Ministry of Education, Culture, Sports, Science and Technology (MEXT)
Forum for Nuclear Cooperation in Asia (FNCA) Biofertilizer Project

FNCA Biofertilizer Newsletter

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Overview of FNCA Biofertilizer Project 2011

Tadashi Yokoyama, Tokyo University of Agriculture and Technology (TUAT)

In order to promote environmental friendly sustainable agriculture in Asia, FNCA Biofertilizer Project aims to develop biofertilizers with radiation sterilization technology, using benefical microorgamisms, which increase the yields of crops while reducing the environmental burden of excessive use of chemical fertilizers.

At the first phase of this project from 2001 to 2006, FNCA Biofertilize Manual was published, which gives information and experiences of biofertilizer use in Asian countries, their effectiveness, efficient production processes, storage and application on different crops, as an important outcome.

At the second phase from 2007 to 2012, a main objective is developing multifunctional biofertilizer having both function of plant growth promoting and resistance against plant pathogens. And other two objectives are improvement of inoculants by radiation-based microbial mutation breeding in order to keep high quality inoculant under tropical condition, and dissemination of radiation sterilization method of carrier using ^{60}CO to improve quality of carrier for biofertilizers.

In this newsletter, we introduce the activities of the FNCA Biofertilizer Project in 2011.

At first, we would like to introduce the FNCA 2011 Workshop on Bifertilizer Project. It was held on September 27th - 30th in Ulaanbaatar, Mongolia and a total of 22 participants from 8 countries participated.

At the workshop, summaries of research activities in this phase were reported by the participating countries. In addition, a discussion was held on specific activities to be conducted in the next phase starting in fiscal 2012, and agreements were made on activities such as evaluation of survival ability of microorganisms for biofertilizers, publication of the "FNCA Guideline for Biofertilizer Quality Analysis" on these microorganisms and quality control in 2012, and development of a radiation breeding technique for developing multifunctional biofertilizers. Furhter, exriments of synergy effect between biofertilizer and irradiated oligochitosan was planned as a new research activity.

It is also confirmed that irradiation sterilization of carriers has a better result compared to autoclave, in view of viability of the inoculant in carrier, production cost of biofertilizer in big volume for commercial purposes. Private companies in Malaysia and Indonesia have already used the irradiation of inoculant carrier for commercial purpose, however all Project Leaders should make efforts to enhance the use of radiation sterilization of carriers in collaboration with nuclear research center in their own countries and more precise cost comparison of radiation sterilization and autoclaving should be studied.

The participants visited the Mongolian State University of Agriculture (MSUA) to check the types of crops, seasons for seeding and harvesting, fertilizers used and contents of studies conducted in Mongolia, and inspect the soil chemical analysis laboratory, microbiology laboratory, etc. in the university.

Participants of the Workshop in Mongolia

Country News

Biofertilizer Activities in Bangladesh

Md. Saidul Islam, Bangladesh Atomic Energy Commission (BAEC)

In Bangladesh, following organizations are involved organizations involved in biofertilizer activities:

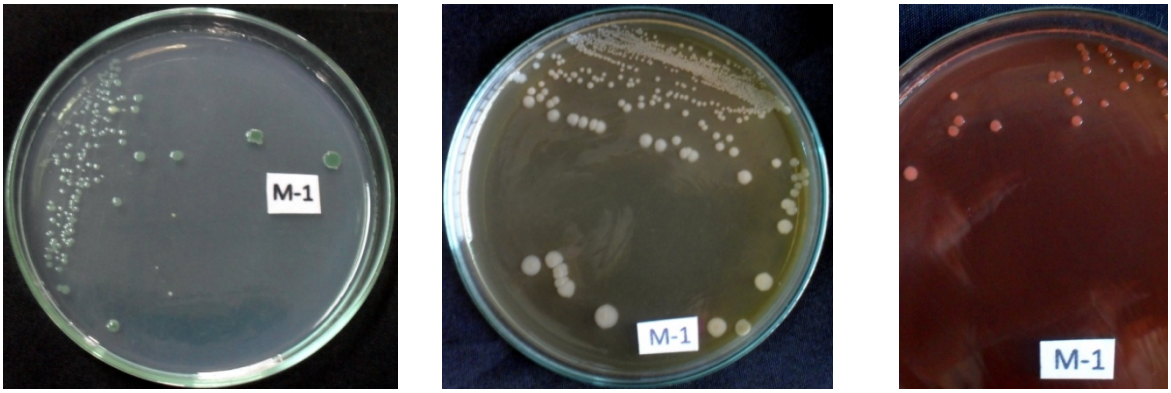
- Bangladesh Institute of Nuclear Agriculture
- Bangladesh Agricultural University
- National Institute of Biotechnology
- Bangladesh Agricultural Research Institute
- Bangabandhu Sheikh Mujibur Rahman Agricultural University

