INOCULANT PRODUCTION IN RWANDA :

USE AND RESEARCH

by

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Abstract.

In July 1983, a pilot plan for inoculant production was set up in ISAR, supported by FAO (Rome, Italy) with the collaboration of IRAT (Montpellier - France). Soybean inoculant has been produced for three years with an extension program on inoculation technique at the small farm level.
This inoculant activity is very successful in Rwanda and well accepted by farmers. Therefore, the production is not sufficient to supply the demand.
Now, an important new goal of the inoculant production unit is to continue the studies about bean spontaneous nodulation and, later on, produce a suitable bean inoculant.

Introduction.

In Rwanda, leguminous crops represent 32 % of the area planted to subsistence crop and, hence, these plants are very important. So, in Rwanda, bean is the main legume but soybean area is increasing. At the moment, the main activity of BNF program in Rwanda is the production of the soybean inoculant, its quality control and also the extension of the use of it.

I. INOCULANT PRODUCTION.

A. Process.

The inoculant production consists of a 20 l fermentor developped by IRAT and accessory equipment (mill, controlled temperature chamber, laminar flow cabinet) - The rhizobium culture grows in the fermentor under aerobic conditions at 28°C - Aeration and mixing are achieved by means of a flow of filtered air - Temperature is regulated by a water bath.

The different steps of inoculant production process are as follows :

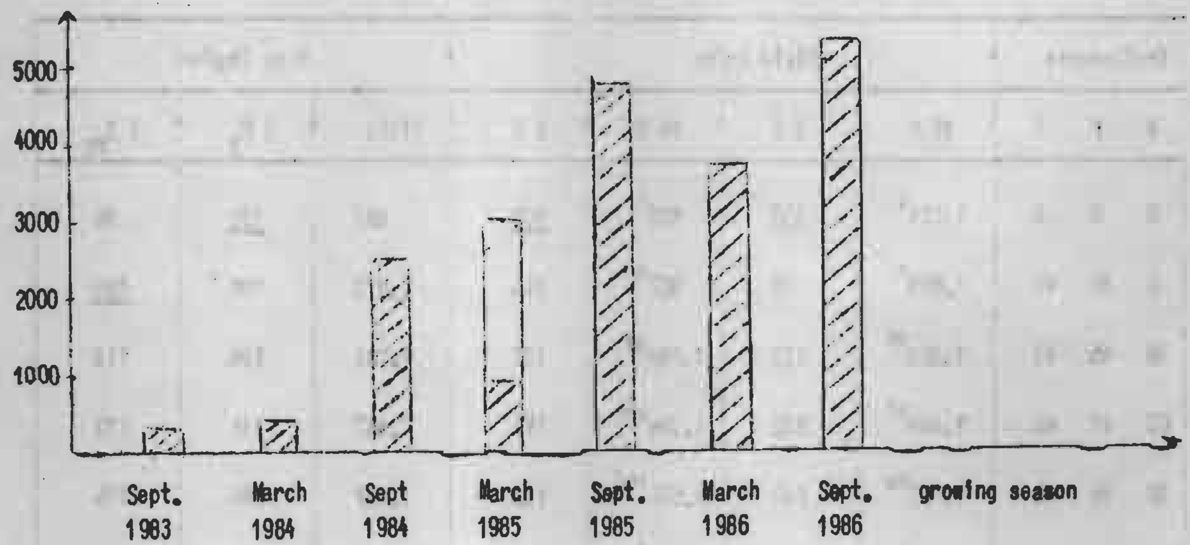
Peat produced locally is air dried, ground and sieved to pass through a 0,25 mm sieve - pH is adjusted to 6.4 by adding 3 % of local lime - 50 g (or 25 g) of this carrier is packed into polyethylène bags and autoclaved 3 times for 1 h with 24 h intervals.

A 1 l rhizobium primary culture is grown upto 10^9 bacteria/ml - In the meantime the fermentor filled with 19 l of yeast extract mannitol (YEM) broth is autoclaved. Then the fermentor is inoculated with the previously prepared culture, and the 20 l broth culture develops upto 10^9 bacteria/ml. 33 ml of the culture (67 % of peat dry weight) are injected into each bag (Vincent, 1970).
The bags are incubated for 8 days at 28°C to obtain 10^{10} bacteria/g of inoculum. From each fermentor 5 packets are sampled for quality control. Finally inoculant is stored in a cool place before utilization.

