FNCA Mutation Breeding Project

Five Years Plan of Sub-Project on improvement of Composition or Quality in rice (2008ver.)

Country	FY2007	FY2008	FY2009	FY2010	FY2011
Bangladesh		1) Collection of salt tolerant rice landraces from coastal regions. 2) Determination of protein and amylose content in the collected landraces. 3) Irradiation of seeds by different doses (250-400 Gy) of gamma ray. 4) Raising of M_1 generation in the experimental field. M2 generations are being raised in the field as well as fresh irradiations of Morichshail and Ashfall were done and M1 are now being grown in the field. 5) Development of embryogenic calli from mature seeds. 6) Establishment of regeneration system from embryogenic calli. In addition, irradiated seeds of Takshoyl were used to regenerate plants and 19 plants have been regenerated from those calli which are now growing in the pot and are now at the booting stage.	1) Collection of seeds from M_2 plants and raising of M_3 population in the experi- mental field for screening and selection. 2) Irradiation of embryogenic calli with different doses (20-60 Gy) of gamma rays. 3) Maintenance and scree- ning of calli onto MS/N6 medium added with 0.5-1.5% NaCl for 120 days with periodical subculturing. 4) Regeneration of M_1V_1 plants from surviving calli on NaCl-free medium.	1) Raising and evaluation of putative mutants in M_3 generation in the saline soil of coastal region for high protein, high amylose and high yield. 2) Raising and selection of M_1V_1 plants in NaCl-free soil to get M_2V_2 seeds. 3) Screening and selection of M_2V_2 plants for high protein, amylose and yield in pot culture treated with 0.5-1.5% NaCl under greenhouse condition.	1) Raising and evaluation of mutants in M4 generation in the saline soil of coastal region. 2) Raising of M_3V_3 in the fields of saline affected coastal areas for selection. 3) Evaluation of selected plants in the succeeding generations for protein content, amylose content, yield and salinity tolerance.

China	1) Harvest M1 generation seed 2) Selection of mutants with good plant character from M2 generation.	1) Purification of breeding materials (M3) 2) Analysis of amylose content from selected M3 generation to screen M4 lines with low amylose content 3) Select good M3 lines with low amylose content to cross with the other varieties with good quality	1) Purification of M4 lines and make cross with CMS lines and primary evaluation of restoring ability. 2) Growing F1 and F2 generation from cross of last yea and select good plant with desirable agronomic traits.	1) Mutant lines with good restoring ability crosses with more CMS lines for evaluation of heterosis. 2) Selection of (F3、F4) lines with good plant character and primary analysis of amylose content in F4 generation to preserve potential combinations	1) Possible combinations with good heterosis enter field trails 2) Selection of (F5、F6) lines with good plant character. 3) Amylose content analysis for selection of LAC lines , after then, make cross between selected LAC lines and CMS lines in 2011 and evaluation of restoring ability and heterosis in 2012 and 2013.
Indonesia	1. Construction of breeding materials cross between elite indica varieties (IR36, IR64, Diah Suci) and unique japonica varieties (Pandan Wangi, Rojolele, Koshihikari) 2. Development of M2 of KI 237 and KI 432.	Purification of breeding materials (M3, M4). Selection of early maturity and dwarf stature.	1) Multiplication of seeds of pure lines (M5 lines) 2) Screening the lines for amylose contents and other characters related to grain quality.	1) Screening the lines for amylase contents (Cont.) 2) Breeding for high yielding and grain qualities of rice varieties using selected lines	1) Breeding for high yielding and grain qualities of rice varieties using selected lines (Cont.) 2) Writing final report
Korea	**Color rice**				
	1) Collection of breeding materials from foreign and native rice germplasm 2) Irradiation of radiation (acute/chronic, gamma, ion beam) 3) Harvesting M2 seeds	1) Culturing M3 plants and selection of useful mutants 2) Analysis of functional compounds: Anthocyanin, Chrisanthemin (C3G; cyanidin 3-glucoside), tocoperol, etc.	M4-5 generation field trial, analyses of functional compounds and related molecular markers, and selection	Selection of promising lines	Local adaptability trials and registration

