

Parallel Session Summary on Biofertilizer Project

Session 1 Country Report

Ten countries reported research progress for 2016. Summaries of their reports are as follows.

1) Bangladesh (Dr. Md Kamruzzaman Pramanik, BAEC)

As the application of biofertilizer renders eco-friendly agricultural practice, research has been undertaken to explore and apply different type of potential biofertilizers to increase crops yield. Besides, a comparative study on the effect of sterilization methods of carrier for biofertilizer was conducted and radiation-sterilization method was found slightly better than autoclave-sterilization. Synergistic effect of PGP and biofertilizer was also studied but significant effect has been not confirmed yet.

2) China (Dr. Fan Bingquan, CAAS)

1. High effective P-solubilizing and antagonistic strains against pathogen fungi have isolated from soils. Most of them are multifunctions, and some of them were already identified.
2. More than 10 kinds of biofertilizer were studied in greenhouse and field condition. The increase of tomato yield in various biofertilizer treatment in field are from 21 to 29%, the sunflower yields increased by 20-30%.
3. There was a positive effect between oligochitosan and biofertilizer. The maize biomass in treatment of oligo-chitosan with biofertilizer Y16 was increased by 20-25% than control.
4. We have conducted biofertilizer experiment in garlic plant in field, the results will be achieved next May.

3) Indonesia (Prof. Iswandi Anas, IPB)

Study on multifunctional of microbial strains able to solubilize phosphate and potassium has been carried out. We have collected several good multifunctional strains and these strains will be further tested for their ability to produce phytohormone for plant growth as well as for their ability to inhibit pathogen. Through FNCA collaborative research in 2017, the beneficial characteristics will be improved through mutation of these selected strains by using gamma irradiation as well as ion beam accelerator.

Synergistic effect of biofertilizer and oligochitosan and the use of super water absorbent (SWA) for several crops under different cultivation methods will be continued through collaborative research with EB FNCA Project Leader of Indonesia.

4) Japan (Dr. Shotaro Ando, JIRCAS)

Bacillus biofertilizer TUAT1 were inoculated to paddy rice with three different types of slow release fertilizers, but differences of fertilizers did not affect yield of rice. The relative values of amplified PCR band were highly correlated with the number of TUAT1 strain in soil, which

was counted by plate dilution method.

5) Kazakhstan (Ms. Olga Timofeyeva, “Promishlenoe snabzhenie” LLC)

In Kazakhstan, biofertilizer has not been produced yet and the first step for introduction should be set up within one year. Before introduction, several issues such as soil, culture, fungus strains, and materials will be discussed and researched. At the same time circumstances and industrial needs will be checked with accumulated data that we already have. We hope to invite all of you to Kazakhstan.

6) Malaysia (Ms. Rosnani Binti Abdul Rashid, Nuclear Malaysia)

Malaysia reported on advances in radiation mutagenesis study to generate multifunctional biofertilizer organisms, and discussed some progress in the investigation on synergy between biofertilizer and plant growth promoter (irradiated oligochitosan) in ornamental plant, leafy vegetables and rice. In addition strategies for extension of biofertilizer products to end users either via commercialisation or technology transfer, along with reporting on current publication and efforts to develop protocols for radiation sterilisation of new biofertilizer carrier material.

7) Mongolia (Dr. Delgermaa Bongosuren, IPAS)

In Mongolia most soils are low in nitrogen and phosphorus and the all chemical fertilizers are imported. The large-scale crop enterprises grow mainly wheat and potato.

At present new varieties of wheat and potatoes are being used by farmers. The need for generating more data on the response of biofertilizer to new varieties is very essential to convince more farmers on the Rhizobacterial biofertilizer usage. 6.0 tons of biofertilizer is produced and distributed to farmers in this year. The results showed that biofertilizer can increase soil fertility and biomass, as well as crop yield.

The pot experiment was carried out on synergy effect between bio fertilizer and irradiated oligochitosan on cucumber. The result showed that this novel biofertilizer increased yield.

8) The Philippines (Ms. Julieta Anarna, UPLB)

Two experiments were conducted to demonstrate efficacy of *Bio N* using new variety of rice and cultivar of corn used for human consumption as the test crops. The control plots used on rice experiment were the farmers practice and combination of Bio N was tested. All the plants applied with Bio N demonstrated increase in yield. Gamma irradiation sterilization dose of Bio N carrier is more effective in the sterilization of *Bio N* carrier using 20kGy and increased lifespan/storage of Bio N biofertilizer by 10 months. Continuous promotion and extension of Bio N technology through establishment of techno demo farms, briefing on the proper application and timing of technology were conducted. Demonstration for other crops such as vegetables and sugarcane were also established, Monitoring, quality control and technical assistance were extended continuously to the accredited manufacturers. Bio N inoculation can substitute or complement the amount of nitrogen fertilizer requirement of the test plant.

The combined application of biofertilizers and oligochitosan showed synergy effect by enhancing the growth and yield of the tests crop. Biofertilizers can play an important role in increasing production and improving the quality of food produced by farmers. Public confidence, trust and acceptance are key factors in determining the commercialization of biofertilizers in agriculture.

9) Thailand (Dr. Phatchayaphon Meunchang, DOA)

We continue to conduct research and development on the biofertilizer, and 4 types of biofertilizer; a) Rhizobium 37tons, b) PGPR 12 tons, c) Phosphate solubilizing fungi 2tons and d) Abuscerlar Mycorrhiza 3tons were produced and supplied to farmer in 2016.

