More rice for Africa: enhancing smallholder farmers' rice yields in Africa through the use of efficient and low cost endophytic Actinomycetes biopesticide

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BG90-2 | Kogoni 91-1 | BG90-2 Virus A | Kogoni 9-1 Virus A

Inhibition of rice vegetative growth by the Rice Yellow Mottle Virus (RYMV)

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- In Mali; rice, the dominant commercial food crop, account for 12.3% of agricultural value and generates $ 83.3 million (Baris, 2005),
- Unfortunately, rice is affected by the bacterial leaf blight, the Rice Yellow Mottle Virus and Cecidomyie diseases with incidences ranging between 70 to 85% (Sere, 2005; Sara et al., 2010),
- Synthetic pesticides are the most used to control against these diseases, but they high prices and negtive impacts to Human and environmental health limite they use by smallholder farmers in Mali
- Several research results pointed out that biopesticides constitute a good alternative to synthetic pesticides and our objective is to i;prove rice production by formulating and using and efficient biopesticide to control RYMV and BLB in rice fields.

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Research Approach:

- Development of endophytic bacteria-based biopesticides;
  - Selection of biocontrol endophyte bacteria
  - Selection of good support for biopesticide formulation
  - Formulation of efficient endophyte bacteria biopesticides
- Improvement of technicians, extension specialists, and leading farmers’ skills through pilot testing and training on the production and utilization of endophyte bacteria biopesticides, and best rice cultivation techniques.
- Dissemination of extension materials on the endophytic bacterial-based inoculum production technology for practical use by extension workers and farmers to increase awareness of biopesticide technology applications.

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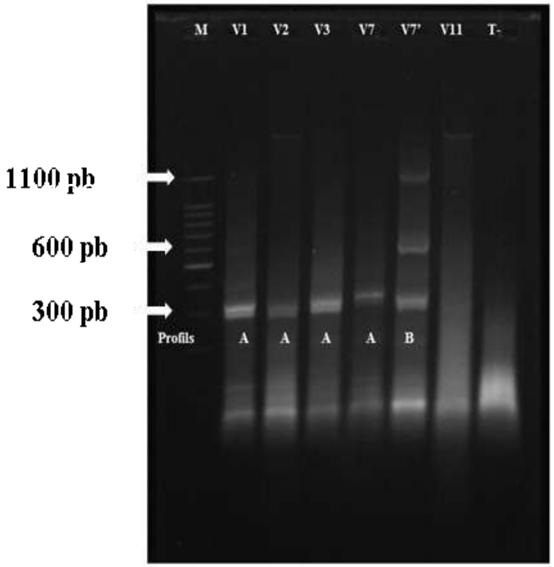

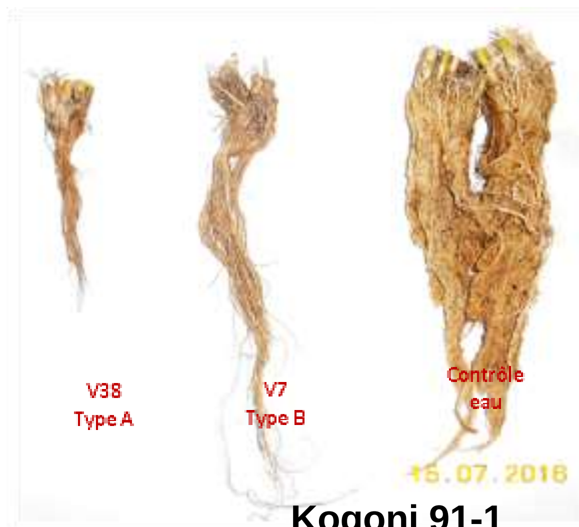

Two types of RYMV identified: (i) type A with one band of 300 pb (ii) type B with 3 band of 300, 600 and 1100 pb.

- Inoculation of the most cultivated rice variety Kogoni 91-1, showed that the RYMV type A is more virulent that the type B.
- The rice variety SK 20-28 is tolerante to the the type of the RYMV testeed,
- The RYMV inhibe the growth of infectd rice root

➢ **Improving plant root growth in infected plants may be a good way to minimi RYMV disease' negative impacts on rice yield**

