



ESSAI 4

Nutrition innovante

COLZA / COMPARAISON ANUELLE
D'EFFICACITÉ DE 2 BIOSTIMULANTS
APPLIQUÉS AU SEMIS



Product
Trichoderma harzianum

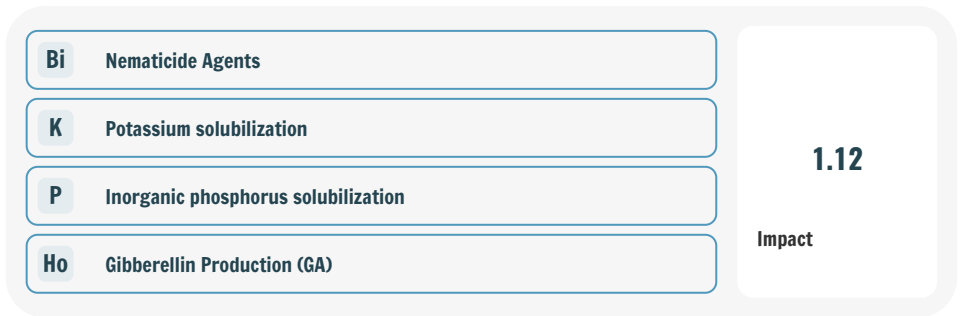
Year
2020

Treatment
Trichoderma harzianum

Crop
Rapeseed (Brassica napus L.)

Locations
3

Effects and Tendencies

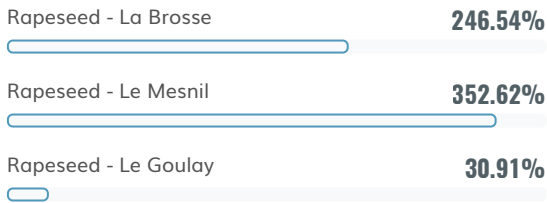


Tendencies

Nematicide Agents

Locations

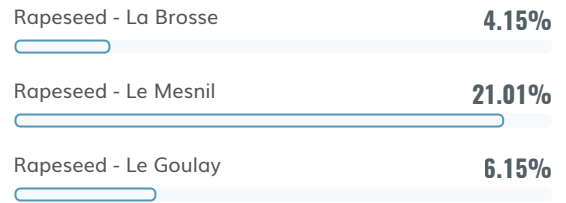
352.62%



Potassium solubilization

Locations

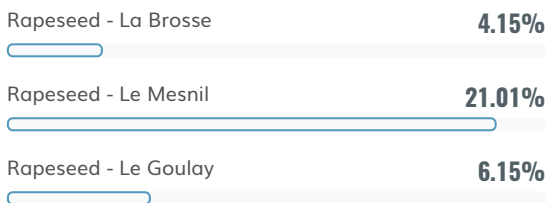
21.01%



Inorganic phosphorus solubilization

Locations

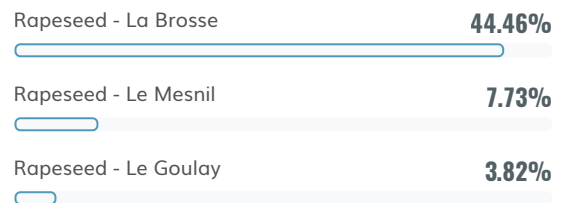
21.01%



Gibberellin Production (GA)

Locations

44.46%



ANNEX 0

Methodology and Materials

Methodology

Samples were collected before (T0) and fifteen days after the treatment application (T1), with a total of 90 soil samples over three blocks. Soil samples were collected in triplicate, in order to ensure accuracy and account for the natural variability of the microbial communities across samples. Bulk soils were collected in sterile tubes according to BeCrop® Instructions, at a depth of 2-6 inches. Samples were collected as a composite of several cores in each block, in order to ensure representativity of the area.

