Annex 3. Session Summary

Session Summary of FNCA 2016 Workshop on Mutation Breeding Project

Session 1 Country Report on Application of Mutation Breeding of Rice for Sustainable Agriculture

Nine member countries presented progress and activity plan on the application of mutation breeding of rice for sustainable agriculture. The brief summaries are as follows:

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

BINA Dhan -14 are becoming more and more popular to farmer in the different area of Bangladesh. Bangla leaflets about the agronomic practice of BINA Dhan -14 is distributing to farmer to grow their interest about this rice. Finally one advance mutant line irradiated by carbon ion beam is selected from the mutant lines of BARRI dhan 29. This high yielding early mature line is released as new mutant variety called BINA Dhan -18. Three land races of rice collected from the southern part (costal area) of Bangladesh called Lombur, B-11 and Hori dhan are irradiated by carbon ion beam from Japan and further experiment is going on.

China (Prof. Shu Qingyao, ZU)

We revealed, at a single-nucleotide resolution and the genome-wide level, the types, frequency and distribution of mutations induced by gamma rays across different chromosomes and genomic regions. We demonstrated a lesion mimic mutant of Jiazhe B had enhanced resistance to the devastating pest insect, brown planthopper (BPH). We continued the evaluation and breeding of a few previously selected mutants. Two early maturing mutants, one semi-dwarf mutant, were bred into CMS lines.

Indonesia (Dr. Sobrizal, BATAN)

Through 200 Gy irradiated SKI 64, SKI 88, SKI 153 and SKI 276 lines, 12 homogeneous early maturity mutant lines were selected. Growth duration of mostly 12 lines were around 100 days from sowing to harvesting, they are significantly shorter than those of check varieties. To improve Diah Suci performance 6 and 7 promising lines were selected through ion beam irradiation and cross breeding techniques, respectively. All lines are under various examinations to fulfil the variety release requirements in Indonesia.

Japan (Dr. Hiroshi KATO)

Presenter proposed the hypothesis that we can directly acquire higher yield crop mutants like in microorganisms by a newly developed mutation breeding scheme. It was confirmed, but the gene effects for high yield were limited and might be caused by minor genes.

Malaysia (Dr. Sobri Bin Hussein, Nuclear Malaysia)

The project on rice mutation breeding in Malaysia for sustainable agriculture is progressing well as per scheduled. In order to comply with Malaysia regulations for registration, disease

screenings were also conducted on all the potential mutant lines. Thus, this studies indicated that NM2 (ML3), NM3 (ML10) and NM5 (NMR 151) could be slightly better candidate for foliar blast resistant as compared to NM1 (ML30) and NM4 (NMR 152).

Mongolia (Dr. Dolgor Tsognamjil, IPAS)

1. Rice

- In 2016 we are tested 38 rice variety, 14 varieties matured partially under irrigated condition. Highest yield given varieties were Hokkaido-10, Nanatsuboshi, Longjing-27 and Longjing-47. This year we started mutation breeding using M_3 generations of Hoshinoyume (100 Gy gamma ray) and M_2 generations of Nanatsuboshi (150 Gy gamma ray). Mutants of Hoshinoyume were matured 12 days earlier and mutants of Nanatsuboshi and 1 day earlier than control. We have selected 30 plants, 67 panicles from M_3 Hoshinoyume and 5 plants, 22 panicles with from M_2 generation of Nanatsuboshi.