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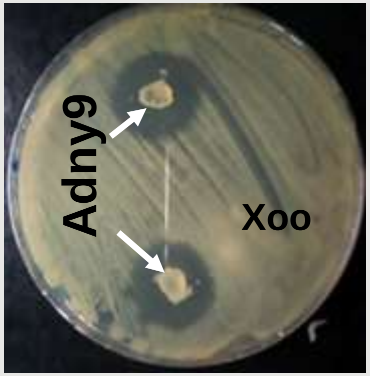
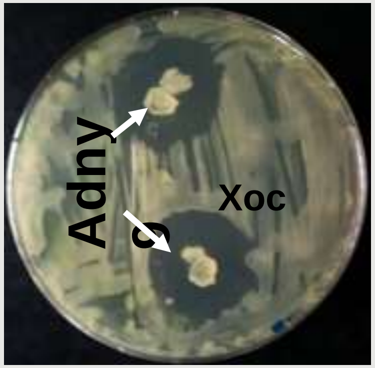
AHB12

H7

Two endophytic Actinomycetes isolate (AHB12 et H7) activate the systemic defense of rice plants against the RYMV





One endophytic *Bacillus* isolated in rice can effiiently control the two isolates of *Xanthomonas oryzae*

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Production de biochar by smallholder farmer for biopesticide formulation

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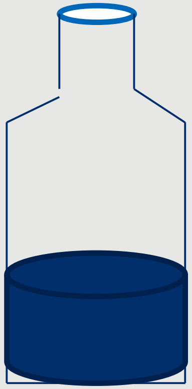
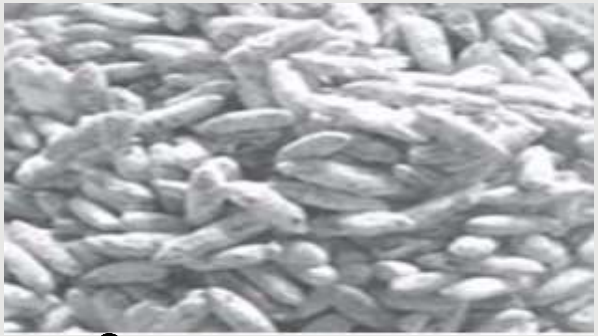


Bacterial inoculum production in liquid medium



Bacterial spores production on rice

Centrifugation

Bacterial cells

Spores

supernatant

<u>Powder formulation</u>:
Pulverize bacterial spores onto a sterile biochar; let dry and put in sterile Aluminium bags (1Kg/bag)

<u>Water dispersible formulation</u>
Milk
Maltodextrin
Citric acid
Bicarbonate de Sodium

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Smallholder women farmers inoculate rice seeds with biocontrol endophyte bacteria using cassava flour and locally produced biochar

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Tests of the biopesticide in collaboration with voluntary rice farmers, showed a decrease of:

1. Rice field infested by the Rice Yellow Mottle Virus
2. More than 20% of the disease after 2 weeks, and
3. More than 70% of the disease after 4 weeks

After harvest; we obtain, in average, a 70% increase in rice production in fields infested by RYMV and Bacterial leaf blight diseases

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Visit to infested rice field treated with the biopesticide in Baguineda

Healthy rice plant showing good production after treatment with the biopesticide in Baguineeda

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Table 1. Effect of the selected biopesticide on rice production (Kgha) in high infested fields

Treatments	Rice production in test fields (Kg/ha)				Average
	Field 1	Field 2	Field 3	Field 4	
Biopesticide	4.3	4.7	4.1	5.7	4.7
Control	2	2.03	1.67	1.08	1,69

The formulated biopesticide tested in collaboration with voluntary rice farmers showed, in average, a 278% increase in rice production in rice fields infested with African Gall Midge and RYMV diseases compared to rice infested and non treated.

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- 140 researchers, farmers, decision markers, NGOs and attend a conference on biochar presented by the Pr. Stephen Machado
- 110 rice farmers, mainly women, were trained in biopesticide production and utilization techniques,
- 52 smallholder farmers, out of which 29 rural women, were trained in business plan preparation..

Training session (Biochar)

Conference session

Training session (biopesticide)

A

B

Training on business plan preparation (A)
Certificate delivery (B)

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Next steps

- Evaluate the impact of soil and plant microbiomes on the efficacy of the biopesticide
- Set up biopesticide production unit to be managed by rural women

How data and results from your project will impact stakeholder decisions and the development problem:

- Training rural women farmer to set up a biopesticide production and produce biopesticide will empower them to: (i) ensure easy access to good quality biopesticide at the exact time when needed as alternative to synthetic pesticide, (ii) promote good agricultural practices locally, and also (iii) create local employment opportunities.

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Challenges faced in collecting meaningful data:

- Train our PhD student to use new up-to-date bioinformatics tools to study soil and plant microbiomes
- Insecurity in some test areas

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Photo with Linda's lab member

Thank you

[Field visit]