

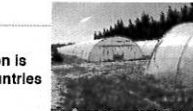
Nematostatic N₂-fixing *Crotalaria* for sustainable greenhouse vegetable production

Le Roux C., Carlet F., Jourand P., De Belder E., Kulagina N., Caillère J., Bourrillon J., Ducouso M., Baudoin E., Prin Y., Tisseyre P., Boursot M., Duponnois R., Galiana A., de Lajudie P., CIRAD-IRD-SupAgro-Univ. Montpellier II, UMR Symbioses Tropicales et Méditerranéennes, Campus de Baillarguet TA-82 J, Montpellier Cédex 5, France. www.mpl.ird.fr/lstm Deleuze F., Société Delbon, 62 rue Michele, 13990 Fontvieille – France, <http://www.delbon.com>

Background

Tunnel greenhouse vegetable production is rapidly expanding in Mediterranean Countries

High humidity
High temperature
Short duration of the cultures



Pest problems (nematodes)

No satisfying treatment against nematodes (Chemicals against nematodes are toxic to the users & soon banned in Europe
Common practice : 3 month sanitary period with empty greenhouse (fallow)
Action of solar rays / xolone treatment
Tourteau of castor-oil plant

Objectives

> to improve vegetable production (yield, sustainability, quality) by exploiting the agronomic & biological properties of *Crotalaria* spp. plants

- nitrogen-fixing root nodules
- Arbuscular Mycorrhizas (AM) symbioses
- control root-knot nematode populations (nematostatic compounds production)

> To reduce the use of chemical fertilizers and pesticides.
> field application and transfer to farmers,
> To develop cost-effective, environment-friendly and sustainable management practices

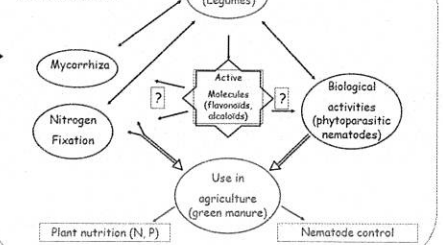
> To study the impact of the utilisation of *Crotalaria* in rotation with vegetables on

- chemical and biological soil fertility,
- bio-control of nematode populations
- vegetable product yield and quality (safety, health, market value).

> In Mediterranean industrial greenhouse vegetable production

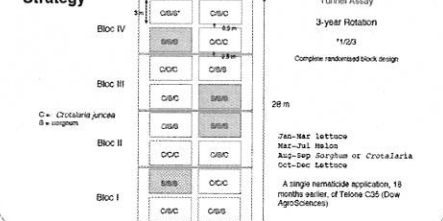
> on the commercial scale
> In 2-3 countries (France, Spain, Morocco)

Alternative

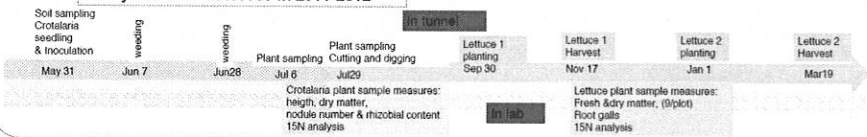


Assay on nematostatic and green manuring effects of *Crotalaria juncea* in tunnel vegetable production in two farms South France (Noves & Airmargues)

Strategy

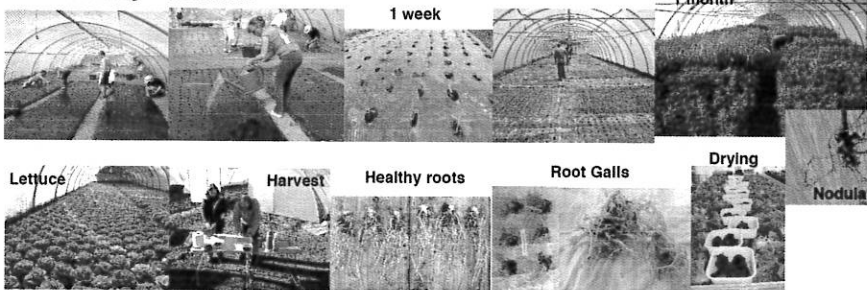


Assay schedule in Noves in 2011-2012

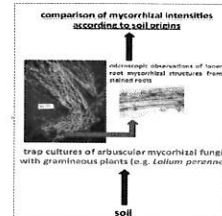


Crotalaria seedling

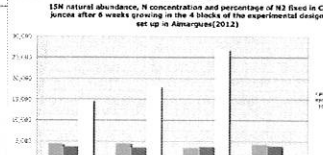
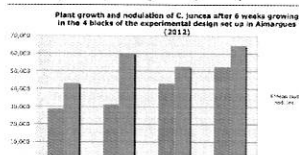
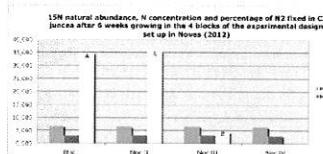
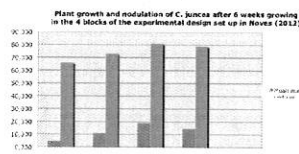
Inoculation



Microbiological impact of *Crotalaria* on soil and roots



Crotalaria plant growth & root nodulation (2011)



Lettuce harvest (fresh weight)

Noves nov 17, 2011

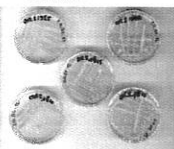
Traitement / Modalité	Newman-Keuls (SNK)	Moyenne (g)	Groupes	P<0.0001
C/S/S	364	A		
C/S/C	352	A		
C/C/C	352	A		
S/S/S	300	B		

- a block effect (P<0.05)
- a treatment effect : previous culture influences salad biomass, with sorgho < crotalaria (P<0.05)
- interaction blocks x treatments is variable
- Gall attack: moderate in 2010, null in 2011 in Noves; severe in Airmargues in 2011

Airmargues Jan 10, 2012

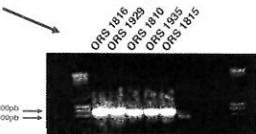
Traitement / Modalité	Newman-Keuls (SNK)	Moyenne (g)	Groupes	P<0.05
CSS	425	A		
CSC	409	A	B	
CCC	403	A	B	
SSS	376	B	B	

5 strains

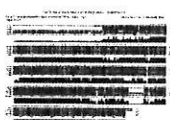


Inoculum strain molecular characterization

16S-23S ITS
PCR-Amplification



Sequence Alignment
The 5 strains are *Bradyrhizobium* spp.



CONCLUSION & PERSPECTIVES

- Very positive green manure effect of *Crotalaria juncea* on lettuce biomass in both sites and within two successive campaigns in Noves
- Δ¹⁵N measurements are in progress to evaluate the part of nitrogen fixation in this effect (transfer).
- Reduced gall attack was observed in all cases when lettuce was preceded by *Crotalaria*
- Possible remnant effect of *Crotalaria* will be examined in next years
- N transfer from *C. juncea* necromass to lettuce: analysis in progress
- An additional experiment is being settled in Murcia (Spain) in 2012, with tomato

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« Legumes: key multifunctional legume crops for an energy-efficient and environmentally friendly future European agriculture