Rapeseed - La Brosse

| | | | | | | |
|-------------------------------------|--------------|--------|--------|-----------------------|--------|--------|
| T1 2020-09-25 x6 codes | C22016 | C22017 | C22018 | C22019 | C2201A | C2201B |
| | C22010 | C22011 | C22012 | C22013 | C22014 | C22015 |
| Samples x2 types | No treatment | | | Trichoderma harzianum | | |

Rapeseed - Le Mesnil

| | | | | | | |
|-------------------------------------|--------------|--------|--------|-----------------------|--------|--------|
| T1 2020-09-25 x6 codes | C2201I | C2201J | C2201K | C2201L | C2201M | C2201N |
| | C2201C | C2201D | C2201E | C2201F | C2201G | C2201H |
| Samples x2 types | No treatment | | | Trichoderma harzianum | | |

Rapeseed - Le Goulay

| | | | | | | |
|-------------------------------------|--------------|--------|--------|-----------------------|--------|--------|
| T1 2020-09-25 x6 codes | C2201U | C2201V | C2201W | C2201X | C2201Y | C2201Z |
| | C2201O | C2201P | C2201Q | C2201R | C2201S | C2201T |
| Samples x2 types | No treatment | | | Trichoderma harzianum | | |

ANNEX 1-2

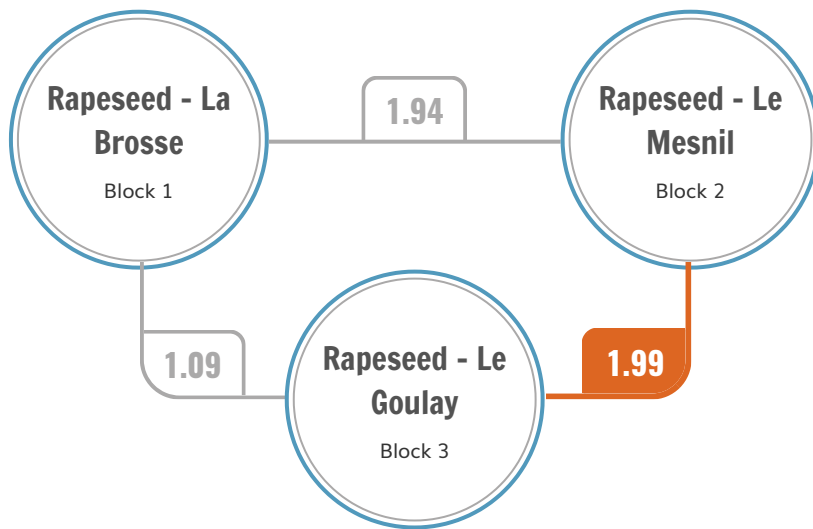
Locations Affinity

Comparative Analysis

The taxonomic structure of both bacterial and fungal communities associated with all samples across the three blocks was analyzed through a multidimensional analysis (nMDS). Overall, at macroscale level, soil location defined soil microbiome clusters better than condition (treated and untreated) or sampling time (T0 and T1).

Macroscale: Among Locations

Microbiome Affinity



Pre-Evaluation

Good microbiome affinity

Locations present a reasonable distance in terms of microbiome

Same-crop locations

Locations grow the same crop, comparison makes sense

Same Soil texture

Similar soil textures make good sense for a comparison

Microscale: Locations over Time

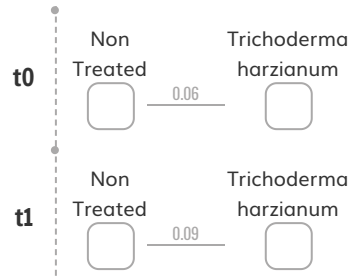
Buno-Bonnevaux

Rapeseed - La Brosse

Among times



In each time



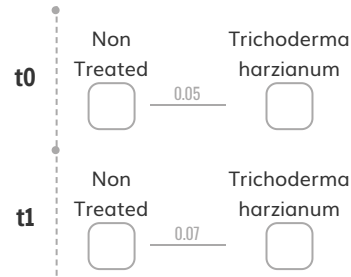
Tousson

Rapeseed - Le Mesnil

Among times



In each time



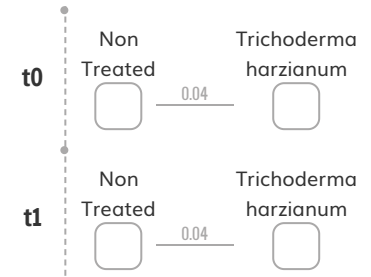
Noisy-sur-Ecole

Rapeseed - Le Goulay

Among times



In each time



ANNEX 3

Nutrition Analysis

Nutrition Analysis

The taxonomic structure and potential for nutrient cycling of both bacterial and fungal communities associated with all samples across the three blocks were analyzed through a multidimensional analysis (nMDS). Overall, at the macroscale level, location defined soil microbiome clusters better than condition (treated and untreated) or sampling time (T0 and T1).

