IHC 2022
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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

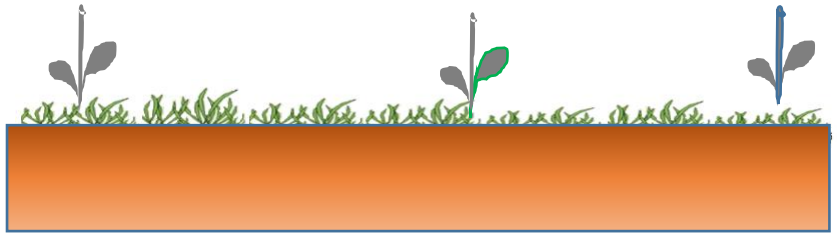
6 treatments combining :

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

. 2 modes of fertilization : **Organic - Mineral**

Soil cover management

SP



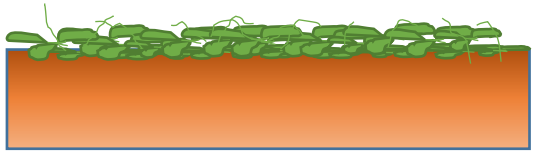
At the end of the fallow period, mowing of the weeds (rotary cutter)

Banana planting on live vegetal cover

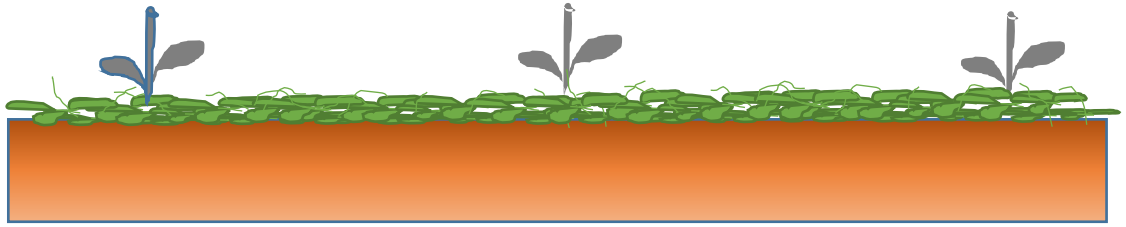
Mowing of weeds every 2 months

Soil cover management

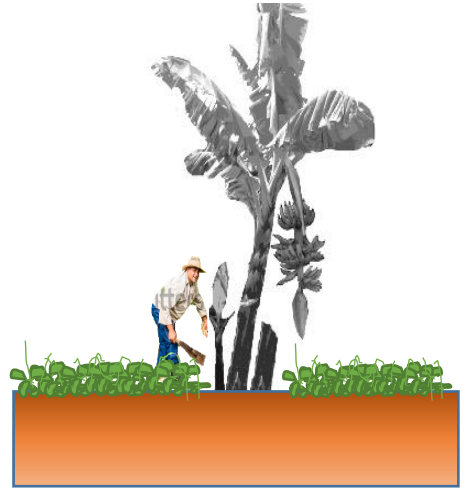
PU



