

Annex 5. Conclusion and Recommendation

Conclusion and Recommendation

1. The meeting recognized that progress has been achieved to prove the better shelf life and QA/QC of biofertilizer produced by using carrier which is sterilized by radiation than those of sterilized by autoclaving with steam.
2. The meeting agreed that Project Leaders will take strategic actions described in attachment-1 in order to achieve the extended use of irradiated carrier instead of autoclaved carrier for commercial production of biofertilizer because of advantage of radiation sterilization as described in the para 1.
3. The meeting took note that synergetic effects between biofertilizer and oligo-chitosan for disease control of tomato rice and cabbage.
4. The meeting recommends that a common protocol should be set up for testing synergetic effect between biofertilizer and oligo-chitosan for disease control of crops.
5. Meeting appreciates Dr. Ando and Dr. Phatchayaphon for preparation of draft FNCA Guideline for Biofertilizer.
6. Meeting agreed that all PLs will review the Guideline to inform comments to revise and refine the draft in order to complete the Guideline before end of JFY2013.
7. Meeting agreed that the title of the biofertilizer guideline is changed to “FNCA Guideline for Biofertilizer” with two volumes of Vol. 1 Quantification of Beneficial Microbes in Biofertilizer for Quality Assurance and Control and Vol. 2 Production of Biofertilizer Carrier Using Radiation Technology, and Vol. 2 will be prepared in JFY2014.
8. Meeting agreed that the Guideline will be published on the home page of FNCA BF Project which anyone can access to benefit all stakeholders.
9. Meeting took note that multifunctional biofertilizer is under study in Member countries by simultaneous application of more than two species of microorganism which has different function, and developing mutant of microorganism induced by gamma ray or ionbeams.
10. Meeting noted that a multifunctional biofertilizer (Mamezou) which is mixture of Azospirillum and Rhizobia is in commercial market by Tokachi Noukyouren in Japan.
11. Meeting took note that mixture of different species of microorganism (AP1, AP2, AP3) which have function of antagonistic to bacterial wilt, phosphate and potassium solubilizing, and nitrogen fixing will be commercialized when the company find enough size of market in Malaysia.
12. Meeting agreed the Plan in JFY2014 as Attachment 2

Attachment 1

The strategy for commercial application of radiation sterilization of carries in FNCA Member Countries.

Malaysia

1. Irradiation of carrier for sterilization has been used successfully for commercial production of biofertilizer by private company (MYAGRI) since 2009.
2. For irradiation of carrier the Co-60 radiation service facility of MINTec-SINAGAMA at Nuclear Malaysia is used.
3. Expansion of application of irradiated carrier by other biofertilizer producer depending on market.

China

1. The PL will find biofertilizer producers which have interest in using radiation sterilization instead of autoclaving, and explain the advantages of radiation sterilization.
2. The PL will contact with CNNC (China National Nuclear Corp.) and/or private companies for radiation services in order to irradiate the carrier in commercial scale.
3. Biofertilizer company irradiates carrier by existing radiation facility of CNNC or other company.
4. Biofertilizer company should prove that better quality biofertilizer can be produced by using irradiated carrier than autoclaving with the support of the PL.
5. The biofertilizer companies will start commercial production of biofertilizer using irradiated carrier.

Thailand

1. The PL has proved by experiments that radiation sterilization of carrier is better than steam autoclaving in terms of quality of biofertilizer.
2. The PL will transfer the technology of sterilization of carrier by radiation to biofertilizer producer.
3. Biofertilizer producer will irradiate carrier for sterilization by using radiation service facilities for commercial production of biofertilizer.

Vietnam

1. The PL will find company to produce inoculum in industrial scale, and to produce biofertilizer for commercial application.
2. The PL will guide the company to produce biofertilizer using irradiated carrier.
3. Biofertilizer company irradiates carrier by the existing radiation facility of Vinagamma of VAEI for commercial biofertilizer production.

