

Development of Agricultural Systems in the Mekong Delta of Vietnam: Current rice cultivation and problems involved¹

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Abstract: This paper aims to address two objectives: (1) to discuss the evolution of agrarian systems in the Mekong Delta and (2) to discuss the present status of intensive rice farming and issues and problems involved. The evolution is clarified through the discussion of changes in rice farming overtime, while current intensive rice farming is evaluated from an agronomic point of view. Agricultural change is closely linked with physical conditions, the settlement process, canal excavation and land reclamation as well as the socio-economic situation and government policy. Current intensive rice farming has a number of problems. These pose a need for a participatory research approach to introduce suitable ecosystem-specific systems bearing minimum risk, in order to support the development of sustainable agriculture and to protect the environment.

1. Introduction

Agricultural systems in the Mekong Delta (MD) have undergone a tremendous change during the last decade. Farming of many rice farmers has changed from a way of self-sufficient production for household consumption to a commercial production for exporting. Agriculture based on low-input, single crop rice farming has changed to diversified farming with intensive production of two or three rice crops per year. As a result, the MD produces about 17 million tons of rice annually (52% of national rice production) and average yields are 4.3 t/ha. Though the Delta is favorable for rice production, it is also suitable for different fruit trees, aquaculture, etc., all of which have been practiced by the MD farmers.

This paper has two objectives. The first one is to discuss the development process of agricultural systems in the MD. Some important events will clarify the development process of agricultural systems in relation to technological and socio-economic changes. The second objective is to discuss the current rice-based farming systems with emphasis on rice cultivation and problems involved. Rice farming often depends on large amounts of chemical fertilizers and pesticides and is threatened by flood in the rainy season, and saline water intrusion is very common in the dry season in some areas of the delta. Consequently, it is environmentally hazardous and one should take this into account with regard to the development of sustainable farming systems.

2. General information on physical environmental

Geographically, the MD is situated in the southernmost of Vietnam, consists of 12 provinces. The total area of the MD is of 3.97 million ha and it holds about 12% of the total area of the

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country. The MD has a monsoon tropical climate, stretches between 104°50' to 106°50' longitude and from 8°40' to 10°55' latitude.

The climate in the MD is warm with average temperature ranging from 26.4 to 28.8°C. In the MD, there are two well-defined seasons: the rainy and the dry. The rainy season lasts from May to November (supplied 80% of the rainfall) and the dry from December to April. The average rainfall ranges from 1000 mm to 2000 mm. The rainfall distribution among areas in the region is different: high in the forest areas (2000-2400 mm) and relatively low in the northeast (1400-1600 mm). The MD is influenced by the flow of the Mekong River, the diurnal tidal movement of the Eastern Sea and the semi-diurnal tidal movement of the gulf of Thailand. The high rainfall combined with the high discharge of about 40,000 m³/sec of the Mekong River result in regular flooding of 0.5 to over 4.0m depth during the wet season on the poorly drained, depressed areas. Serious flood damage occurs annually.

The MD is a flat and low laying region, which was formed through slow alluvial depositions. According to Sanh et al (1998), alluvial soils cover 28%, acid sulphate soils 41% and saline soils 21% of the Delta. The remaining soils are mountainous, peat soils.

3. Historical change in agricultural systems

The evolution of agrarian systems of the Mekong Delta of Vietnam has been intensively studied by a number of researchers (Sanh et al., 1998; Son, 1998; Tuan et al., 2000). Generally, the development of agricultural (rice farming systems) of the MD is closely associated with its physical conditions (soils and water), the settlement process, canal excavation and land reclamation as well as the socio-economic situation and government policy. Rice farming was found for a long time ago during the *Oc-eo* era and was continued by pioneer Vietnamese settlers in the delta. A summary the evolution of agrarian systems is shown in Box 1.

▣ Box 1: Evolution of agrarian systems in the Mekong Delta

1. **Rice farming at Oc-eo period** (roughly before 1857): Collection of wild rice for food and cultivation of floating rice; under the Nguyen dynasty several canals were dug; the development of canal systems attracted migrants to exploit land along canals for rice cultivation.

