5.2 IMPROVEMENT OF TRADITIONAL LOCAL RICE VARIETIES THROUGH INDUCED MUTATIONS USING NUCLEAR TECHNIQUES

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SUMMARY

"Improvement of local rice varieties for high yield, resistance to disease and insect pests (brown plant hopper and rice blast) and export quality through induced mutations for the Mekong Delta" started from in 1993. After six years, it showed effecting on the field in the MD as well as at the south of Vietnam. TNDB-100 manifest very wide adaptation and yield stable variety. THDB is suitable for deepwater rice region, coastal area, where rice cultivation effected by acid sulphate and salinity conditions, is especially. Both varieties are good example for the method. Thank to good Co-operation from extension center from provinces. Hundred classes of extension were organized to recommend to the farmers. And thank to the strongly supporting from IAEA so that nearly 400, 000 ha of TNDB-100 occupied at the south of Vietnam as well as nearly 15,000 ha of THDB grown in the coastal as well as rainfed lowland rice areas at the South of Vietnam.

To continue the rice improvement by this technique, seeds of six traditional local varieties were exposed under different dose of gamma rays to create new mutants. At present day hundred improved breeding lines were selected, a dozen of uniform lines were isolated and entranced the yield trail as well as regional testing program. From these would be selected improved varieties contribute to the rice cultivation at the south of Vietnam in the next years.

I. BACKGROUND

Rice is the main food and export product from agriculture in Vietnam. The Mekong Rive Delta (MD) being "the rice basket", and main source to exports. This region supplies more than 50% of rice product and 90% of rice for exporting yearly of the country. Vietnam exported 4,5 million tons of milled rice to the world market in 1999 and became the second rice export in the world. At present Vietnam's rice yield is higher than that of many countries in South East Asia. However the quality and export price is generally lower. In addition annually 1,7 M ha of the delta land effected from salinity as well acid sulphate and/or drought with different levels in dry season. Single cropping have been replaced by double, even triple crops in some areas. This is depending on the condition by fresh water from the Mekong River through canal systems as well as characteristics of the new rice varieties released to cultivation practice. Quality improvements and breeding rice for areas affected

from salinity and acid sulphate soil condition play an important role in increasing the value and markets of the rice exports. Currently improved rice varieties induced through conventional method have been profitable contributed in these areas. In 1993 rice breeding through induced mutations using nuclear techniques applied at the Cuu Long Rice Research Institute (CLRRI). For 6 years only, this obtained meaningful results. This method gained result that conventional method could not be. It was bring on local traditional varieties low yield susceptible to disease and insect pests and could not withstand at salinity & sulphate soil as well as bad quality became new varieties with higher yield better resistance to disease and insect pests and withstand at the advert soil condition and better quality for exporting. Furthermore it take shorter time than conventional method so that this method estimated as a cheaper method. Two induced mutants namely TNDB100 and THDB, which created under RC/7479 in 1993 and released as national varieties under TC project VIE/5/013 in 1997-1998 that supported from IAEA, are now growing in larger scale in the MD as well as through out the South of Vietnam are evidences for this techniques.

II. OBJECTIVES

1.To create new induced mutations with short duration, resistant to brown plant hopper (BPH) & rice blast (RB) and suitable for rice cultivation areas and export quality in the Mekong Delta at the coastal areas (saline and acid sulphate soil) is especially.

2.Enlargement area of induced mutations (TNDB-100 and THDB) at the MD as larger as possible.

III. MATERIAL AND METHOD

Using effect of various mutagens to create induced mutations from traditional local varieties.

The main mutagens used in rice breeding at the CLRRI were, gamma rays from source of ^{60}Co, ($\gamma^{60}Co$) and chemical mutagen used as EMS to create different mutants with different objectives to use in rice improvement for the country. In this program two local traditional varieties namely Tai Nguyen Duc (TND) and Tep Hanh (TH) used for study. These varieties after soaking in fresh water for 24 hours then pull out and put them in incubator for germinating take place to the moment of 57, 60, 63, 66, 69, 72, and 75 hours. After that was exposed under different dose of gamma rays 5, 10, 15, 20 and 25 Kr. The M1, M2, M3 generation on ward grown in the breeding field to select good induced mutations.