The Bangladesh Institute of Nuclear Agriculture has developed peat based rhizobial inoculants for six pulse crops and one for dhaincha cultivation, which are cheap and easy to handle. All these inoculants are environment friendly and can be used as substitutes of nitrogen fertilizer. The country's legume production can be increased substantially by application of the inoculants, which will be helpful in removing the malnutrition problem of the country. Moreover, it also improves the soil health.

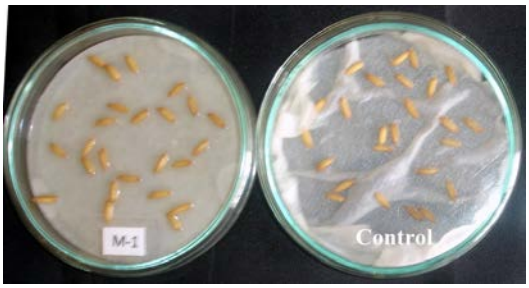
Awareness program for end users of biofertilizer

Bangladesh Agricultural University has already released Rhizobium biofertilizer for nut, soybean and lentil. Research is on going on cyanobacterial biofertilizer for rice cultivation and effect of Biofertilizer and Plant Growth Regulators on growth of summer mungbean.

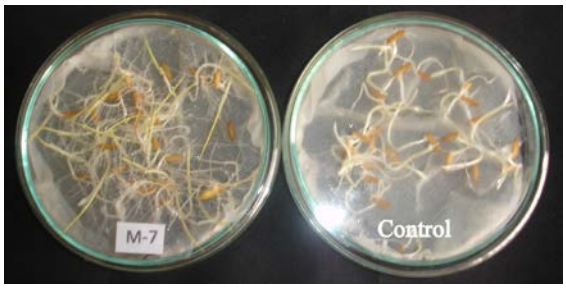
National Institute of Biotechnology is a newly established Institute under the Ministry of Science and Technology, Govt. of Bangladesh with adequate research and ancillary facilities. Environmental biotechnology division of the Institute is involved in the development of rice biofertilizer. Soil and rice root samples have been collected and from different localities of the country to isolate bacterial strains. The strains were identified and nitrogen fixing potentiality has been studied. Rice seeds are inoculated by the selected strains to observe their effect on germination and plant growth.



Colony of *Azospirillum* strain M-1 on Different Media



Rice seeds of 1 day after inoculation



Rice seed of 6 days after inoculation

Bangladesh Agricultural Research Institute is the largest multi-crop research institute conducting research on Biofertilizer (Rhizobiun inoculum) for increased production of pulses. The production of grasspea, lentil, mungbean, gardenpea, chickpea, soybean increases by 4-59% due to the use of BARI developed Rhizobium inoculum.

Bangabandhu Sheikh Mujibur Rahman Agricultural University is working on Rhizobium as a crop enhancer and biofertilizer for increased cereal production. Rhizobacteria as bioenhancer and biofertilizer for growth and yield of banana (Musa spp. cv. 'Berangan')

Table: Recommended biofertilizers for use in Bangladesh

Crop	Institutes	Selected biofertilizer
Lentil	Agriculture University, BINA	DUM-160, BINA-LT-18
Gram	BINA	BINA-CP-2
Cowpea	BINA	BINA-COP-7
Dhaincha	BINA	BINA-DC-9
Borboti	BINA	BINA-MB-1
Mugbean	BINA	BINA-MB-1
Nut	Agriculture University, BINA	BAU-700, BINA-GN-2
Soybean	Agriculture University, BINA	BAU-1007, BINA-SB-4

FNCA Biofertilizer Research Activity in 2011

Fan Bingquan, Chinese Academy of Agricultural Sciences (CAAS)

In 2011, high effective phosphate-solubilizing biofertilizer were developed and field experiments were conducted.

