Research article

Challenges of Dry Season Rice Production under Irrigation Scheme of Tapeing Thmor Water Reservoir

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Abstract This paper examines the barrier of dry season rice intensification of community's irrigator under Irrigation scheme of Tapeing Thmor Water Reseroir. In total, 61 water using households and water use committees were selected for interviewing. The representatives of FWUC argue the irrigation is functioning quite well but smallholder farmers complain to have no access to irrigation water, supposedly due to inappropriate design and functioning of the canal systems. Some also argue that water management at the community level is not well organized, which leaves part of the smallholders farmers with no opportunities for dry season rice production. Field work also reveals that agricultural extension services are not entirely efficient and not evenly spread out through the community of water using farmers. In addition, the capital and labour needed for smallholder farmers to be engaged in dry season rice production with high purchasing of agricultural inputs usually leads farmers to contract loans from local moneylenders who charge a high interest rate. The paper discusses that further development for dry season rice production under Tapeing Thmor's irrigation scheme should focus on improving agricultural extension services and the provision of affordable access to credit in order to maximize its outreach.

Keywords dry season rice intensification, community irrigator

INTRODUCTION

Rice-based farming systems are the backbone of Cambodia's agricultural sector, which is the main agricultural produce as well as staple food of the country. Rice production contributed a quarter of the agricultural GDP in 2006 and 40.7% of agriculture growth between 2003 and 2006. Most of the agricultural land was dominated by rice cultivation. In 2004, 84.4% of cultivated land was devoted to rice fields. Rice production was estimated at 4.3 million tonnes, with yields averaging slightly more than 2 tones/ha (Bingxin Yu, 2009**)**. Hin Sarith (2003) stated that total cultivation area is 2, 189, 923 ha and for wet season cultivation area around 1,926,004 ha and dry season cultivation area about 259, 919 ha.

The Northwest Irrigation Sector Project placed an irrigation system project to deal with rural poverty by improving agricultural productivities among poorer farmers. The farmers in these project areas will be organized into farmer water user associations and trained on sustainable operations and maintenance of the new irrigation schemes. The project will also train current

agricultural extension workers and place a new group of irrigation extension personnel to help the farmers improve rice production, diversify crops, and integrate livestock and fisheries. It will also help establish rural credit to households (ADB, 2006).

Rice cultivation at dry season usually produces higher yields, but there is a confounding effect with increased fertilizer use. Dry season rice production under an irrigation scheme of Tapieng Thmor Water Reservoir is favorable to intensify rice cultivation in the dry season since water is available. However, the farmer is reluctant to intensify because community water management remains to be the critical issue and it sometimes creates chronic conflict among downstream and upstream water users (David. F et al, 2009).

METHODOLOGY

The universal inquiry of research study has designed both qualitative and quantitative research by collecting information from peasant households, who are the members of irrigation communities. The most qualitative method used was to gather information in water management from the Farmer Water Use Community. Questionnaires were used to conduct interviews with target peasant households and the check-list was designed for collecting information from members of FWUC's committee, staff of NGOs and agricultural officers. Sample selection used a 'Snowball' technique for selecting irrigation members. The size of the sample *(n)* was determined by using Yamane Taro (1967) formula to restrict the number of peasant households for each community. The total number of cultivator for each community at dry season represented for population *(N)* and accuracy level *(e)* was 15%. Two communities were selected among five communities of FWUC of Tapeing Thmor Wate Reservoir. In total, 61 peasant households were selected using the Yamane Taro formula for conducting interview.

Yamane Taro Formula (1967), Equation: $n=N/1+N.e^2$ (1)

The main variable in socio-economic and technical practice was assigned into forms of semi-structure and structure interview for collecting the information from peasant households. For information related to the functional irrigation scheme and management of water distribution, non-structure interviews were used to gather information from the committee of water distribution (FWUC). For the rest of actors in agricultural intervention issue as well as the design of non-structure interviews for the district department of agriculture and ECOSORN. Otherwise, the regulatory framework of water management committees was collected as the document from FWUC to verify the performance of the community in water distribution. Collected data was classified into two kinds of data called quantitative data and qualitative data. Qualitative data analysis has been carried out by synthesis in three dimensions of a theoretical model, a framework design of FWUC, and an application of water distribution to evaluate the performance of community water in water management. The portion of quantitative data has been analysed in SPSS program, and the output has been discussed by using tabulation and cross-tabulation of variables with percentage values and p-values in descriptive statistics.