2 types of inoculant packet are produced : 40 g and 80 g packet. Every packet of 80 g enables to inoculate 5 ares of soybean. Every 80 g packet is sold for 25 Rwandan francs (0.21 US $).

B. Production : see diagram n°1.

diagram n°1 : Inoculant produced and solf from 1983 to 1986.



As shown on the diagram n°1, the production is rising from 1983 to 1986, but unfortunately the inoculant unit can supply only 30 % of the demand.
Nevertheless the new laboratory under construction with two more fermentors will supply the adequate quantity of inoculant in the future (project supported by FAO - TCPRWA/4508).

C. Result.

Soybean inoculant input has been found equivalent to 60 N kg/ha to 90 N kg/ha. See table n°2.

Traitements			Yield kg/ha				Mean (kg/ha)		
N	P	K	85 A	% C	85 B	% C	Yield	% C_A	% C_{PK}
0	0	0	1.104[a]	100	800[a]	100	952	100	94
0	45	45	1.099[a]	99	927[a]	116	1.013	106	100
30	45	45	1.352[ab]	122	1.056[ab]	132	1.204	126	119
60	45	45	1.440[ab]	130	1.254[abc]	157	1.347	141	133
90	45	45	1.550[bc]	140	1.584[bcd]	198	1.567	165	155
120	45	45	1.903[c]	172	1.896[d]	237	1.900	200	187
Inoc.	45	45	1.415[ab]	128	1.785[cd]	223	1.600	168	158

C = Control

C_A = Absolute control (0 - 0 - 0)

C_{PK} = Control + PK (0 - 45 - 45)

These encouraging results about soybean inoculation urge inoculant unit of Rwanda to investigate BNF of bean, main legume in the country.

II. BNF of BEAN (Phaseolus vulgaris L.).

First step of investigation about bean in 1984 - 1985 (Tranchant et Hakizimana, 1985) found out the interesting results about spontaneous nodulation of bean.
They demonstrated that in the average, bean spontaneous nodulation was rather poor in spite of the presence of native strains in the soil. But they also found out that the volume of nodules was different according to the bean varieties and soil environment.
The last observations carried out on this matter is as follows (work in progress).

Table 3 : Spontaneous nodulation of P. vulgaris at a fonction of soil type and bean variety.

DATE OF SOWING : 16 OCT 1986 - Vegetative stage = PRE-FLOWERING

Volum of Nodulas (5 plants) ml / Rep	SITE N°1 : Fertile Soil (Organic Matter)							SITE N°2 : Poor Soil : affected by leaching low rated organic-matter						
	1	2	3	4	5	6	Mean	1	2	3	4	5	6	Mean
MASTER	3	0,3	0,4	2,4	1,3	1,5	1,48	1,7	0,1	0	0	0,1	0,4	0,38
CARU 27	3,5	5,6	1,2	1	2,6	3,2	2,85	1,2	0,5	0,1	0,1	0,3	0	0,36
BAYOMEX	7,2	6,7	3,7	3,8	2,5	2,6	4,41	1,6	0,4	0,3	0,1	0,4	0,2	0,5
RUBONA 5	2,5	2,3	3,2	0,6	1,4	0,9	1,81	1,4	0,9	0,5	0,5	0,4	1,4	0,85
						$\bar{X}$	2,64						$\bar{X}$	0,52

This field trial shows, once more, the double influence of the crop variety and the soil environment. According to these successive résults, we are undertaking studies in collaboration with plant improvment program of ISAR and CIAT. Nevertheless, recent observations of HERVE Saint Macary (IRAT - France p.c.) in Cameroun 1985 pointed out the possibility of a good response to inoculation of bean So, our goal in the future can be listed as follows :

1°/ Improvment of spontaneous nodulation of bean by various agricultural techniques

2°/ If possible, to put into shape an effective inoculant for bean.

III. OTHER FIELD OF INVESTIGATION.

Inoculant unit of Rwanda keeps interest in BNF by Azolla anabaena and also in finding out new effective strains for peas, leucaena and lucerne. Unfortunately the busy schedule of the unit does not allow strong investigation on that matter.

CONCLUSION.

From 1987, Rwanda will be able to supply the farmer demand, about 30.000 80 packets of inoculant for soybean a year. But inoculant production unit should produce more and more very high quality inoculant, meanwhile keeping interest in extension side. The new target, improvment of bean nodulation, is really a big challenge. But we hope that our studies and researches will enable us to present some practical results in two years.

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