The Philippines

1. Radiation sterilized carrier has been used for commercial production of Bio-N.
2. Capacity of radiation service facility of PNRI is not enough for increasing amount of

irradiated carrier production for other type of biofertilizer.

3. Recommending government to construct a new multi-purpose radiation facility for biofertilizer, mutation breeding, food irradiation, SIT under UPLB. If this is not possible, it is recommended that capacity of radiation facility of PNRI should be increased.
4. Using irradiated carrier to produce other type of commercial biofertilizer in addition to Bio-N for improved QA/QC.

Mongolia

1. Formulation of government policy about biofertilizer application to enhance sustainability of agriculture in Mongolia.
2. Encouraging Mongolia Nuclear Energy Agency to install multi-purpose radiation facility which can be used for irradiation of carrier.
3. Demonstration of using irradiated carrier for biofertilizer production.
4. Making strategy to produce biofertilizer in commercial scale.

Attachment 2 Project Activity Plan for 2014

1) Extension of Radiation Sterilization for Commercial Biofertilizer Production

1. The meeting recognized that progress has been achieved to prove the better shelf life and QA/QC of biofertilizer inoculant produced by using carrier which is sterilized by radiation than those of sterilized by autoclaving with steam.
2. Dr. Machi proposed to compile data of beneficial effects on irradiation carriers to keep biofertilizer organisms in comparison to autoclave carriers.
3. One possible challenge is making a paper to submit an international academic journal using data obtained from all country members.

2) Development of Multifunctional Biofertilizer and Strategy for Extension to Farmers

1. Every member countries worked on multi-functional biofertilizer, by using single strain that had multifunction, or multi-strain inoculants that had different function.
2. For the plan in JFY2014, all members will continue to study on combination of microbes to find multi-functional biofertilizer, to develop production technologies of each member country, and to evaluate the economic benefit of multi-functional biofertilizer for extension to farmers.
3. Mutant having the beneficial multi-function will be developed by mutation induced by irradiation.

3) Evaluation of Experiment for Synergistic Effect of Biofertilizer and Irradiated Oligochitosan

1. We have several positive synergy effects between biofertilizer and irradiated oligochitosan in this year.

2. In case of Vietnam, application of a P-solubilizing *Bacillus* biofertilizer with 300 ppm of oligochitosan treated with soil and leaves clearly inhibited the bacterial wilt of tomato caused by *R. solanaceum*. In case of Mongolia, application of a multistrain biofertilizer containing *Azospirillum*, *Azotobacter* and *Azoarcus* with 100 ppm of oligochitosan applied to leaves at every 2 week did not show a reduction of tomato yield under a *Fusarium* contaminated soil. And in Malaysia, application of 40 ppm of oligochitosan at 1week before application of a multistrain biofertilizer containing *Klebsiella* and *Enterobacter* significantly increased rice yield under a pot experiments.
3. All country members agreed with further test to confirm synergistic effect of biofertilizer and irradiated oligochitosan. And, all country members recommend that a common protocol should be set up for testing synergetic effect between biofertilizer and oligochitosan for disease control.
4. The result of these experiments will be shared with the FNCA EAA Project.

4) Development of FNCA Guideline for Biofertilizer Quality Assurance and Control

1. Draft of “FNCA Guideline for Biofertilizer Vol.1 Quantification of Beneficial Microbes in Biofertilizer for Quality Assurance and Control” was proposed and way to finalize the revision was discussed and agreed in members. Chapter 2, 4, 5, 8, and 9 will be modified by experts from the Philippines, Thailand, Thailand, Vietnam, and China, respectively. This volume is planning to be published by PDF on the FNCA website in this fiscal year.
2. Contents and editorial process of Vol. 2 were also discussed and title is agreed to be “FNCA Guideline for Biofertilizer Vol. 2 Production of Biofertilizer Carrier Using Radiation Technology”. Draft of Vol. 2 will be prepared next year by expert from Malaysia.