Rhizobium inoculant production in the N2Africa soil microbiology laboratory at Kalambo in the Sud Kivu province, Democratic Republic of Congo

The Faculty of Agriculture, Université Catholique de Bukavu, DRC, a partner of N2Africa, is implementing rhizobiology activities in the framework of the objective 3 of the N2Africa project, which global goal being enhancing inputs from BNF in smallholder farming systems. The aim of objective 3 can be summarized as follows:

- selection of superior rhizobia strains with enhanced BNF capacities adapted to various environmental stresses and develop effective inoculant delivery systems;
- establishment of a state-of-the-art laboratory and culture collection of elite strains of rhizobia for target legumes;
- and establishment of rhizobial inoculant production through partnership with the private sector.

As stated by Giller (2010), studies have demonstrated the existence in African soils of rhizobia that are more effective than existing inoculant strains for beans and tree legumes; thus a substantial program of research on rhizobial strain selection is likely to yield results within a relatively short time period.

A goal of rhizobium scientists is to discover new and better strains for use in legume inoculants. This pursuit entails the collection of isolates, strain characterization, assessment of symbiotic capacity and comparison to strains currently included within inoculants. Ongoing activities at Kalambo are bioprospection by collecting 213 rhizobium strains in 44 sites in Kalehe, Kabare, Walungu, Uvira and Idjwi locations, authentication and effectiveness of isolates collected strains, screening in greenhouse for BNF of collected isolates, conducting 50 MPNs in the greenhouse, 25 on soyabean and 25 on beans, quality control of reference commercial strains and production of inoculants for use in local trials.

With bioprospection 213 nodules samplings were collected and authentication test showed that only 103 isolates were selected. Effectiveness index was achieved in the greenhouse through nodules number, nodules scoring and leaf scoring from promiscuous (SB19) and specific soyabean (SB24) by inoculating those soyabean species in the presence of commercial stain Semia 5019, using modified Leonard jar as designed by Paul Dr Woomer (photo1). The aim of this is to select elite strains under greenhouse conditions.

Elite strains are determined by their ability to replace those already in use as commercial legume inoculants. First it is important that the strains be identified and not confused with one another and those already in use. Strains of rhizobia, previously selected in potted field in a greenhouse are evaluated in the field environment so as to further identify the most effective strains for inoculants production. Second, more comprehensive field testing is required to assure that the candidate elite strains perform across a wide range of field conditions, with direct comparison to commercially available inoculants.

Photo 1: modified Leonard Jar in Kalambo greenhouse during effectiveness test on soyabean

Photo 2: effectiveness index about leaf color

Photo 3: inoculants in the incubator, produced at Kalambo

Inoculating promiscuous soyabean with Dwl16 and Dcb1 gave highest nodules number (28 and 27 nodules respectively). The same rhizobia strains (Dwl16 and Dcb1) gave the highest nodules number for the specific soyabean (SB24). Interaction between Rhizobia strains and type of soyabean grown was highly significant. Nodule scoring was significantly affected by the interaction strain-variety and the type of strains inoculated. Inoculating promiscuous (SB19) with the strains D08a, Dkl2, D15ii,

Dkbm7, Dwl16, DCb1, D18a and Dkbm5 gave highest score ranking of nodules (4, meaning abundant, > 20 nodules). For the specific soyabean (SB24), the strains Dkt2, D21 and Dlrh gave the highest score of nodules.

Concerning leaf scoring, inoculating the promiscuous soyabean SB19 with Dcb1, Dkat2, Dken gave the highest green color to the leaves (photo 2). Effectiveness index (based on nodules number) of fifteen indigenous Rhizobia isolates (Dwl16, Cb1, Dkt2, Dken, Dkbm7, D30b, D20, D18a, D15ii, Dkl5, Dkl2, Dkbm5, Dkl7, Dkl4 and D08a) was higher compared to the commercial isolate SEMIA5019 for promiscuous soyabean (SB24) while for specific soyabean (SB19), only five indigenous rhizobia isolates (Dwl 16, Cb1, D15ii,D08a andDkmb5) gave higher results compared to the commercial isolate SEMIA5019.

Other activities carried out meanwhile are quality control of 2 commercial strains, inoculant production at Kalambo laboratory at very small scale (32 packets) (photo 3) using diluted cultures of rhizobium and presterilized peat with available equipment and quality control of commercial strain and Rwandan inoculum, quality control of inoculum produced at Kalambo, quality control of Kalambo inoculums. Quality control of commercial strains gave following results:

Inoculant name	10^{-5}	10^{-6}	10^{-7}	10^{-8}
RB&A	896	680	528	512
Soya	968	922	590	252

Results of the quality control of Kalambo were at 10^{-9} dilution $12x10^{9}$ cells; the range of acceptation of inoculum is between 10^{8} and 10^{9} cells per gram of inoculants but some countries can accept the lower level of 10^{6} (Beck *et al.*, 1993).

The Nitrogen- fixing potential of greenhouse selected strains of soyabean rhizobia will be verified in the field environment in order to assess the BNF capacity and competitiveness of native rhizobia isolates on performance of soyabeans and beans compared to reference strains. Effectiveness index will now be carried out on beans and inoculant production from elite strains will be done after field tests.

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