Annex 3. Session Summary

Session Summary of FNCA 2018 Workshop on Mutation Breeding Project

Session 1 Follow-up on Sub-project on Sorghum and Soybean

Follow-up report on the Sub-projects in Sorghum and Soybean was presented. The summary is as follows:

1. Sub-project on Drought Tolerance in Sorghum and Soybean (Mr. Arwin, BATAN, Indonesia)

Soybean is an important food in Indonesia, to make tofu, *tempe* (fermented soybean), *kecap* (soy sauce) and so on. Soybean consumption in Indonesia is 2.5 million t/year, but the national production is only 0.9 t/year. Thus, the national soybean production is less than 40% of the national consumption, and Indonesia strongly depends on imports from USA and Brazil. To increase the national soybean production, Indonesia needs new varieties (high yield, resistant to major pest and diseases). Until now Indonesia has released 10 soybean varities via mutation breeding technique, and they has been disseminated in 20 provinces in Indonesia.

Session 2 Country Report on Mutation Breeding of Major Crops for Low-input Sustainable Agriculture under Climate Change

Nine member countries presented current progress and 5-year plan for the project on Mutation Breeding of Major Crops for Low-input Sustainable Agriculture under Climate Change. The brief summaries are as follows:

Bangladesh (Dr. A.N.K. Mamun, BAEC)

BINA Dhan -14 and BINA Dhan -18 are becoming more and more popular to farmers in the different area of Bangladesh and the cultivation area is also increasing. Recently, another variety called BINA Dhan -19 is released in 2017 from the parent variety NARICA-10. This mutant variety is selected from the seeds of NERICA-10 irradiated with 40 Gy of carbon ion beams at QST Takasaki in 2013. This new variety started to be cultivated in rain-fed condition in both Aus and Aman season in Bangladesh.

China (Prof. Shu Qingyao, ZU)

Mutation techniques, together with other molecular and biotechnological methods (anther culture, genomic editing, molecular marker assisted selection, etc.), will be deployed to breed new rice varieties for sustainable production under climate changes in China. In addition, new genetic and gene resources, breeding techniques and methods that could enhance breeding new rice varieties will also be developed.

Indonesia (Mr. Arwin, BATAN)

LISA (Low Input Sustainable Agriculture) for soybean

1. Zero tillage cultivation in paddy field after harvest of rice.
2. Low input cultivation using remaining nutrition in rice field.
3. Development and use of soybean varieties with early maturity and drougt tolerant under less water conditions in dry season.

Japan (Prof. Hirokazu Nakai, Shizuoka University)

Mutation breeding and/or cross breeding of rice for adaptability to low input sustainable agriculture and/or bacterial leaf blight resistance have been conducted in the condition of nature farming in these 14 years. We could select a number of breeding lines for adaptability to nature farming, which are to be registered as commercial varieties in the near future.

Malaysia (Dr. Sobri Bin Hussein, Nuclear Malaysia)

In order to meet the FNCA's theme "Mutation Breeding of Major Crops for Low-input Sustainable Agriculture under Climate Change", several treatments were conducted. The results showed that NMR 151 and 152 are the most suitable varieties to be planted under different climate conditions. On top of that, NMR 151 showed a moderately tolerant rate under salinity environment.

Mongolia (Dr. Dolgor Tsognamjil, IPAS)

The wheat mutant varieties developed including:

- Development of dual-purpose mid maturing mutant wheat variety Darkhan-141 is suitable for both purpose and registered as a perspective variety for food and feed.
- New wheat mutant variety Darkhan-172 (chemical treatment NaN_3) is early maturing (80-89 days) with high grain yield 1.72-2.53t/ha.
- The drought tolerance study with PEG6000 revealed that the wheat variety Darkhan-141 has good drought tolerance and the SOS1 and SOS2 genes are expressed in Darkhan-141.

Rice mutation breeding program started since 2014 and we succeeded selecting 125 plants, 219 panicles and 24 rows from M2-M5 generation.

The Philippine (Ms. Ana Maria S. Veluz, PNRI)

Three (3) traditional varieties of rice obtained from the Philippine Rice Research Institute namely Umangan, Native Borie and Licoy were irradiated with 250 Gy at a dose-rate of 3.683 kGy/hr. The seeds were sown and transplanted in the field but golden apple snails devoured most of the seedlings so the experiment was repeated. Irradiation with the same dose level and dose-rate was done and seeds were sown the following day and transplanted for growth and development.

Thailand (Dr. Kanchana Klakhaeng, RD)

Rice varieties which have resistance to biotic stress or tolerance to abiotic stress contribute to achieve low-input sustainable agriculture under climate change. This project aims to develop drought tolerant, photoperiod insensitive and early maturing rice lines/varieties using gamma ray and e-beam irradiation. M3 lines of IR57514-PMI-5-B-1-2 were screened for drought tolerance during Panicle Initiation (PI) stage, unfortunately, it's rain during PI stage. M4 lines were screened for blast disease. The result showed that 112 non-glutinous and 4 glutinous mutant lines were identified as blast resistant, in which the 4 glutinous mutant lines were composed of 2 early-maturing and 2 intermediate-maturing lines. Further information is still needed for releasing new rice varieties which are adaptable for low-input sustainable agriculture under climate change.

Vietnam (Dr. Le Huy Ham, AGI)

Mutation breeding has been actively involved in breeding of most important crops in Vietnam like rice and soybean.

For rice: During 2008-2018: 11 new mutant varieties have been developed, registered as new varieties and released to production, bring a lot of benefit to farmers. Like improvement of yield, reduction of chemical use and improvement of rice production efficiency. In rice from carbon ion beam irradiation, we have obtained promising lines for further evaluation in coming years: 6 lines (M7), 6 lines (M6), 31 lines (M5); and from helium ion beam irradiation, 27 M2 good mutants were selected in the first screening.

For soybean: We started soybean mutation breeding using Ion beam since new phase of the project 2018. Very first results of showed that ion beams induce large diversity of growth duration, plant height, plant structure and productivity of mutants.

It is defined lethal dose for 50% death of total plants (LD_{50}) was 60 Gy (with rice) and 50 Gy (with soybean) in carbon ion irradiation; 30 Gy (with rice) and 25 Gy (with soybean) in helium ion irradiation.