
Dynamics of rainfed lowland rice varieties in north-east Thailand

Shuichi Miyagawa
*Faculty of Agriculture,
Gifu University, 1-1 Yanagido,
Gifu 501-1193, Japan*

Introduction

Almost half of area under rice cultivation in the world is rainfed. As rainfall is an important factor determining crop growth and yield, low and unpredictable rainfall regimes mean uncertainty of crop performance and hence risks to livelihood of small farmers. North-east Thailand is situated on the Korat Plateau (100-200 m amsl) characterized by intense weathering and leaching. Rice is grown over an area of 600 million ha. As irrigation potential is limited due to undulating topography and rain shadow effect, much of rice cultivation is rainfed. Rainfall, apart from being too low to support high rice yields, shows wide inter-annual variations. Usually, it is

not possible to plant rice in every plot. Cropped fields suffer the risks of getting damaged due to flood or drought as evident from long-term monitoring of cropped area and yields in selected villages. The average yield (1.6 t ha^{-1} over 1985-1998 period) of north-east Thailand is lower than the national average of 2.0 t ha^{-1} , according to the Agricultural Statistics of Thailand of every crop year (Alpha Research 1995, 2001).

Ecology of rice varieties

In early 1980s, about 30 rice varieties were planted in the village Don Daeng (Miyagawa, 1996). The predominant varieties were mostly glutinous which constitute staple food of the regions. Based on length of maturity period, varieties were classified as: early-, medium-, late- and extremely late-maturing varieties. Although medium-maturing variety group had the highest cultivar diversity, the late-maturing variety group covered the largest fraction of cropped area. Choice of a variety is, by and large, guided by topographical conditions. Rice fields in Don Daeng village are located on shallow saucer shaped topography, locally referred to as *nong*. Typically, a farmer owns his rice plots from the bottom to top of a *nong* and identifies them as lower, middle and upper rice fields.

Mid-April is the beginning of rainy season. Lower rice fields of a *nong* get first inundated by June or July. Plowing, harrowing and transplanting follow soon after inundation. Adequate water accumulation in upper fields of *nong* occurs at a much later date compared to lower fields. Thus, transplanting proceeds from the lower fields planted with late-maturing varieties followed by middle fields planted with medium-maturing varieties and the upper fields planted with early-maturing varieties (Figures 1-3). The time of onset of rainy season is quite uncertain, but rainy season ends always by the mid-October. Flooding in lower fields lasts longer than the upper fields. Traditional varietal selection is thus adapted to the prevailing climate and topographic conditions. For optimum yields, early-maturing varieties are planted in the highest/upper fields and late-maturing varieties in the lower fields. While sowing/transplanting begins from lower to upper fields in a *nong*, harvesting proceeds from upper fields with early-maturing varieties to lower fields with late-maturing varieties (Figure 2).

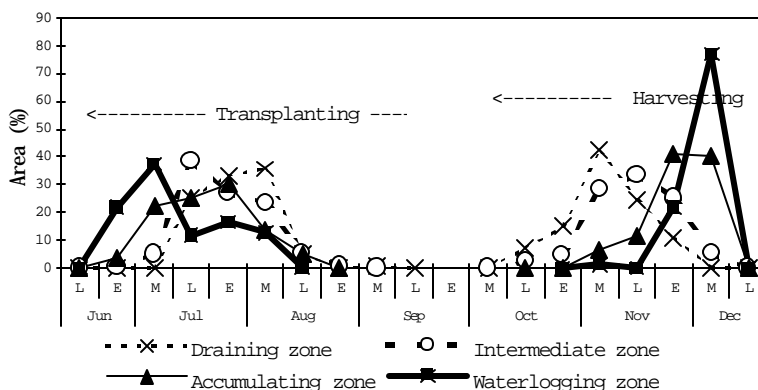


Figure 1. Progress of transplanting and harvesting in Don Daeng (1983)

