Late transplanting caused by water shortage leads to yield reduction in plot-to-plot fields in Central Laos

Irrigation systems in the semi-mountainous areas of Laos (officially the Lao People's Democratic Republic) are not well-developed. Most farmers do not have direct access to irrigation water, thus they depend mainly on plot-to-plot irrigation and rainwater. Fields in the upper parts of the system have priority, and there is low flexibility in water use especially in the lower parts, including the target area at N Village in the northwestern part of Vientiane Province. This study aims to clarify the location of low productivity fields, identify the constraints to crop yield, and propose measures to increase yield, in the hope of making a contribution to improve lowland rice productivity.

As noted during the 2013 crop season, transplanting of rainy season rice started at the beginning of July and was completed in mid-August. However, even as transplanting went on in the upper and middle parts of the lowland area in mid-July, the lower fields still had not received water and had not even began plowing. In such fields, transplanting started from the beginning of August (Fig. 1). After transplanting, there was no serious water shortage in the entire lowland field areas. Fields with yields greater than 4.0 t ha^{-1} were mainly located in the upper and middle parts; in contrast, fields with low yields (less than 2.0 t ha^{-1}) were located in the lower part of the area. A relational analysis of the yield at 137 plots showed that grain yield was significantly higher in fields that had early ponding (before 20 July) and early transplanting (in July) than in fields that had late ponding (after 21 July) and late transplanting (in August) (Table 1). There was no correlation between soil fertility and rice grain yield (total nitrogen: R^2=0.004, available phosphorus: R^2=0.08). Field experiments also indicated that grain yield in early transplanted field (in July) was higher than in late transplanted field (unpublished data). The results suggested that late transplanting caused by water shortage led to yield reduction in the lower fields of the plot-to-plot irrigated area. In order to increase grain yield in the lower fields, transplanting should be completed by the middle of July, and early irrigation or increasing irrigation amount in the upper fields are necessary to accelerate water supply to the lower fields.

In order to share water resources to the lower fields, a consensus on water allocation among villagers is essential. The head of N village or a local government staff should play the role of coordinator. Farmers' working schedules should also be arranged to avoid labor conflicts caused by the change in transplanting time. In addition, water resource development and irrigation facility improvements are necessary to increase the capacity according to expanding water demand from the mid-June to early July. Irrigation facilities are not developed in 73% of agricultural lands in the five countries of Indochina, which means that most fields are irrigated plot-to-plot. The results of this research, therefore, can contribute to such plot-to-plot fields.

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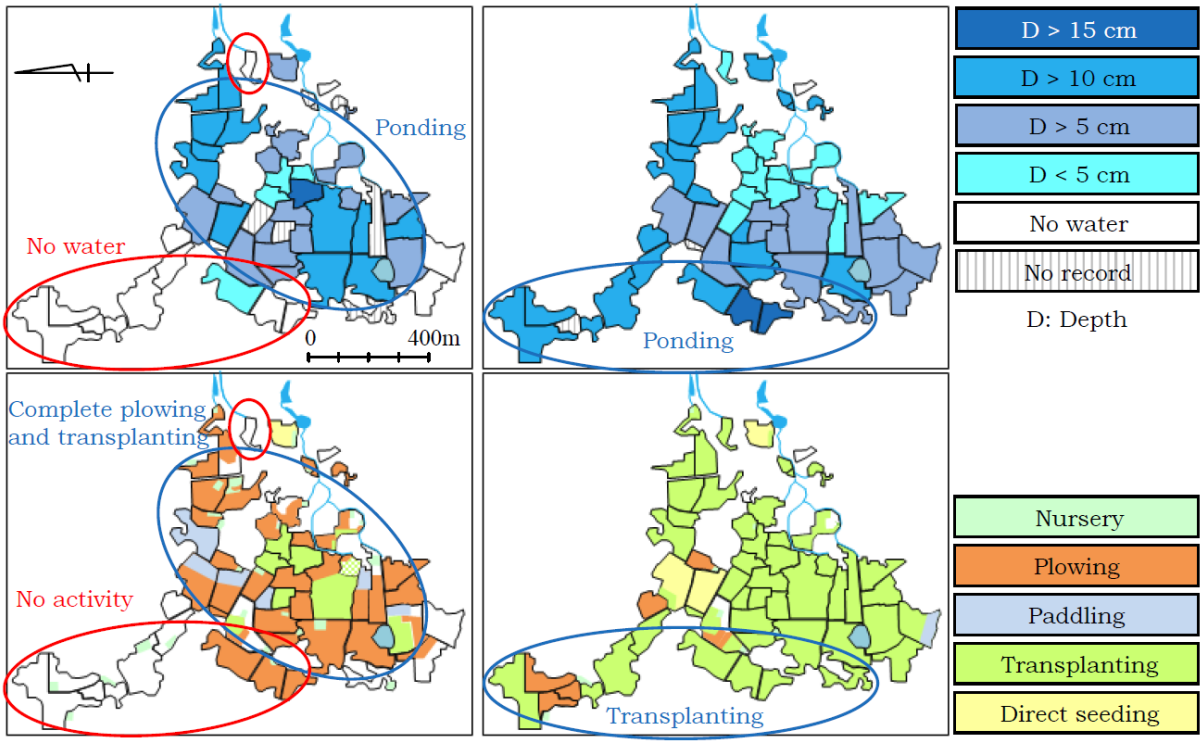

14 July 2013 04 August 2013

Fig. 1. Surface water depth (upper) and practiced farming activities (lower) in each field

Table 1. Relationship between grain yield and start times of ponding/ transplanting

Classification		N*	Avg. grain yield t ha^{-1}	Note
Start time of ponding	Before 20 Jul	108	3.87 [a]	Significant difference between a and b at $p < 0.05$ according to t test
	After 21 Aug	29	2.22 [b]	
Start time of transplanting	Before 14 Jul	28	4.20 [a]	Significant difference between a and b at $p < 0.05$ according Tukey-HSD test
	15 Jul – 28 Jul	64	3.68 [a]	
	29 Jul – 11 Aug	45	2.88 [b]	

* Sampling quadrats (1 m × 1 m) were installed in 47 field blocks as shown in Fig. 1. Three large field blocks were divided into two parts, and three quadrats were installed for each (in total 150 plots in 50 blocks). The relationship between yield and times of field ponding and transplanting were analyzed. The 13 samples (4 plots harvested by farmers before sampling and 9 plots in direct seeding field) were excluded from the analysis (n = 137).