1. Suitability of phosphate-solubilizing strains with soil types and crops.

The suitability of phosphate-solubilizing strains with various soils and different crops were studied in pot experiment under greenhouse conditions. Phosphate-solubilizing strain P30-1and P31 are suitable for Sierozem and corn; strain P24-3 and P40-1 are suitable for Vertisol -winter wheatsustem; strain P24-5, P36-1 and P31 are suitable for Paddy soil and canola; strain P30-1and P36 are suitable for Salinized Chao soil and canola; strain P2-1A and P21% for ALBISOL and corn; strain P2-1A, P41-3Aand P36 for Chao soil and wheat; strain P21 and P36 for Chao soil and corn system; atrain P2-1A, P30-1and P41-3A are suitable for Drab soil corn; strain P30-1, 41-3A, P36 and P2-1A are suitable for Chernozemic soil and corn system; strain P36, P10-7and P30-1 are suitable for Black soil and soybean system; strain P36, P21 and P10-7 are suitable for Black soil and corn condition.

2. The experiment results of phosphate-solubilizing biofertilizer in field conditions

Eight phosphate-solubilizing biofertilizers were developed based on above research results. Field experiments to evaluate the effects of the biofertilizers were conducted in Hebei Province and Heilongjiang Province.

2.1. effects of 4 kind of biofertilizers on soybean yields in Heilongjiang

Compound fertilizer at a rate of 25kg/666.7m^2 as N-P_2O_5-K_2O 15-15-15 was applied to all treatments. Four kinds of phosphate-solubilizing biofertilizer were tested and each was applied at a rate of 15 kg/666.7m^2. The results showed that biofertilzer can increase soybean yield compared to control (CK). Application of No.1, No.5, No.6, and No.7 biofertilizer have increased soybean yield by 16.0%, 9.8%, 6.3% and 2.4 % in Longmen Farm and by 14.9%, 10.6%, 6.1% and 13.7% in Keshan County in Heilongjiang Province (**table 1**). Biofertilizer No.1 had got the highest yield of soybean in both sites.

Table 1. Effects of 5 biofertilizers on soybean yields in black soils

Location	Biofertilizer No.	N-P_2O_5-K_2O 15-15-15 (kg/666.7m^2)	Grain number of a plant (grain)	Weight of 100 grains (g)	Yield (kg/666.7m^2)	Yield increase (%)
Longmen Farm	1	25	39.8	19.2	229.5a	16.0
	5	25	38.1	19.0	217.1a	9.8
	6	25	36.9	19.0	210.2a	6.3
	7	25	38.8	19.1	222.4a	12.4
	CK	25	34.9	18.9	197.8b	
Keshan County	1	25	41.0	19.3	237.2a	14.9
	5	25	39.4	19.3	228.3a	10.6
	6	25	38.2	19.1	219.0a	6.1
	7	25	40.6	19.3	234.8a	13.7
	CK	25	36.4	19.0	206.5b	

2.2 Effects of phosphate-solubilizing biofertilizers on corn yields in field experiment in Cangzhou City, Hebei Province

Cmpound fertilizer as N-P_2O_5-K2O 17-6-22 was applied at a rate of 25 kg/666.7m^2 to all treatments. Five kind of phosphate-solubilizing biofertilizers were tested and each biofertilizer was applied at a rate of 25 kg/666.7m^2.

Application of No.4 biofertilizer increased corn yield by 11.45% and No.7 biofertilizer increased by 10.14% over control in Chao soil (**table 2**).

3.3 Effects of phosphate-solubilizing biofertilizers on corn yields in field experiment in Shijiazhuang City, Hebei Province

Chemical fertilizer at a rate of N 12.5, $P_2O_5$3.3 and K_2O 6kg/666.7m^2 was applied to all treatments. Five kind of phosphate-solubilizing biofertilizers as no.1, no.4, no.5, no.7, and no.8 were tested and each of them was applied at a rate of 25 kg/666.7m^2.

The results showed that no.4 biofertilizer had got the highest yield (average 695.84kg/666.7m^2) that increased by 34.21% compared to control; application of no.8 biofetilizre had got a significant higher yield (average 655.31 kg/666.7m^2), it increased by 26.39% above control (**table 3**). Other biofetilizer treatments had got a obvious increase of corn yield compared to control.

Table 2. Effects of biofertilizers on corn yields in Cangzhou city (kg/666.7m^2)

Replication	Biofertilizer No.					
	CK	2	3	4	7	8
1	520.9	521.1	571.5	589.6	574.5	564.4
2	525.0	537.4	564.3	580.8	582.2	568.2
3	534.6	528.9	578.6	590.9	584.0	571.1
mean	526.8b	529.1b	571.5a	587.1a	580.2a	567.9a
Yield increase	-	2.3	44.7	60.3	53.4	41.1
Increase rate %	-	0.44	8.49	11.45	10.14	7.8

Table 3. Effects of biofertilizers on corn yields in Shijiazhuang City (kg/666.7m^2)