Pueraria cover installation during the fallow period



Banana planting on live Pueraria cover

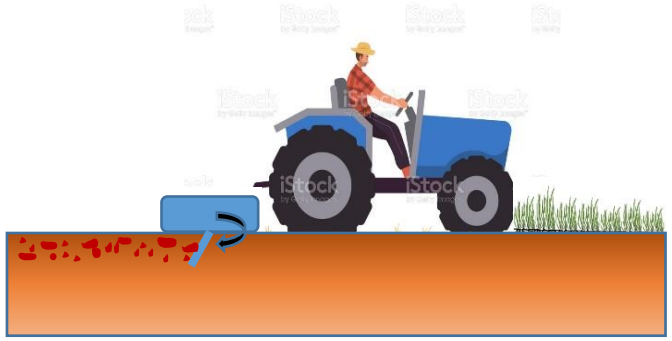


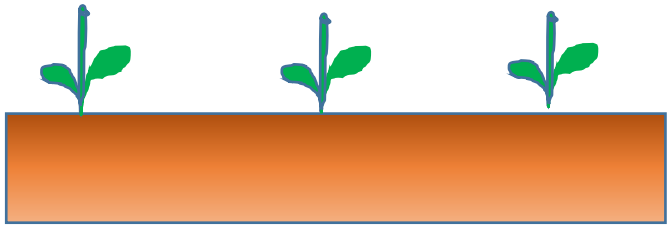
Banana foot clearing every 2 months

(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

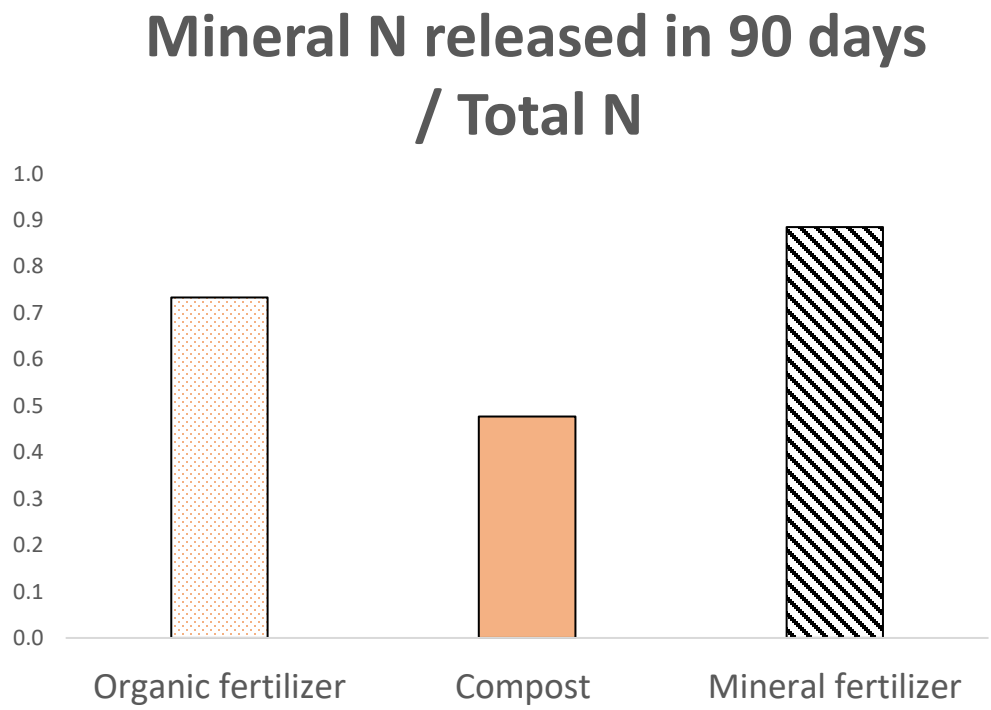
. At planting: 2 liters/plant of compost
. Application every month of complete organic fertilizer

Mineral

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

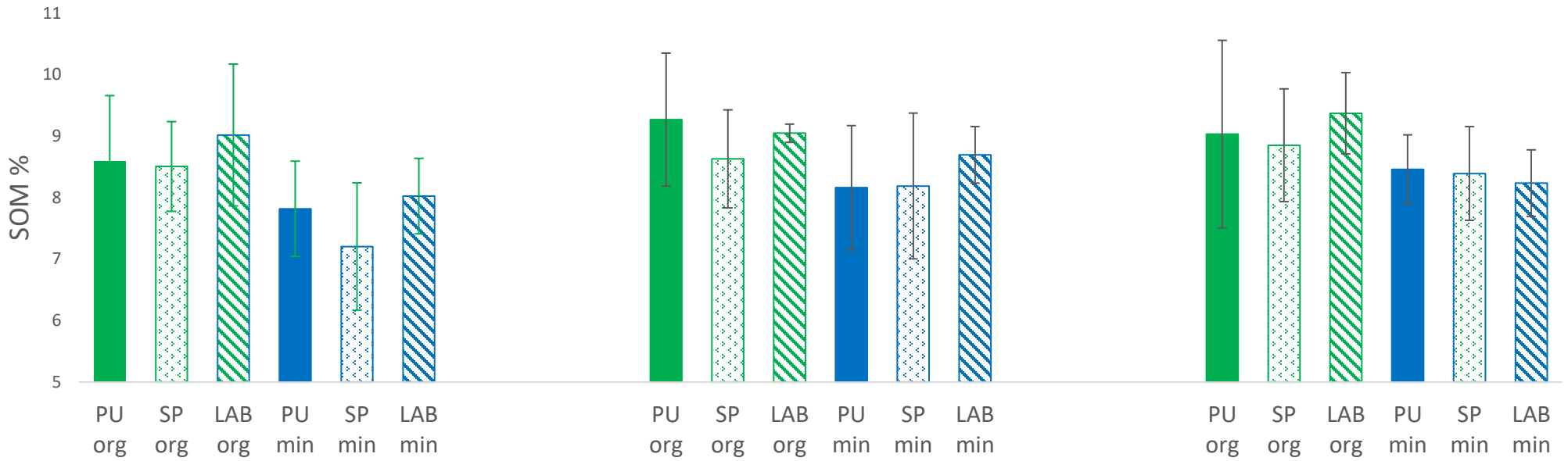
Doses of fertilizers are calculated to bring in both treatments the same amount of available nitrogen.

