South East Asian Studies, Vol. 16, No. 2, September 1978

Some Ecological Observations on Rice-Growing in Malaysia

Hayao FUKUI* and Yoshikazu TAKAYA*

Rice cultivation and its environment in the continental part of Southeast Asia are now quite a familiar theme to the authors since they have been working there for more than a decade (Fukui, 1971 and 1974; Kaida, 1973 and 1974; Kyoto University Team, 1976; Takaya, 1971 and 1974). Except for a short visit to Java in 1973 (Fukui and Hattori, 1974; Matsumoto *et al.*, 1974), both had no opportunity to undertake a field study on rice-growing in the insular part of Southeast Asia until recently. Their study in this part of Southeast Asia started with a two-month field trip to Sarawak by the senior author in 1976 (Kyoto University Team, 1977) followed by the one to Peninsular Malaysia by both lasting 45 days in 1977.

This paper is a brief summary of their basic understanding of the rice culture and its environment in West Malaysia.

I An Overview

As elsewhere, rice cultivation and its environment are not at all homogeneous throughout West Malaysia. Several distinct types in terms of agro-environment relationship can be identified. Yet, when compared with rice cultivation in continental Southeast Asia, it seems to be adequate to summarize the basic characteristics of Malaysia's rice cultivation as one undertaken in perhumid conditions.

In general, the factors determining the hydrological conditions of agricultural land are numerous. In case of rain-fed agriculture whose main source of water is rain water falling directly upon individual farm plots or *in-situ* rainfall, precipitation itself and some physical properties of the soil related to water retention might be more important than others. In case of rice agriculture, *padi* land is normally situated in areas into which water falling in other places eventually flows into and tends to remain. Therefore, landform becomes as important a determinant as precipitation in affecting the hydrological conditions of *padi* land. Furthermore, the lateral movement of water to and from *padi* land as affected by landform could greatly be modified by man's manipulation through the construction of irrigation and drainage works.

To sum up, the most relevant determinants affecting the hydrological conditions of *padi* land are: (a) precipitation, (b) landform, and, (c) the degree of human manipulation of lateral movements of water.

* 福井捷朗, 高谷好一, The Center for Southeast Asian Studies, Kyoto University, Japan

This is the general conclusion of the authors' past experience in different parts of Asia (Fukui, 1977), and the same seems to apply to Malaysia, too. Therefore, the perhumid conditions of Malaysian *padi* land will be discussed from these three points of view.

The amount and seasonal distribution of rainfall differ substantially in different parts of West Malaysia. In a certain region, e.g., the northwestern coastal plain, the dry season is more pronounced than in other regions. Yet, even there, the number of dry months does not exceed two or three. This means that for nine to ten months, over 100 mm per month rain falls even in the driest part of Peninsular Malaysia. In the other parts of Peninsular Malaysia, the dry season is either shorter or less pronounced than the Northwest.

Alternating dry and wet months might more or less be taken cognizance of by the local people. But its significance in terms of rice cultivation is much less in West Malaysia than in continental Southeast Asia. If the Malaysian standard for the dry period is applied to Central Thailand, for example, the rainy period in the latter might become only three to four months.

The historical evidence in continental Asia suggests that lowland rice cultivation did not necessarily start in the perennially or semi-perennially damp swale. It seems that the areas which receive and, at the same time, release water such as the alluvial fans, are most preferred. Reclamation of the water-receiving areas such as deltaic plains are rather recent developments followed by areal extension to the water-releasing areas such as terraces and plateaux where water is chronically in short supply.

A similar pattern of development in lowland rice cultivation can be seen in Malaysia. The seemingly oldest *padi* fields are found in the narrow valley bottoms of hilly regions. Lowland *padi* might first be cultivated in these stream valleys in combination with upland *padi* on the slope. As elsewhere, lowland *padi* gradually shifted to the coastal lowlands. These coastal lowlands are particularly wet in West Malaysia partly because of the weak development of alluvial plains. In many places in Malaysia, the narrow strip of marine sediment along the coast directly borders on the semi-recent terraces with limited fluviatile material between them.

Rice in Malaysia is not of utmost importance as in the traditional rice-exporting countries and regions of continental Asia. In West Malaysia, therefore, the flat to gently undulating land had been occupied by rubber and other estate crops before the aerial extension of lowland *padi* would have started from the water-receiving to the water-releasing areas.