IV. RESULTS

Two induced mutations isolated namely TNDB-100 from (TNDB) and THDB from (TH) varieties respectively. Tai Nguyen Duc and Tep Hanh are two traditional local varieties. These were irradiated at dose of 5Kr, and the germinated to the moment 75hs. And at dose of 20Kr, and germinated moment of 57hs, respectively. These mutants entranced for national testing program in larger scale at 11 provinces in the MD in 1996. These varieties identified as good quality for exporting. Since 1997 TNDB100 variety expanded so quickly that not only in the MD but also for so many provinces in the South of Vietnam.

- **TNDB100 variety** was recognized as national variety in 1997. It is the first time an new improved variety released from mutation breeding using nuclear techniques in the MD. The releasing TNDB-100 variety verified that the improvement of traditional local rice varieties through induced mutations using nuclear techniques is a very effective method. After

releasing for two years only, TNDB-100 not only accepted by farmers at the Mekong Delta but also accepted by farmers at so many provinces at the south of Vietnam. In accounting this variety occupied at the Mekong Delta about 41,250 ha in 1997, and 84,250 ha in 1998. And 203,750 ha in 1999. Among this Vinh-Long province only TNDB100 grown about 150,000 ha in 1999. The areas occupied at the south of Vietnam by TNDB100 up to Winter - Spring rice crops in 1999- 2000 estimated and showed in the Table 1.

TNDB-100 possess better characters in compare to their original (TND) that is short duration (95 - 100 days while duration of TND is 180 - 200 days due to it's photosensitive so that it gown only one crop per year), short stature 95-100 cm meanwhile original variety is 180 - 200 cm height), high yield (1.5 time higher than original variety), better resistance to disease as well insect, and export qualities is especially. It should be noticed that TND is a variety with good cooking quality but could not export due to high chalkiness score Furthermore it is a variety very wide adaptation to acid sulphate soils as well as need low input but gave high out put. Farmers they grown 3 crops per year on their field while only one crop per year if they used TND variety. This character is coincident with condition of the poor farmers that still the most popular in the MD region. That is one of the reasons to explain why the TNDB-100 accepted very fast by the farmers at the south of Vietnam.

Table 1: Amount seed provided to the extension centers in early year of 1997 and Areas of TNDB-100 occupied up to at the end of year 1999.

No	Province	Amount seed provided (kg) in early of 1997	Area occupied at the end 1997(ha)	Area occupied at the end 1998(ha)	Area occupied at the end 1999(ha)	Average yield (tons/ha)
1	An - Giang	10	1,000	1,000	1,000	5.00 - 8.00
2	Bac - Lieu	50	800	100	300	5.00 - 6.00
3	Ba Ria - Vung Tau		500	500	2,000	5.00 - 6.00
4	Ca mau	1000	2,000	3,000	8,000	5.00 - 7.00
5	Can - Tho	10,000	12,000	16,000	18,000	5.00 - 6.00
6	Dong Thap	100	300	5,850	5,000	5.00 - 7.00
7	Dong nai		100	2,000	6,500	5.00 - 5.50
8	Ho Chi Minh city	100	700	2,910	300	4.50 - 6.00
9	Kien - Giang	100	2,000	16,480	21,000	5.00 - 6.00
10	Long - An	10	1,500	250	400	6.50 - 7.50
11	Soc Trang	500	3,000	3,000	3,000	4.50 - 5.00
12	Tien Giang		2,000	500	1,500	6.00 - 7.00
13	Tay - Ninh		300	300	1,000	4.80 - 6.00
14	Vinh - Long	12,000	15,000	70,000	145,000	5.50 - 7.00
15	Lam Dong		50	50	100	5.00 - 6.00
16	Ninh Thuan	100		110	300	4.50 - 8.00
17	Daklak			15	50	6.00 - 8.00
	Total	**23,870**	**41,250**	**112,050**	**203,450**	