	Amylose library				
	1) Ilpumbyeo: irradiation of gamma ray with 250 dose 2) Harvested M2 seed	Culturing M2 plants and selection of amylose mutants after analysis of amylose content and seed morphology	1) Culturing M3 mutant generation and reselection after analysis and characterization 2) Molecular analysis using amylose mutants	Characterization and line selection	1) Construction of mutant library with various amylose contents 2) Selection of promising mutant lines for new variety
Japan	1) Research method : Use existing amylose variants 2)Research Object : Raise Koshihikari NILs relating to amylose 3)Expected achievements : Broadened amylose variants	1) Research method : Use mutagens such as gamma-rays and ion beams 2) Research Object : Screen amylose variants from primary varieties 3) Expected achievements : Creation of amylose library	1) Research method : Use mutagens such as gamma-rays and ion beams 2) Research Object : Screen amylose variants from primary varieties 3) Expected achievements : Creation of amylose library	1) Research method : Use mutagens such as gamma-rays and ion beams 2) Research Object : Screen amylose variants from primary varieties 3) Expected achievements : Creation of amylose library	1) Research method : Evaluate amylose library under various cultivation conditions 2) Research Object : Evaluate amylose library 3) Expected achievements : Completion of amylose library
Malaysia	Irradiation of seeds of advanced lines of MR 211, MR219, and MR 256, Q74 with gamma rays (re-irradiation) and ion beams Field screening of M1-M2 populations •At present 38 lines from M4 of MR211 (300 and 400Gy) and MR219 (300 and 400Gy) were selected for further testing. • Conducted preliminary analysis for amylase content • Conducted molecular screening for specific markers such as amylase	Line screening of selected mutant lines from M3-M4 Laboratory analysis of amylose content and total starch content. Molecular screening with specific microsatelitemarker • Planting and 15,000 M1 seeds of MR211 and MR219 (advanced lines) using 300Gy and 400Gy and harvest of M2 seeds • Preliminary laboratory test for drought resistance using PEG (Polyethylene Glycol) at 0,12, 20, 30, 40 and 50% PEG	Mutant confirmation in lab (PCR-based) and field condition Evaluating the promising mutants for high yield and quality traits (M5- M6) To screen potential mutant lines of MR 211, MR219, and MR 256, Q74 with low amylase and total starch content. Starch profiling using molecular techniques.	Yield trials of advanced mutant lines Advance Yield Trial of promising mutant line Quality evaluation of advanced mutant lines for Milling quality, physical quality, chemical and sensory	Adaptability study of selected mutant line in several location of grainy area Local varification Test/Regional trial at Farmer plot Release

		• Shoot elongation was inhibited at 40 and 50% PEG • Greenhouse screening for minimal water requirement was conducted using MR211 (300 and 400Gy) and MR219 (300 and 400Gy) • From 500 lines tested, 55 lines from M3 of MR211 (300 and 400Gy) and MR219 (300 and 400Gy) were selected based on average seed weight			
The Philippines	1) Irradiation of seeds 2) Determination of radiosensitivity to gamma radiation 3) Growing of M_1 generation 4) Planting of Htthe M2 generation	1) Identification of mutants in the M_2 generation 2) Planting M3 generation 3) Selection and Determination of amylose and protein content and other grain quality attributes.	1) Selection of mutants with improved grain quality in the M_4 nd later generations 2) Determination of amylose and protein content of selected mutants	1) Multiplication of desirable mutants 2) Determination of amylose and protein content of selected mutants	Submission of desirable mutants with improved grain quality to the National Seed Industry Council for registration
Thailand	**Low Phytate in Rice**				
	1) Genetics studies of Low phytic acid mutants derived from M6 of irradiated variety SPR1), ~~RD23,~~ 2) Generation of Mapping population for Low Phytate (LP) traits. 3) Analysis of genes involved in phytic acid biosynthesis of the generated population. Achievement: F2 progenies of a cross between M6 mutant with Wild type were obtained to study genetic	1) Yield, Fe content and other agronomic traits evaluation of derived LP mutant lines. 2) LP molecular marker developing. 3) Developing simplified protocol of breeding screening technique for high Fe content. 4) Generate new mutant populations (using LP mutants as parents) for high Fe content.	1) Continue yield, Fe content and other agronomic traits evaluation of derived LP mutant lines. 2) Screening for Low Phytate mutants combined with good grain quality (eg. Low amylase, aroma) from newly generated population using MAS.	1) Study on G x E and stability in term of Fe content in advance LP mutant lines performed good agronomic characters and acceptable grain yield. 2) Analysis of Fe content and cooking quality of elite LP mutants. 3) LP mutants with good grain quality to be selected for other agronomic traits by conventional pedigree selection.	1) LP mutant derived from SPR1 cultivar with high Fe bioavailability and acceptable cooking quality will be recommended. 2) LP mutants with good grain quality to be continue selected in further breeding program.