In continental Southeast Asia, the traditional water control measures are often seen in the water receiving-releasing areas such as the alluvial fans of intermontane basins. There are many cases in which these water control measures are closely related to some political structure. In West Malaysia, the traditional water control measures certainly existed in the narrow valleys but since the acreage covered by a single weir is very limited, the construction and maintenance of these weirs and connecting ditches are within the capacity of individual peasants or a small group of them. The water control infrastructure created by the government began to appear in West Malaysia when lowland *padi* cultivation started to shift to the coastal lowland. The construction of the waterways for both transportation and drainage in Kedah plain is such a case.

More recently, double-cropping of *padi* becomes possible through large-scale irrigation schemes such as the Muda scheme. This and other schemes in West Malaysia are quite different from the irrigation projects of continental Southeast Asia because the former primarily aims at the double-cropping of *padi* while the latter aims at stabilizing and improving traditional single cropping of *padi* in most cases. Though the irrigation schemes in Malaysia contributed to improving and stabilizing the traditional main season cropping of *padi* besides introducing double-cropping, the hydrological conditions of *padi* fields remained as perhumid as or even became wetter than before.

As briefly stated above, both climate and landform resulted in the perhumid conditions of Malaysian *padi* land, and the recent development of water control measures did not so far seem to be effective in terms of improving such conditions.

II Implications of the Perhumid Conditions to Traditional Rice-Growing

That there are at least nine consecutive months with over 100 mm monthly rainfall implies that the shifting cultivation of hill *padi* could be quite a stable form of agriculture. Insufficient burning of forest vegetation due to the short dry period rather than drought during the course of growth, might have been a more serious cause of crop failure for hill *padi* cultivation. Upland *padi* cultivation (a continuous cropping of *padi* on non-submerged soil) which is seen here and there in West Malaysia also suggests a great dependability of rainfall. Relatively recent shifts from hill to lowland *padi* in Malaysia compared to continental Southeast Asia in general is considered partly due to the favorable rainfall pattern for hill *padi* cultivation in the former.

With the shift of *padi*-growing from hills to lowlands, the semi-perennially moist conditions are further accentuated as a combined result of climate and landform as mentioned earlier. The potential period during which lowland *padi* could be cultivated is usually longer than the actual growth period of *padi*. The growth period can be chosen within a rather wide time span according to the year-to-year fluctuations in rainfall, *padi* varieties available, labor resources and so forth.

At an interview with a *padi* planter near Melaka, it was heard that the normal planting season is June but this year he actually planted his crop in October because of water shortage in the 1977 season. Such a situation is unimaginable in the continental part of Southeast Asia with its distinct wet and dry periods.

The long wet period permits the *padi* planters to start land preparation after their fields are over-saturated with water. This means that the soil is already soft at the time of land preparation and what they have to do is to remove the vigorous growth of perennial weeds. As a result, ploughing tools are not traditionally popular and, instead, tools for cutting and removing sedges (*tajak*) are widespread. The draft animal may be used for harrowing, but rarely for ploughing.

Since the whole *padi* lot is over-saturated with water (shallowly inundated in most cases) at the time of planting, it becomes difficult to find a suitable plot for the wet nursery. But the great dependability of rainfall permits the raising of seedlings on dry or upland nurseries. The young seedlings in the dry nursery are transplanted to the shallowly inundated plot and, in some cases, they are uprooted again after a month or so, and re-transplanted to the whole field.

Thus, the *tajak* and dry nursery/double transplanting symbolize the characteristics of rice cultivation under perhumid conditions. Such a type of rice cultivation is mainly prevalent in the lowland areas of insular Southeast Asia, but is sometimes seen in the southern tip of some of the deltaic plains of continental Southeast Asia as well.

In continental Southeast Asia, the change in orientation of rice cultivation from basic subsistence to commercial production took place in the late 19th century. This change was not necessarily accompanied by increases in yield per unit acreage. Rather, the areal extension of *padi* land to the then sparsely populated deltaic plains is considered to have enabled large-scale production for commercial purposes.

A similar trend can also be observed in West Malaysia. As an example, it is said that the large-scale reclamation of the Kedah plain started in the 19th century. However, Malaysia could not produce a sufficient amount of rice for export or her own consumption until recently. There might be many causes for that. *Padi*-growing under perhumid conditions which is symbolized by the use of *tajak* may be one of the causes.