THDB variety

THDB produced from Tep Hanh (TH) variety. TH is one of the local traditional varieties at the deep water rice areas in the MD. It is not like TND. TH variety is good cooking and good quality for export, but plant height is too tall (200 - 240 cm). And very long duration (180 - 240 days) due to it's photosensitive character as well as very low yield (2-3 tons/ha only). THDB differ from TH by the good characters. Such as, They are shorter plant height, medium maturity with photo-insensibility (125 - 135 days), double grain yield higher than TH as well as so better resistant to disease and insect pest, good resistant to

lodging, suitable for rainfed lowland rice regions at the coastal areas of the MD. The regions that fishes, grapes, shrimps and rice are present in the field at the same time. Such as provinces of Soc - Trang, Ca - Mau, Ben - Tre, Bac - Lieu and Ho Chi Minh city also. Because, it is transplanting only one crop per year and the farmers grow this variety almost they are very poor farmers. And living far from economic, polity, education centers. They suffered traffic very difficulty condition while we could not support to them so that THDB areas could not expand lager on the field in compare to TNDB-100. One of more different reason prevent the enlargement of THDB area due to long growth duration so that there are no farmers wanted seed multiply this variety in the Winter - Spring rice crop to produce seed for to transplant at the Autumn - Winter and Mua crop. So such so Area transplanted by THDB up to Autumn - Winter crop season 1997 and 1998 event at the end of 1999 still limited. Agronomic characters as well as the area occupied in 1997, 1998 and 1999 were showed in Table 2.

Table 2: Areas occupied by THDB in South of Vietnam up to at the end 1999

No	Provinces	1997 Area (ha)	1998 Area (ha)	1999 Area (ha)	*Grainyield (Ton/ha)*	Remark
1	Soc - Trang	2,000	5,100	5,000	5 -8	Good tolerant to acid
2	Ca - Mau	2,000	1,000	1,500	6 - 7	sulphate soilsgood
3	HO CHI MINH city	1,000	1,000	2,000	6 - 7	resistance to disease and
4	Bac - Lieu	500	5,200	5,000	6 - 7	insect pests, and
5	Dong - Thap	200	200	200	6 - 7	lodging
6	Dong Nai			200	6 - 8	
7	Ba ria- Vung tau			50	5 - 7	
8	Tay ninh			50	6 - 8	
9	Daklak		2	50	7 - 9	
6	Ben - Tre	500	500	200	5 - 6	
7	Can Tho	500		200	6 - 7	
	Total	**6,700**	**13,502**	**14,450**		

Releasing THDB variety was meaningful in the coastal areas in the South of Vietnam. In the normally condition, farmers in these regions grow only one rice crop/ yearly with photoperiod sensitivities. Almost is local variety that not only very low yield but not stable. Before releasing of the THDB have not yet any good new variety has been accepted in these

regions. Although THDB still has not yet completed variety, but it verified that Nuclear techniques can be use to improve rice for deepwater areas. The THDB is rather suitable and stable for this region.

The THDB recognized as a national variety to grow at the coastal areas at the south of Vietnam by Scientific Committee of the Agriculture and Rural Development Ministry in 1999.

• **Creating new mutants for rice cultivation at the south of Vietnam emphasis at saline soil condition.**

To create new mutants, dry seed of six traditional local varieties which are well adapted to saline soils of the coastal areas in the MD namely: *Ngoc Bui; Ngoc Nu; Mot Bui; Trang Tep, Taïm Xoan and KhaoDakmali* were exposed under gammar rays of dosage of 20; 25; 30 and 35 Kr with 100 gram seed for each dose. Seed after treatment growing in the rice breeding field as M1, M2, M3 and so on in 1998 and 1999. From these more than 20,000 induced mutations were selected at the end of 1998. And 400 improved breeding lines isolated at the end of year 1999. Almost these improved breeding lines possess very characters. Such as very short duration (90-95 days from seed to seed only), high yield (6-8 tons/ha), good resistance to disease and insect pests (emphasis Brown Plant Hopper and Rice Blast). Among these there are 12 uniform lines are conducting primary yield trial, two lines entranced as testing program in the year of 2000.

IV. CONCLUSION

1. The variety of TNDB-100 is expanding very fast not only in the MD but many provinces in the South of Vietnam also. It became a national variety and to richer rice variety population in these regions. It showed TNDB-100 is very wide adaptation similar their original variety but so better quality for exporting.
2. The variety of THDB is also quite well variety, but suitable at the deepwater rice regions. These regions almost are rainfed lowland rice. Farmers are very poor and traffic is too difficulty.
3. The new induced mutants harvested almost at the dose of 20, 25, and 30 Kr. These mutants would be isolated for improved varieties so that contribute to rice production at the south of Vietnam in the next years.

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