ACTION PROGRAM ON DOUBLE CROPPING RICE A YEAR IN TIDAL SWAMP LAND, KALIMANTAN INDONESIA *)

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1. Introduction

Numerous periodicals and journals about Tidal Swamp land in Kalimantan, Indonesia have been published. The purpose of writing this paper is merely to introduce efforts in increasing productivity of this land by double cropping rice a year.

Traditionally, planting rice on tidal swamp land in South and Central Kalimantan have been done by local farmers since 50 — 60 years ago when the forest in this region was opened and reclaimed to become rice fields. For this purpose, farmers dug a narrow drainage ditch perpendicular to the river so that the land can be superficially drained when the tide is low and flooded when the tide is high.

As it is known that the water level in this region is up and down within 24 hours due to the raising of the big river water and sea water which is influenced by the position of the sun and the moon against the earth.

The fluctuation of the tide water on the field varies, where at Barambai, South Kalimantan, and Tamban Luar, Central Kalimantan, the maximum depth is up to 300 — 400 mm in December — January (rainy season) and the minimum is not flooded in August (dry season with rainfall below 60 mm).

Cultural practices of the tidal swamp land rice are rather different from the usual intensive wetland rice. It seemed that the cultural practices were adjusted to the local condition especially to water level and labour scarcity.

Usually local farmers plant late maturity varieties (± 10 months maturity) which are presumably photoperiod sensitive and only flower in July/August

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Nurseries are transplanted at least twice as follows.

1. Start with the lay out of dry bed nurseries at the beginning of the rainy season (October/November) on elevated sites by putting about 50 seeds per hole, with the seeding rate ± 5 kg seeds for one hectare rice crop. This first step nurseries called "tradakan" are transplanted at ± 40 days age into the second step nurseries called "ampakan".
2. The second step nurseries (ampakan) are pulled and transplanted to the field at ± 40 days age.
3. The third nurseries called "lacakan" are planted on the watered field.

During this period, land preparation is started which consists only of cutting the vegetation (weeds) using big sickle called "tajak". They do not apply plow and harrow as usual. If soil preparation is too deep, cat clay will be exposed and toxic to the crop. The cut vegetation is allowed to rot on the levee called "puntalan" and apllied as green manure for the next rice growing season.

The purpose of the "lacakan" nursery is to promote tillering in order to obtain an amount of seedling for one hectare field, and awaiting for the proper condition with regard to the water level for the final transplanting to the field which usually fall in February or March.

The third nurseries are pulled and transplanted at ± 55 — 60 days age. The best spacing for local varieties is 35 x 35 cm due to the high tillering ability (Noorsyamsi and Hidayat).

Management practices after planting are usually only weeding and pest control, especially against rodent and stink bug. They do not use to apply fertilizer.

Harvesting season fall in August/September. So that by planting local varieties they only harvest once a year with an average yield ± 2.2 ton dry grain per hectare.

In order to increase rice production, the government expanded agricultural land and started opening the tidal swamp land in 1969. It is assumed that about 7.340,000 ha such land in Indonesia which are suitable for rice growing could be opened.

For irrigation and drainage purpose, the government built **GAMA Canal System** which is famous as **Fork System** (designed by Gadjah Mada University) through where irrigation water from the river flow up to the field at high tide period and drain low pH water with toxic element soluted in it down to the river at low tide period.

2. Experiment Result of Gadjah Mada University Tidal Swamp Land Study Group

One of the so many experiments resulted by this University stated that double cropping rice a year in this tidal swamp region is feasible by planting non local varieties (high yielding, medium maturity, photoperiod non sensitive varieties) in the first season (October — March) and continue planting either local varieties or non local varieties in the following season (March — July/August).

The major problem for the first season planting is the heavy damage of pest due to small scale planted area and is difficult to control. Consequently they fail to harvest.

It is assumed that if the planted field is in a wide scale as in the second season, the pest problem could be minimized easily.

Based on this assumption, action program on double cropping rice a year conducted in this region with farmers participation.