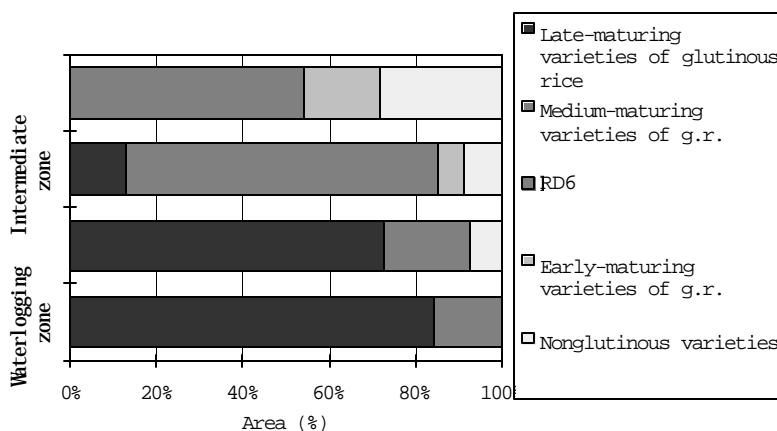


Figure 2. Relationship between planted area ratio of varieties and water condition of paddy field in Don Daeng (1983)

All varieties have strong photosensitivity and hence critical day length differs among varieties. Panicle differentiation stage which is very sensitive to water stress, is reached before the end of rainy season (middle October) in early-maturing varieties, much earlier than the medium-maturing and late-maturing varieties. Late-maturing varieties have the longest growth duration with early transplanting and late harvesting (Figure 3). Rice yield in Don Daeng was higher when the growth period was longer and vegetative growth was more vigorous (Miyagawa and Kuroda, 1988).

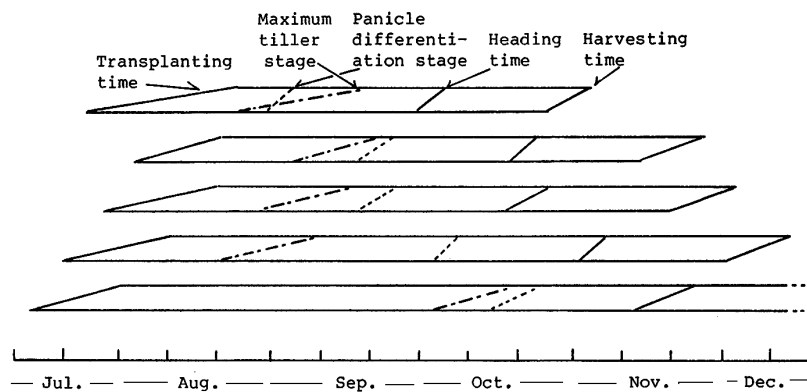


Figure 3. Growth stages of varieties in Don Daeng (1983). a; early-maturing varieties (glutinous), b; medium-maturing varieties (nonglutinous), c; medium-maturing varieties (glutinous), d; late-maturing varieties (glutinous), e; extremely late-maturing varieties

Varieties RD6 and Khao Dok Mali (KDML)

Improved glutinous variety, RD6 was released in 1978. During early 1980s, 1% farmers planted this variety over 0.3% of area under rice in Don Daeng. In the year 1991, 92% of farmers planted RD6 over 74% of area under rice (Miyagawa, 1995). In the year 1999, 93% of farmers planted it on 87% of rice fields (Aoki and Miyagawa, 2000). Agricultural statistics shows that RD6 variety was sown in 83% of total glutinous rice area in the north-east in the year 1995. This corresponded to 40% of total area of main season rice. Extreme dominance was found in many districts of Kalasin, Khon Kaen and Loei provinces (MAPNET, 1999).

