



WORKSHOP en TUNISIE, 15-17 Avril, 2024

on

A new technology in agriculture: application to Pear Cactus

Meeting places: INAT, Nabeul et Zaghouan

Organizers: Sonia Labidi, May Granier, Sofiène Hammami, Besma Sghaeir, Karim Aounallah, Sana Dhane, Silvio Gianinazzi, Vivienne Gianinazzi-Pearson.



**Promoting soil fertility, yield and income in smallholder agriculture of semiarid and arid Mediterranean regions
by management of beneficial soil microbiota, conservation agriculture and intercropping**

CONTENT: Report and Program

REPORT

The PRIMA workshop in Tunisia took place April 15-17, 2024. Oral presentations were followed by a visit to the ongoing INAT field trials, a practical workshop with farmers and a round table meeting.

1. Workshop 15-17 April (see the enclosed program, Annex 1)

- The workshop organized by Dr Sonia Labidi, our partner in the project, took place at INAT in Tunis.
- 63 participants were present coming from different economic and academic backgrounds: farmers, engineers involved in training programs for farmers and popularization of new technology, and academics engaged in technological transfer.
- It is important to note that the General Director of INAT in his opening address underlined the importance of the PRIMA technology for ensuring a sustainable future in Tunisian smallholder agriculture.
- The active participation of the CEO of the ONG ATAE (<https://atae-tunisie.org>), association strongly engaged in restauration activities of degraded agricultural lands in Tunisia, should be underlined.
- Participants were very interested in the subject and asked many questions, particularly on how to produce and use inoculants targeted to Barbary fig cactus (prickly pear) or other specific cultures, and the economic feasibility of the proposed biotechnology in Tunisia.

2. Visit to INAT field trials in Nabeul

The ongoing trials have been designed in order to assess improved quality production of prickly pear by indirect enrichment of beneficial soil microbiota *via* intercropping of prickly cultures with a leguminous plants (vetch) inoculated with mycorrhizal fungi.

3. Practical workshop at a farm in Zaghouan

The aim of this practical workshop was:

- (i) to present to farmers 3 microbial products: two conceived by INAT researchers and one elaborated within our project by our Algerian partner Plantabiotek DZ,
- (ii) to show how these microbes can be detected using staining and stereomicroscope techniques, and
- (iii) to inoculate prickly pear cactus at plantation in the field and 4 other horticultural plants in order to demonstrate that the PRIMA technology can be widely used.

This practical workshop was made possible through the farmer network of ATAE: it was held in a farm of Karim Skik in Zaghouan, one of the most touched regions by climate change in Tunisia, and has involved 28 participants: farmers, technical experts in agriculture and INAT staff involved in the project.

This part of the program was highly appreciated by farmers not only because of its novelty for them, but also because they realized that this new technology could be easily adopted by them providing that necessary technical information (soil characteristics, choice of inoculum, methodology of application according to culture involved....) could be made available to them.

4. Round Table

This round table, organized in collaboration with the ONG ATAE, was addressed mainly to technicians and agronomic engineers, including a representant of OIT (Ordre des Ingénieurs Tunisiens), involved in the promotion of this new technology based on beneficial soil microbes. It was accompanied by active discussions. The 15 participants asked many questions, not only concerning how to choose the right inoculum, how to manage the different inocula in the field, but above all how they could be helped in setting up a local production in order to avoid importing inocula from outside Maghreb. The latter remark is in agreement with the aims of the project and with what Plantabiotek DZ is doing, that is producing inoculum with regional strains

5. Test QCM

One test was performed after the Round Table (See Annex 2). Results were the following:

- **Content of presentations:** 42% most satisfied, 33% satisfied, 25% partly satisfied
- **Expectation:** 67% fully met, 25% partially met, 8% not at all met
- **Organization:** 34 % most satisfied, 54% satisfied, 8% partly satisfied, 4% not at all satisfied

75% of participants were satisfied about the content of the workshop, for **67% of them** the workshop **fully met their expectations** and for **88% of them the organization was satisfactory**. Furthermore, if the event will be offered again: **83% of participants declared that they would participate again.**

A specific test, to evaluate the knowledge of participants, was realized on the request of ATAE (see Annex 3): **100%** correct answers were given to Questions 1, 3, 6, 9, 10, 11 and 12, **91%** to Question 8, **82%** to Questions 2 and 5, whilst only **64%** to Question 4.

