Direct seeded rice production under variable field-level water conditions in tropical monsoon Indochina Peninsula

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Water availability for production of both irrigated and rainfed rice differ greatly due to monsoon rainfall amounts and patterns in tropical Asian countries. Introduction of irrigation system, both in terms of irrigation facilities and organization such as water community, is most powerful to increase and stabilize rice production, but this is costly and attainable only very limited areas. One of the least costly methods is also well known for rainfed rice that assigns cultivars with different flowering time to fields with different water availability. It is not known however, how choices of crop establishment methods, traditionally popular transplanting, and recently increasing direct seeding to cope with current and future agricultural labor shortage, will contribute to stabilize rice production for resource poor farmers under different water conditions.

In order to assess the nature of adaptive management of direct seeding rice technology under different water conditions in Northeast Thailand and Northwest Cambodia, farmer field investigation (in total 50) and sets of agronomic experiments were conducted from 2003 to 2007 to compare direct seeding with transplanting under different water conditions (non-flooded and drought prone, non-flooded without severe drought, shallow flooded, and deep flooded conditions) with/without weed control. In general crop establishment method and water conditions had strong interactive effects, affected by weed infestation; direct seeded rice yield equally or higher than transplanted rice under favorable water conditions, while transplanting could achieve better seedling establishment under stressed conditions (e.g. water, weeds) and out yielded direct seeding. In a few cases, both practices were interchangeably used by farmers for the same field who encountered unexpected flooding or drought, both in Thailand and Cambodia, so that no planting or complete crop establishment failure was avoided.

From the 5-year case study of continuous observation, a qualitative future analysis for the paddy fields was conducted. In Scenario 1, where a large scale irrigation system is successfully introduced in rainfed areas with relatively high water availability, dry season irrigated rice becomes feasible; cultivars with earlier maturity and higher market value will be desired, but also it would be likely to have effects on diversity of maturity length for rainy season rice cultivars. As the length of off-farm period is shortened, labor saving technology is to be further needed. In Scenario 2, where global warming will slightly increase the average rainy season precipitation in rainfed tropical monsoon Asian regions, a failure of transplanting, or severely damaged establishment of direct seeded rice will be avoided or alleviated, but a increase of heavy rainfall will increase risks for flooded damage against germination or young seedling of direct seeded rice. In Scenario 3, where occurrence of drought increases, direct seeded rice is more likely to reduce yield than transplanting unless technical innovation is delivered.

In any cases increasing technological levels both for transplanting and direct seeding will strengthen the capacity of farmers to cope with uncertain future water availability in rice fields. Improvement of labor productivity for transplanting, and land productivity for direct seeding are identified as important to stabilize and increase future rice production in rainfed fields in tropical monsoon areas in Thailand and Cambodia. Technologies for stable plant establishment, such as inexpensive land leveling, suitable cultivar development, environmentally safe weed control methods, supplementary resource uses are needed for future direct seeded rice production.