Indigenous non-glutinous rice varieties are grown in southern provinces of North-east Thailand. The non-glutinous variety KDML (*Chao Mali* or *Hom Mali* in farmers' dialect) has been extending also in traditional glutinous rice zones. In the year 1995, area under KDML reached 71% of the total area under non-glutinous rice and 37% of the total rice area in north-east Thailand. More than 80% area under KDML was observed in almost all districts of Buriram, Surin and Sisaket provinces in the year 1997 (MAPNET, 1999). In Don Daeng, area under KDML extended from 7% of total planted area in the year 1983 to 15% in 1991 (Figures 2, 4). In contrast,

farmers of a rainfed rice growing village in Yasothon province were planting KDMI in 51% of the total planted area in 1991. They grew non-glutinous rice on a very small scale in the early 1980s (Miyagawa, 1996; Nakada, 1995). RD6 was bred from KDML105. Both varieties belong to the medium-maturing variety and now cover 80% of rice fields in north-east Thailand.

Adoption process

The reason of adoption of variety RD6 by farmers was different from that of variety KDML. Farmers got attracted to RD6 for its grain quality, taste and productivity (Miyagawa, 1995). They appreciated that once steamed in the morning, RD6 rice can maintain its soft quality until evening. RD6 has a higher grain: straw ratio and responds to fertilizers better than other varieties. When RD6 was introduced without fertilizer input as in early 1980s, most farmers did not grow it because they were uncertain about its yield potential. Further, farmers were compelled to try to raise yields on existing fields rather than experimenting the new varieties on new land because all scope of agricultural expansion had already exhausted in north-east Thailand.

In the late 1980s, as investment in rice cultivation increased, RD6 spread rapidly not only in the village Don Daeng but in many other villages in the north-east. Funds for investment had outflowed from cash crops and off-farm jobs. Mutual communication among villagers coupled with efforts by government agencies played a catalytic role in expansion of this variety. Expansion of non-glutinous KDML variety derived from its higher economic value compared to glutinous rice. In some villages of Yasothon province, KDML variety was adopted after achieving higher production of glutinous rice from RD6 using high rate of organic manure/chemical fertilizer application.

Impact on agroecosystem

RD6 and KDML expansion was not a simple phenomenon of variety change in rice cultivation. It was a reflection of transformation of indigenous rainfed rice cultivation in north-east Thailand. This transformation was characterized by introduction of power tiller, chemicals, supplemental irrigation, hiring of labor along with replacement of many indigenous varieties by RD6 and KDML. As a

matter of fact, all rice fields on topo-sequence were occupied by RD6 and KDML, which happened to be medium-maturing varieties (Figure 4). As a result of concentration on medium-maturing varieties, all rice fields had to be harvested in the same time though transplanting time varied among plots (Figure 5). Labor shortage was avoided because operating area per household reduced with time and harvesting and threshing machines became available.

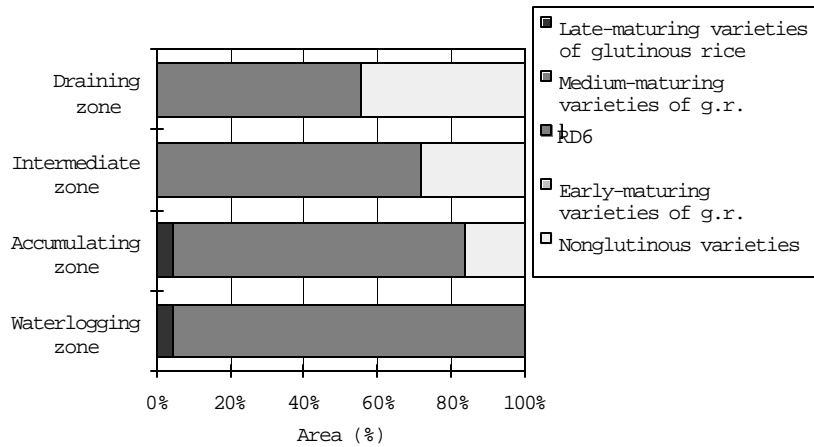


Figure 4. Relationship between planted area ratio of varieties and water condition of paddy field in Don Daeng (1991)