For the commercial production of rice in the deltaic plain of continental Southeast Asia, the draft animal is as important as the land itself. The constant supply of animals from the Dry Zone and Shan Plateau of Burma to the Irrawaddy delta, and from the Northeast of Thailand to the Chao Phraya delta, are good examples of this. With the help of these animals, the pioneering peasants were able to produce a marketable surplus of rice by cultivating a large acreage per household.

In the perhumid lowland, ploughing of soil by draft animals has not traditionally been emphasized. Cutting and removal of tall grasses are done solely by human labor. This might have been a significant disadvantage to Malaysian rice-growing in terms of increases in the marketable surplus of rice by acreage expansion per household.

III Implications of the Perhumid Conditions to Modern Rice-Growing

Since the 1960's, large-scale irrigation schemes have been implemented in various parts of West Malaysia. Their primary aim was to enable the double-cropping of *padi* and thus to attain self-sufficiency in rice. By the 1970's, this objective was realized. When we look back on the past development of commercial rice production in the deltaic plains of continental Southeast Asia and compare it with the Malaysian experience, their contrasts are strikingly clear.

As discussed earlier, the Malaysian setting is unsuitable for the large-scale commercial production of rice by acreage expansion partly because of the smaller manageable acreage per household. Instead of this disadvantage, the prolonged wet condition of *padi* land favors the introduction of double-cropping of rice. Shortening of the growth period of one crop by introducing new varieties of rice, farm mechanization and some supplementary irrigation suffice for double-cropping under perhumid conditions.

This Malaysian example may suggest that, as far as the perhumid conditions persist, the marketable surplus of rice in substantial volume might only be possible by double-cropping of rice. One cannot expect it simply by reclaiming new land for extensive rice-growing.

By the introduction of rice double-cropping, not only self-sufficiency in rice for West Malaysia as a whole has been attained, but also the income of rice planters has substantially improved. Double-cropping today is not mere repetition of yesterday's single-cropping in two periods. Fertilizers, new varieties, various machines and modern post-harvest facilities were also incorporated into the new cropping pattern. Yet, the perhumid condition still persists. Vigorous growth of weed, removal of it before planting, non-importance of ploughing and the dry nursery are all still commonly practiced.

It appears that the perhumid condition is not taken as something disadvantageous for rice-growing by the hydraulic engineers who designed the physical structure of the scheme as well as by the peasants themselves. Water is controlled for each large block of land surrounded by the trunk irrigation and drainage canals. There are no minor ditches of any kind in the block at all. It seems to us that drainage in the Malaysian sense of the term means prevention of excess inundation but not necessarily 'drying' of soil. It can be said that the existing water control system for rice double-cropping facilitated the continuation of the perhumid condition throughout the year.

The self-sufficiency in rice and the substantial improvements in rice cultivators' incomes were achieved by double-cropping. This means that the emphasis has been placed mainly on improvement of land productivity. Though further increases in land productivity can also be expected from now on, the major improvements experienced during the last decade may not occur in the near future. Yet, further leveling-up of *padi* farmers' income, if not of the total production of rice, will sooner or later become mandatory, when income increases in the other sectors of economy are taken into consideration. It appears that improvement of labor productivity rather than of land productivity should be emphasized in the future.

At this moment, the farmers who own the relatively large acreages of *padi* land depend on hired labor to a large extent. If labor productivity is significantly improved, hired farm laborers as well as small-holders are likely to be removed from rice farming. If there are no job opportunities for them, improvements in labor productivity in rice farming might be disastrous from the social point of view.

Nevertheless, it seems to be worthwhile to discuss the possible measures to increase labor productivity for two reasons. First, it is because the heavy and continuing subsidy would become the only way to maintain the income level of *padi* planters on par with that of the rest of population if the numbers of rice planters are kept at the present level. Second, one does not have to be so pessimistic about job opportunities for the surplus labor released from the rice sector.

By whatever way, substantial increases in labor productivity would be very difficult to achieve without improving perhumid conditions. Vigorous drainage to eradicate perennial weeds and to give the soil a greater capacity to bear heavy machines will be required for increases in labor productivity. Timely irrigation and drainage of the individual plots rather than block-wise water control will become indispensable. In conclusion, what will be required are: (a) change from the 'block' water control to the 'plot' water control by construction of lateral canals and minor ditches, and, (b) significant increases in drainage capacity, which would most likely require large pumping stations.