Location	Biofertilizer No.	N-P_2O_5-K_2O (kg/666.7m^2)	Yield (kg/666.7m^2)	Yield increase (kg/666.7m^2)	Increase (%)
Shijiazhuang City	CK	12.5-3.3-6	518.46d	-	-
	1	12.5-3.3-6	640.44b	121.98	23.50
	4	12.5-3.3-6	695.84a	177.38	34.21
	5	12.5-3.3-6	555.42d	36.96	7.13
	7	12.5-3.3-6	619. 97c	101.51	19.58
	8	12.5-3.3-6	655.31b	136.85	26.39



Demonstration & field experiment of phosphate-solubilizing biofertilizers **Biofertilizer Product**

Evaluation of Bio-Organic Fertilizer to Substitute Partly an Inorganic Fertilizer for Sustainable Rice Cultivation

Dr. Iswandi Anas and Dr. Muchlis M. Bakrie
National Nuclear Energy Agency and Bogor Agricultural University, Indonesia

Background

More than 73% of agricultural soil in Indonesia including rice field have been degraded as indicated by low organic matter content of the soil. Although the dosage of inorganic NPK fertilizers was increased, there was no significant increase of yield was observed. Irrational application of pesticides with a high dosage caused serious environmental pollution. In the last few years, the price of raw materials for phosphorous and potassium fertilizers increased tremendously. The use of good quality of organic fertilizers is the best alternative to cope all problems mentioned above. Organic fertilizers can be improved their quality by using beneficial soil microbes such as *Azotobacter, Azospirillum* and phosphate solubilizing fungus. It is known as bio-organic fertilizer. However, farmers are reluctant to use a big amount of organic fertilizer.

To make it attractive to the farmers, granule form of bio-organic fertilizer is a good choice and the dosage is kept at the rate of hundreds kg per ha.

Aim of the study was to study the ability of bio-organic fertilizer to reduce the dosage of inorganic NPK fertilizer without reducing yield

Treatments:

A1 = Conventional rice cultivation; A2 SRI rice cultivation; P0 = Without fertilizer; P1 = 100% Inorganic Fertilizer (Urea 200kg; SP-36 75 kg; KCl 50kg; P2 = 75% Inorganic Fertilizer + BIOST 200kg; P3 = 50% Inorganic Fertilizer + BIOST 200kg; P4 = 50% Inorganic Fertilizer

BIOST contains *Azotobacter, Azospirillum* and phosphate solubilizing fungus.

Results:

Table 1. Number of tillers under Conventional rice cultivation and SRI with different inorganic and bio-organic fertilizer (BIOST) combination (Muchlis, 2010)

Treatments	Plant age (days after transplanting)				
	14	28	42	56	70
	Plants per hill $^{-1}$				
Rice Cultivation					
Conventional	7,7a	18,8a	19,1b	16,5b	15,7b
SRI	2,2b	6,3b	24,9a	28,1a	25,8a
Fertilization					
Without Fertilizer	4,5a	10,5a	19,6b	20,9b	16,9b
100% Inorganic NPK	5,1a	13,2a	22,7ab	23,7ab	22,8a
75% Inorg +200 kg Bio-organic Fert.	5,0a	13,3a	22,4ab	23,6ab	21,0ab
50% Inorg +200 kg Bio-organic Fert.	5,7a	13,9a	24,5a	25,3a	23,9a
50% Inorg	4,5a	11,9a	19,8b	20,4b	19,4ab

Table 2. Effect of rice cultivation system and combination of in-organic and bio-organic fertilizer on yield of rice

Fertilization	Yield at Harvesting		Dry Yield	
	Conv	SRI	Conv	SRI
	ton ha^{-1}			
Without	4,50f	5,69d	3,42f	4,44d
100% Inorg	6,13c	7,75a	4,90bc	6,72a
75% Inorg +200kg Bio-organic Fert.	5,55d	6,49b	4,40cd	5,16b
50% Inorg +200kg Bio-organic Fert.	6,01c	7,94a	4,62cd	6,77a
50% Inorg	4,98e	6,09c	3,83e	4,99b
Average	**5,43b**	**6,79a**	**4,23b**	**5,61a**

Table 3. Effect of rice cultivation system and combination of in-organic and bio-organic fertilizer on N, P and K up-take