Available nitrogen = mineral nitrogen released 90 days after fertilizer application



Results

Soil organic matter

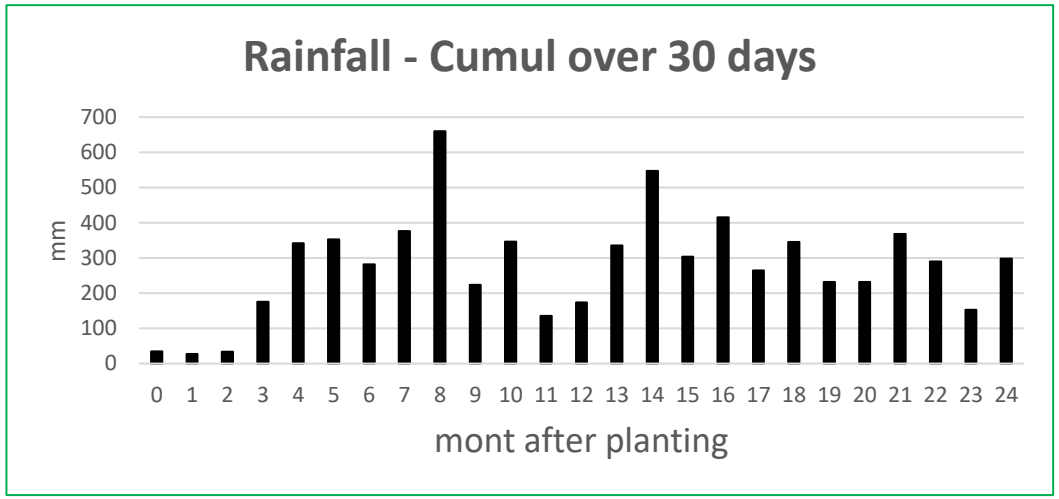


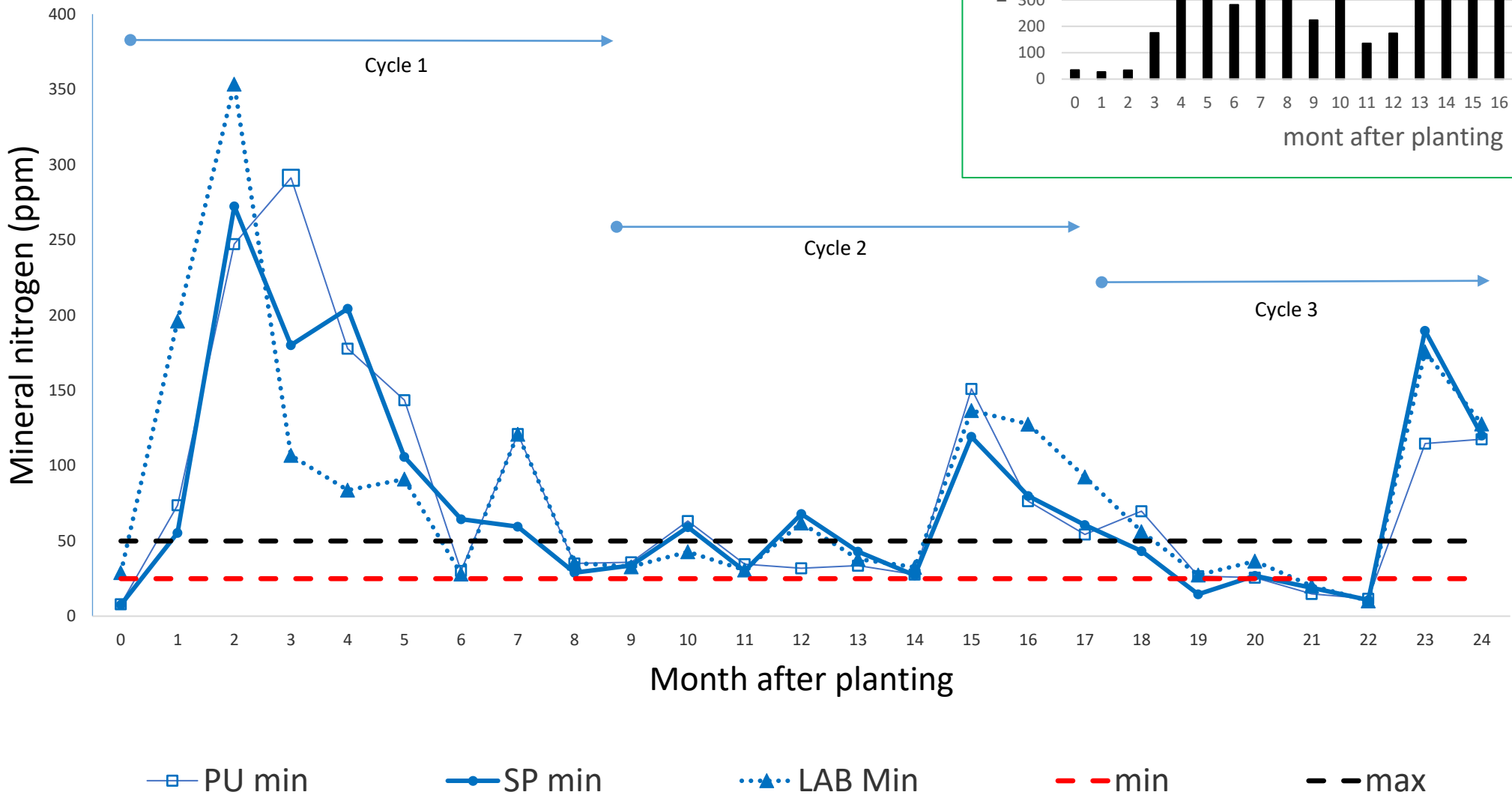
. Soil organic matter was significantly higher with organic fertilization

