



Healthy soil where KNF methods have been used

Photos © David O'Carroll

# Creating Resilient Soil with Microbes

**Rozie Apps** explores how Ballagh Micro Farm in Devon is bringing Korean Natural Farming to the UK, where beneficial microbes are being used to create healthy soil through powerful natural fertilisers

In *PM98*, we learnt how David O'Carroll makes organic soap at Ballagh Micro Farm in Devon, using locally sourced hemp, sunflower and rapeseed oil. David's passion is to bring organic back to our farms and tables. As well as making organic soap, David has set up a 4.45 hectare (11 acre) agroforestry learning centre for natural farming methods. The aim is to create and showcase how healthy soil can be created within a forest floor environment.

After discovering permaculture, David was on the hunt for methods to naturally create healthy soil; studying authors such as Jeff Lowenthal and Elaine Ingham led David to Indigenous Microorganisms (IMO) and Korean Natural Farming (KNF). "I have been using KNF for a

number of years on a smaller scale, before starting our agroforestry project. I have combined KNF and other methods of natural farming to accelerate the change in soil biology. IMO are the missing element in the agroforestry system as I understood."

KNF was founded in the 1960s by Cho Han-Kyu. It focuses on natural biological systems in the soil. By utilising self-made microorganisms that have been living in native environments for centuries, alongside added nutrient solutions, this style of farming maintains and increases healthy microbes, enabling healthy plants. It is used to create healthy soils as well as an odour control in animal husbandry and composting.

Beneficial fungi, bacteria and yeasts make up IMO which have two major functions: they decompose complex organic compounds like animal waste and dead plants into nutrients, making them easier for plants to absorb; and they can suppress various diseases and promote healthy soil through the compounds they create, such as antibiotic substances, enzymes and lactic acid.

There are many elements to KNF, but here we explore how David uses IMO ... IMO needs to be collected and cultivated through several stages; mixed with specific KNF inputs to create fertilisers, pesticides and compost. It is best to collect IMO from old-growth, undeveloped areas ideally at a higher altitude. But to guarantee a wide range of microbe diversity, which creates high resilience, you can do as David does, and collect IMO from many places through different seasons. In areas such as moorland/national parks, look for perennial shrubs, and undisturbed decaying plant matter under broadleaf trees. It's best to avoid collecting IMO under conifers as this can be too acidic.

### Collecting and Cultivating IMO

There are several methods for collecting and cultivating IMO. These processes are very specific and it's best if more research is done before following these techniques; they are a guide.

The main collection method creates an inoculation, which is used to create a specialised compost (similar to the Japanese Bokashi method) and liquid fertiliser. There are four stages:

- **IMO#1** IMO are collected on hard-boiled rice in a natural container (2/3 full and lightly packed); in Asia this is bamboo; in the UK, David uses cedar wood, which works particularly well with microbes. The box is placed where microbes will feed (an undisturbed forest floor) and inoculate the rice. A breathable cover prevents contamination and a metal cage prevents rodents and other animals from eating the rice. It's also important the collection is protected from moisture. The collection can take 3-5 days to complete and is weather dependant (during winter is not encouraged). If travelling to a location is difficult, collect suitable leaf mould and material to work with at home – a better option than none.

Once the rice is covered in a vibrant white mycelium (like candy-floss) the collection is complete. This is IMO#1.

- **IMO#2** Immediately after successful collection add IMO#1 to equal parts raw cane sugar which acts as a stabiliser to arrest microbial activity. Binding water with the sugar molecules puts the microbes in a state of suspended animation. This is IMO#2, and it can be stored in a glass jar (with a breathable lid), for the next stage. It's advisable that various IMO collections are stored separately. One spoonful can be added to water to make a quick IMO feed spray. IMO#2 is effectively a broad spectrum of highly concentrated fungal spores.

2ml of IMO#2 with 1000ml of water can be used for manure making.

1ml of IMO#2 with 1000ml of water is good to dip seed roots in at transplantation time.



Collecting microbes using rice



IMO2 once it's stabilised

- **IMO#3** IMO#2 is then used as the microbial inoculant and is mixed with water into a 'carb and a carbon' medium, traditionally rice hulls or bran, with a specific recipe of micronised inputs with various uses/functions. These are: BRV; brown rice vinegar – cleanser; FPJ: fermented plant juice – food (see box on how to make); OHN: Oriental herbal nutrient – medicine; SW: seawater – minerals. Dilute IMO#2 with water (1:1000) and mix fully mix with the medium. The micronised inputs also need to be diluted 1:1000 in water before adding to the IMO#2 water. The medium needs a 65-70% moisture level (test by forming a ball that breaks when squeezed). This mixture is made on a soil floor (not concrete), and is covered in rice straw (David uses hemp stalks) with ventilation and 70% shade; it will need turning during the first 24 hours. The temperature mustn't rise above 65-70°C



Collecting leaf mould; The muslin or sock filled with leaf mould, being soaked in rainwater

otherwise an anaerobic process will occur (above body temperature is not advised – test with an elbow). Once the temperature reduces (indicating reduced microbial activity), the bran will be covered in white hyphae. It can now be stored for later use (its moisture levels having dropped to 40%, restricting moisture for the microbes) or it can be made into IMO#4. This method can be practised on a smaller scale for the beginner (David typically makes a 25kg batch as standard, often scaled up if required). The power of IMO is truly realised with IMO#4.