Treatments	Up-take		
	N	P	K
	g hill^{-1}		
Rice Cultivation Method			
Conventional	0,182b	0,024b	0,219a
SRI	0,308a	0,037a	0,243a
Fertilization			
Without	0,093c	0,011c	0,102c
100% Inor	0,274b	0,031b	0,258b
75% Inorg +200 kg Bio-organic Fert.	0,298b	0,033b	0,242b
50% Inorg +200 kg Bio-organic Fert.	0,381a	0,049a	0,374a
50% Inorg	0,164c	0,019c	0,161bc

Figure 1.
The performance of subtitution of NPK inorganic fertilizer with biofertilizer at conventional rice cultivation (left) and SRI rice cultivation methods

Conclusion:

1. Bio-organic fertilizer application can replaced 50% inorganic NPK fertilizer with the same yiled as 100% NPK Inorganic Fertilizer.
2. The effect of bioorganic fertilizer is more in SRI cultivation method compared to conventional rice cultivation method.

Biofertilizer: showing its presence in the Malaysian agricultural scene

Khairuddin Abdul Rahim, Malaysian Nuclear Agency (Nuclear Malaysia)

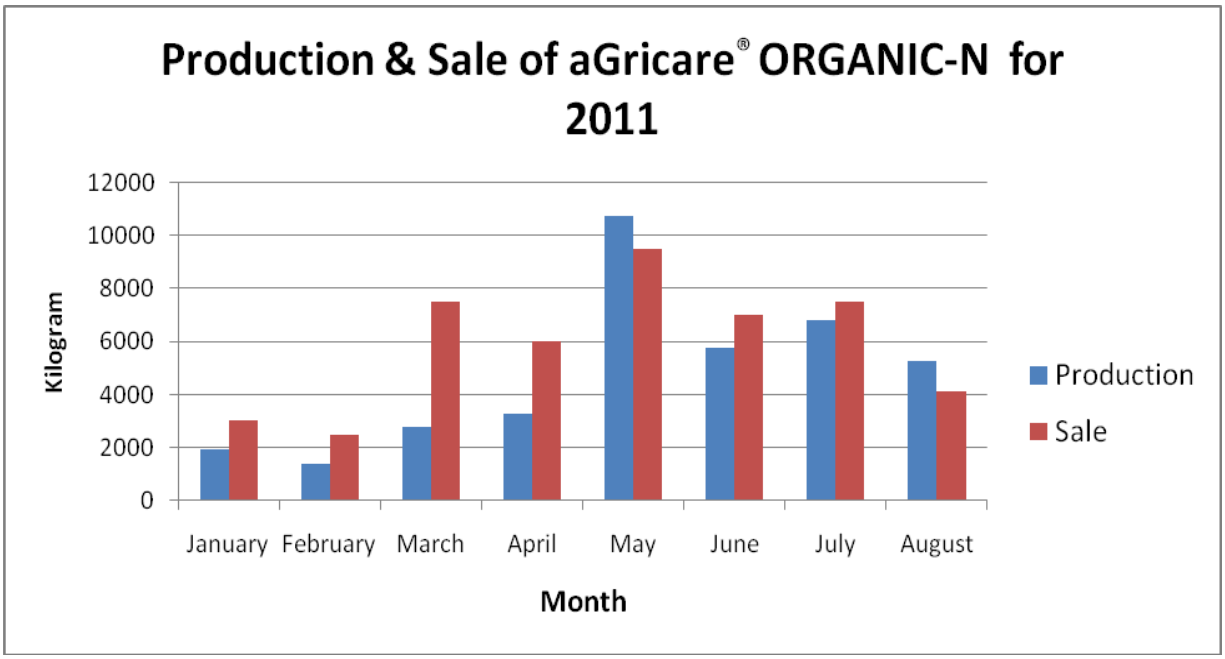
The year 2011 has seen significant inroads by biofertilizers in the Malaysian agroindustry, through determined efforts by researchers in the field over the years, and the increasing acceptance by the plantation industries involving the country's most important commodities, oil palm and rubber. Through the platforms of Sustainable Development and Green Technology, biofertilizer has positioned itself well, and with proper support through continuous R&D and innovation in the public and private sectors, it will provide an impact in Malaysian agriculture. It is indeed common nowadays to see biofertilizer products displayed in expositions or exhibitions and being entered in competitions on innovation and new products awards. That this undertaking is also supported by traditional users of chemical fertilizers and other agrochemicals, is indeed refreshing, and gives a glimmer of hope for further successes.

