

**WORKSHOP in MOROCCO, September 18-21, 2023**

on

**A new technology in agriculture: application to Pear Cactus**

**Meeting place: Essaouira Farmer Cooperative**

**Organizers:** Abderrahman Ait Hamou, Naïma El Ghachtouli, Silvio Gianinazzi, Ilham Zouitane, Monica Ossino and Vivienne Gianinazzi-Pearson

ورشة عمل

**تقنية جديدة في الزراعة:  
تطبيق على الصبار الكمثري**

**تعاونية الصويرة الزراعية**

2023 21-18 شتنبر



**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

### 1. Visit to Mohamed VI Polytechnic University in Ben Guerir

Mohammed VI Polytechnic University, located in the municipality of Benguerir near Marrakech, was established in 2013. It is a Moroccan non-profit private research university orientated towards applied research and innovation, and engaged in economic and human development, with a focus on African development.

The aim of our visit was to discuss with the entomology team led by Professor Karim El Fakhouri because of their research on biocontrol of the cochineal *Dactylopius opuntiae*. This insect has within a few years destroyed all the plantations of barbary fig (pear) cactus in Morocco; only a few small border plantations have survived due to treatments with insecticides.

Very promising results have been obtained by Professor El Fakhouri's team, who have identified a strain of *Pseudomonas* as being pathogenic towards the cochineal *Dactylopius opuntiae*, and therefore a potential biocontrol agent of the insect.

Moroccan farmers are now starting to plant resistant varieties of barbary fig cactus, selected by INRA Morocco, but these are less productives, fruits are more acidulous than the susceptible variety and they are not very appreciated by local people, although this seems to be the opposite in Europe. This new program of plantation could be an excellent opportunity for applying the new technology proposed by our PRIMA project.

### 2. Workshop

The Essaouira Farmer cooperative, where the workshop took place, has recent buildings equipped with all the facilities for its activity, including a restaurant where we appreciated the quality of the food. Seventeen farmers participated to the Workshop, some of which were also olive producers. The program enclosed (in 4 languages) was distributed to participants together with a training brochure in Arabic on beneficial soil microbiota. Oral presentations were implemented with practical demonstrations on how to identify and how to inoculate cactus plants with beneficial soil microbes. Participants were very interested in the subject and asked many questions, particularly on how to produce and use inoculants targeted for barbary fig cactus in Morocco. Following our explanations, farmers declared that they would study the feasibility of producing inoculants for their use, in collaboration with our Moroccan partner. We assured them of our support if they decide to start the process of inoculant production.

### 3. Field visit of fruit groves

A visit to the local area of barbary fig cactus production gave us an idea of the very dramatic impact of cochineal *Dactylopius opuntiae*, resulting in the decimation of barbary fig cactus plants in the field. Although barbary fig cactus, in this region, is usually planted as a border of numerous small plots (about a few hectares each), the total surface destroyed has been evaluated at about 25000 hectares: no one plant survived. Some new plantations have been realized either with the resistant variety or the susceptible variety, but in the latter case plantations are continuously monitored for *Dactylopius opuntiae* and locally treated with insecticides when necessary. Sampling of soil was performed in these plantations for microbiota analyses by our Moroccan partner. Inoculation of cactus cladodes with beneficial soil microbes was also demonstrated.

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## PROGRAM

### September 19, 2023

#### *Morning*

- Introduction to the workshop (NE)
- What do we mean by 'a new technology in agriculture'? (SG)
- Basic knowledge about the beneficial soil microorganisms involved in this new technology (VGP)
- What do these beneficial soil microorganisms look like? (NE, IZ)
- How can we show the effectiveness of these beneficial soil microorganisms in plant production? (NE, IZ)
- Can these beneficial soil microorganisms protect plants against root and aerial plant diseases? (SG/NE/VGP)

#### *Afternoon*

- How to obtain inoculants based on these beneficial soil microorganisms, safety aspects? (SG)
- Guidelines for the production of autochthonous inocula (SG)
- How to inoculate plants with beneficial soil microorganisms? (NE, IZ)
- How to maintain beneficial soil microorganisms active in agricultural soils? (SG)
- Conclusions and future plans (NE)
- Verification of concept acquisition (MCQ test) (NE, IZ)

### September 20, 2023

#### *Morning*

- Presentation of the state of the art of prickly pear culture in the region of Essaouri
- Field visit of fruit groves

#### *Afternoon*

- Field demonstration about methods on:
  - sampling of beneficial soil microorganisms
  - plant inoculation with beneficial soil microorganisms

## WORKSHOP in MOROCO, 18-21 settembre, 2023

su

### Una nuova tecnologia in agricoltura: applicazione alla cultura del Fico d'india

#### **Luogo del Meeting : Cooperativa Agricola d'Essaouira**

**Organizzatori:** Abderrahman Ait Hamou (AA), Naïma El Ghachtouli (NE), Silvio Gianinazzi (SG), Ilham Zouitane (IZ), Monica Ossino (MO) e Vivienne Gianinazzi-Pearson (VGP)

## PROGRAMMA

### 19 settembre 2023

#### **Mattino**

- Introduzione al workshop (NE)
- Che cosa intendiamo per 'una nuova tecnologia in agricoltura'? (SG)
- Conoscenze di base relative ai microrganismi benefici del suolo coinvolti in questa nuova tecnologia (VGP)
- Come identificare i microrganismi benefici del suolo? (NE, IZ)
- Come dimostrare l'efficacia dei microrganismi benefici del suolo nella produzione delle piante ? (NE, IZ)
- Effetti protettivi dei microrganismi benefici del suolo nei confronti delle malattie delle radici e della parte aerea delle piante (SG/NE/VGP)