PGPR biofertilizer using irradiated carrier by gamma ray was developed. It is being tested in farmer field at present and it will be disseminated to farmer. For this biofertilizer, prototype of production factory was developed and it will be set up at DOA research center soon.

10) Vietnam (Dr. Pham Van Toan, VAAS)

For multi-functional biofertilizer applying for peanut growing in sandy soil, the study concentrated on selecting the N-fixing, P-solubilizing, Cilicate solubilizing, and polysaccharid producing microorganism and testing the effect of multifunctional biofertilizer on peanut yield in Cathiep and Cattrinh commune, Phucat district, Binhdin province. As results, 4 microbes (*Bradyrhizobium japonicum*, *Bacillus megaterium*, *Paenibacillus castaneae* and *Lipomyces starkeyi*) were seleted for the multifunctional biofertilizer production based on the biological activity, the capability to adapt to sandy soil conditions and the improverment of nutrition uptake by peanut. The yield of peanut inoculated with multifunctional biofertilizer was 17% higher than control without inoculation. By using multi-functional biofertilizer, farmer can get an benefit of 7-12 million VND/ha more than farmer practist.

To study the synergy effect of irradiated oligochitosan and biofertilizer, the green house experiments with maize were carried out. The result showed that synergy effect between oligochitosan and biofertilizer was occured, but not significant. Season for it maybe the wrong application direction for oligochitosan. The experimenst should be repeated in the next year.

Session 2 Extension of Radiation Sterilization for Commercial Biofertilizer Production

Each country presented the status of using gamma irradiation for commercial production of biofertilizers. It was proven in each country that gamma irradiation was effective and efficient in sterilization that could enhance survival and shelflife of biofertilizers. This sterilization technique can be applied in large scale production. Although this technique is beneficial in biofertilizer production, there are limiting factors for the application namely the accessability, availability of the facility and relatively high irradiation cost for biofertilizer production.

Session 3 Development of Multifunctional Biofertilizer and Strategy for Extension to Farmers

Member countries isolated microbes for screening the multi-functional biofertilizes that supply

nutrients such as nitrogen, phosphorous and potassium. Some member countries extended the multi-functional biofertilizer application to the farmers by mean of field trial in farmer and cooperative fields. Philippine, Thailand, Malaysia, Vietnam, Indonesia and other FNCA members started extending multi-functional biofertilizer to the end users.

Session 4 Evaluation of Experiment for Synergistic Effect of Biofertilizer and Irradiated Oligochitosan, Plant Growth Promoter, in 2016 and Future Prospects

The study on the synergistic effect of biofertilizer and irradiated oligochitosan was evaluated. It was agreed to continue this research until 2017. Main target crops will be rice, tomato, and chili in proper treatments with suitable application of chemical fertilizer.

Proposal to Electron Accelerator Application Project

- 1) Nutrient content of materials should be informed.
- 2) Same oligochitosan product from China, Malaysia, Thailand or Vietnam would be provided to member countries of biofertilizer project.
- 3) Not only yield data but also some parameters should be measured to show the advantage of materials. For example, in order to show the effect of plant growth promotion by enhancement of nutrient uptake, nutrient content (nutrient concentration x dry weight of plant) should be measured. In order to show elicitor effect, ratio of occurrence of disease should be measured.
- 4) Joint workshop in 2017 is proposed to continue information exchange.

Session 5 Development of Publication for Compared Effect of Radiation Sterilization and Autoclave

Sterilization of carriers for biofertilizer using gamma irradiation gave better results compared to autoclaving. Gamma irradiation sterilization slightly changes the properties of carriers but autoclaving changes the carrier properties significantly especially when mineral soil is used as carrier. Gamma irradiation at the rate of 30 kGy is mostly suitable for most of microbial inoculants such as mineral soils, peats, compost, zeolite, perlite etc. These findings will be published in Indonesia, Philippine, Thailand and Vietnam. China and Malaysia have already published new paper on this issue.

Session 6 Development of FNCA Guideline for Biofertilizer Quality Assurance and Control

Procedure to submit the articles for the “FNCA guideline Volume II: Production of Biofertilizer Carrier Using Radiation” is discussed. Based on previous draft, responsible person for each topic to provide the articles was agreed. Comparison of gamma irradiation and autoclave for carrier sterilization in China and the Philippines will be added. Published papers on comparison of radiation sterilization and autoclave of carrier will be included in this guideline. The deadline to submit the edited articles is on March 30, 2017. Dr. Khairuddin Bin Abdul Rahim, PL of Malaysia will be the chief editor and NSRA will have responsible as secretariat of this guideline. This guideline will be published before the end of this phase of project.

Session 7 Project Activity Plan for 2017

Project activity plan for 2017 was discussed and agreed as follows;

- 1) Development of the multifunctional biofertilizer,
- 2) Evaluation of the synergistic effect of biofertilizer and irradiated oligochitosan,
- 3) Accumulation of the data of the advantage of radiation sterilization of carriers in comparison with autoclave sterilization,
- 4) Publication of “FNCA Guideline Vol.2 Production of Biofertilizer Carrier Using Radiation”.

Session 8 Summary of Parallel session for Biofertilizer Project

The summary of parallel session on Biofertilizer Project was discussed and agreed by all participants.