RESULTS

Labor of family member occupied on cultivated land area

Involvement of labor by family members in their rice cultivation is important for their productions. Normally in rice production of Cambodian peasants, they could intensify a labor into their production depend on amount of labor in their family, so possibility of rice production in a family was determined by a number of labor in their family. Table 1 shows results on peasant households who cultivated on surface area less than 2 ha. The number of working family members involved is significantly rather than the peasant households who has land cultivated area larger than 2 ha. For example: the peasant households who has small scale of land cultivation (<.50 ha) and family

member around 2-3 people, it indicated around 11.9%, so it suggest that small cultivation area, but a labor of family member involved more that the peasant households who have the large scale of land cultivation (3.50 ha) and family member about 2-3 people was revealed only 2.4%. Actually, peasant household who have large scale of land cultivation hired extra labor or machinery to work instead of human labor because they preferred to save time and human labor to do other works.

Table 1 Labor of family member and cultivated land area

		Land Cultivation (ha)				
		<.50	.50 - 1.99	2.00 - 3.49	3.50+	Total
Family Member (labor)	<2	20.0%	80.0%	0.0%	0.0%	100%
	2 - 3	11.9%	71.4%	14.3%	2.4%	100%
	4+	0.0%	66.7%	33.3%	0.0%	100%
Total		11.5%	72.1%	14.8%	1.6%	100%

Intensified labor in cultivated land area

Adoption of high technology in rice cultivation has reduced the need for human labor. However, additional labor force has remained necessary for some peasants who had a large scale farm and faced labor shortage in their family. Regarding this research study, K.Helmers (1997) stated in his report that most of the research found evidence that peasant household frequently experienced labor shortage and they usually hired labor during peak demand. During dry season, labor shortage was not a significant problem during cultivation because the scale of land cultivation area was not too large in comparison to labor in the region. The result of study showed that 33.3 % of small scale farm (less than 0.50 ha) hired additional labor, and large scale farm (more than 3.50 ha), hired 100% additional labor to assist their cultivation. On the contrary, Chi-quire analysis of these interviews demonstrated that the scale of cultivated land area with hiring of additional labor is not significant. Consequently, hiring of additional labor did not depend on the farm scale or cultivated land area.

Peasant's experience of dry season rice cultivation and agricultural intervention

Dry season rice production under Tapeing Thamor irrigation scheme has appeared a couple of years ago, since Democratic Kampuchea regime toppled. The investment by the government in irrigation systems accompanied by the adoption of green revolution ensured food security and doubled rice export as the core policy of Cambodia's government. Tapieng Thamor irrigation scheme has opened access to peasants in intensifying rice production at dry season. Lack of experience in dry season rice production was the problem which peasants faced in their production. An empirical result indicated that (Fig 1) about 35% of a peasant irrigators has never been engaged in dry season rice cultivation. There were 62% of a peasant irrigators has been engaged experience from 1-2 times and only 3% of a peasant irrigators involved in dry season rice cultivation from 3-4 times. Temporarily, all the experiences that they had at dry season were so little to lead the peasant to overcome the challenges they faced. Agricultural extension service offers limited access to the peasants at the community level.

In order to accompany the rehabilitated irrigation scheme, there were many NGOs and government officers involved to provide the agricultural service package for building capacity of peasants. According to the obtained result indicated in Fig 1, 48% of peasants do not have agricultural intervention from the rest. They practiced their cultivation by carrying out an experience at the previous time in wet season or an experience which shared from their neighbour. The peasants who regard agricultural intervention about 52% were target group of NGOs. They regarded agricultural package either service or material such technical support, fertilizer and seeds, but those peasants were not significant to intensify their productions compare to the peasant without intervention, so it's consistent with evolution of the district agricultural department stated

through the speech that majority of peasants couldn't benefit from their production, but some peasant could benefit because the situation of their land cultivation closed to the canal.