. No effect of soil cover management

Soil mineral nitrogen

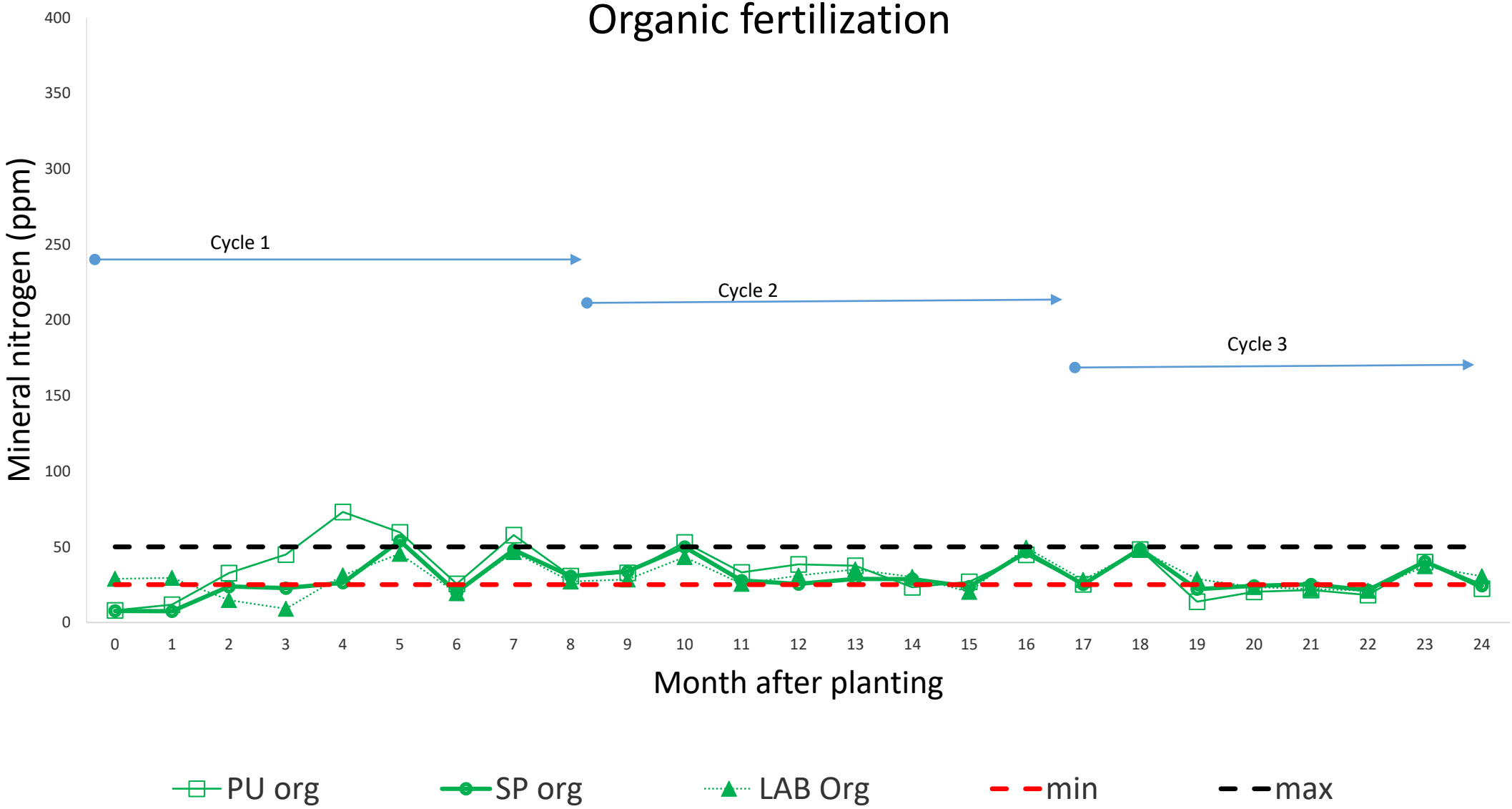
Mineral fertilization





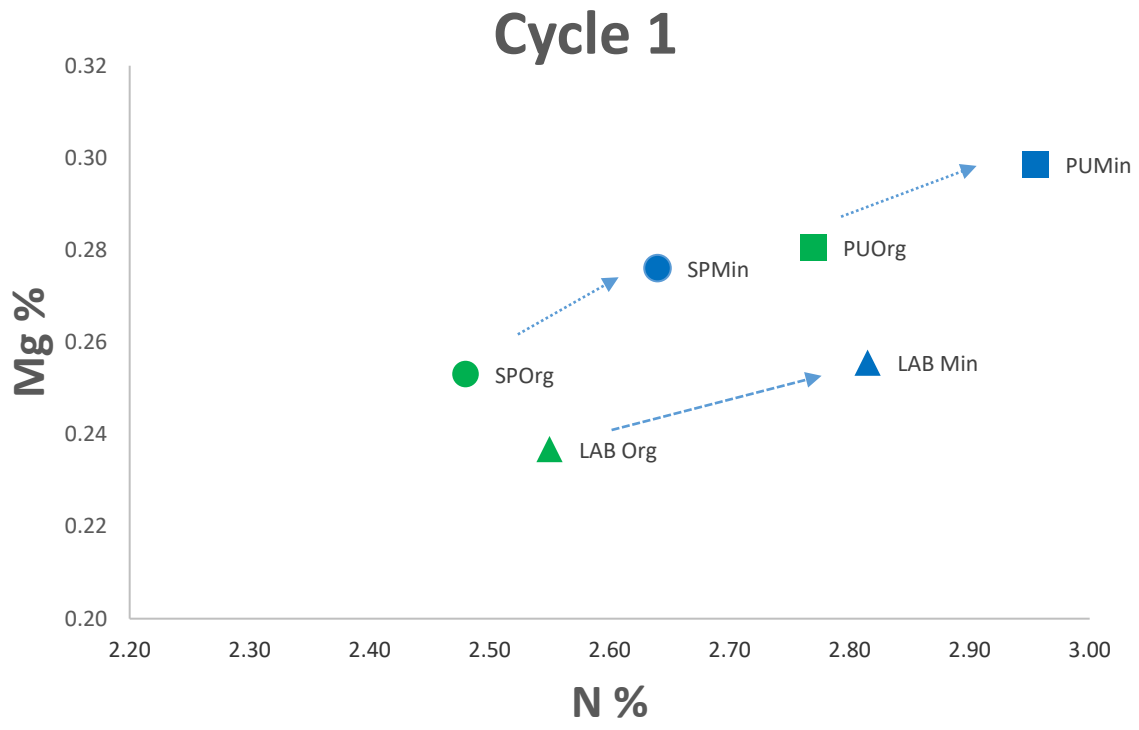
Soil mineral nitrogen

Organic fertilization



