# ****What can fungi do for your IPM strategy?****

*Key points from webinar #3 in the series* ***Sharing farmer knowledge across the farming sector on ways to work with nature to reduce pesticide use,*** *Feb. 2022*

This webinar for farmers and agronomists focussed on how fungi - those living in the soil and the fungal biocontrol agents applied as biopesticide products - can help to keep pests and diseases in check, while reducing reliance on pesticides*.* Expert speakers who shared their practical experiences were:

* **Karl Ritz, Emeritus Professor of Soil Ecology, University of Nottingham** explained how soil works as a living system and how understanding the soil ecosystem can inform effective crop management strategies.
* Former **‘Soil Farmer of the Year’ Tim Parton** shared his experience in making use of beneficial soil fungi, regenerating soils and managing nature to work cost-effectively for his business.
* **Dr Dave Chandler, microbiologist and entomologist, University of Warwick Crop Centre**, described current status, opportunities and challenges of microbial pest control using biopesticide products in the UK, with a focus on horticulture

**Key points**

* By managing soils to promote diverse microbial communities, farmers can benefit from numerous ecosystem services, including nutrient cycling and biological control of soil-borne plant diseases and pests,
* It all starts with a healthy soil- this is the farmer’s biggest asset.
* Beneficial fungi have evolved an intimate relationship with plants over millions of years- they want to work with us and be our friends, so we need to feed and look after them.
* To work well, fungal biopesticides must be applied as part of an IPM strategy, not as a ‘silver bullet’, single method solution.
* To get the most out of biopesticide products, growers need to understand what each product can and can’t do and how it differs from conventional pesticides, as well as upskilling in crop monitoring for decision making and in suitable application techniques.

***A. Soil biomass- the biological engine of the earth***

With a mass between 5-100 tons per hectare, the living organisms in the soil perform many soil functions and provide invaluable ecosystem services. The vast bulk of the soil fungi component exists as largely invisible fungal threads (hyphae), interconnected in a network (mycelium) which forms a transport and communication system, linking fungi with plant roots and with each other. This fungal network efficiently extracts and transports nutrients from the environment but is also very delicate and easily destroyed by heavy or regular ploughing and certain other agronomic practices.

Karl’s research demonstrates clearly how prone monoculture cropping and its associated lack of underground biodiversity is to epidemic levels of plant diseases, without a diverse, and well-balanced soil microbe community. Pathogenic fungi, such as *Fusarium oxysporum* species responsible for many serious diseases, are much less able (by 2-3 orders of magnitude) to colonise plant root zones and spread when there is a rich, diverse set of other fungi present in the soil. Some of these may be non-pathogenic Fusarium species which can occupy the ‘Fusarium-shaped niche’ and help stop the plant disease species getting a hold.

Factors for successful management of the soil’s biological engine are:

* Avoid messing up the architecture (i.e. don’t destroy soil structure)
* Keep ‘fuelling the engine’ with plant-based material and other organic matter
* Replace what you remove
* Encourage and maintain soil diversity to build resilience into your cropping system

 ***B. Making active use of soil beneficial fungi and bacteria on an arable farm***Over the last 15 years, Tim has developed and refined a whole farm approach to managing soil on his 300ha farm in Staffordshire, based on diverse rotations, cover crops and minimum tillage. Spring lupins are fantastic soil improvers and pollen source, while grass leys also support soil health.

His strategy for keeping crops healthy and resilient is by careful, tailored good nutrition and avoiding loading the plants with sugars, which are precisely what pests, e.g. aphids, want to eat. Tim brews up his own mixtures of beneficial microbes, including nitrogen-fixing and phosphate-releasing bacteria and Trichoderma fungal species and *Bacillus subtilis* bacterium for controlling disease-causing Fusarium species. He has been able to reduce pathogenic Fusarium levels from 36% incidence in untreated plots to only 2% in plots treated with his biological brews.

He injects compost slurry into the seed drill trench, which helps growing plants produce carbohydrates and amino acids, rather than sugars, which then stimulate beneficial soil fungi. Home-saved seed is used as it will already have a population of beneficial microbes living on/in it (endophytes), best suited for setting seedlings off to a good start in his fields. As a result of his regenerative system working with, rather than against, Nature, Tim hasn’t applied any insecticide for over 7 years, no pre-emergence herbicides, no plant growth regulators and he tries to minimise fungicide use, to protect beneficial soil fungi.

 ***C. Fungi for managing crop pests and diseases in IPM***More than 1,000 fungal species evolved to kill arthropods and are very common in nature. We can manipulate some of them as products to apply for direct control. Researchers select strains within a species with a very narrow host range so that they can target specific pests, without causing too much collateral damage to beneficial insects.

Bioinsecticides work really well in tomato IPM as a supplement to the primary biocontrol agents released, parasitic wasps and predators, e.g. *Beauveria bassiana* is effective for spider mite control when control by predatory mites starts to decline. In earlier days, growers would need to apply an insecticide but they can now apply a *B. bassiana* biopesticide instead, which delivers better control and is completely compatible with natural enemies.

More biofungicides are coming onto the market e.g. Gliocladium species fungi and *Bacillus amyloliquefasciens* bacterium for Botrytis rot, *Ampelomyces quisqualis* for powdery mildew and Trichoderma species for soil pathogens. Compared with synthetic fungicides, these have several advantages: multiple modes of action hence disease resistance development is much less likely; they stimulate plant growth; and they ‘turn on’ plants’ natural defence mechanisms. Biofungicides tend to work best at low-medium levels of disease and careful timing, based on monitoring, is critical.

Webinar recording is available via: <https://www.agricology.co.uk/sharing-farmer-knowledge-across-farming-sector-ways-work-nature-reduce-pesticide-use>

These webinars are part of a project to share farmer knowledge across the farming sector on ways to work with nature to reduce pesticide use. The project partners are RSPB, The Soil Association, Nature Friendly Farming Network, Pesticide Action Network UK, and CoFarm Cambridge.

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