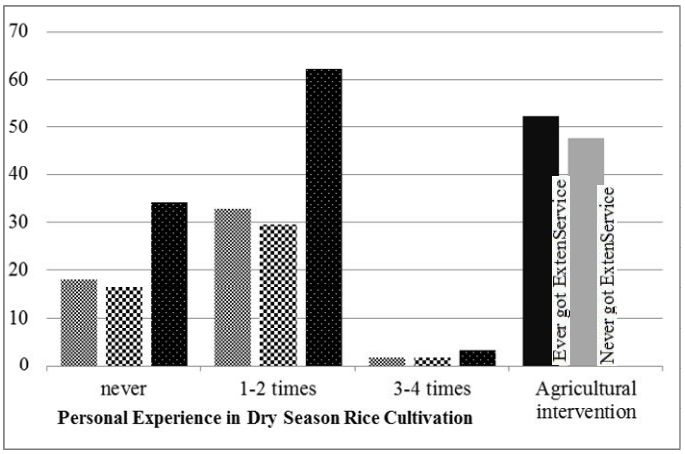

Fig. 1 Experience in dry season rice cultivation and agricultural intervention

Accompanying of technology

Oxen are still the most popularly used for land preparation and transportation. Each pair of animals is capable of plowing between 0.2 and 0.25 ha per day and the average farm area worked per pair is 2 ha, otherwise hand-held walking tractor has an ability to work 4-5 times more compared with a pair of oxen (Rickman et al, 1995). Although, oxen remain the popular power source for peasants, the research result indicated only 44.3% of pair animal are used as dragging animals at one time. On the other hand, hand-held walking tractors are used for cultivation at approximately 75%. In comparison between a hand-held walking tractor and dragging animal, it revealed that around 31% of peasant household used both animal and machine because a hand-held walking tractor could not operate in difficult circumstances. Otherwise peasants who have only a pair animal were approximately 13%. They kept it for transportation and plowing in floating rice area. On the contrary, there was no peasant in the research areas who do land preparation by a pair of animals in dry season rice cultivation. Most of the peasant prefers to plow and harrow with hand-held walking tractor because its task can be accomplished much faster.

Table 2 Using drag animal and hand held walking tractor

		Hand-held walking tractor		
		Yes	No	Total
Drag animal	Yes	31.1%	13.1%	44.3%
	No	44.3%	11.5%	55.7%
	Total	75.4%	24.6%	100.0%

Capital shortage

Adopting modern varieties in dry season needed more requirements of fertilizer, pesticide, and so on. The requirement of agricultural input was required twice as much in comparison to wet season because at that time they could use only traditional variety. In order to increase their production, some peasant household used their capital to buy fertilizer and pesticide, but other peasant households loaned credit because they could not meet to dose of fertilizer application for modern varieties. As the analyzed result, 85% of peasants loaned credit when they began to prepare land for cultivation, 12% when they needed fertilizer during maintenance and only 12% when they harvested.

Accompanying of credit provider

Lack of credit availability is considered to be a major constraint on rural development. Actually, necessary of credit accrued to the peasants, when they begin to practice cultivation, they always loaned credit to fulfil gap in crop cycle. Currently, rural credit services are provided through NGOs and informal institution or in cooperation with NGOs and international organizations. According to empirical result, it demonstrated that peasant loaned money from different channels such as kinship around 17%, nearly 64% from domestic merchants and from the formal credit institute around approximate 19%. Most of the peasant who preferred to loaned money from the domestic merchants don't have a land certificate or are unable to reimburse on time. Interest rates among three channels, most of the peasant loaned from the domestic merchants with an interest rate around 2.05-4.69%. Otherwise, in comparison to the same level of interest rate with a formal institution, it's indicated nearly 15%. If we look back to the percentage of peasant loaned money from the domestic merchants in an interest rate 4.70-7.34% the percentage continued to increase in comparison to different actors of credit provider at the same level of interest rate.

Function of water supply

After Tapieng Thmor Water Reservoir was rehabilitated under the project of Minister of Water Resource and Metrology (MWRAM), its capacity also was enlarged to store water at approximately 160 million m^3 equal to 12000 to 20000 ha of the water body at wet season, and it could supply rice cultivation around 9365.91 ha. For the dry season it has a capacity to store water at a volume around 70 to 80 million m^3 and it has a possibility to irrigate around 7000 ha at dry season. Currently, there are 5 communities registered under Farmer Water Use Community's Tapieng Thmor, but only 4 communities that activated in dry rice cultivation, in total around 897 ha. Theoretically, the volume of water at dry season shows it is possible to irrigate six times what is needed to cultivate the area of the activated communities under an irrigation scheme.