As mentioned earlier, Malaysian rice farmers are generally much more indifferent than those in the continental countries about water control because of the perhumid conditions in the lowland areas of Malaysia. One should not blame their indifference particularly insofar as modern facilities ensure a continuation of the perhumid condition by block-wise water rather than plot-wise water control. For plot-wise water control, re-appraisal of the existing system should first be done.

Re-examination of the existing system is likely to reveal that the irregular-shaped small plots surrounded by minor ditches running along contours would be the future picture for plot-wise water control unless large-scale earth moving is carried out in order to flatten the land surface. The large and rectangular plots with a straight alignment of minor ditches are possible to obtain only after costly land consolidation. The evolutionary process of improvement of the physical conditions of *padi* land elsewhere is that from the smaller and irregular plot to the larger and rectangular plot which becomes possible by the gradual leveling of land through ploughing and puddling for generations. However, with modern equipment for earth moving, such evolutionary processes might not necessarily be followed. Anyway, substantial land and water improvements would be indispensable to increases in labor productivity which is felt to be mandatory in increasing incomes of *padi*-growers.

Now, let us return to the question of how to absorb the surplus labor which will become available because of increases in labor productivity in rice farming.

Improvement of labor productivity may result in occupancy of a large acreage by fewer better-off farmers. But this is not the only possible picture for the future. What is actually happening in many countries is an increase in the number of part-time farmers. In the extreme case, they cannot be called 'farmers' anymore. Factory workers who practice farming during the week-end may be a more adequate expression.

Such part-time farmers may not necessarily be regarded as ideal farmers. Rather, a full-time farmer with a large holding of land tends to be better thought of. Regardless of this, the actual trend is definitely toward an increase in part-time farmers particularly in the traditional rice-growing countries.

There are ecological reasons for this trend. One of the reasons is that, as mentioned earlier, lowland rice depends on both *in-situ* rainfall and water flowing naturally or artificially into rice land which is thus normally found in the alluvial valleys. The other is that prior to the introduction of modern technology for yield increases, land productivity in rice farming was much higher than that of the rain-fed upland crop agriculture. This is particularly so when one takes into consideration the intensity of land use in lowland rice farming; neither fallowing nor rotation is known in lowland rice agriculture, hence the intensity is unity, while in the rain-fed upland agriculture the intensity is always below this.

Because of these factors, population and all types of economic activity tend to concentrate in the alluvial valleys and land holdings are divided into small lots. Therefore, the average distance between the farm and the factory or any other off-farm jobs can be less in the traditional rice-growing regions than in the European or North American type of agriculture.

Thus, as a means of absorbing the surplus labor, part-time farming will become more common in rice agriculture regardless of whether this is preferable or not. The authors believe that due attention should be paid to part-time farming at least as a temporary means of surplus labor absorption in rice-growing communities rather than only to transmigration from the rural to urban areas.

References

Fukui, Hayao, "Environmental determinants affecting the potential dissemination of high yielding varieties of rice: a case study of the Chao Phraya river basin," *Tonan Ajia Kenkyu* (*South East Asian Studies*), 9 (3), 348–374, Kyoto University, Kyoto, 1971.

Fukui, Hayao, "An agro-environmental study of the Vietnamese part of the Mekong delta," *ibid.*, 12 (2), 157–176, 1974.

Fukui, Hayao, and Hattori, Tomoo, "Agricultures of six villages in central Thailand and central Java," *ibid.*, 12 (3), 308–321, 1974.

Fukui, Hayao, "An ecologist's view on the development of rice farming communities." In: Proc. International Conference on Rural Development Technology: an Integrated Approach, Asian Inst. Tech., Bangkok, Thailand, June 1977.

Kaida, Yoshihiro, "A subdivision of the Chao Phraya delta in Thailand based on hydrographical conditions: water conditions in deltaic lowland rice fields (I)," *Tonan Ajia Kenkyu* (*South East Asian Studies*), 11 (3), 403–413, Kyoto University, Kyoto, 1973.

Kaida, Yoshihiro, "Hydrography of rice land in the Vietnamese part of the Mekong delta," *ibid.*, 12 (2), 143–156, 1974.

Kyoto University Team, "The research on rice culture and its environmental conditions in the Irrawaddy delta," The Center for Southeast Asian Studies, Kyoto University, Kyoto, 1976 (Its Discussion Paper Series, in preparation).

Kyoto University Team, "A study of padi cultivation in the state of Sarawak," The Center for Southeast Asian Studies, Kyoto University, Kyoto, 1977 (Its Discussion Paper Series, No. 96).