3. A Double Cropping Rice Action Program

To introduce this double cropping method to the farmers, starting in 1977/1978 at Barambai, South Kalimantan and 1978/1979 at Tamban Luar, Central Kalimantan, an action program has been conducted for two years where farmers (transmigrant farmers) were invited to participate on it.

To accomplish this program, a farmers group at the tertiary canal which consists of about 30 — 40 farmers was organized under guidance of a contact farmer. This farmers group organization is called "Lumbung Desa".

All extension activities, distributions of agricultural production input, cooperations in pests control, and water regulations were conducted in "Lumbung Desa" level.

Due to the ability of the transmigrant farmers are very weak in applying agricultural inputs such as fertilizers and pesticides, a packed credit was given to each farmer participating in this program costed ± Rp 19.000,-- (nineteen thousand rupiahs or about $ 31.00).

When the farmers succeed in harvest at the end of each program they should pay back their credits in natural form (rice grain) to the "Lumbung Desa" and is being used as further farm work capital of their farmers group.

This organization was suggested to built a small storage house or "Lumbung" for keeping rice grain owned by their group, and is going to be on sale in growing season when rice price is high. Normally at harvesting

Table 1. **Target and Realization of Planted Area in The First and Second Planting Seasons.**

Year	Barambai, South Kalimantan				Tamban Luar, Central Kalimantan			
	Target (Ha)	Realization (Ha)	Percentage (%)	Area Per Farmer (Ha)	Target (Ha)	Realization (Ha)	Percentage (%)	Area Per Farmer (Ha)
	The first planting season							
1977/1978	200.0	160.5	80	0.47	---------- no program ----------			
1978/1979	216.7	78.4	36	0.30	176	55.2	31	0.36
1979/1980	---------- no program ----------				161	56.0	35	0.22
	The Second Planting season							
1978	160.5	54.3	34	0.16	---------- no program ----------			
1979	78.4	50.6	65	0.41	55.2	10.5	19	0.20
1980	---------- no program ----------				56.0	21.9	39	0.21

time the grain price is so low, that applying floor and ceiling price policy is necessary.

Extension Works And Farmer's field day was organized by subject matter specialist and field extension personnels at the harvesting time.

4. Result of The Program and Discussion

4.1. An Area Planted With Non Local Varieties

Table 1 consists of target and realization planted areas, and a planted area per farmer with non local varieties in the first and second planting seasons.

It is seen from table 1 that the realizations are always lower than the targets. This is due to the lack of seedling because of heavy damage by mole crickets or "orong-orong" on the nursery. It seemed that these crickets, where in usual wet rice are not really pest, in tidal swamp rice fields are economic significance. This insect is explosive if the soil condition is wet (neither dry nor flooded). When the soil is completely dry or flooded this insect dies.

Farmers in this region regularly have 1.75 ha field. But they are incapable of planting all their field with non local varieties due to lack of labours for soil preparation intensively. Most of the farmers realized that planting non local varieties require intensive soil preparation.

In the second planting season, eventhough all of their field are planted with rice, the area of non local varieties are smaller than in the first planting season. This phenomena reflects that most of the farmers are still in doubt about the success of planting non local varieties in comparation to local varieties. The second reason is because they do not have enough time between harvesting the first crop and planting the second season for soil preparation intensively.

4.2. The Yield Per Hectare

The yield of the program based on 5 x 5 square crop cutting listed in table 2.

Table 2 indicates that eventhough the yield of non local varieties are not as high as in usual wet land field (only 38.11 qu/ha), but it is still higher than local varieties (34.81 qu/ha).

Table 2. **The Yield (qu/ha dry grain) Based Upon Crop Cutting 5 x 5 sqm During 1977 — 1978 At Barambai And 1978 — 1980 at Tamban Luar**

Varieties	Freq. Of Crop Cutting	Yield q/ha
Local Varieties	103	34.81
Non Local Varieties (average)	251	38.11
IR 26	17	28.0
IR 30	11	28.9
IR 32	106	43.4
IR 34 x)	3	50.1
IR 36	24	34.6
IR 38	55	33.6
C_4-63	25	37.0
Line No. 41	2	40.0
Asahan	5	41.4
A d i l	3	29.0

x) Very susceptible to bacterial disease and the crop cutting frequency is very low.

