How to maintain high quality of bradyrhizobia inoculants: a challenge in Europe and the rest of the World

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Historically: Quality standards already established since 1970

Obaton &Rollier : CR Acad.Agric. 1970,

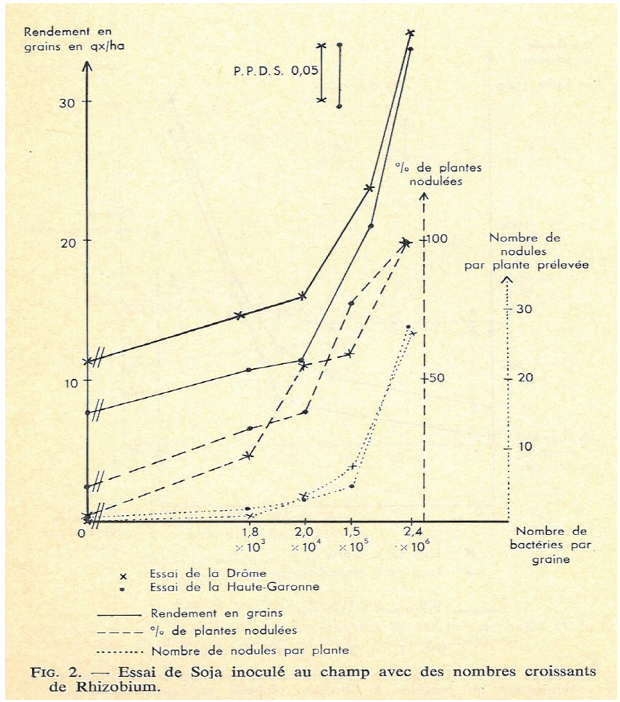
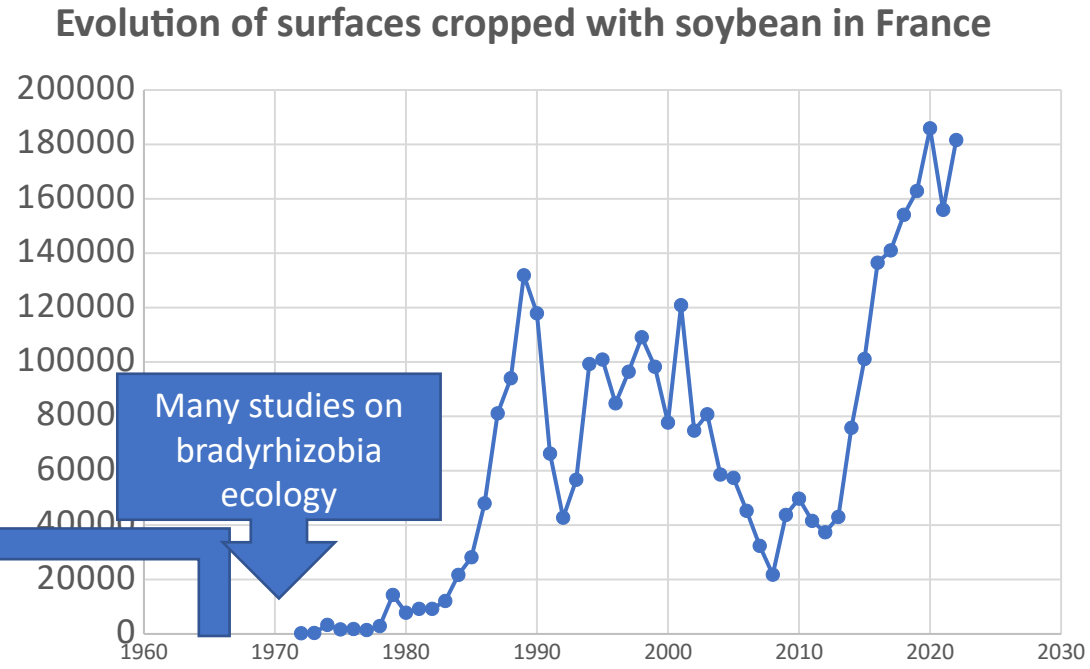


FIG. 2. — Essai de Soja inoculé au champ avec des nombres croissants de Rhizobium.