Banana mineral nutrition *=> Significant effect only on nitrogen and magnesium*

Leaf content in Nitrogen and Magnesium



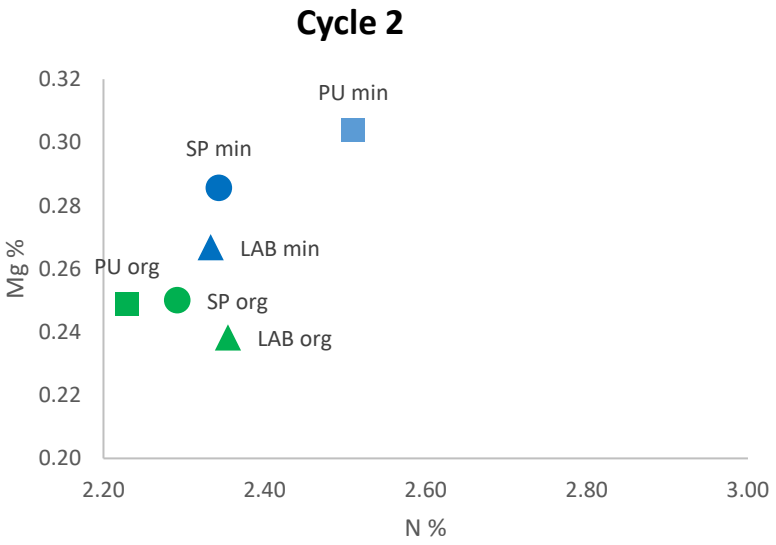
N and Mg significantly higher :