Malaysian Agri Hi-Tech Sdn. Bhd. (MYAGRI), the bioproducts company with BioNexus status, which utilises culture of Bacillus megaterium, a biofertilizer inoculum generated through R&D of Malaysian Nuclear Agency in one of its products, agriCare® ORGANIC-N, produced about 40 t of the product in 2011, with a reportedly increasing demand until the present. B. megaterium is well known of its phosphate solubilising properties. However, in our earlier study it has been shown to exhibit biological nitrogen fixing capabilities, thus making it a potentially multifunctional biofertilizer organism. MYAGRI is also one of Malaysia's biofertilizer companies actively utilising Nuclear Malaysia's gamma irradiation facility, MINTec-SINAGAMA, to irradiate substrates in its bioproducts formulations. In the Bioinnovation Award at BioMalaysia 2011, MYAGRI bagged 'The Most Promising Innovation Award' for one of its bioproducts used in rice and other crops.

R&D involving biofertilizer microorganisms has also flourished in the past year. At the home front, Nuclear Malaysia received a ScienceFund grant for the project "Elucidating interactions of phosphate biofertilizer on rhizobacteria and their effect on uptake of phosphorus and nitrogen using isotopic tracer technology". This two-year project will produce at least one multifunctional biofertilizer formulation, and one of its target crops is rice grown under minimal water condition. Most of the rice in Malaysia is cultivated under the flooded system, where much water is being utilised under regimented government-aided irrigation schemes. The mutation breeding of rice to suit cultivation under minimal mater regime or aerobic condition provides a new potential area where biofertilizer can play an important role, especially in complementing the agrochemical inputs. Under aerobic condition, many biofertilizer microorganisms could be tested, including the arbuscular mycorrhiza. This opens a new phase for biofertilizers in the coming years. The universities are also actively conducting research on

biofertilizer organisms, through the Fundamental Research Grant Scheme and others, targeting on multifunctionality, namely, plant growth promoting, dinitrogen fixing, phosphate solubilising and potassium solubilising, for crops such as oil palm, pepper, vegetables and rice. This bodes well for the agriculture industry as there are still many indigenous microorganisms with potential to be explored and developed.

At national level biofertilizer has also being positioned in new projects on the scopes of Green Technology, Food Production Technology and Innovation, Crops Adopting to Climate Changes and the current development project under the Tenth Malaysia Plan (2011-2015). The future looks bright for biofertilizer and the Malaysian agriculture sector.



(source: MYAGRI)

Product from MYAGRI utilizing *Bacillus megaterium* cultures produced by Malaysian Nuclear Agency
(photograph, source: MYAGRI)

Bio N™: Biofertilizer Technology as an Alternative Source to Nitrogen Requirement of Tomato and Eggplant

Julieta A. Anarna, University of the Philippines Los Baños (UPLB)

Introduction

Tomato (*Lycopersicum esculentum* Miller) and eggplant (*Solanum melongena*) are the two most important crops produced by the Filipino farmers. These solanaceous crops require large amount of nitrogen. Most of the farmers cannot afford to apply the right amount of nitrogen fertilizer due to its high cost, hence they cannot get better yield.

The application of *Bio N*™ a microbial inoculant in powder form that contains 2 species of nitrogen-fixing bacteria have been recognized by Filipino farmer. *Bio N*™, the nitrogen fixing inoculants that were initially developed for rice and corn have now been of interest for use in other test crops to improve the yield and at the same time reduce the chemical nitrogen input.

The need for generating more data on the response of *Bio N*™ to new crops are very essential to convince more farmers on the *Bio N*™ usage.

Materials and Methods

Seeds of tomato c.v Atlas and eggplant c.v Casino were sown in trays containing sterile coconut coir dust and garden soils as the germination medium. Two weeks after, both tomato and eggplant seedling was pricked/ transplanted to plastic cups and hardened for 5 days before these were transplanted to the field. The experimental field area was at BIOTECH demo farm.

The amount of fertilizer that was used in this field test was based on the general fertilization recommendation used by the Institute of Plant Breeding in the absence of soil analysis. This consisted of a basal application of 10 grams/hill of complete fertilizer (14-14-14). Ten days later and 2 weeks thereafter, 1 tbsp of a combination of 2 parts Urea (46-0-0) and 1 part muriate of potash was applied as side dress to each plant.

The trial was conducted at the BIOTECH Demo farm and the set up was laid in a Randomized Complete Block design (RCBD) with 4 replications using the FPA protocol. The plot size was 10 square meters and the seedlings were distanced at 50 cm. between hills. Each furrow had 10 plant population.