Dose effect if *Bradyrhizobium* naturally absent from soil



Many studies on bradyrhizobia ecology

- Sterilized solid support (peat)
- Absence of contamination
- More than 10^6 bradyrhizobia / seed

During the 70's and 80's

- Many research studies on Rhizobia ecology
  - Methodological breakthrough : immunochemical methods, and later MLST, WGS
  - Survival in soil, population dynamics regulation
  - Competition for nodule occupancy

- Closed collaboration between
  - Public research (INRAE)
  - Industrials (LIPHA, Bioprox, Microbio)
  - Farmers technical institut (Terres Inovia , former CETIOM

***Bradyrhizobium diazoefficiens* G49**
Strain selected by INRAE

INRAE know-how licences guarantee :

- Long shelf life of inoculants
- Control of genotypic and phenotypic properties of the G49 licenced strain
- Strain provided each year to industrials
- Quality control on each commercial batch prior to marketing

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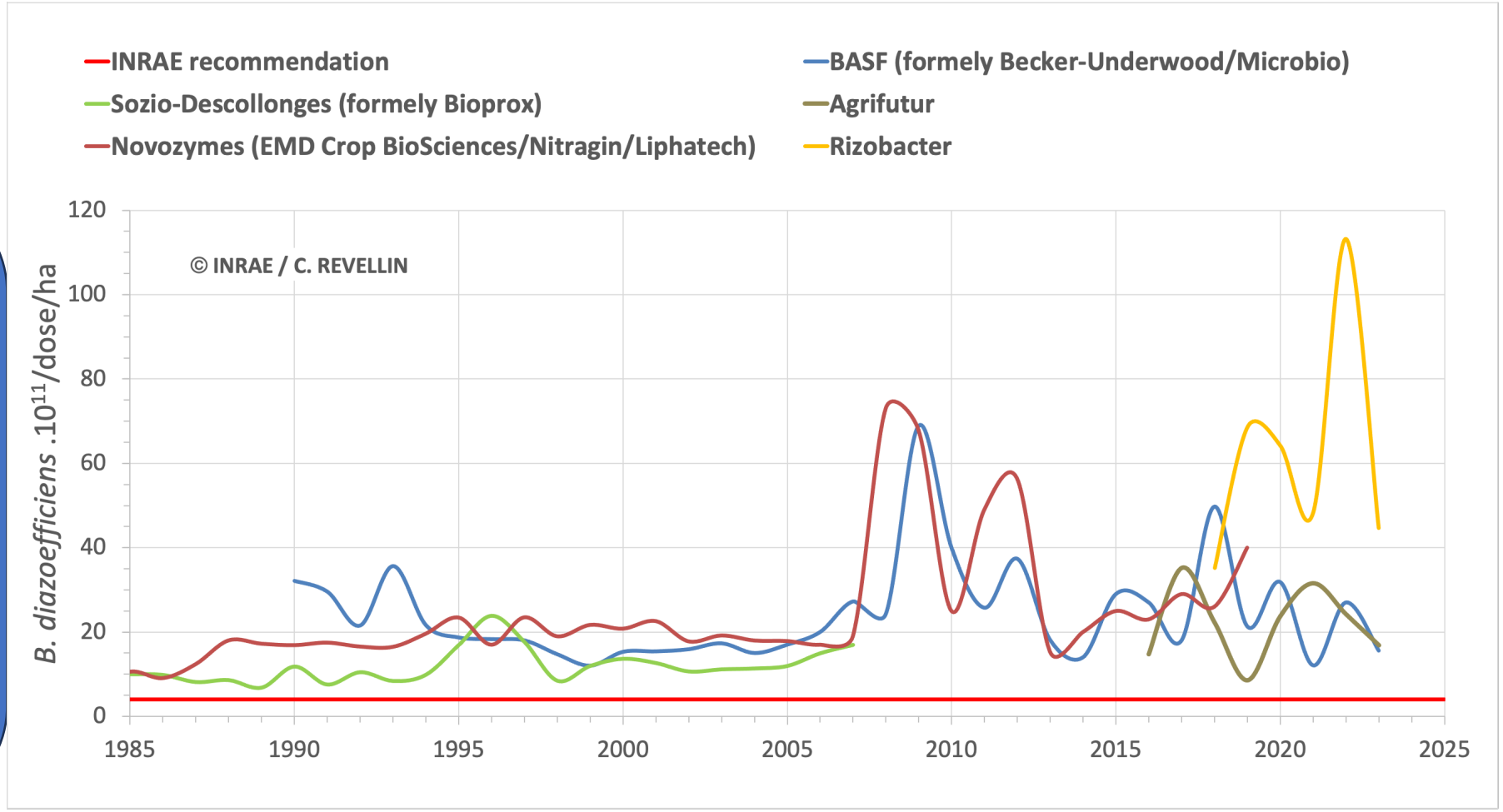
Farmers confidence built on 40 years of controls and labelling

Success story:

- Efficient use of BNF
- Farmers confidence
- Able to Promote new types of inoculant:
  - Clay microgranulars,
  - sticky additives,
  - liquid inoculation



Over 40 years of controls : only 1% of defective inocula

Often over the threshold

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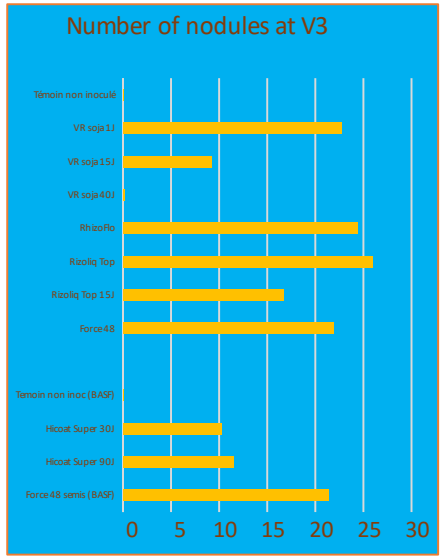
Involvement of Terres inovia