It is assumed that among the non local varieties tested, IR 32 is the most suitable for tidal swamp condition.

Crop cutting in the second planting season shows that yield capacity of the local varieties is a little bit higher than the non local varieties. This is due to less intensive soil preparation for non local varieties (see table 3). And also yield capacity for the same non local varieties is usually higher in the first planting season than in the second season when water is decreasing.

The range of the yield based upon crop cutting during two years program is 20 — 111.2 qu/ha at Barambai and 8 — 68.4 qu/ha at Tamban Luar. This data indicates that potential yield of the tidal swamp rice is high if the proper management practices could be applied.

Table 3. **The Yield (qu/ha dry grain) Based Upon Crop Cutting By Year And Location.**

	Barambai						Tamban Luar					
Year	Non Local Varieties	Range	Freq. Of Crop Cutting	Local Varieties	Range	Freq.Of Crop Cutting	Non Local Varieties	Range	Freq.Of Crop Cutting	Local Varieties	Range	Freq. Of Crop Cutting
The first planting season												
1977/1978	47.4	48 -111.2	53	-	-	-	---------- no program ----------					
1978/1979	39.6	20 - 72.0	53	-	-	-	22.0	8 -48	26	-	-	-
1979/1980	----------		no program	----------			37.7	9 -68.4	52	-	-	-
The second planting season												
1978	17.0	. n.a	44	27.0	n.a.	14	---------- no program ----------					
1979	33.7	18.4 -58.8	45	39.6	20-58.4	51	28.9	18.4 -54	11	31.1	8-44	24
1980	----------		no program	----------			28.3	16 -39	11	31.5	20-48	14

n.a data not available

4.3. Pest Damage

Result of experiment conducted previously showed that if the cropping area is not wide enough (500 — 1,000 sqm) the yield of the first planting season is almost nothing due to the heavy infestation of pest (rodent, stink bug, borer, and birds).

In this program, with cropping area ranging from 10.0 to 160.0 ha in one location, with appropriate integrated pest control, pest infestation could be minimized as indicated in table 4.

Pest damage in 1978/1979 at Tamban Luar is very heavy, and this phenomena is in accordance with the very low yield at that year (± 22.0 qu/ha), while in 1979/1980 where pest damage is not heavy, the yield increases up to 37.7 qu/ha.

4.4. Introduction of "gogo rancah" system

To avoid mole cricket infestation in the seedling stage, "gogo rancah" was demonstrated to the farmers.

This system is just a combination of upland rice system and wetland rice system. The first step is planting by direct seeding and raising it as upland rice. When the frequency of rain increases, the field is flooded and raised as irrigated rice.

The result of this demonstration is that gogo rancah system can be harvested one week earlier and yields 52 qu/ha dry grain, 12 qu/ha more than transplanting system. The problem incountered is that in transplanting system weeding is almost unnecessary, while direct seeding requires 2 — 3 times weeding which needs many labours and costs.

4.5. Demonstration Using Thresher

Farmers in tidal swamp area usually harvest their rice by using a small sickle or "ani-ani" and cutting cars one by one. This method is very time consuming while labours are very scarce at that time.

Demonstration in harvesting by using normal sickles and cutting one hill at once following threshing by using pedal threshers is much more rapid than the old system.

Data listed in table 5 proves the above mentioned statement.

Table 4. **Percentage of Damage by Some Pests During A Two Year Action Program at Barambai and Tamban Luar.**

Year	Rodent (%)	Borer (%)	Hama Putih Palsu (%)	Plant Hopper (%)	Stink bug (%)	Planted Area (Ha)
Barambai, South Kalimantan						
1977/1978	4.4	4.05	17.1	1.05	0.3	160.6
1978	----------	----------	n.a	----------	----------	1,800.0
1978/1979	12.9	9.9	1.05	n.a.	26.0	78.4
1979	0.0	7.1	n.a	n.a.	1.4	1,800.0
Tamban Luar, Central Kalimantan						
1978/1979	46.7	10.7	n.a.	n.a.	33.0	55.1
1979	----------	----------	n.a.	----------	----------	3,905.0
1979/1980	0.7	2.7	n.a.	n.a.	6.1	55.9
1980	----------	----------	n.a.	----------	----------	3,905.0

