, Natural England, University of Lincoln

Industry partners: BASF, Frontier Ltd, Innovation for Agriculture, LEAF, NRM, Wye & Usk Foundation

Through close interaction between researchers, growers and agronomists, the project aims to demonstrate the benefits of maintaining a close check on the biological health status of soils, across entire rotations, in terms of both productivity and sustainable safeguarding of our soils for the future.

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