Mineral nutrition of banana in organic agriculture

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In organic agriculture

1. No herbicide for weeds control => live vegetal cover on the soil which may compete with banana for nutrients uptake

2. Fertilization based on organic fertilizers => nutrients are available only after organic matter mineralization

In these conditions, adjusting the fertilization to the crop demand for nutrients is a challenge for the farmer

**Objectives:** Assess the effect of soil vegetal cover and organic fertilization on banana nutrition and yield parameters
Experimental design
6 treatments combining:

. 3 modes of soil cover management: SP - PU - LAB

. 2 modes of fertilization: **Organic** - **Mineral**
Banana planting on live vegetal cover

At the end of the fallow period, mowing of the weeds (rotary cutter)

Soil cover management

SP

Banana planting on live vegetal cover

Mowing of weeds every 2 months
Soil cover management

PU

Pueraria cover installation during the fallow period

Banana planting on live Pueraria cover

Banana foot clearing every 2 months

(Pueraria: twining plant able to climb on banana)
Soil cover management

LAB

At the end of the fallow period, soil tillage with a heavy spading machine

→

Banana planting on loosened bare soil

→

Mowing of the weeds regrowth every 2 months (rotary cutter)
Fertilization

Organic
. At planting: 2 liters/plant of compost
. Application every month of complete organic fertilizer

Mineral
. At planting: 150 g/plant of Di-Ammonium Phosphate
. Application every month of complete mineral fertilizer

Doses of fertilizers are calculated to bring in both treatments the same amount of available nitrogen.

Available nitrogen = mineral nitrogen released 90 days after fertilizer application
Results
Soil organic matter was significantly higher with organic fertilization. No effect of soil cover management.
Soil mineral nitrogen
Organic fertilization

Mineral nitrogen (ppm)

Month after planting

Cycle 1
Cycle 2
Cycle 3

PU org
SP org
LAB Org
min
max

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Banana mineral nutrition => *Significant effect only on nitrogen and magnesium*

Leaf content in Nitrogen and Magnesium

**Cycle 1**

N and Mg significantly higher:

1. with mineral fertilization
2. with Pueraria cover
Banana mineral nutrition

Leaf content in Nitrogen and Magnesium

- N and Mg significantly higher with mineral fertilization
- No more effect of soil cover management

<table>
<thead>
<tr>
<th>Mg/N</th>
<th>R²</th>
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<tbody>
<tr>
<td>Cycle 1</td>
<td>0.39</td>
</tr>
<tr>
<td>Cycle 2</td>
<td>0.38</td>
</tr>
<tr>
<td>Cycle 3</td>
<td>0.51</td>
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Magnesium uptake related to Nitrogen uptake
Soil - Plant relation

Nitrogen uptake related to soil nitrogen availability

No clear soil-plant relation for Mg uptake:
  . no relation with the level of Mg available in the soil
  . no relation with the cations ratios in the soil

In fact, Mg uptake seems driven by Nitrogen uptake *

* Mulder, 1956, Nitrogen-Magnesium relationships in crop plants, Plant and Soil 7, n° 4, 341-376
Yield indicators

**Fruits number of the bunch and flowering date**

- **1st cycle**
  - Flowering date significantly later with organic fertilization
  - Fruits number significantly higher with Pueraria cover

- **2nd and 3rd cycle**
  - No increase of flowering date delay with organic fertilization
  - No effect on fruit number
Conclusions

. Low soil nitrogen availability is a major concern in organic banana:
   Low N uptake $\Rightarrow$ affect Mg uptake
   $\Rightarrow$ delay flowering

. It can be explained:
   A large part of the nitrogen input remains on organic form and is not available at
   short-term

. In organic agriculture, planting banana on a live legume cover (*Pueraria*) enables to
   improve nitrogen availability and banana crop performance.
Thank you for your attention