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Setting and Diffusion of a Production System for Legume *Rhizobium* Inoculants

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Abstract

UPIL (Unité de Production d'Inoculum pour Légumineuses) has been designed for producing high-quality *Rhizobium* inoculants for legumes in developing countries. It consists in a stainless steel fermentor where the medium is sterilized. *Rhizobium* is grown in it with a temperature regulation and controlled aeration.

In Rwanda, where inoculating soybean can result in yield increases of 60%, the system has been used since 1983. The production of inoculants and their use by farmers has been growing since then.

UPIL is presently used in more than ten other countries.

Keywords: *Rhizobium*, inoculation, fermentors, tropical legumes

1. Introduction

Transferring a technique from an experimental stage to the real environment is often difficult. In the case of the inoculation of legumes with *Rhizobium*, there are many obstacles to such a transfer. For tropical regions, the supply of farmers with specific and high-quality inoculants is one of the major constraints to be faced.

Techniques for growing rhizobia in simplified fermentation vessels exist (Date and Roughley, 1977) but they have seldom been applied in developing countries. A system called UPIL (Unité de production d'Inoculum pour Légumineuses) has been set and tested for this purpose.

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2. Materials and Methods

UPIL consists of a 30 l or 50 l stainless steel fermentor and several accessories allowing to grow aerobic bacteria, particularly *Rhizobium*, in optimal conditions. The main principles of its use are:

- *medium*: classical Yeast Extract Mannitol broth (Vincent, 1970) is made in the fermentor and sterilized by placing the whole fermentor in a suitable autoclove for 1 hr at 115°C.
- *Inoculation*: for a 30 l fermentor, 1 l of a *Rhizobium* liquid culture is introduced aseptically in the inoculation port.
- *Aeration*: performed by injecting sterile air in the fermentor through a porous stainless steel plug at the rate of 5 l air $h^{-1}l^{-1}$ of medium.
- *Temperature regulation*: controlled by water bath or heating elements connected with a temperature probe and electronic switch. Optimal temperature is usually 30°C.
- *Agitation*: additional agitation can be done with a magnetic bar.
- *Control*: samplings can be done during the growth for quality checks or *Rhizobium* countings.

In these conditions, UPIL allows growing dense cultures of any kind of *Rhizobium* (Montange and Beunard, 1984).

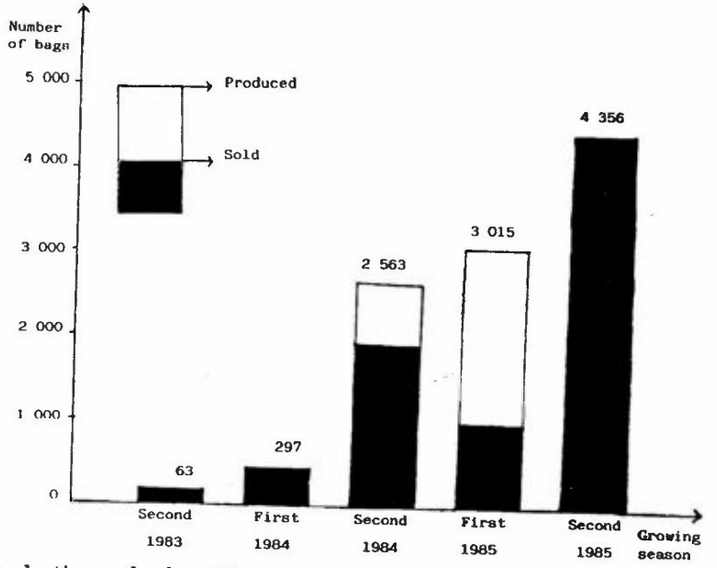

Figure 1. Production and sales of Inoculants in Rwanda.

Table 1. Soybean inoculation in Rwanda. Yields (kg ha^{-1}).

Type of experimentation	Field trial	Field trial	Field trial	Field trial	Field trial	Demonstrations
Treatments — Place	Butare	Butare	Save	Save	Rubona	Upper and lower values (7 sites)
Year	1984 Second season	1985	1984	1985	1983	1984
Control - No fertilizer	797	1.239	224	1.488	373	276 - 1.000
Inoculated - No fertilizer	1.276	1.963	630	1.792	401	455 - 1.600
Inoculated + Fertilizer (0-45-45)	1.474	1.590	517	2.191	444	537 - 2.050
Control + Complete fertilizer (50-45-45)	1.314	1.501	265	2.167	457	not included in demos
Ratio $\frac{\text{inoculated}}{\text{non inoculated}}$	1.6	1.6	2.8	1.2	1.1	1.0 - 4.2
Ratio $\frac{\text{inoculated 0-45-45}}{\text{50-45-45}}$	1.1	1.1	1.9	1.0	1.0	—

The liquid culture is then mixed in bags containing a sterile carrier and can be used as inoculants for legumes.

3. Results and Discussion

In Rwanda where it has been used for 6 years, UPIL has allowed national institutions to manufacture soybean inoculants. The results obtained by researchers and extentionists (Table 1) can be also expected in the farmers conditions and the demand for inoculants is growing so fast (Fig. 1) that an increase in the production capacity is necessary. Since the system allows the multiplication of the number of fermentors, it is not a problem.

4. Conclusions

Rwanda is a good example of the fact that producing inoculants locally does not necessarily result in failures, provided a great care is taken in maintaining high-quality standards. Already set in more than ten developing countries, particularly through FAO projects, UPIL is allowing them to start the production of adapted inoculants.

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