Trichoderma harzianum's Impact

1.12 | Rapeseed - La Brosse



1 | Rapeseed - Le Mesnil



0.76 | Rapeseed - Le Goulay



Major Nutrients Evolution

C

Carbon Pathways

0

Claims for *Trichoderma harzianum*

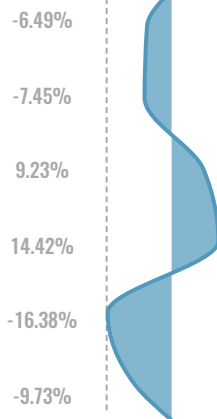
Carbon Pathways

- ◆ Carbon Fixation
- ◆ Aerobic respiration
- ◆ Fermentation
- ◆ Methanogenesis
- ◆ Organic matter release

Buno-Bonnevaux

Rapeseed - La Brosse

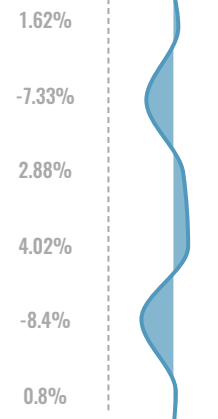
Change Chart



Tousson

Rapeseed - Le Mesnil

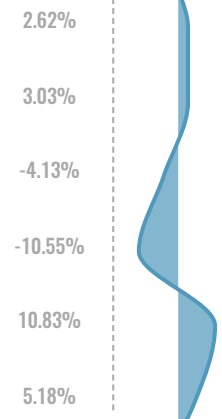
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



N

Nitrogen cycle

0

Claims for *Trichoderma harzianum*

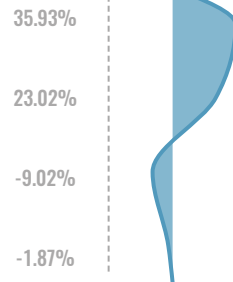
Nitrogen cycle

- Inorganic nitrogen release
- Inorganic nitrogen consum...
- Inorganic Nitrogen cycle he...

Buno-Bonnevaux

Rapeseed - La Brosse

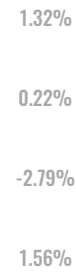
Change Chart



Tousson

Rapeseed - Le Mesnil

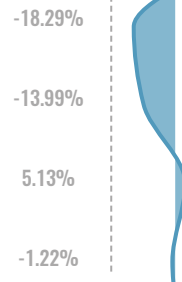
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



P

Phosphorus Pathways

1

Claims for *Trichoderma harzianum*

x1

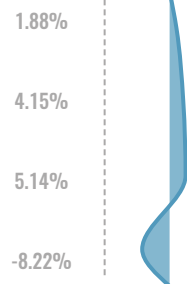
Phosphorus Pathways

- Inorganic P solubilization
- Inorganic P consumption
- Organic P assimilation

Buno-Bonnevaux

Rapeseed - La Brosse

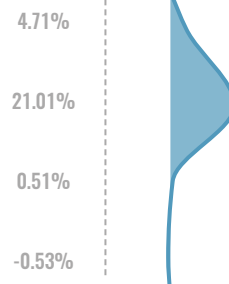
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Tousson

Rapeseed - Le Mesnil

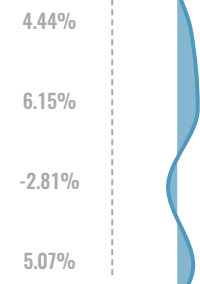
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