2. **Traditional rice farming systems period** (roughly 1857-1966): The mode of farming was predominant by tenant farming. Several canals were excavated and land reclaimed for rice cultivation; various rice growing methods were practiced, floating rice in deep water flood areas, single and double transplanting of rice; high yielding varieties (IR5 and IR8) were introduced in 1966.

3. **Transition from traditional rice to high yielding rice farming period** (roughly 1966-1975): High yielding rice (IR5 & IR8) was cultivated under irrigation; Double rice cropping was practiced.

4. **Rice-based farming systems development stage** (roughly 1976-1988): After the war farmers went back to their villages for rice production (rice land was 2 million ha, areas of double rice cropping increased); collective farming and later on contract farming were established; plantation of fruit trees and upland crops were developed. Policy reform "*Doi moi*" took place in 1986.

5. **Intensification of rice-based farming systems stage** (roughly 1988-1999): Rice farming shifted to more intensification and diversification, areas under triple and double cropping increased; various rice-growing methods were applied; privatization and commercialization in agricultural production.

6. **Sustainable (ecological) farming systems stage** (beginning from 1990s onwards): "Sustainable agriculture" terminology began to be used in government policy since the 1990s; strengthening management agricultural and other resources to improve livelihoods; new government policy on "*change in the economic structure of agricultural systems*" was released (2000); incorporating agribusiness management for rice production (2001).

▣

From the early of settlements onwards, rice production has always been the main concern of MD farmers. Rice fields expanded from arable land nearby canals to all areas where rice could be grown. The area under rice cultivation increased rapidly and types of rice-based systems became more complex. In the early 1900s, rice farming was mainly rainfed. Floating rice was also grown on a large scale, mainly in the flood plain areas of the Long Xuyen quadrangle and the Plain of Reeds. Modern rice cultivation started with the introduction of high yielding varieties (such as IR5 and IR8) in 1966. With the introduction of modern rice, farmers began to apply chemical fertilizer and pesticides, used irrigation water and machinery and obtained higher yields. Figure 1 shows changes in cultivated area for the three types of rice-based systems in the MD from 1900-1995.

Nowadays, the farming systems in the MD have almost completely changed, especially in rice production. These changes are accelerated since 1986 after a rapid change in government policy, often known as “*Doi moi*” or renovation. Starting from 1992, Vietnam produced rice not only for self-sufficiency but also for surplus rice for exporting, and that surplus rice entering the world markets was from the Mekong Delta. In 1998, Vietnam became the second largest exporter of rice in the world, only preceded by Thailand.

4. Current rice cultivation and environmental issues and problems involved

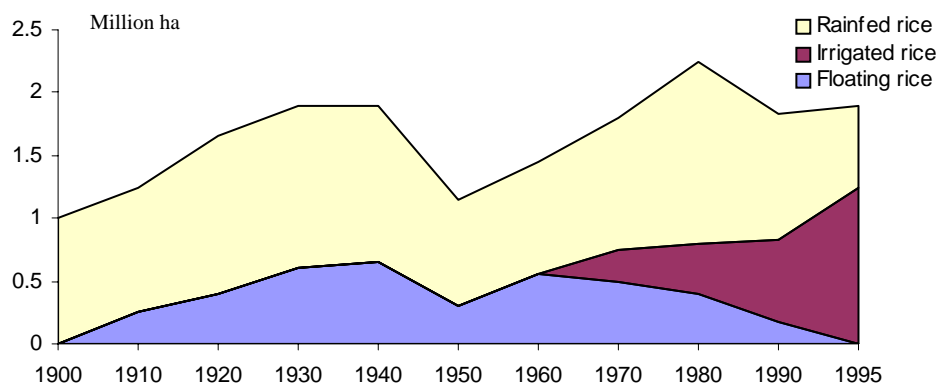


Fig. 1 Changes in cultivated area for the three types of rice cultivation in the Mekong Delta
 Source: Adapted from D.K. Son (1998).