Example in 2018

Field trials in bradyrhizobia free soils

Farmers surveys on practicies

TERRES INOVIA

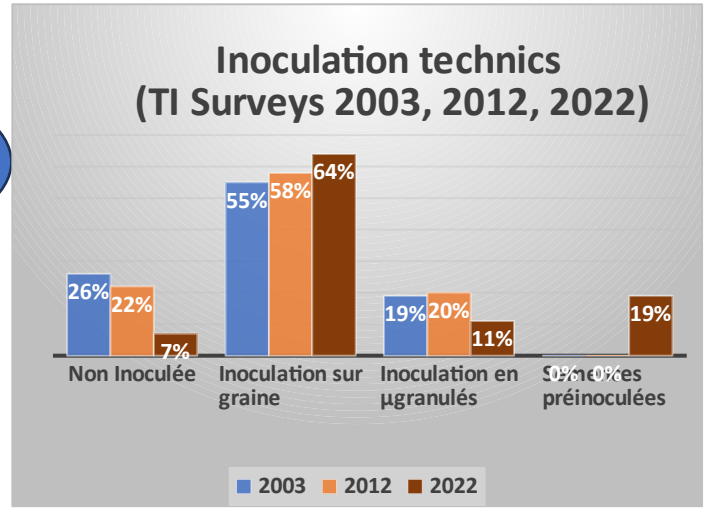
Farmers applied research institut

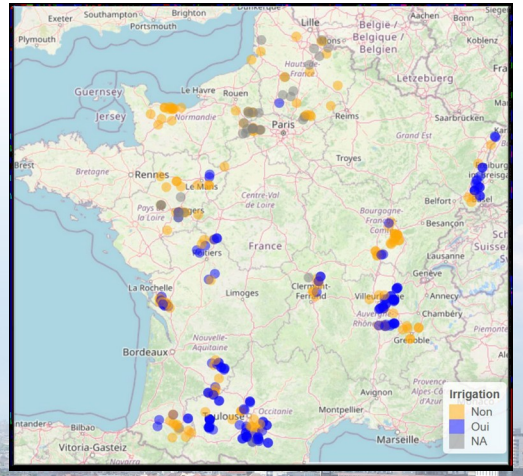
Network of 320 farmer fields in 2021 & 2022

See Poster 158 Tribouillois et al

Extension activities

From field meeting, papers, to webinars





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What has changed in the recent years ?

- New UE rules for Pesticides, fertilizers and other products: CE N°1107/2009 ; application in 2011 at the UE level
  - Aiming to :
    - Improve Health and environment protection
    - Harmonize and simplify rules among UE states
    - Increase free circulation of products inside UE
  - French law : « loi d'orientation agricole » October 2014

=> Mutual recognition of market authorizations among UE states

French market autorisation
through National Agency (ANSES)
Full dossier with assessment of efficacy and safety

2 alternatives

Mutual recognition
Heterogeneity of criteria among states
Administrative procedure
Variable assessment of efficacy and safety, depending on the country

French situation : a risk of levelling down

Market Authorization in France: Full dossier submitted through ANSES

Type	Product	producer	Strain
Peat on seed	NPPL	BASF	G49
	Nitrogen	Agrifutur SRL	G49
µgranulars	Nitrogen GR	Agrifutur SRL	G49
Peat with sticky additive	NPPL Force48	BASF	G49
Liquid + C solution	Rizoliq Top	Rizobacter	G49
	Vitalianz R soja	Calister	G49

80% Market share
Leader : RIZOBACTER – De SANGOSSE

Market Authorization in France
Through mutual recognition without quality label

Type	Product	producer	Strain
Pre-inoculated seeds	HICOAT Super	BASF	532C
Peat on seeds	BIOFIXIN S	U. Zagreb	D344
Liquid	LIQUIFIX	Legume Technology	SEMIA 5079 & 5080

Other inoculants without any authorization coming from neighboring countries: Efficacy? Quality? Strain identity? Purity? Absence of pathogens?

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Perspectives

- Burning Questions?
  - Necessary Harmonisation among European countries
  - Ability to promote Independent quality controls and corresponding quality label ?
  - Is it sound to use different strains? Which criteria to apply ?

- How to address these issues?
  - COST action (European level) : ROOT-BENEFIC
  - QUAL-INO Carnot Plant2Pro national French project
  - Direct discussions with us : x.pinochet@terresinovia.fr; cecile.revellin@inrae.fr

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Thanks for attention