

# **Inoculants and Nitrogen Fixation of Legumes in Vietnam**

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*Editor:* D. Herridge

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# Contents

Preface	5
Legume N and Inoculants: Global and Vietnamese Perspectives <i>David Herridge</i>	7
Nitrogen Fixation of Soybean and Groundnut in the Mekong Delta, Vietnam <i>Nguyen Huu Hiep, Cao Ngoc Diep and David F. Herridge</i>	10
N <sub>2</sub> Fixation of Groundnut in the Eastern Region of South Vietnam <i>Nguyen Thi Lien Hoa, Tran Yen Thao, Phan Lieu and David Herridge</i>	19
Rhizobial Inoculation and N <sub>2</sub> Fixation of Soybean and Mungbean in the Eastern Region of South Vietnam <i>Ha Huu Tien, Tran Minh Hien, Mai Thanh Son and David Herridge</i>	29
The Impact of Background Rhizobial Populations on Inoculation Response <i>Jo Slattery and David Pearce</i>	37
Potential for Legume Inoculation in Vietnam <i>Pham Van Toan</i>	46
Development and Evaluation of Liquid Inoculants <i>Paul Singleton, Harold Keyser and Eve Sande</i>	52
Inoculation Responses of Soybean and Liquid Inoculants as an Alternative to Peat-Based Inoculants <i>Tran Yen Thao, Paul W. Singleton and David Herridge</i>	67
Selection of Strains of Root Nodule Bacteria to Improve Inoculant Performance and Increase Legume Productivity in Stressful Environments <i>Graham O'Hara, Ron Yates and John Howieson</i>	75
Effects of Rhizobial Inoculation and Inorganic Nitrogen Fertiliser on Vegetable Soybean ( <i>Glycine max</i> (L.) Merr.) Cultivated on Alluvial Soil of Cantho province (Mekong Delta) using <sup>15</sup> N Isotope Dilution Technique <i>Cao Ngoc Diep, Vo Huy Dang, Nguyen Van Ngau, Mai Thanh Son and Tran Phuoc Duong</i>	81
Development of Elite Inoculant <i>Rhizobium</i> Strains in Southeastern Australia <i>Jo Slattery and David Pearce</i>	86
Development of Inoculant Production and Utilisation in Thailand <i>Nantakorn Boonkerd</i>	95
Legume Inoculants and Quality Control <i>David Herridge, Greg Gemell, Elizabeth Hartley</i>	105

## Preface

ACIAR Project LWR2/98/27 'Increasing yields and nitrogen fixation of soybean, groundnut and mungbean in Vietnam through rhizobial inoculation' commenced in April 1999 with the broad mission of laying the foundation of a program to produce sufficient high-quality rhizobial inoculants to satisfy Vietnam's expanding legume industry.

Specific objectives of LWR2/98/27 were to:

- Quantify N<sub>2</sub> fixation by legumes in farmers' fields in Vietnam using natural <sup>15</sup>N abundance and xylem ureide methods and to identify farmer management practices that either depress or contribute to N<sub>2</sub> fixation.
- Evaluate the quality of inoculants, currently produced in Vietnam.
- Complete multi-location inoculation experiments to determine the most effective strains for each species and benefits of inoculation in terms of yield and N<sub>2</sub> fixation.
- Enhance the capacity in Vietnam to produce and distribute high quality rhizobial inoculants through research and training and infrastructure development.
- Lay the foundation for a development project to produce large volumes of high quality rhizobial inoculants in Vietnam.

It was our intention that, at the end of the project, the potential benefits of rhizobial inoculation in Vietnam would have been quantified and the capacity of inoculant R&D and quality control (QC) in the country enhanced. The long-term aim, however, was to develop a large-scale, efficient inoculant production facility, preferably in the hands of the private sector, with technical inputs, such as the R&D and QC, from the Government research institutes and Universities. We recognised that this may only be achieved through a larger, long-term funded project. Thus, this ACIAR small project was instigated as a precursor to that larger project, providing technical information and scientific capacity as well as momentum.

A technical workshop at the Vietnam Agricultural Science Institute (VASI) in Hanoi during 17–18 October, 2001, was the trigger to collate, interpret and publish outputs of the LWR2/98/27 experimental program and to plan a next phase of the Vietnam inoculants program. The workshop in Hanoi attracted about 30 participants, mainly country scientists associated with LWR2/98/27, VASI Microbiology Department personnel and scientists from the Hanoi University. Dr Paul Singleton, NifTAL-University of Hawaii, Dr Nantakorn Boonkerd, Suranaree University, Thailand, Dr Graham O'Hara, CRS-Murdoch University, Australia, and Ms Jo Slattery, NRE Rutherglen, Australia, participated as did Dr Tony Fischer, ACIAR Land and Water program manager.

Seventeen technical papers were presented during the two days of the workshop, covering applied and fundamental issues of rhizobial and non-rhizobial inoculant production and application. A number of the papers clearly outlined the substantial economic benefits from replacing fertiliser N with rhizobial inoculation in legume cultivation in Vietnam. Vietnam cultivates about 700,000 ha of legumes annually, equally distributed between the north and the south of the country. Production is about 700,000 t, worth A\$350 million. None of the crops are inoculated and all are fertilised with 30–150 kg N/ha at a cost to the farmers of A\$50–60 million annually. Results from LWR2/98/27 inoculation experiments in the Mekong Delta and in the Eastern region in the south of the country indicate this to be an unnecessary cost, and one that could be substantially reduced if fertilising with N was replaced by inoculation. The cost of the latter would be in the order of A\$2 million annually.

In the 23 experiments, profitability was increased by as much as A\$760/ha through inoculation and substantially reduced fertiliser N inputs. Average grain yield responses

for groundnut, relative to the -N and +N uninoculated controls, were 12%, and 7% (8 experiments), although responses in the very acidic Mekong delta averaged 42% (relative to -N control) and 28% (relative to the +N control). For the 13 soybean experiments, the average response was 19%, relative to the -N control. Individual experiments showed grain yield responses of 40–50%. Yields of the inoculated and +N plots were almost identical.

It was also clear that for inoculation to become a reality, high-quality inoculants would need to be as readily available in the market place as fertiliser N and farmers would need to be educated in their use, just as they are educated about using fertilisers and chemicals. Not every legume crop would need to be inoculated. In many of the established legume areas in the country, the naturalised rhizobia already present in the soil would be adequate. In other areas, however, inoculation would have clear economic benefits.

The workshop ended very positively with consensus among the group that a new coordinated program would be developed encompassing large-scale inoculant production in both the north and south of Vietnam, and associated research, extension, policy development and evaluation. The program would likely involve the key institutes in Vietnam currently doing rhizobiology research and international collaborators from the U.S., Thailand and Australia. Funding would be sought from international agencies. The expectation is that Vietnam can mimic the success story of Thailand, where inoculant production increased from 30,000 units in 1980 to >1 million units 13 years later. This is the challenge.

David Herridge  
Leader, LWR2/98/27