#### **Pomeriggio**

- Come conseguire degli inoculi basati sui microrganismi benefici del suolo ? Problemi di sicurezza (SG)
- Linee guida per la produzione di inoculi autoctoni (SG)
- Come inoculare le piante con i microrganismi benefici del suolo ? (NE, IZ)
- Come mantenere attivi i microrganismi benefici nei suoli agricoli? (SG)
- Conclusioni e prospettive future (NE)
- Accertamento dell'apprendimento dei concetti (test a risposta multipla) (AA, SG, NE, VGP)

### 20 settembre 2023

#### **Mattino**

- Presentazione della problematica della cultura del Fico d'India nella regione di Essaouira
- Visita delle piantagioni

#### **Pomeriggio**

- Dimostrazione in campo dei metodi di:
  - campionamento dei microrganismi benefici
  - inoculazione delle piante con microrganismi benefici

## WORKSHOP au MAROC, 18-21 septembre, 2023

sur

### Une nouvelle technologie en agriculture : application au Figuier de barbarie

#### Lieu du Meeting: Coopérative agricole d'Essaouira

**Organisateurs :** Abderrahman Ait Hamou (AA), Naïma El Ghachtouli (NE), Silvio Gianinazzi (SG), Ilham Zouitane (IZ), Monica Ossino (MO) et Vivienne Gianinazzi-Pearson (VGP)

#### Programme

##### 19 Septembre 2023

###### *Matin*

- Introduction (NE)
- Qu'entendons-nous avec nouvelle technologie en agriculture ? (SG)
- Connaissances de bases concernant les microorganismes du sol impliqués dans cette nouvelle technologie (VGP)
- A quoi ressemblent ces microorganismes bénéfiques du sol ? (NE, IZ)
- Comment pouvons-nous démontrer l'efficacité en production végétale de ces microorganismes bénéfiques du sol ? (NE, IZ)
- Ces microorganismes peuvent-ils protéger les plantes vis-à-vis des pathogènes des racines et des parties aériennes ? (SG, NE, VGP)

###### *Après-midi*

- Comment trouver des inocula basés sur de ces microorganismes du sol, aspects sécuritaires ? (SG)
- Guide pour la production d'inocula autochtones (SG)
- Comment inoculer les plantes avec des microorganismes bénéfiques du sol ? (IZ)
- Comment maintenir actifs les microorganismes bénéfiques du sol dans les sols agricoles (SG)
- Conclusions et plans futures (NE)
- Vérification des connaissances acquises (test QCM) (NE, IZ)

##### 20 Septembre 2023

###### *Matin*

- Présentation de la problématique de la culture du Figuier de Barbarie dans la région d'Essaouira
- Visite de plantations

###### *Après-midi*

- Démonstration au champ de la méthode de :
  - échantillonnage du sol pour l'isolement de microorganismes bénéfiques telluriques
  - inoculation des plantes par des microorganismes bénéfiques

## ورشة عمل في المغرب , 18- 21 سبتمبر 2023

### تقنية جديدة في الزراعة: تطبيق على الصبار الكمثري

### مكان الالتقاء: تعاونية الصويرة الزراعية

**المنظمون:** عبد الرحمن أيت حمو(ع ا) ، نعيمة الغشتولي (ن ا) ، سيلفيو جيانينازي (س ج) ، إلهام زويتان (إ ز)، مونيك أوسينو (م أ) ، فيفيان جيانينازي بيرسون (ف ج ب)

#### البرنامج

19 سبتمبر 2023

#### الصباح

- مقدمة عن ورشة العمل (ن ا)
- ماذا نعني بالتكنولوجيا الجديدة في الزراعة (س ج)
- المعرفة الأساسية بالكائنات الحية الدقيقة المفيدة في التربة المشاركة في هذه التكنولوجيا الجديدة (ف ج ب)
- كيف تبدو هذه الكائنات الحية الدقيقة المفيدة في التربة؟ (ن ا, إ ز)
- كيف يمكننا إظهار فعالية هذه الكائنات الحية الدقيقة المفيدة في التربة في الإنتاج النباتي؟ (ن ا, إ ز)
- هل يمكن لهذه الكائنات الحية الدقيقة المفيدة في التربة حماية النباتات من أمراض الجذور والبراعم؟ (س ج, ن ا, ف ج ب)

#### بعد الظهر

- كيف تحصل على اللقاحات بناءً على الكائنات الحية الدقيقة المفيدة في التربة، الجوانب الأمنية؟ (س ج)
- دليل لإنتاج لقاحات محلية (س ج)
- كيفية تلقيح النباتات بالكائنات الحية الدقيقة المفيدة في التربة؟ (ن ا, إ ز)
- كيف تحافظ على الكائنات الحية الدقيقة المفيدة في التربة الزراعية؟ (س ج)
- الاستنتاجات والخطط المستقبلية (ن ا)
- التحقق من اكتساب المفهوم (اختبار QCM) (ن ا, إ ز)

20 سبتمبر 2023

#### الصباح

- عرض لحالة فن زراعة التين الشوكي في منطقة الصوري
- زيارة ميدانية لبساتين الفاكهة

#### بعد الظهر

- عرض ميداني حول أساليب:

- أخذ عينات من الكائنات الحية الدقيقة المفيدة في التربة
- تلقيح النبات بالكائنات الحية الدقيقة المفيدة في التربة