SUGARCANE X JACK BEAN COMPETITION IN INTERCROPPING SYSTEM UNDER CONTRASTED NITROGEN AND WATER AVAILABILITY

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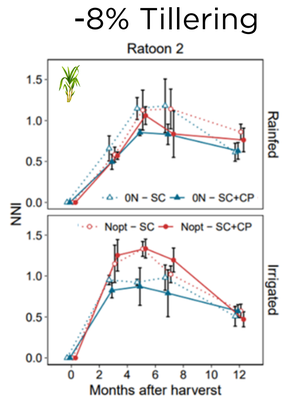
- **Sugarcane = Major crop** in Réunion Island → **54%** of Agricultural Land [1]
- Main problem → **weed management** → Sugarcane Legume **intercropping** has been successfully used to reduce herbicide use [2] → Intercropping led to an average sugarcane **yield loss** of 6% in Reunion Island. [3]
- AIMS: evaluate the competition mechanisms between a legume (*Canavalia ensiformis*) and sugarcane depending on environmental conditions (water and nitrogen availability). [4]

METHODS

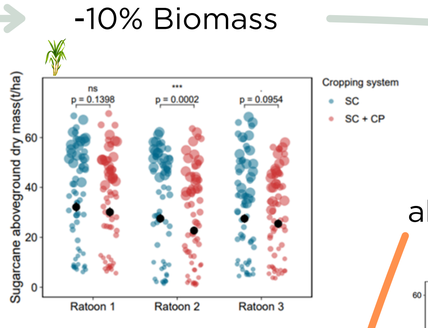
- Three years of sugarcane legume intercropping compared to monocropping (ratoon crop)
- Crossed treatment with or without irrigation and with or without N fertilization
- Aboveground and belowground sugarcane development measurements
- N and water balance measurements:
  - soil water content down to 1m
  - soil organic N (0-30cm)
  - 15N natural abundance (fixation)
  - Litter bags (legume decomposition)
  - 15N legume enrichment (N uptake by sugarcane from legume decomposition)

MAIN RESULTS

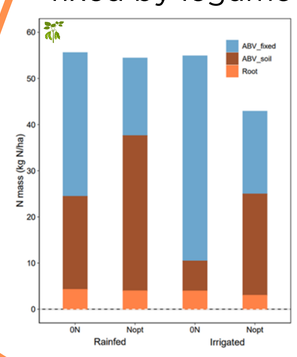
Increase in sugarcane N stress
-8% Tillering



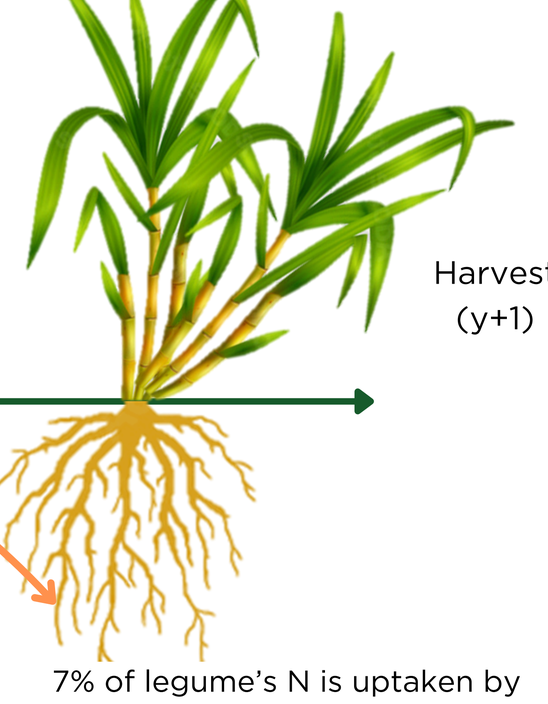
-10% Biomass



about 50% nitrogen fixed by legume



-15% yield
+25% Lodging
(under irrigation)



Harvest (y)

Legume sowing (1 month)

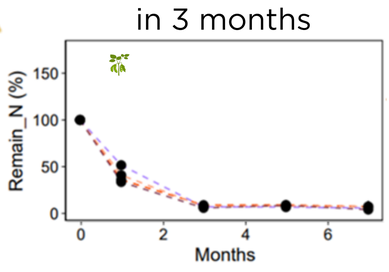
Fertilization (1 and 3 months)

50% of N loss

Legume death (~8 months)

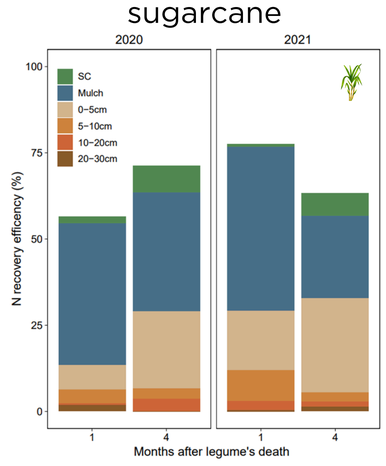
Harvest (y+1)

Decomposition in 3 months

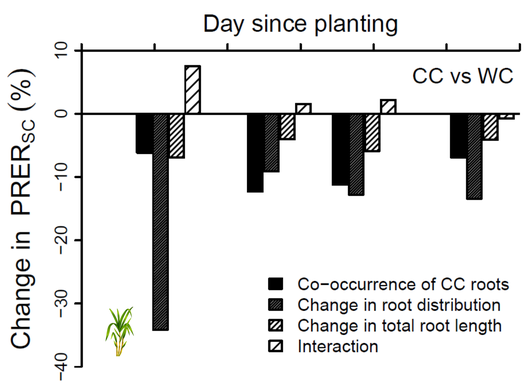


<1% of N lixiviation

7% of legume's N is uptaken by sugarcane

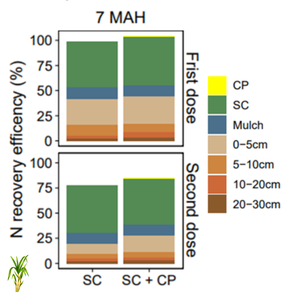


Decrease in soil volume explored by sugarcane roots [5]



-12% in sugarcane root biomass

No competition for urea



Little evidence of water competition (but low water stress)

MAIN CONCLUSIONS & PERSPECTIVES

Plasticity and interspecific interactions :

- No evidence of direct competition for soil resources
- Plastic response of sugarcane (root avoidance strategy, tillering response to neighbor) inducing higher stress under constraints environments

N facilitation effect of legume:

- High N loss (volatilization?) due to legume-sugarcane mulch interaction
- A need to better synchronize N release (legume death) and sugarcane N demand

Perspectives - improvements in intercropping management:

- Change in sowing and destruction dates [3]
- Mulch management on the sugarcane row to limit N losses [4]
- Companion crop valorization by farmers and assessment of adoption limits in practices in real farms (IntercropValues project)

- [1] Agreste La Réunion (2023) *Memento 2023.*
- [2] Soulé, M. et al. (2024). *Field Crop Research.*
- [3] Viaud et al. (2023). *Field Crop Research.*
- [4] Viaud P. 2023. PhD. Analyse des processus de compétition et de facilitation dans les agrosystèmes canne-à-sucre x légumineuses.
- [5] Christina, et al. (2023). *Plant and Soil.*

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