	mapping of *lpa1*				
	Low Amylose and Low Protein in Rice				
	●Low Amylose and Low Protein in Rice 1) Compositional analysis of Glu A and Glu B in rice genetic stock (Thai local varieties) using conventional screening techniques (SDS-PAGE). 2) Chemical analysis for amylose content of the individuals with low glutelin. 3) Data compilation for amylose content and protein library. Achievement: setting a protocol and laboratory equipments.	Additional work : 1) Developed a simplified method for amylose content of the variants in early generation and contributed the other participated members. 2) Seed multiplication of IR64 and Koshihikari. 3) Induce mutation in the varieties KDML105 (low amylose) , CNT1, CNT80 and SPR1 (high amylose) using gamma ray irradiation. Achievement: already done and M2 progenies were obtained. 4) Mutants screening for storage protein low glutelin and low amylose content using conventional technique. 5) Identification of glutelin by SDS-PAGE with Coomassie Blue staining and PCR in low glutelin mutants. Achievement: waiting for low glutelin mutants	1) Development of Glu A-I and Glu B-1 antibodies through recombinant protein expression system as described by Tanaka (2004) 2) Develop simple screening technique using glutelin antibodies for large-scale screening and breeding effort. 3) Low glutelin and low amylose mutants (M2 plants) will be selected.	M3 mutants with low glutelin and low amylose will be selected for desire agronomic traits by pedigree selection mean. Low glutelin and low amylase still be maintained using screening technique previously developed.	1) M4 mutants with low glutelin and amylase will be further selected for desire agronomic traits. 2) M5 seeds will be derived and analysed for other desire grain qualities eg. aroma, cooking quality and will be tested for disease and insect resistance.

Vietnam		1) Field Trials for Red ST lines for Yield - Quality: Amylose, Protein,... Direct determinations of aroma components - Minerals: Fe, P, Zn, Cr,... (particularly high Fe content lines as new sources of germplasms) 2) Field Trials for ST combined lines, particularly following ST16, ST19, ST21 And TDS 3 (an elite mutant line pure from Tamthom traditional cultivar)	1) Continue for pure line selections for elite lines from ST16, ST19, ST21 populations for stable characters improved for regional acceptance and for large scale productions. 2) Start with Ion Beam irradiation to traditional rice cultivars with special quality: M1 will be conducted in Soctrang Province for further selections.	1) Regional Acceptance of ST Red lines 2) Regional Acceptance of ST Combined lines and TDS 3. M2 – M3 screening for Ion beam irradiated rice cultivars for non-photoperiod sensitive and semi-warf plant type. - Prof.Dr. Nguyen Thi Lang - Mekong Delta Rice Research Institute, Can tho (Low Phytic Acid and High Quality Rice) - Dr. Do Khac Thinh – Institute of Agricaluture Sciences, HoChiMinh City (High Yield and Quality Rice	1) Pure line selections for Ion Beam Treated Rice cultivars 2) Pure line selections for LPA (Dr. Long) 3) Pure line selections for High Quality (Dr. Do Khae Thinh)