ANNEX 1 : Program

WORKSHOP ProSmallAgriMed¹- PRIMA

Tunisie (du 15 au 17-04-2024)

Une nouvelle technologie en agriculture : application au Figuier de Barbarie

Lieu des Meetings : INAT, Nabeul et Zaghouan

Organisateurs : Sonia Labidi (SL), May Granier (MG), Sofiène Hammami (SH), Besma Sghaier (BS), Karim Aounallah (KA), Sana Dhane (SD), Silvio Gianinazzi (SG), Vivienne Gianinazzi-Pearson (VGP).

Programme

15 Avril 2024

Exposés : Salle de conférences à l'INAT

- 8h30 : Adresse de bienvenue au Workshop- Directeur général de l'INAT : M. Fayçal Ben Jeddi
- 8h35 : Présentation du projet PRIMA : ProSmallAgriMed et introduction au Workshop (SL)
- 9h00 : Qu'entendons-nous avec nouvelle technologie en agriculture ? (SG)
- 9h20 : Connaissances de bases concernent les microorganismes du sol impliqués dans cette nouvelle technologie (VGP)
- 10h00 : Comment reconnaître et démontrer l'efficacité en production végétale de ces microorganismes bénéfiques du sol ? (SL, SD)
- 10h20 : Pause-café
- 10h40 : Qu'est qu'on peut attendre de ces microorganismes dans le cas du Figuier de Barbarie ? (VGP, SL)
- 11h00 : Où trouver des inocula basés sur de ces microorganismes du sol ? (SG)
- 11h10 : Guide pour la production d'inocula autochtones (SG, SD)
- 11h30 : Production d'inoculum commercial pour l'agriculture du Maghreb : l'exemple Algérien (Hicham Messaoudi)

14H00 : Visite des expérimentations de l'INAT chez des agriculteurs à Nabeul (SL)

¹Promoting soil fertility, yield, and income in Smallholder Agriculture of semiarid and arid Mediterranean regions by management of beneficial soil microbiota, conservation agriculture and intercropping

16 Avril 2024

Ateliers pratiques chez des agriculteurs : Bir M'cherga, Zaghouan

Un traducteur français-arabe sera mis gentiment à disposition par l'ATAE*

A 9h00 chez l'agriculteur :

- Présentations des différents inocula (HM, SL, SD)
- Inoculation des plantes avec des microorganismes bénéfiques du sol. Démonstration *in situ* (HM, SL, SD)
- Faut-il inoculer tous les ans ? Et si non comment maintenir actifs les microorganismes bénéfiques dans les sols agricoles (SG)
- Pause-café enrichi (ATAE)
- Vérification des connaissances acquises (test QCM) (MG, ATAE)

**ATAE : Association Tunisienne pour l'agriculture Environnementale*

17 Avril 2024

- **9h:00-** Table ronde organisée à l'INAT en collaboration avec l'ATAE avec la participation des formateurs (jeunes ingénieurs et autres protagonistes du monde agricole) aux nouvelles technologies en agriculture.

ANNEX 2 : Evaluation form



WORKSHOP:

A new technology in agriculture: application to Pear Cactus TUNIS 15-17 Avril 2024

Dear Participant,

Thank you for attending our **workshop**. In our effort to improve the organization and the impact of Prosmallagrimed events we invite you to complete the following questionnaire. In most of the questions you will be asked to rate your satisfaction on a scale by ticking the appropriate answer. In some of the questions you will be asked to describe your personal opinion in a few words and to give suggestions for future improvements of the content and overall organization of the workshop.
Thank you in advance for your valuable review and remarks.

1. CONTENT OF THE PRESENTATIONS

Were you satisfied with the **content of the presentations**?

<input type="checkbox"/> Most satisfied	<input type="checkbox"/> Rather dissatisfied
<input type="checkbox"/> Satisfied	<input type="checkbox"/> Dissatisfied
<input type="checkbox"/> Partly satisfied	

2. EXPECTATIONS

What did you **expect** from the Event?

Where the above **expectations met**? ☐ Yes, fully met
☐ Partially met
☐ Not met at all

If **no**, please describe those expectations which were not (fully) met.

What did you find **most useful**?