Cultivation and irrigation situation

The Irrigation scheme was rehabilitated only main canal by connecting from the reservoir, but a sub-canal was not constructed to facilitate water distribution. Lack of a sub-irrigation scheme to drain water from main canal, peasants could not expend their paddy plot far away from the main canal because it is difficult to drain water for irrigation. It required more equipment to facilitate irrigation, so the increased production cost could not benefit the peasant. As the result of observation, the peasants in CWU's Tankam cultivated far from main canal in average approximately 137 m. Particularly, peasants are located at CWU's Ponley, and they cultivated an average distance from the main canal to paddy plot approximately 76 m. On the contrary, most of the peasants in CWU's Tankam could use old sub-irrigation schemes. Actually, most of the peasants could practice their cultivation at dry season, as long as their rice field was not far from main canal by more than 1ha.

Water shortage

Crop Irrigation is based on water availability and the situation of rice field or knowledge of peasant. There are some differences of crop irrigation among two communities. CWU's Tankam located downstream are always faced with water scarcity more than CWU's Ponley because of the situation of a canal that is unable to hold water and transfer water properly. Its consequent upon a shallow canal and some part of a physical canal was damaged. Crop irrigation was done when water was available in the community, and sometime they were unable to irrigate because water was unavailable. Although it is a time of crop water demand, it brought water utilization in the community into competition. As the imperial result revealed that 57% of member irrigators never faced with water shortage during their cultivation and 43% has been faced with water shortage

because of the turn of water delegation is not a time for irrigation, otherwise illegal activities of irrigator's irrigator's members at upstream such as blocking water stream. So, those issues have contributed to water inadequate.

Performance of FWUC in water management and distribution

Farmer Water Use Community was organized by Ministry of Water Recourse and Metrology and the regulatory framework was designed and authorized by FWUC and MoWRAM. As the result of verifying using principle design in common pool resources management of E.Ostrom have been published in 1990 as the model theory in order to verify with the regulatory framework of FWUC, which almost consistent with model theory. On the contrary, implementation couldn't carry out to the field work because it lacks of participation from a team members. Only few members worked actively in water management and distribution, so they could not respond at all. The gap in water management and distribution contributed to water usage at the community level into the complexity. Parity of water distribution was not equal access between upstream and downstream. Sometime the peasant who located at the upstream was abused the turn the peasant at downstream, but the relevant authorities never punished the ones who violated operational rule, even the rule was regulated yet. The child experience in water management and distribution of FWUC was the problem of less activation of FWUC. Anyway a lack of financial support as well as the issue that FWUC could not operate water distribution properly to communities.

CONCLUSION

This paper addresses some important aspect of challenges in dry season rice intensification in an area where water command of Tapeing Thmor Water Reservoir. Water body in the reservoir was surplus 6 times in comparison to the cultivated area, but some peasant faced with water shortage for irrigation application, even some part of an irrigation scheme was rehabilitated. The performance of community in water distribution is not organized well because only few members of FWUC, who worked in water action. All the process in their cultivation almost was replaced by machinery, although human labors are significant to intensify their cultivation. Field work also revealed that agricultural extension services are not entirely efficient and not evenly spread out through the community of water user peasants. In addition, the capital needed for small holders peasants to be engaged in dry season rice production with high purchasing of agricultural inputs. It usually leads farmers to contract loan from local moneylenders which charge a high interest rate.

REFERENCES

ADB (2006) Irrigation infrastructures for improving agricultural production. Country Water Action: Cambodia, ADB Project Profile: Northwest Irrigation Sector in Cambodia.

Bingxin, Y. (2009) Rice production response in Cambodia. International Association Agricultural Economists, China.

David, F., Leonardo, G., Maria. Z. and Rada, K. (2009) The potential of rice intensification in Paoy Char, Banteay. Meanchey province, western Cambodia, Case study in Trapeang Thma Khang Tboung and Poay Ta Ong Villages. SLUSE Report 2009, Faculty of Life Science, University of Copenhagen, Demnark.

Hin, S. and Kong, K. (2003) Country report on horticulture in Cambodia, Ministry of Agriculture, Forestry and Fisheries, Cambodia.

Helmers, K. (1997) Rice in Cambodia economy: Past and Present. H.J. Nesbitt (ed.), Rice production in Cambodia. Cambodia-IRRI-Australia Project, Cambodia.

Rickman, J. F., Pyseth, M., Sothy, O., Theary, C. and Nhem, S. (1995) Farm mechanization and crop production in Cambodia. Cambodia-IRRI-Australia Project Baseline Survey Report No 5, CIAP, 20.