Fermenting a soil revolution

FERMENTING organic matter in a similar way to ensiling grass rather than composting waste can lead to greater improvements in soil health while helping farmers reduce their carbon footprint.

Initial independent trials commissioned by agricultural manufacturer Agriton and done by Feed Innovation Services, Wageningen, in the Netherlands, has shown fermenting organic waste significantly reduces carbon and organic matter losses, making more nutrients available to subsequent crops.

The process known as bokashi, Japanese for fermented organic matter, involves fermenting organic waste anaerobically where a mix of seashells, lime, clay minerals and 80 species of micro-organisms consisting of lactic acid bacteria and yeast are added. It is then sealed in plastic wrap.

After six to eight weeks the bokashi is ready, similar to the process for ensiling forage crops.

Agriton commercial director Andrew Sincock said composting grass cuttings in windrows led to 60% losses in weight from 13,400kg to 5070kg over six weeks while fermented bokashi grass cuttings lost just 3% from the same starting weight.

In addition, the bokashi had a higher carbon-to-nitrogen ratio, at 19:5 compared with 10:1 – an important indicator for soil organic matter content and fertility.

"Farmers are under increasing pressure to reduce their greenhouse gas emissions and many are seeking to improve soil health at the same time.

"Soil health and carbon sequestration are very likely to form part of Britain's new environmental land management scheme," Sincock said.

Overall, from the original 13,400kg of grass cuttings the resulting bokashi contained 1198kg of organic matter and 599kg of carbon more than the compost-treated grass, with higher levels of nitrogen, energy, ash, protein and cellulose.

SUPERIOR: Trials have found fermented bokashi is much better for soils and the environment than compost.

Mineral levels were also considerably higher with greater potassium, sodium, magnesium, sulphur and other micronutrients.

The trial also considered the carbon footprint of the compost and bokashi.

The bokashi performed favorably because it did not require turning while the compost was turned almost daily.

In total, the bokashi required 350kg carbon dioxide to produce – 3041kg less than the compost.

When weight loss was accounted for compost used 669kg carbon dioxide/t while bokashi used 25kg/t.

Sincock said increasing knowledge of soil sciences shows regenerative practices are sustainable and profitable, which can lead to reduced flooding, healthy ecosystems and sustainable crops.

"When you consider 1kg of humus can hold 4kg of water and is about 50% carbon by weight, increasing organic matter in soils by one percentage point would increase water-holding capacity by 160,000 litres/ha and carbon by roughly 40,000kg/ha."

After the initial trial Agriton commissioned a second independent trial with Dutch firm SPNA Agroresearch to look at the impact of bokashi on both crops and soil. It was found to enhance soil nutrient and biodiversity levels.

Replicated over three years, bokashi-treated winter wheat averaged 8.9t/ha against compost at 8.7t/ha with similar protein levels and specific weights.

After three years soil analysis revealed nitrogen content was significantly higher in the bokashi-treated plots at 2402mg/kg of nitrogen compared with compost at 2298mg/kg.

Sulphur, phosphate and potassium levels were also significantly higher, with organic matter content rising from 4.6% in the control to 4.7% with compost and 5.2% with the bokashi.

Biological life in the soil was also generally higher when treated with bokashi rather than compost, with reduced levels of harmful nematodes while weed and disease pressures were not statistically different.

Sincock highlights how the trials were so promising the team extended them for another four years, where they are now in their final year, with full results expected early next year.

"Carbon is the building block of all plant life and humus is the most important element of any farming system.

"Anything farmers can do to improve their soils will benefit productivity, the environment and sustainability in every sense of the word," he said.

The soil organics mystery is solved

SCIENTISTS have solved the mystery of why adding organic material like manure to soils improves flood and drought resilience, climate control and crop yields.

Founded on more than 50 years' worth of data from a unique field experiment, researchers at Rothamsted Research have shown common farming practices drain the soil of carbon, altering the structure of soils' microscopic habitat and the genetics of microbes living in it.

The team of microbiologists and physicists considered almost 9000 genes and used x-ray imaging to look at soil pores smaller than the width of a human hair.

In healthy soils relatively low nitrogen levels limit microbes' ability to metabolise carbon compounds so they excrete them as polymers that act as a kind of glue that is good for soil – creating an extensive network of pores that allow for greater circulation of air, nutrients and retention of water.

However, a lack of oxygen in soil results in microbes having to turn to nitrogen and sulphur compounds for their energy – inefficient processes that result in increased emissions of the greenhouse gas nitrous oxide, among other issues.

Writing in the journal Scientific Reports, the researchers said the Victorian-era switch from manure to ammonia and phosphorous-based fertilisers has caused microbes to metabolise more carbon, excrete fewer polymers and fundamentally alter the properties of farmland soils when compared with their original grassland state.

Lead researcher professor Andrew Neal said "Manure is high in carbon and nitrogen, whereas ammonia-based fertilisers are devoid of carbon. Decades of such inputs, and soil processes typically act over decades, have changed the way soil microbes get their energy and nutrients and how they respire."