- **IMO#4** Mix IMO#3 with equal parts of your native soil, water and the same micronised inputs from the previous stage. This effectively is ‘training your dirt’; trained by super-beings that have new skills and abilities that will be learnt by native soil.

As with the process for mixing and turning of IMO#3 the same process will occur and needs keen observation and an adequate environment for success.

Microbes replicate every 30 minutes, so gradually increasing the batch size they’re added to enables them to multiply exponentially. Once they’ve reached IMO#4, there are trillions available. IMO#4 is either spread as a compost on your soil as an amendment to increase the microbes, or it’s added to water (with micronised inputs) to create a liquid feed, which reaches a larger area than as compost.

Do not be put off; it sounds complicated but if you’ve ever made bread/sourdough, kombucha or grown mushrooms, you have introduced a microbe to a medium to increase the numbers as they replicate.

### A UK Twist

David wants to make KNF accessible in the UK, sourcing more local ingredients. He often uses a different collection and cultivation method too. This method is less traditional, and he recommends anyone wanting to get involved in KNF to use the traditional IMO methods above first. It is important to thoroughly understand the process before experimenting.

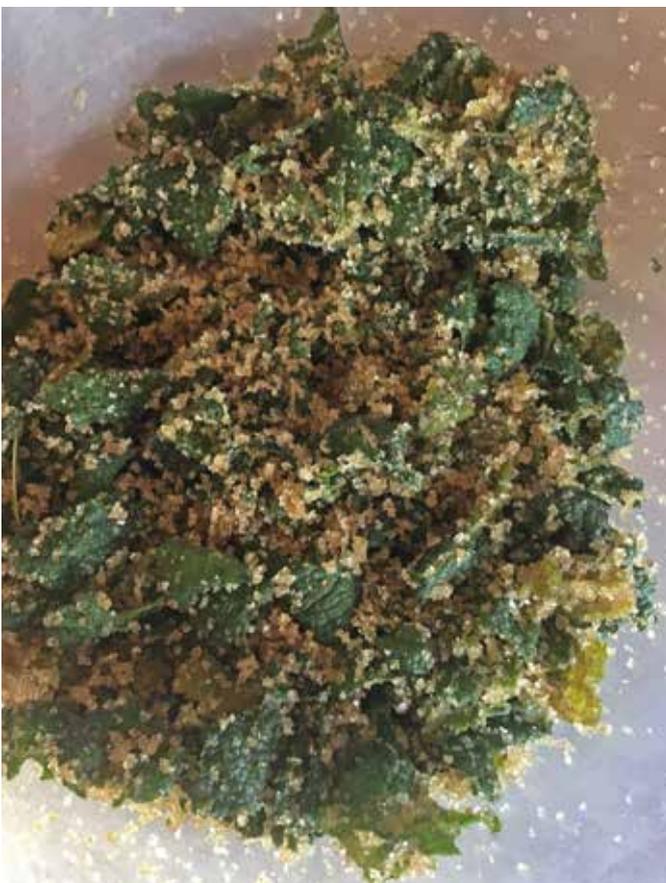
David’s simplest method is to collect leaf mould containing IMO. This held within a sock and squeezed into a barrel of rainwater. The sock is then left to hang on the side, dripping into the barrel. The same is done with a sock of boiled potatoes (food for the microbes). A pinch of sea-salt is added; sea salt contains trace elements of many different minerals, feeding the microbes. The microbes feed on the starch, creating heat which creates a current, creating a ring of bubbles (foam) on the water’s surface. Once a foam covers the water surface around the barrel (like a wave line) the microbes have finished feeding, and activity slows down, eventually leading to the microbes’ death if the solution is not used at peak activity. This anaerobic method creates a live microbe solution. David applies this liquid to the soil, diluted 1:30 with water, to encourage the multiplication of microbes as well as to their compost toilets, where the microbes increase the decomposition rate and eliminate odours. This immediate solution is quick and effective and uses minimal ingredients, making it cheaper and more accessible. If peak activity is missed, this liquid can be combined with crop residue to create a fertiliser.