K

Potassium Pathways

1

Claims for Trichoderma harzianum

x1

Potassium Pathways

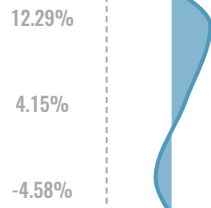
Potassium solubilization

Potassium consumption

Buno-Bonnevaux

Rapeseed - La Brosse

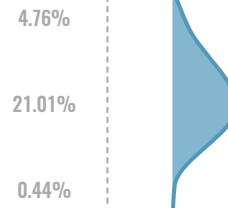
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Tousson

Rapeseed - Le Mesnil

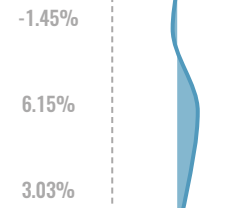
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



Min

Minor Nutrients Evolution

0

Claims for Trichoderma harzianum

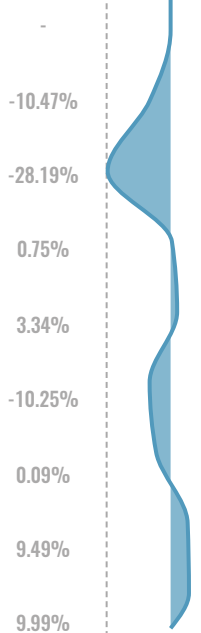
Minor Nutrients Evoluti...

- Iron assimilation
- Zinc transport equilibrium
- Manganese transport equili...
- Sulfur Cycle Equilibrium
- Calcium Transport
- Copper Export
- Magnesium transport
- Chlorine transport

Buno-Bonnevaux

Rapeseed - La Brosse

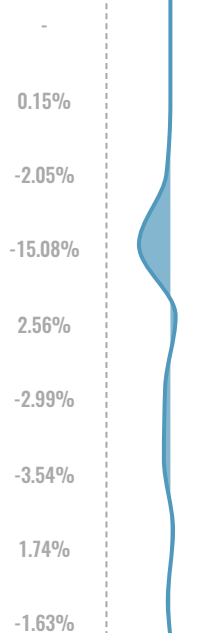
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Tousson

Rapeseed - Le Mesnil

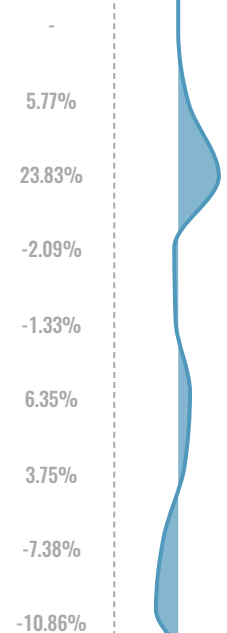
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



ANNEX 3

Phytohormones and Stress

Hormones and Stress

The taxonomic structure and presence of beneficial organisms from both bacterial and fungal communities associated with all samples across the three blocks were analyzed through a multidimensional analysis (nMDS). Overall, at the macroscale level, location defined soil microbiome clusters better than condition (treated and untreated) or sampling time (T0 and T1).

Phytohormones and Stress Adaptators Evolution

Ho

Hormone Production Evolution

1

Claims for *Trichoderma harzianum*

x1

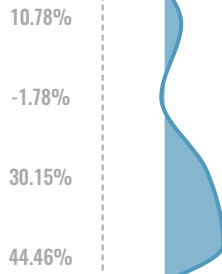
Hormone Production Ev...

- ◆ Auxin Production (IAA)
- ◆ Cytokinin Production (CK)
- ◆ Gibberellin Production (GA)

Buno-Bonnevaux

Rapeseed - La Brosse

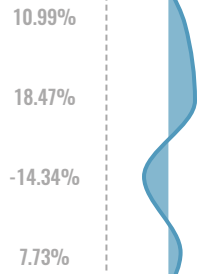
Change Chart



Tousson

Rapeseed - Le Mesnil

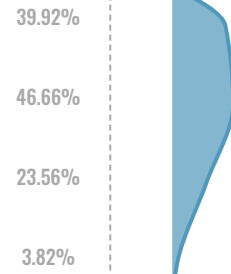
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



St

Stress adaptation Evolution

0

Claims for *Trichoderma harzianum*

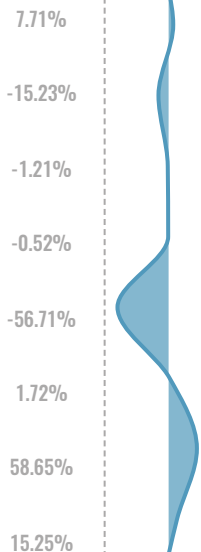
Stress adaptation Evolu...

