Soil biota management and agroecological transition in lily (*Lilium longiflorum* Thunb) farming in Southeast Mexico

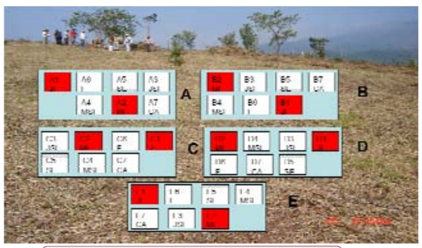
Guadarrama-Zugasti, C.[1]; Trejo-Aguilar, D.[2]; Barois, I.[3]; Franco-Navarro, F.[4]; de los Santos, M.[3]; Martínez-Romero, E.[5]

[1]Universidad Autónoma Chapingo, México,e-mail: carolusver@yahoo.es; [2]Universidad Veracruzana, México; [3]Instituto de Ecología A.C., México; [4] Colegio de Postgraduados, México; [5]Instituto de Investigaciones Genómicas UNAM, México.

INTRODUCTION

For solving soil-borne disease problems in lily crop (Lilium longiflorum Thunb.), to preserve soil biota biodiversity and eliminate agrochemical use, an on-farm type trial was carried out along two seasons in a participative research framework within the buffer zone of the Santa Marta Biosphere Reserve at Southeastern Mexico. Lily bulb rotting has caused lily crop disappearance as an agricultural activity in the region. Crop loses because root diseases range from 50 to 100 % when accounting on an individual commercial plot. Loses have extended to the entire region reaching al least ten counties around the buffer biosphere reserve and bulb rotting has become an endemic lily disease in the near by lily cropping regions. At the same time, this area has suffered severe deforestation in the last few years, which has caused loss of the microbiota diversity and soil fertility . Reincorporation of locally collected beneficial organisms during the first phase of the Below Ground Biodiversity Project such as nitrogen fixing bacteria and AMF to improve deteriorated soils was the core strategy in this trial. Agroecological principles as crop rotation, , management of local soil biota and their interactions, agroecosysttem redesign (Gliessman 2007), below-ground transition (Guadarrama-Zugasti 2010), and participatory-action research (Bacon et al 2005) were used as a guiding conceptual framework along the study.

MATERIALS AND METHODS



Arrangement of treatments

Soil solarization

Blocks C, D and E with 7 treatments

Inoculation of AMF and N-fixing bacteria

Description of treatments

Tratamientos	Descripción
1	Rotation and relay of lily with *Pachyrrhyzus erosus* inoculated
2	Rotation and relay of lily with *M. pruriens* inoculated
3	Rotation and relay of lily with *Pachyrrhyzus erosus* without inoculation
4	Rotation and relay of lily with *M. pruriens* without inoculation
5	Monoculture of lily with soil solarization and manure addition
6	Lily farming with local agricultural practices
7	Lily farming without rotation and without local agricultural practices (absolute control)

Lily relay with *Mucuna pruriens*

Two of the four rotation-relay treatments were inoculated with a consortium of mycorrhizal fungi (VAM) collected in the area: (Glomus aggregatum, Glomus geosporum, Glomus etunicatum and Glomus constrictum) and with several strains of Bradyrrhizobium spp. VAM were applied to the root system as powder sustrate (5 g per plant) and bacteria was injected (5 ml of distiled water) . Manure was collected on the cattle raising ranches around the experimental area and applied on the solarization plots before covering with plastic film at rates of 50 k each replication plot with 61% moisture average. Chemical fertilizer (17-17-17) was applied in treatment 6 once a year.

RESULTS AND DISCUSSION

Alternatives practices reduced damage on lily bulbs, increased soil fertility and modified soil biota. Solarization plus manure treatment achieved the best results in plant development (Fig. 1a), disease reduction (Fig. 1b) and harvest yield (Fig. 1c); VAM root colonization in treatments 1 and 2 showed significant differences with non-inoculated treatments 3 and 4 (Fig. 1d) confirming inoculation as a good alternative practice. Overall, the two inoculated treatments were non-conclusive but still showed potential if relay leguminous crops have a management improvement. Solarization reduces AMF population in the soil indirectly reducing weed and pathogen populations, however, AMF maintain propagules of infectivity. Results also include an agroecosystem redesign proposal (Fig. 2) for short and long term rotation-relay cropping. Inoculated and solarization plus manure treatments have been extended to technology transfer plots with forty small farmers in the region during the current season.

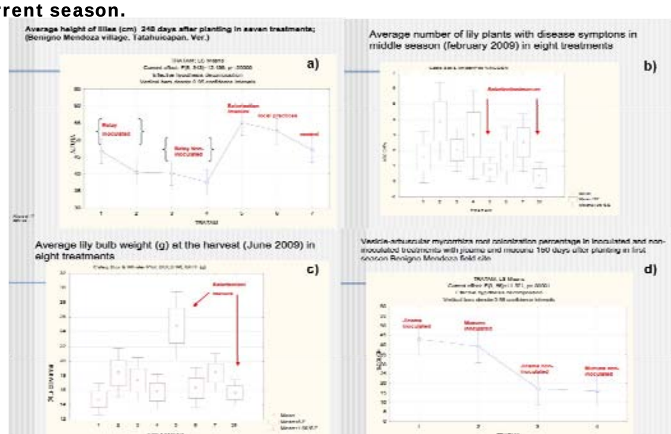


Figure 2. Lily agroecosystem redesign

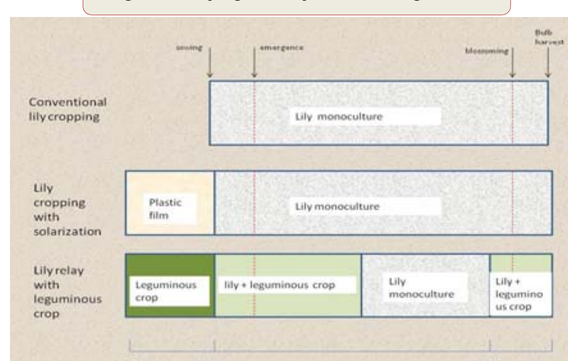


Figure 1: a). Lily development (height) in seven treatments. b). Disease sympton assessment in eight treatments (treatment 5II is treatment 5 for a second season) c)Lily bulb yield in eight treatments (second season) d) VAM root colonization in inoculated treatments (1 and 2) and non-inoculated treatments (3 and 4).

- Bacon, C., V.E. Méndez & M. Brown (2005) Participatory action-research and support for community development and conservation: Examples from shade coffee landscapes of El Salvador and Nicaragua. Center Research Brief # 6. Center for Agroecology and Sustainable Food Systems. University of California: Santa Cruz, CA, USA.
- Gliessman, S. 2007. Agroecology. The ecology of sustainable agrifood systems . CRC. Boca Raton, Fla.
- Guadarrama-Zugasti, C. 2010. La transición agroecológica en el sureste de México: rediseñando el agroecosistema para cultivo de azucena entre pequeños agricultores. X Seminario Internacional de Agroecología, Porto Alegre, 8-10 de diciembre 2009.