2. Wheat

- In 2016 we are continued screening and selection of advanced mutant lines with improved mutant traits through field test. There are treated 4 wheat varieties and 3 rapeseed varieties by 2 different doses and increased potential mutant population. In the initial materials field we are planted 2406 lines of M_1-M_4 generation.
- Evaluation the promising mutants for improved traits and drought tolerance. Screened one mutant lines to drought resistance. In the yield trial which is final stage of breeding process, studied 4 mutant lines and early maturing Darkhan-196, mid late maturity lines Darkhan-205, Darkhan-210, Darkhan-209. Harvest index was 20.4% in early maturity mutant Darkhan-196. Yield not significantly increased compare than control but maturity was 6 days earlier than control. Gluten content was higher than control by 2.4%.
- In 2016 breeder seed production of mid maturing Darkhan-141 “Perspective” variety’s occupied 0.39 ha and harvested 0.4 t seeds. We have organized demonstration days among farmers to introduce new mutant varieties. In this farmer day participated 100 farmers

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

Selected mutants lines of two traditional (native) rice varieties namely Umangan and Native Borie were seeded for M3 generation planting through organic farming and sprayed with car rageen showed promising agronomic traits when harvested. Gamma irradiation had significantly affected the number of days to flowering, number of tiller/plant and number of seed/panicle in variety Umangan. Early flowering and increased number of tiller/plant was obtained in irradiated dose of 200 Gy and 300 Gy than in the control. High number of seed/panicle was obtained at treatment dose of 200 Gy as compared with 300 Gy and the control plants. In native variety Native Borie, the number of days to flower, plant height at maturity and number of tiller per plant were significantly affected by the radiation treatments in this generation. The treated plants flowered one week earlier than the control. Plant height was reduced at irradiated treatments and increased in number of tiller per plant as well in these treatment as compared to the control.

Thailand (Dr. Kanchana Klakhaeng, RD)

To screen for anaerobic germination ability, 4 deep water rice varieties (DWR) and 2 floating rice varieties(FR) were irradiated with e-beam. M4 plants were screened in the field condition and further work is being carried out in M5 & M6 generation.
To screen for submergence tolerance, 4 DWR, 2 FR and 9 HYV (high yielding rice) varieties were irradiated with e- beam. 317 mutant lines of RD31 were identified and M4 plants will be screened for disease and insect resistance with good grain quality. For the remaining varieties will be screened for further importance disease and insect with good grain quality.

Vietnam (Dr. Le Huy Ham, AGI)

Evaluation of gamma mutant DT 80 in spring and autumn season 2016 proved that this is an outstanding variety. In November 2016 it has been licensed to a seed company for further steps toward registration as national variety. As result of evaluation of the line derived from ion beam irradiation, two promising mutants were selected - D10 and D14 - for further evaluation in 2017.

Session 2 Follow-up on Sub-project on Sorghum & Soybean, and Banana

Follow-up reports on the Sub-projects in Sorghum & Soybean and Banana were presented respectively. The summaries are as follows:

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

So far, 3 sorghum and 10 soybean varieties have been released by BATAN. All released varieties have been growing largely and given significant economy impact to famers in Indonesia. Recently, sorghum and soybean breeding programs at BATAN focus on developing varieties with high grain yield and grain quality, early maturity and adapted to adverse conditions. Eight sorghum and 13 soybean promising lines have been selected and all lines are under various examinations to fulfil the variety release requirements in Indonesia.

2. Sub-project on Disease Resistance in Banana
(Ms. Ana Maria S. Veluz, PNRI, the Philippines)

Development of BBTV resistant Lakatan through gamma-irradiation had been successfully done as part of integrated management strategies against BBTV. Based on several disease reaction parameters used, five mutant lines namely lines 13-30-2, 22-28-2, 9-28-2, 9-28-3, 9-29-1, 23-30-2, and 28-30-2 were selected and were evaluated in multi-locations trials.
The project aims to make 'Lakatan' banana production more profitable to small farmers by reducing losses due to BBTV infection by 20% through adoption of disease resistant cultivars. Prior to commercialization of improved 'Lakatan' mutant lines, assessment of the agronomic, yield, and economic performance of the mutant lines across several locations in the country is currently being conducted. More than 20,000 plantlets from mutant lines were micropropagated and planted in yield and demonstration trials. To date, BBTV incidence in different trial sites ranged from 0.4 to 13.3%. The performance of the BBTV resistant mutant varieties varied depending on the specific locations The five mutant lines will be registered with the National Seed Industry Council (NSIC) as new Lakatan varieties.