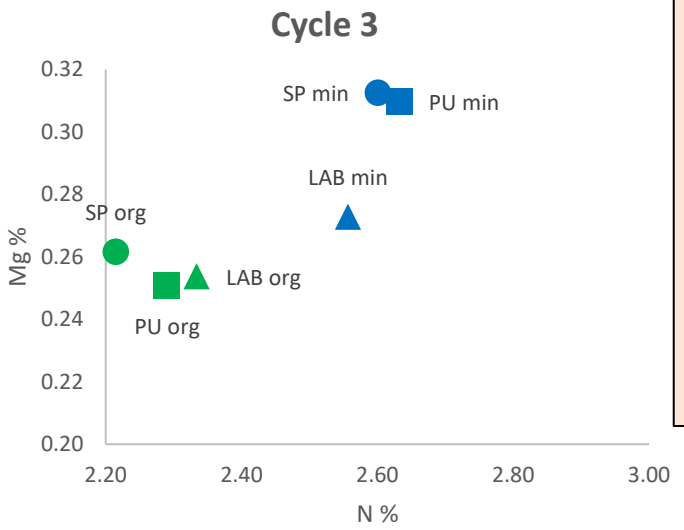
1. with mineral fertilization

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

Mg/N	R^2
Cycle 1	0,39
Cycle 2	0,38
Cycle 3	0,51

Magnesium uptake related to Nitrogen uptake

Soil - Plant relation

Nitrogen uptake related to soil nitrogen availabilty

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

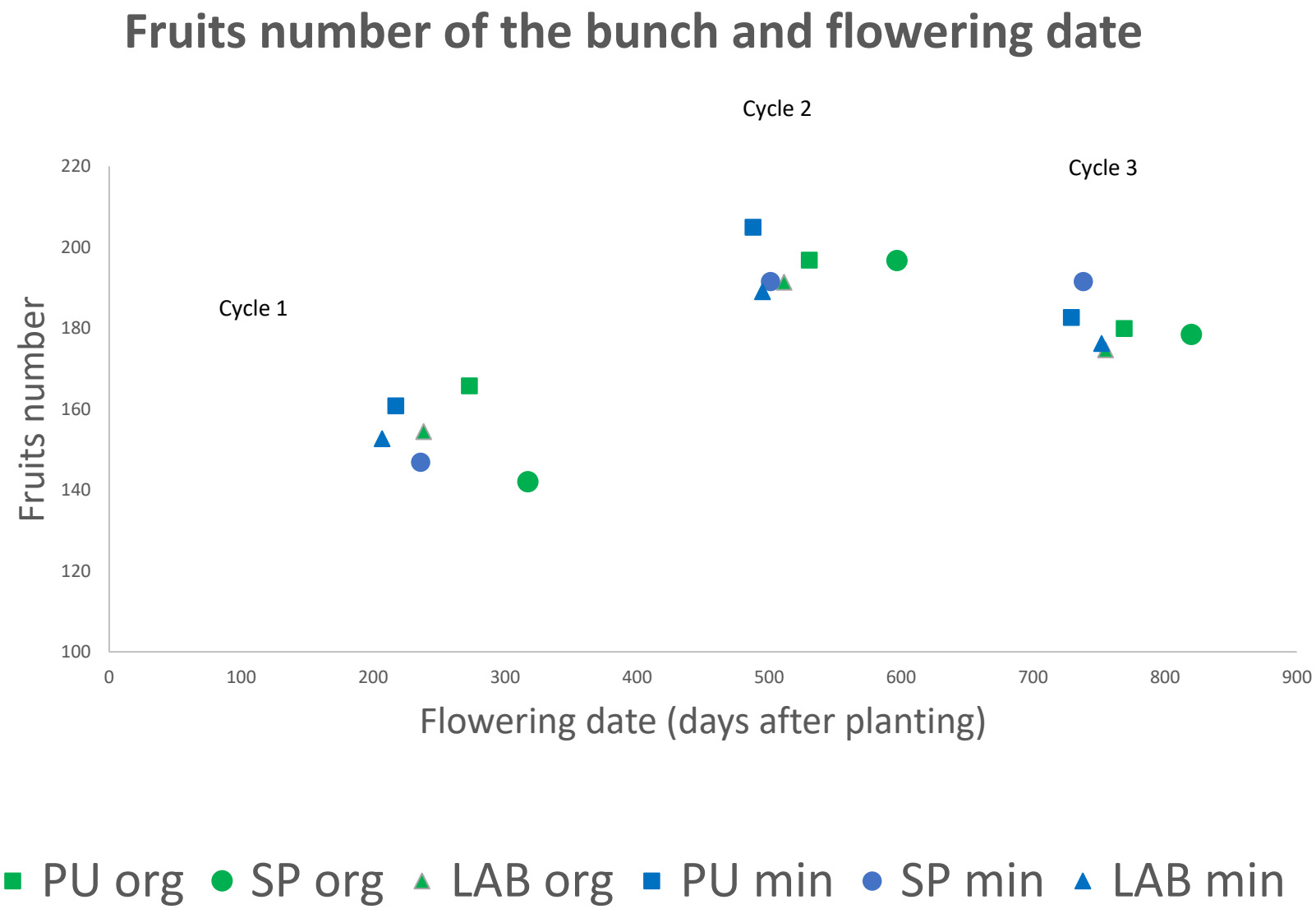
In fact, Mg uptake seems driven by Nitrogen uptake *

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

* *Kussow et al, 2011, Evidence, Regulation, and Consequences of Nitrogen-Driven Nutrient Demand by Turf grass, ISRN Agronomy, vol,12, ID 3599284, 9 p.*

* *Osaki et al, 1996, Carbon-Nitrogen Interaction Related to P, K, Ca, and Mg Nutrients in Field Crop. Soil ScL Plant Nutr., 42 (3), 539-552*

Yield indicators



1rst 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 => affect Mg uptake

=> 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
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