Matsumoto, Eiji, Suvijanto, Kaida, Yoshihiro, and Takaya, Yoshikazu, "Environmental conditions of three representative villages in central Java," *Tonan Ajia Kenkyu* (*South East Asian Studies*), 12 (3), 300–307, Kyoto University, Kyoto, 1974.

Takaya, Yoshikazu, "Physiography of rice land in the Chao Phraya river basin," *ibid.*, 9 (3), 375–397, 1971.

Takaya, Yoshikazu, "A physiographic classification of rice land in the Mekong delta," *ibid.*, 12 (2), 135–142, 1974.

Comments

by S. JEGATHEESAN*

In the absence of either a substantive paper or presentation by either of the two researchers on this topic, discussion is rather difficult. The first part, on the physical characteristics of Malaysian padi areas, by Dr. Y. Takaya, is essentially descriptive and straightforward, and I have only two observations to raise. The physical description of padi areas as "peaty mud" and "peaty accumulation" must be disputed. The major padi areas in Malaya, viz., the Kedah/Perlis coastal plain and the Kelantan delta can by no means be characterized as peaty. The Kedah/Perlis coastal plain is largely heavy marine clay with sandy loam soils toward the eastern upland fringes. The Kelantan delta consists of sandy loam and bris soils. Dr. Takaya's observations appear to have been based on the padi areas of Krian and Tanjung Karang — which are not typical of Malayan padi areas in general.

Dr. Takaya in addition states that "... well drained tracts are domain of rubber and oil palm, and only difficulty drained tracts, which comprise trash boxes of water from the rubber land, are used as *padi* land ...". I am not quite sure how to interpret this observation. It is sometimes fashionable nowadays for economic historians to suggest explanations for some current problems in rural poverty by reference to colonial land use and land alienation policies which led to alienation of high fertility land for plantation purposes, leaving only marginal areas for peasant agriculture. While this

* Head, Planning and Evaluation Division, Muda Agricultural Development Authority, Malaysia

might be true of upland crops, its applicability to padi land is questionable. Almost by definition, the well-drained undulating topography of areas suitable for rubber and oil palm, are not suited for wet-rice cultivation without substantial investments in land leveling and terracing. It is accepted however that poor drainage, and indeed in a broader sense, poor water control are presently major problems of the main padi areas. The emphasis on tertiary development, upgrading of irrigation infrastructure and on-farm development should however alleviate this problem to some extent in the future.

In Part II, Dr. H. Fukui devotes some attention to several aspects of water control for padi. In general, his comments are in order, but there would, in many cases, seem to be over-generalizations, drawn from few and non-representative observations. His characterization of padi cultivation as retaining some basic characteristics of hill padi cultivation, uneven land, poor maintenance, non-ploughing, *changkul* technology, etc., are not typical or even generally true of Malayan padi areas — certainly in the case of Muda, Province Wellesley and plots of Tanjung Karang they are not. However, his comments on the alignment of irrigation-drainage channels, terminal facilities, earth-moving and the need to emphasize agro-hydrology rather than civil engineering in irrigation systems design is opportune. Awareness of the importance of good water control within farm plots as an essential prerequisite for good farm management is not new, but only recently appreciated in Malaysia. I am glad to note that present plans for on-farm and tertiary irrigation development are already incorporating points raised in Dr. Fukui's paper.

The second part of the paper deals with measures for the intensification of padi production. Dr. Fukui sees either farm size increases per family or productivity increases per unit area as the only solutions to increase padi farmer incomes. I would suggest that some combination of both is most appropriate. Acreage extension per farm family is a tempting suggestion, but we need to consider the magnitude and nature of the adjustments necessary to provide farm families with farms adequate to meet certain minimum income levels. With unalienated land suitable for rice virtually non-existent, or at best, very limited, acreage extension per farm family can only be achieved by siphoning small farmers out of the padi sector. For the Muda area alone, such minimum farm sizes would be about 3–4 hectares. Assuming, for instance, that all farmers presently operating 1 ha. and less would be the first to be induced to leave and their farm holdings re-distributed to the next largest class, this would involve re-settlement of 42% of the farm households in Muda — or more than 25,000 farm households. Apart from the sheer magnitude of this task, the implications of such an out-migration to the agricultural labor supply of the region need to be considered. Small-farm households are net suppliers of labor to large farms which in turn provide cash employment to hired labor — a sort of symbiotic relationship — which can only be replaced with large-scale mechanization if agricultural output is not to fall.