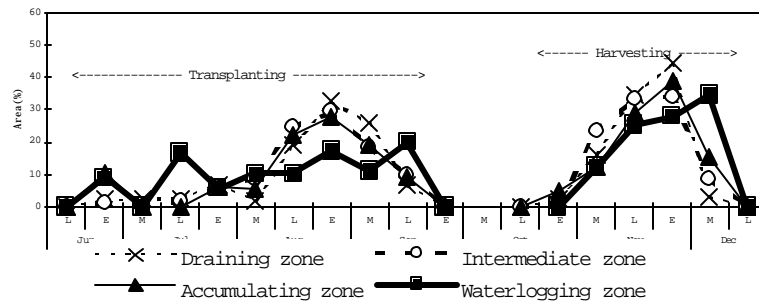


Figure 5. Progress of transplanting and harvesting in Don Daeng (1983)

Farmers must have decided to adopt RD6 and KDML after evaluating their merits/demerits in comparison with the varieties they were growing. A gradual increase in rice yield continues in Don Daeng (Figure 6). The new system may be improving rice production in rainfed conditions. Apart from RD6, now a few farmers grow some new improved varieties developed by Rice Research Institute. In spite of such improvements, rice production contributes only 2% of the total cash income of farmers. Expenditure in rice cultivation is twice the income from selling of rice. The system is sustained with support from off-farm jobs to farmers.

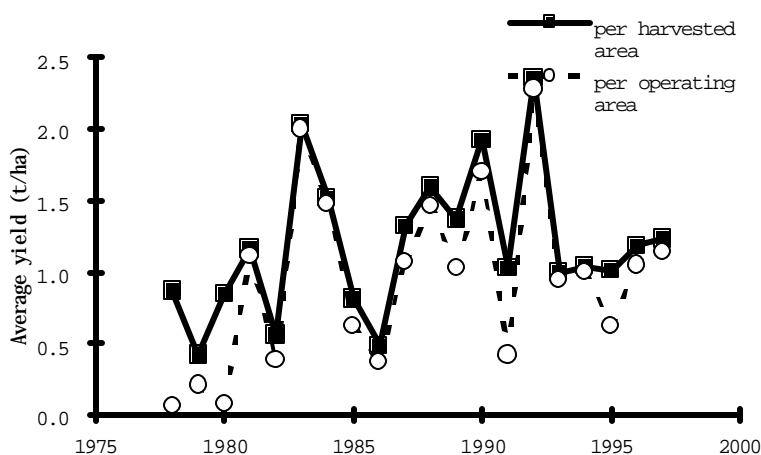


Figure 6. Changes of average yield among farmers in Don Daeng

References

- Alpha Research. 1995. Thailand in Figures 3rd edition. Alpha Research Co., Ltd., Bangkok, Thailand.312-313.
- Alpha Research. 2001. Thailand in Figures 7th edition. Alpha Research, Co., Ltd. Bangkok, Thailand.361-362.
- Aoki, A. and Miyagawa, S. 2000. Changes of rice yield of rain-fed paddy field for 20 years in Don Daeng village of north-east Thailand. *Japan Journal of Tropical Agriculture* 44: 51-52.
- MAPNET. 1999. Sub-district level agricultural survey of north-east Thailand, 1997. North-eastern Regional Agricultural

Extension Office, Thailand.

Miyagawa, S. 1995. Expansion of an improved variety into rain-fed rice cultivation in north-east Thailand. *Southeast Asian Studies* 33: 187-203.

Miyagawa, S. 1996. Recent expansion of non-glutinous rice cultivation in north-east Thailand: Inter regional variation. *Southeast Asian Studies* 33: 547-574.

Miyagawa, S. and Kuroda, T. 1988. Variability of yield and yield components of rice in rain-fed paddy fields of north-east Thailand. *Japan Journal of Crop Science* 57: 527-534.

Nakada, Y. 1995. Surplus rice and seasonal labor migration: A case study at a village in Yasothon province, north-east Thailand. *Southeast Asian Studies* 33: 609-624.