- ◆ Exopolysaccharide production
- ◆ ACC deaminase (ACC-d)
- ◆ Heavy metal solubilization
- ◆ Salicylic acid (SA)
- ◆ Salt tolerance
- ◆ Abscisic acid (ABA)
- ◆ Siderophore production

Buno-Bonnevaux

Rapeseed - La Brosse

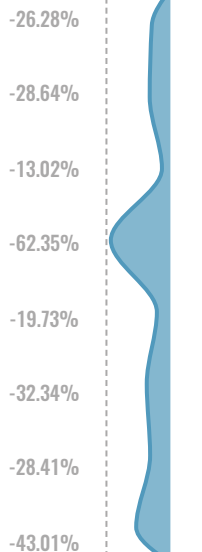
Change Chart



Tousson

Rapeseed - Le Mesnil

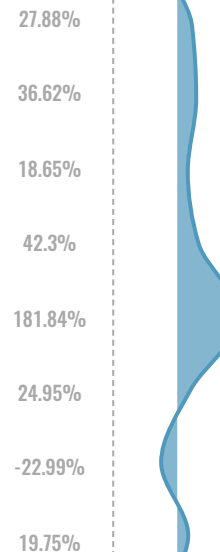
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



ANNEX 4

Health and Biocontrol

Health and Biocontrol

The taxonomic structure as well as the presence of pathogens and biocontrol agents in both the bacterial and fungal communities associated with all samples across the three blocks were analyzed through a multidimensional analysis (nMDS). Overall, at the macroscale level, location defined soil microbiome clusters better than condition (treated and untreated) or sampling time (T0 and T1).

Biocontrol Evolution

Bi

Biocontrol

1

Claims for *Trichoderma harzianum*

x1

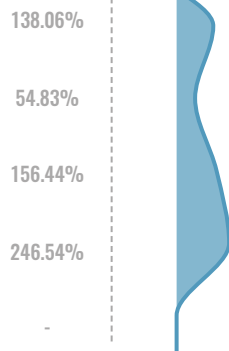
Biocontrol

- ◆ Fungicide Agents
- ◆ Insecticide Agents
- ◆ Nematicide Agents
- ◆ Bactericide Agents

Buno-Bonnevaux

Rapeseed - La Brosse

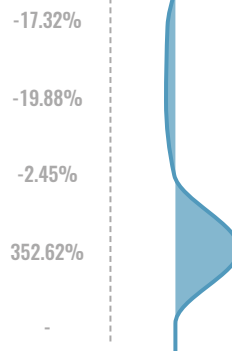
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Tousson

Rapeseed - Le Mesnil

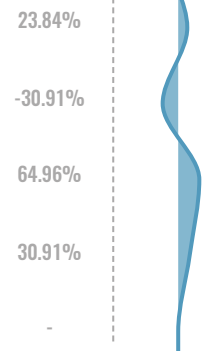
Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart



Pathogens Evolution

Hlt

Rapeseed Pathogens Evolution

0

Claims for *Trichoderma harzianum*

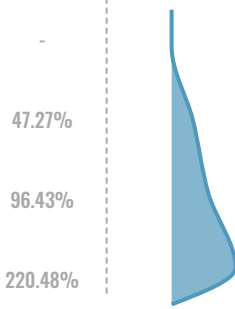
Rapeseed Pathogens Ev...

- Damping off
- Fungal root rot
- Seedling disease complex

Buno-Bonnevaux

Rapeseed - La Brosse

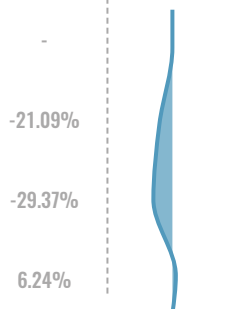
Change Chart



Tousson

Rapeseed - Le Mesnil

Change Chart



Noisy-sur-Ecole

Rapeseed - Le Goulay

Change Chart