The MD is considered as the rice bowl of Vietnam and currently about 2 million ha are under rice. Approximately 70% of the rice area is irrigated or semi-irrigated lowlands and 30% is rainfed lowland. More than 80% is under modern rice varieties. Direct seeding is a common practice in the delta. The MD has three major rice cropping systems: triple rice cropping, double rice cropping and single rice cropping (including *mua* or traditional rice). Triple rice cropping (winter-spring, summer-autumn, and autumn-winter) is practiced in the alluvial zone under irrigation and shallow or not inundation. Double rice cropping (winter-spring and summer-autumn cropping) is commonly practiced in the flood zone with slightly to medium acid sulphate soils (Angiang & Dong Thap), and in the rainfed, coastal zone. Single rice cropping (mainly *mua* and medium duration rice) followed by other crops or aquaculture is commonly practiced in rainfed coastal areas.

Table 1 shows the change in cultivated area for the three rice cropping systems in recent times. The cultivated area of triple cropping shows an increase of 13.1% between 2000-

2001, while cultivated area of double and single cropping (*mua* & autumn-winter crop) decreased. In the MD, winter-summer and summer-autumn rice are important crops. There is an increase in harvested area, yield and production for both these crops, while *mua* and autumn-winter cropping has decreased (Table 2). In general, major reasons for decrease of the area under rice are conversion to shrimp culture, fruit trees and other crops. These changes are also linked to government policy on “*change in the economic structure of agricultural systems*” which was released in 2000.

Table 1. Change in cultivated area for the three rice cropping systems in the MD in recent time.

Rice-based systems	1995	2000	2001	Change in % (2001/2000)
Triple rice cropping (x10 ³ ha)	245.9	224.9	254.4	13.1
Double rice cropping (x10 ³ ha)	846.9	1295.6	1283.1	-0.9
Single rice (includes <i>mua</i>) (x10 ³ ha)	873.7	681.2	452.7	-33.5
Total rice land	1966.5	2201.7	1990.2	-9.6

Source: data from Cantho Statistical Department (2002).

Table 2. Harvested area, yields and production of rice by cropping season in the Mekong Delta between 1995 and 2000.

Cropping season	1995	1997	1998	1999	2000	Growth rate in % (‘95-‘00)
1. Winter-Summer cropping						
Harvested area (10 ³ ha)	1035.7	1254.0	1349.0	1449.9	1482.9	7.4
Yield (t/ha)	5.16	5.33	5.30	5.00	5.27	0.4
Production (10 ³ ton)	5348.5	6689.8	7148.0	7251.5	7811.3	7.8
2. Summer-Autumn cropping						
Harvested area (10 ³ ha)	1397.6	1510.2	1776.0	1933.9	1843.0	5.6
Yield (t/ha)	3.79	3.48	3.53	3.72	3.96	0.9
Production (10 ³ ton)	5296.4	5250.1	6275.9	7200.9	7306.9	6.6
3. <i>Mua</i> & Autumn-Winter						
Harvested area (10 ³ ha)	757.3	716.4	635.6	602.9	595.9	-4.7
Yield (t/ha)	2.89	2.67	2.98	3.03	3.34	2.9
Production (10 ³ ton)	2186.7	1910.1	1894.7	1828.4	1988.1	-1.8

Sources: Adapted from Vietnam Statistical Yearbook (2000) and our calculation.

Though the MD has a large area suitable for rice, rice production is not profitable due to high production costs and low farm-gate prices. The rice farmers try to improve their income by diversifying farming systems. As a result, various alternative rice-based systems involving fruit trees, other cash crops, livestock and aquaculture have been practiced in the region and proved to be more profitable than rice monoculture. From a bio-environmental point of view, alternative integrated rice-fish/shrimp systems would be more advantageous than rice monoculture (triple cropping) for a number of reasons: farm resources are utilized more efficiently; such systems are less likely to suffer from pests and diseases and are less environmentally harmful; weeds can be controlled; total production is expected to increase. However, despite the successful cases, we should raise a number of issues and problems (Table 3).

