DEPARTMENT OF AGRICULTURE AND FISHERIES


# Soil Management, Organic Matter, Biological Activity and Disease Suppression

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## Management

- Management of the soil in banana crops can alter the physical, chemical and biological properties.
- Options for soil management of banana crops include tillage, irrigation, nutrient application and groundcovers.
- Our work has concentrated on nitrogen fertiliser and groundcover management as having the greatest impact on soil properties.

## Soil Organic Matter

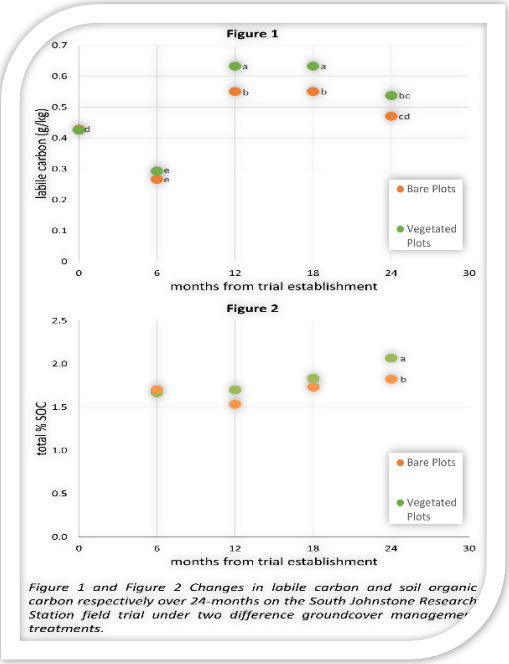


*Figure 1 and Figure 2 Changes in labile carbon and soil organic carbon respectively over 24-months on the South Johnstone Research Station field trial under two difference groundcover management treatments.*

- Soil organic matter (SOM) is an important indicator for soil health and has large effects on other soil properties and microbial activity.
- SOM is determined by measuring soil organic carbon (SOC), which is composed of different fractions, but it is the labile or active carbon that supports biological activity.
- Labile carbon increased after 12 months under vegetated groundcover.
- Soil organic carbon showed significant differences between management practices after 24 months.
- The change in soil organic carbon under vegetated groundcovers at South Johnstone is equivalent to storing 1 tonne of carbon per hectare per year.

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ACIAR aciar.gov.au
Australian Banana Growers' Council Inc.
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## Soil Bulk Density and Penetration Resistance

- Soil bulk density determines the weight of soil in a given volume e.g. g/cm$^3$ and is a measure of soil compaction or available pore spaces.
- Penetration resistance measures strength of the soil, also a measure of compaction.
- Soil under vegetated groundcover had 4% lower soil bulk density and 4% more pore space than bare soil in the top 10 cm.
- Soil under vegetated groundcover had reduced penetration, particularly in the top 7.5 cm compared with bare soil allowing better movement of air, water, roots and soil organisms.

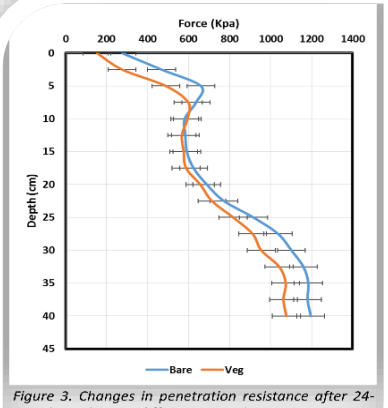


*Figure 3. Changes in penetration resistance after 24-months under two different groundcover management treatments on the South Johnstone Research Station field trial.*

## Soil Nematode Community

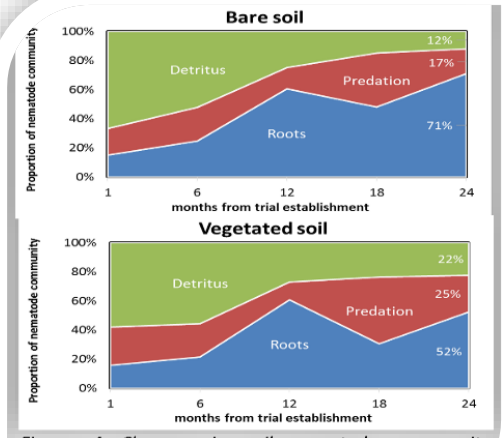


*Figure 4 Changes in soil nematode community composition in bare and vegetated soil after 24-months on the South Johnstone Research Station field trial.*

- Soil nematodes are a major component of the soil food webs
- Microbivorous nematodes (bacterivores and fungivores) are part of the detritus cycle in the soil, plant-parasitic nematodes feed on living plant roots and predatory nematodes feed on other soil organisms.
- The composition of the soil nematode community can indicate how energy is moving through the soil food web.
- Bare soil had a higher proportion of nematodes feeding on the roots of plants and lower numbers of nematodes feeding on other soil organisms either through predation or in the decomposition of detritus. This indicated under bare soil management carbon is more likely to enter the soil via plant roots.

## Panama Disease Suppression

- Disease suppression occurs when disease development is reduced in the presence of the pathogen and a susceptible plant.
- Disease suppression through soil management relies on changes to the total soil microbial community, rather than increasing a specific soil organism.
- Disease suppression cannot be measured directly, requiring indirect methods to determine how the disease may progress under different management systems.
- Disease suppression was not well defined, but recovery of Fusarium from field soil in a laboratory assay tended to be lower with lower nitrogen fertiliser applications and when groundcovers were used.

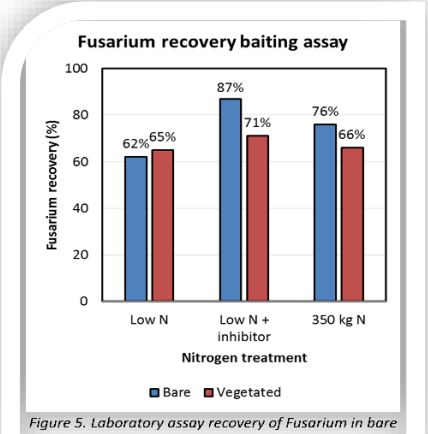


*Figure 5. Laboratory assay recovery of Fusarium in bare and vegetated soil and with different nitrogen fertiliser treatments after 24-months on the South Johnstone Research Station field trial.*

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