## DIY Fermented Plant Juice

To make your own, you need to ferment young and fresh plant matter, such as new leaves and buds. Don't mix different plants together; use separate jars for each plant.

1. Cut plant matter into 3-5cm pieces; this increases contact surface area.
2. Weigh the plant matter and add to container. Add brown sugar, around half the weight of plant matter.
3. Mix with your hands thoroughly as the sugar will be extracting the plant juices.
4. Put the mixture in a net/cloth bag and place in a ceramic pot or plastic bucket, securing with string or rubber band. Add a weight on top of the bag to compress the mixture and cover the pot/bucket; paper or cloth is ideal as it allows air to get inside and for the gas from fermentation to escape.
5. Store in a cool, dry, shady place.
6. After 7 days, lift bag, squeeze any remaining extracts out and pour the liquid from the pot/bucket into a dark coloured jar with a cloth/paper lid to allow gas to escape incase of further fermentation. It is now ready to be used in a diluted form.
7. Compost the plant matter.



LEFT

Four simple stages to making the UK version, using potatoes

RIGHT

Hemp that has been treated with KNF methods. It has a much bigger stem with more hemp fibre.

FAR RIGHT

Hemp that hasn't been treated with KNF methods



David wants to encourage growers and farmers in the UK to use these methods, so he's been experimenting with alternative ingredients to those in KNF, "valuing what is near and cheap, rather than expensive and from a far." He started by replacing rice hulls/bran with wheat bran as it's readily available. However, in recent months he has been working with the British Hemp Association (BHA) due to applying for a hemp license for his soap, leading him to use hemp by-products. Now he combines hemp seed and hulls with wheat bran, (mycelium love the fat content), and he uses hemp stems instead of rice stalks (in IMO#3 creation). David has found that BHA and hemp and cannabis farmers are very open to learning these organic methods. They want to create top quality, organic products, that can be part of a closed-loop system. On board already are founding BHA members, such as Vitality Hemp of West Sussex. They have a network of academic and research institutes with a passion for environmentally responsible farming methods. Also on board are Hempen worker's cooperative in Oxfordshire, who are committed to holistic farming, while creating sustainable livelihoods and making decisions based on principles rather than profit to develop the potential hemp-based economy. Hemp seed oil grown by these farms is used within the hemp soap products made by David.

This has led to exciting relationships with revolutionary figures, who provide the community with incentives to grow hemp in a conscious way, adding value to existing rural land usage and promoting a system which drastically reduces the bottom line costs for farmers and essentially reduces the barriers to entry for budding rural businesses.

## Fertilisers and Pesticides

The main aim of natural farming and what David is trying to share, is the importance of observing Nature. At each growth stage of a crop, such as leaf growth and ripening, a microbial feed can be given, to remedy and maintain health.

IMO#4 can be combined with organic plant matter to create fertilisers and pesticides. By incorporating leaves, stems and buds, you can break the plant down into its individual elements, making the nutrients and minerals absorbable. With this method, green matter is taken from

the plants you wish to fertilise. So tomato leaves are used to feed tomatoes; the tomatine found in tomato leaves has fungicidal properties. Fermented dock leaves are good because their long taproots bring up calcium, phosphorus and iron from the soil. Clover holds nitrogen. Chickweed absorbs potassium, phosphorus and manganese. Dandelions absorb a range of minerals. Sorrel takes up phosphorus.

IMO#4 can be used as a spray on plants to prevent disease – the plants are so covered in good microbes that there's no room for pathogens. David likes to use nutrient-dense seawater to create sprays to encourage fruit to ripen, as the salt forces the sugar content to increase.

In larger agriculture, it is harder to keep pest-free, so pesticides may be necessary. At Ballagh Micro Farm, they look for strong plants that don't attract pests, and utilise their pest repellent properties. For example, they noticed that gorse is never attacked, so they boil it down, extract its useful properties and create a herbal solution which is combined with their soap, acting as a surfactant, distributing the liquid over the suffering plant. There are over 100 plants that can be used like this, such as daffodils, purslane, rosemary, bracken, potato, and lavender. Using plants available on the farm and locally is a no cost, natural pest solution.

David wants to encourage as many people as possible to take up this natural method of rejuvenating the soil. Weather changes are taking place globally due to climate change, and excessive droughts and floods are going to have drastic effects on crops. If methods like this can create organic food, whilst providing healthy and resilient soils, we have a positive solution at our fingertips.

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A big thank you to David for being so passionate and sharing his methods. To learn more about these processes and take a course with David visit [www.ballaghbotanicals.co.uk](http://www.ballaghbotanicals.co.uk)

Interested in making your own compost teas? Check our new book, *Compost Teas for the Organic Grower* by Eric Fisher, available from *PM's* online store at: <https://shop.permaculture.co.uk/compost-teas-for-the-organic-grower.html>

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