Table 3. Major rice-based farming systems in the Mekong Delta and their issues and problems

Farming System	Agro-ecosystem	Issues and problems
1. Triple rice cropping systems	Alluvial soil, irrigated, not flood prone	<ul style="list-style-type: none"> • Intensification of cropping, intensive use of inputs (overuse fertilizer, pesticides) • Increase of rice pests and diseases • Degradation of soil fertility and environmental pollution • Post-harvest technology
2. Double rice cropping systems	Flood zone, slightly to medium acid sulphate soil (Angiang & Dong Thap)	<ul style="list-style-type: none"> • Intensive use of inputs • Threat by floods, dikes to prevent flood • Post-harvest technology
	Rainfed zone (along coastal areas)	<ul style="list-style-type: none"> • Pests and diseases • Drought, weeds • Lack of fresh water
3. Double rice plus upland crop systems	Rainfed zone and/or irrigated	<ul style="list-style-type: none"> • Intensive use of labor • Diversification of farming, sustainable use of farm resources • Maintenance of soil fertility • High total productivity
4. Rice – fish systems	Alluvial zone, irrigated, shallow flooding	<ul style="list-style-type: none"> • High investment for field construction • Less use of chemical • High total productivity • Technical know-how and management
5. Rice – shrimp systems	Coastal zone, brackish water	<ul style="list-style-type: none"> • High investment for field construction • Less use of chemicals • High total productivity • Technical know-how and management • Shrimp diseases
6. VAC systems (garden-pond-livestock)	Alluvial zone, no/or shallow flooding in the centre of MD	<ul style="list-style-type: none"> • Intensive use of labor • Diversification of farming, sustainable and efficient use of farm resources • High total productivity

Despite the principal issues and problems related to major rice-based systems mentioned above, from the agronomic point of view, current rice cultivation has some disadvantages:

Low price of products and high production costs. Farmers often suffer from low or unstable rice prices at harvest time. Sometimes the farm-gate prices per kg of rice approximately 0.07-0.09 US\$, while the production costs are almost the same (0.07-0.08 US\$ per kg). Production costs of rice are high due to several factors such as overuse of fertilizer, pesticides, and high seeding rate and post-harvest losses.

Intensive use of inputs. The common seeding rate ranges from 200-250kg ha⁻¹ in order to ensure good crop establishment and to reduce weed infestation. Fertilizer applications, especially nitrogen, are used at high rate of 90-130kg ha⁻¹N per crop (250-330 kg ha⁻¹N per annum with triple cropping) while only 50% is absorbed by plants.

More likely to suffer from pests and diseases. There is an increase of pests and diseases on rice, especially in triple rice fields. An investigation of the impact of pesticide use in the MD by Nguyen Huu Dung showed that more than 90% of farmers in the MD use pesticides and farmers use pesticide heavily, an average of 1,081 grams of the active ingredient per ha (Wheeler, 1998). In fact, pesticide overuse results in unnecessary and high production costs and is harmful to human, being kill beneficial animal causes and air and water pollution.

Damage due to flood and post-harvest losses for summer-autumn rice crop. A lot of rice land in the upper part of the delta is subject to serious flood damage making the summer-autumn crop more risky. In addition, post-harvest losses are also a big problem. Means for post-harvest management are inadequate. About two-thirds of the farms have no access to drying areas.

In conclusion, this paper aims to review important events which are helpful in understanding the development process of the MD agricultural systems with focused on the transformation of rice farming systems and to discuss the nature of the present status of intensively rice farming and issues and problems involved. All these issues and problems need to be taken into account for further study: there is need for a participatory research approach to introduce suitable ecosystem-specific systems that don't pose too much of a risk. This is in order to support the development of sustainable agriculture and to protect the environment.

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