The following treatments were used in the experiment:

T1 = Control (unfertilized, uninoculated)

T2 = Recommended Rate of Chemical Fertilizer (RRC)

T3= ½ RRC

T4 = ½ RRC + *Bio N*™

T5 = *Bio N*™ alone

T6 = Full RRC + *Bio N*™

Significant Findings

Tomato: The results on tomato conducted at BIOTECH-UPLB statistics showed that all the treated plants demonstrated an increase in yield over the control or untreated plants. The particular variety under the Biotech demo site can only produce 20 tons of fruits if unfertilized. Inoculation with *Bio N*™ can yield 27.83 tons/hectare, which is 35.77% more than the unfertilized plants. The highest was observed in plants that was fully fertilized which is 38.6 tons per hectare, fallowed by ½ recommended rate of nitrogen fertilizers rate in the presence of *Bio N*™. This field data once more confirmed the results from the previous field trial using c.v Diamante as the test plant that inoculation of tomato with *Bio N*™ in the presence of modest amount of inorganic fertilizer can produce a yield comparable of higher than the fully fertilized counterpart which means a saving of half of the required fertilizer input. The yield responses to treatments were within the range of the national potential average of 20-30 tons per hectare.

Table1. Effect of chemical fertilizer and *Bio N*^{TN} inoculation on yield of tomato c.v Atlas under the BIOTECH demo farm, DS 20011.

Treatment	Yield (ton/ha)	% Inc. Over Control
T1 – Control	20.50 B	-
T2 – Full Recommended Rate	36.29 A	77.03
T3 – ½ Recommended Rate	24.91 B	21.54
T4 – *Bio N™*	27.83 B	35.77
T5 – Full Recommended Rate + *Bio N™*	38.6 A	88.13
T6 – ½ RR + *Bio N™*	37.8 A	84.47
C.V – 16.32%		

Eggplant: The results (Table 2) show that the yield of eggplant increased in all treatments over control. However, the increased in yield varied in all treatments. The highest yield 7.2 tons per hectare was recorded in fully fertilized treatments with the presence of *Bio N™* with 91.82 % over the control and has a 38% increase in yield over full recommended rate of fertilizer. The next higher yield was obtained from Treatment 6 with 84.72 % increase over the control and 31.74 % increase over Treatment 3. Although the yield response of each treatment were not within the national potential average of 30 - 40 tons per hectare, the results of the study revealed that *Bio N™* contributed to the yield of the test plant in this experiment.

Table 2. Effect of chemical fertilizer and *Bio N™* inoculation on yield of eggplant c.v Casino under the BIOTECH demo farm, DS 20011.

Treatment	Yield (ton/ha)	% Inc. Over Control
T1 – Control	3.75 C	-
T 2 – Full Recommended Rate	5.22 BC	39.07
T3 – ½ Recommended Rate	5.26 BC	40.31
T4 – *Bio N™*	5.95 AB	58.61
T5 – Full Recommended Rate + *Bio N™*	7.2 A (38%)	91.82
T6 – ½ RR + *Bio N™*	6.93 AB (31.74%)	84.72
c.v – 16.97		

Summary and Conclusion

The two field experimental set ups for tomato and eggplant were conducted at BIOTECH-UPLB demo farm based on soil analysis. The treatments that were used for field trial at BIOTECH demo farm were control (no fertilizer, no inoculation), full recommended rate, ½ recommended rate, ½ recommended rate plus *Bio N™*, *Bio N™* alone and full recommended rate plus *Bio N™*. The experiments were laid out in Randomized Complete Block Design (RCBD) with three replications. The data were subjected to statistical analysis (ANOVA) and Duncans Multiple Ranger (DMRT) in case of treatment differences at 5% level of significance.

Based on the results from the experiments it is concluded that *Bio N™* inoculation complement the amount of nitrogen fertilizer requirement of the test plant was comparable to the yield of fully fertilized plots. It also showed that *Bio N™* inoculation response to modest amount of N fertilizer.

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Biofertilizer Status in Thailand

Sompong Meunchang, Department of Agriculture (DOA)

Biofertilizer is the material consisted of the living microorganism which is able to supply the nutrients to the plant. In Thailand, the rhizobium biofertilizer is the first biofertilizer product and the output rose to 200 tons/year in 1995.

At present, we developed 4 types of biofertilizer product; 1) rhizobium 30 tons, 2) PGPR 5 tons 3) mycorrhizal 5 tons and 4) phosphate solubilizer 2 tons. These biofertilizers are used for different variety of crops. Rhizobium recommended applying with 44 genera of leguminous plant. PGPR biofertilizer recommended applying with maize, rice and sugar cane. Mycorrhizal biofertilizer recommended applying with 22 genera of plants, Now; it was said that the very popular mycorrhizal biofertilizer is for rubber tree. The phosphate solubilizing biofertilizer recommended applying with maize, vegetable and fruits.