If this event were offered again, would you recommend it to a colleague?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Have you participated before in similar events ?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

3. ORGANIZATION

Where you satisfied with the overall organisation of the event?	<input type="checkbox"/> Most satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Partly satisfied	<input type="checkbox"/> Rather dissatisfied <input type="checkbox"/> Dissatisfied
Were you satisfied with the resources and material presented at the event?	<input type="checkbox"/> Most satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Partly satisfied	<input type="checkbox"/> Rather dissatisfied <input type="checkbox"/> Dissatisfied
Were you satisfied with the networking facilitation provided?	<input type="checkbox"/> Most satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Partly satisfied	<input type="checkbox"/> Rather dissatisfied <input type="checkbox"/> Dissatisfied
Were you satisfied with the time dedicated to the different topics?	<input type="checkbox"/> Most satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Partly satisfied	<input type="checkbox"/> Rather dissatisfied <input type="checkbox"/> Dissatisfied
Where you satisfied with the style and level of communication between organisers and participants?	<input type="checkbox"/> Most satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Partly satisfied	<input type="checkbox"/> Rather dissatisfied <input type="checkbox"/> Dissatisfied
Were you satisfied with the event hands-on activities ?	<input type="checkbox"/> Most satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Partly satisfied	<input type="checkbox"/> Rather dissatisfied <input type="checkbox"/> Dissatisfied
Other comments/remarks:		

WE REALLY THANK YOU FOR YOUR SINCERITY AND COOPERATION!

ANNEX 3 : Test ATAE

Test de Connaissance sur les Microorganismes du Sol en Agriculture

Question 1 : Qu'est-ce que la rhizosphère ?

- a) La partie supérieure de la plante
- b) La zone du sol directement autour des racines des plantes
- c) Une maladie des racines des plantes

Question 2 : Quel est le rôle principal des microorganismes bénéfiques du sol ?

- a) Décomposer la matière organique
- b) Protéger les plantes contre les maladies
- c) Explorer le terrain et solubiliser les éléments minéraux
- d) Toutes les réponses ci-dessus

Question 3 : Quel type de microorganisme convertit l'azote atmosphérique en une forme utilisable par les plantes ?

- a) Rhizobiums
- b) Champignons mycorhiziens

Question 4 : Comment les microorganismes du sol contribuent-ils à la fertilité du sol ?

- a) En aidant à la décomposition de la matière organique
- b) En libérant des hormones ou des antibiotiques pour éliminer les mauvaises herbes et les pathogènes
- c) En absorbant la lumière pour la photosynthèse des plantes
- d) Ils contribuent à structurer le sol

Question 5 : Quel est l'avantage des inoculants mycorhiziens et microbiens pour les cultures ?

- a) Ils réduisent le besoin en eau des plantes
- b) Ils stimulent la croissance des racines
- c) Ils protègent les plantes contre les ravageurs et surtout contre les microbes et champignons pathogènes

Question 6 : Quelle est la principale différence entre les rhizobiums et les mycorhizes ?

- a) Les rhizobiums sont des bactéries fixatrices d'azote, tandis que les mycorhizes sont des champignons symbiotiques associés aux racines des plantes
- b) Les rhizobiums sont des virus, tandis que les mycorhizes sont des bactéries
- c) Les rhizobiums sont des champignons, tandis que les mycorhizes sont des bactéries

Question 7 : À quelle fréquence recommande-t-on généralement de mycorhizer le sol pour des cultures optimales ?

- a) À chaque saison de culture
- b) Tous les deux ans
- c) Selon les besoins spécifiques de la culture et du sol

Question 8 : Quel est l'effet des pesticides sur les microorganismes du sol ?

- a) Ils stimulent leur croissance
- b) Ils peuvent réduire leur nombre et leur diversité
- c) Ils n'ont aucun effet

Question 9 : Pourquoi est-il important de favoriser la biodiversité des microorganismes du sol ?

- a) Pour augmenter la résistance des cultures aux maladies
- b) Pour améliorer la structure du sol
- c) Pour réduire le besoin en engrais chimiques

Question 10 : Quel est le rôle des rhizobiums dans les légumineuses comme les haricots ou les pois ?

- a) Ils protègent les racines des légumineuses contre les maladies
- b) Ils fixent l'azote atmosphérique dans les nodosités racinaires des légumineuses
- c) Ils décomposent les matières organiques dans le sol

Question 11 : Quel est l'effet des champignons mycorhiziens sur les plantes ?

- a) Ils améliorent l'absorption des nutriments, notamment du phosphore
- b) Ils produisent des toxines qui protègent les plantes contre les insectes
- c) Ils diminuent la croissance des racines des plantes

Question 12 : Comment peut-on favoriser la présence de microorganismes bénéfiques dans le sol ?

- a) En utilisant des engrais chimiques
- b) En pratiquant la rotation et la diversification des cultures
- c) En irriguant les cultures moins fréquemment