Table 5. **Time Needed For Harvesting and Threshing of 5 x 5 sqm Crop Cutting**

Method Of Harvesting	Time Needed	Method Of Threshing	Time Needed	Total Time	Yield
Using "ani-2"	99'	Using foot	9'	108'	13 Kgs
Using sickle	24'	Using pedal thresher	10'	34'	13 Kgs
Using sickle	21'	By hitting on hard wood	18'	39'	12 Kgs

5. Development of The Improved Varieties With High Adaptability to Tidal Swamp Environment

It seemed that most of the IRRI improved varieties are too short for tidal swamp condition with a special regard to the water level except IR 34.

Effort should be done to develop improved varieties which are at the medium height and maturity, medium elongation ability, tolerant to acidity, salinity, submergence, and Fe and Al toxicity.

To meet the need, crossing has been done between local varieties such as Lemo halus, Karangdukuh, Gadabung and Bayar icip and IR 26, IR 32; IR 34; IR 442-2-58; IR 2153-43-2-5 and IR 1614-389-1-1 as gene source for tolerating deep water, salinity, acidity, problem soils, and brown plant hopper.

At present, some selections of segregation material from the above mentioned crossing are under testing at several locations, particularly offsprings of crossing between Gadabung x IR 32 and Karangdukuh x IR 32.

6. Conclusions

6.1. Double rice cropping on tidal swamp rice field in South and Central Kalimantan are feasible by planting non local varieties in the first planting season and planting either local or non local varieties in the second cropping season. With this method cropping intensity in this region could be increased from 100% up to 200% in the near future.

6.2. In order to succeed the first cropping and free from heavy pest infestation (rodents, birds, stinkbugs) the planted area should be in a wide scale.

6.3. Due to labour scarcity, especially in soil preparation and harvesting time, introducing hand tractor (power tiller) and pedal thresher will

increase farmers' ability to expand their non local varieties crop up to 1.75 ha.

6.4. Farmers will respond positively to this double cropping program if agricultural input's credits are provided by the government.

6.5. This double rice cropping program encourages the farmers to improve their field by building levee, quarterly canals, round canals within field in order to regulate tide water flowing into and out of the field and to stabilize soil water table.

6.6. It is assumed that "gogo rancah" system will be adopted by farmers if herbicide application is feasible (effective and the farmers are capable to use it).

7. Literature Cited

Noorsyamsi & Hidayat 0.0 (1970) **The tidal swamp rice culture in South Kalimantan.** Central Research Institute for Agriculture. Representation Kalimantan.

Soemartono; **Review penelitian tata air dan pertanian dalam rangka program aksi bertanam padi dua kali setahun di persawahan pasang surut Kalimantan Selatan danTengah.** Test Farm PPPPS UGM.

Soemantri S. dan Soemartono (1979). Perkembangan dan masa depan budidaya padi persawahan pasang surut Kalimantan. Makalah pada **the Third Symposium on Tidal Swampland Development Aspects di Palembang, Indonesia 5 — 10 Februari 1979.**

Test Farm PPPPS UGM (1977) Penelitian Pertanian dalam rangka bertanam padi duakali setahun di Unit Pembukaan persawahan pasang surut Barambai Sub P4S Kalimantan Selatan. **Laporan akhir kerjasama Test Farm PPPPS UGM dengan Departemen Pekerjaan Umum.**

Test Farm PPPPS UGM (1978) Ibid. **Laporan Kemajuan II.**

Test Farm PPPPS UGM (1979) Ibid. **Laporan akhir.**

Test Farm PPPPS UGM (1979) Penelitian Tata Air dan Pertanian dalam rangka program aksi bertanam padi dua kali setahun di unit pembukaan persawahan pasang surut Tamban Luar sub PPPPS Kalimantan Tengah. **Laporan Akhir kerja sama Test Farm PPPPS UGM dengan Departemen Pekerjaan Umum.**

Test Farm PPPPS UGM (1980) Ibid. **Laporan Akhir.**