In 2007, irradiation technology was agreed to be use for development of biofertilizer innovation in Department of Agriculture (DOA). DOA uses gamma ray for carrier sterilization of rhizobium biofertilizer, which expands production potential by increasing the survival number for one log and maintaining period to 24 months. In 2011, we use 50 kGy of electron beam for carrier sterilization and 30-150 Gy for developed mutant strains of Azotobacter and Beijerinckia. As a result, we got 5 strains of Azotobacter beijerickia and 5 strains of Beijerinckia mobilis which dinitrogen fixation ability measure by ARA was higher than parent strain 50%. For meet the high efficiency biofertilizer application in the field. We would focus on the specific plant and location of biofertilizer application research and development. Because of the specific of biofertilizer with each variety of plant and basic fertility of soil are main factors for responsibility of all biofertilizer groups.

Fig 1 Seed coated of maize with irradiation carrier of PGPR biofertilizer (a) and the early growth respond of maize seedling at 10 days. (b)

Multi-functional Biofertilizer Research and Development in Vietnam

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Multi-functional biofertilizer play an important role for sustainable agricultural production in Vietnam. Research and development of multi-functional biofertilizer carried out in many research organizations and universities. From 2008 to 2011 more than 35 new N-fixing, P-solubilizing, plant growth promoting microbial strains are selected and used for production. Technologies for multi-functional biofertilizer production are developed and transfer to 6 production companies in different locations. Multi-functional biofertilizer incorporated with organic fertilizer are applied for rice, groundnut, soybean, vegetable, cotton, coffee, pepper and forestry trees in different locations and able to increase crop yield from 10 to 35%, reduce plant root disease and save 20 - 30% of required chemical N and P fertilizers. In frame work of FNCA biofertilizer project, the plan for multi-functional biofertilizer research and development in Vietnam during 2008 - 2011 is follows:

a. Selection of the combination of microorganism having the activity related to plant nutrition, plant growth promoting substrate, plant and soil health;
b. Studying the carriers from irradiated material;
c. Evaluation of the benefit of microorganism to plant and soil health;
d. Production and application of multifunctional biofertilizer;
e. Promoting the expand of biofertilizer use.

In 2011 some main activities are concentrated on:

a. Biofertilizer production: Establishing the multi-function biofertilizer production units in provinces.
b. Field experiments and demonstrations: carrying out 4 experiments to evaluate the efficacy of multi-functional biofertilizer on production of groundnut, vegetable, coffee, pepper and 5 demonstrations to show to farmers the effects of multi-functional biofertilizer on growth, yield and root disease control of groundnut, vegetable, coffee and pepper. Size of experiments and demonstrations are 200 - 300m^2 and 1 - 3 ha.

Results of multi-functional biofertilizer research and development in Vietnam in 2011 can be summarized as follows:

a. Biofertilizer production: The results of study on the capability of biofertilizer production in different locations showed, that it is possibble to establish the multifunction biofertilizer production unit in NgheAn, QuangNam Quangtri, Daclak, Daknong and Binhphuoc provinces. With the fund from Vietnam Ministry of Science and Technology 6 biofertilizer production units are established for 6 provinces in 2010-2011. Multi-function biofertilizer are applied for groundnut, vegetable, coffee and pepper.

b. Effect of Multifunction biofertilizer

- Multifunction biofertilizer can improve the growth and yield of groundnut and vegetable which can replace the N mineral fertilizer without the significant change of groundnut and vegetable yield in Nghean province.
- Biofertilizer incorporated with organic fertilizer can reduce the the root disease of pepper, coffee, increase the yield and bring higher benefit for the farmers in Quangtri, Daclak, Daknong and Binhphuoc provinces.

c. Promotion on biofertilizer production and application: 20 technical training courses are organized in NgheAn, QuangNam Quangtri, Daclak, Daknong and Binhphuoc provinces. 60 technicker and 600 farmers are qualified in biofertilizer production and application.

Effect of multifunctional biofertilizer on groundnut yield in Nghean province in 2011

Place	Yield (tons/ha)		% Increase to FM
	Biofertilizer	Farmer practis (FM)	
Nghi Khanh – Nghi Loc	4.01	3.31	21.14
Dien Phong - Dien Chau	4.53	3.82	18.59
An Hoa - Quynh Luu	4.42	3.64	21.43
Averadge	**4.33**	**3.59**	**20.61**

Production of multi-functional biofertilizer

Multi-functional biofertilizer application to the crops