Case Studies on why AWD Technology is not widely Adopted in Ayeyarwaddy Delta

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Abstract

In Myanmar, rice production is a substantial source of the greenhouse gas (GHG) emissions. Reducing methane from irrigated rice field is an important mitigation measure for the rice growing countries like Myanmar. The practice of Alternate Wetting and Drying (AWD) is the most promising technology for reducing methane emissions from rice cultivation, as well as offering water saving and cost saving co-benefits. However, AWD is not yet widely practiced in Myanmar. The challenge is to understand why AWD is not being widely adopted; identify physical, economic, and/or institutional barriers; and to make recommendations for policies, planning, and implementation of development projects. The International Rice Research Institute (IRRI), implemented two projects in the Ayeyarwaddy Delta which involved demonstration trials of AWD, from 2012 – 2014 in BoGaLay, MawLaMyineGyun and LaButta Townships where trials were implemented in fresh water, brackish water and saline water environments. To identify the conditions that affected adoption of AWD technology in the IRRI project areas, and to describe how these conditions affect the farmers' willingness to adopt AWD in each township, three case studies were conducted in these three townships in September 2015. It was observed that most of the farmers in one village tract of Mawlamyinegyun Township expanded the area cultivated using AWD, in the year following the IRRI project. And also, two out of four farmers in one village tract of Bogalae Township continued to practice AWD on their demonstration plots in the year following the IRRI project. However, all other farmers involved in the trials discontinued the practice of AWD following the end of the IRRI project. As per case studies of three townships, there were three major factors that could decide AWD practice widely adopted or not. Those three issues are (i) water availability, (ii) economic incentive and (iii) leveling of the rice field. Although it was observed that some farmers in Mawlamyine Gyun Township expanded their rice area under AWD technology, these issues were quiet important to widely adopt AWD in that township.

Keywords: AWD, GHG emission, land leveling, salt water intrusion

1. Introduction

Climatic change will have significant impacts for the agriculture sector in Myanmar, requiring adaptation of agricultural systems. There is an urgent need to identify and adopt practices that reduce emissions resulting from agricultural systems as part of the national plans to develop the agricultural sector, increase food security, and reduce poverty.

Rice production is a substantial source of the greenhouse gas (GHG) emissions in Myanmar. Reducing methane from irrigated rice field is an important mitigation measure for the rice growing countries like Myanmar. Years of research have shown that the practice of periodically drying rice fields has the potential to reduce methane emissions by 30-50% without reducing yield. Alternate Wetting and Drying (AWD) has the adaptation co-benefit of requiring less water reducing the cost to pump water to irrigate the fields. [Ref: IRRI Overview of AWD; IRRI & CCAFS InfoNote;]

The International Rice Research Institute (IRRI) implemented two projects in the Ayeyarwaddy Delta which demonstrated trials of AWD, improved varieties, drum seeders, and post-harvest technologies. The two projects were implemented from 2012 – 2014, in collaboration with the Department of Agricultural Research, the Department of Agriculture, and several NGO partners. The AWD demonstration sites were located in BoGaLay, MawLaMyineGyun and LaButta Townships of Ayeyarwaddy Delta Region (10 sites in Bogalay, 11 in Mawlamyinegyun and 12 in Labutta). The AWD trials were implemented in fresh water, brackish water and saline water environments.

In one village tract of Mawlamyinegyun Township, most of the farmers expanded the area cultivated using AWD, in the year following the IRRI project. Also, two out of four farmers in one village tract of Bogalae Township continued to practice AWD on their demonstration plots in the year following the IRRI project. All other farmers involved in the trials discontinued the practice of AWD after the end of the IRRI project.

2. Problem statement

The practice of Alternate Wetting and Drying (AWD) is the most promising technology for reducing methane emissions from rice cultivation, while offering water saving and cost saving co-benefits. However, AWD is not yet widely practiced in Myanmar. The challenge is to understand why AWD is not being widely adopted; to identify physical, economic, and/or institutional barriers; and to make recommendations for policies, planning, and implementation of development projects.

3. Objectives of case study

1) To identify the conditions that affected the adoption of AWD technology in the IRRI project areas in the Ayeyarwaddy Delta
2) To describe how these conditions affect the farmers' willingness to adopt AWD technology in each township
3) To identify the lessons learned from adopting the AWD technology and and its implication for policy and development project planning.

4. Findings of case study

In Myanmar, the characteristics of most ricefields are iregulary shaped, small in sizes and not levelled. In areas likeNayPyiTaw, Yangon and Mandalay, some of ricefields are leveled by farm machinery. However, even if the ricefields in these areas areleveled by farm machines, there is still a gradient of 6 or more inches within the field.

During the dry season, the main sources of water are from irrigation canal of dam in the central and upper Myanmar, and from the streams and rivers in the Ayeyarwaddy delta. In the delta area, there are three type of water availbale for irrigation - fresh, brackish and saline water.

4.1 Case I: Mawlamyine Gyun Township

4.1.1 Summary

A leveled land is one of the most important criteria to successfully adopt AWD during rice cultivation. In Mawlamyaine Gyun township, the rice lands can be categorized into forest land and main land. Relative to the farmers in the main land, the farmers who had demonstration sites on forest land could expand their cultivation under the AWD method in the following year. This is because there was much larger leveled land (2000 acres) for AWD demonstration in the forest land compared to the mainland.

The presence of many rivers and streams in the rice cultivation areas in the township of Mawlamyinegyun provides sufficient water supply during the dry season. However, in only few area farmers can access the irrigation water by the natural flow. Most of the farmers have to pump irrigation water to the field.

The cost of pumping irrigation water varies with distance to the water source. The farmers use diesel pumps to irrigate the field. If farmers practice AWD the cost of pumping can be reduced by half. This provides a substantial economic incentive to farmers to adopt AWD.

To practice AWD successfully, the irrigation water should be under the control of the farmers. This criterion is met in Mawlamyaine Gyun Township since the farmers can take irrigation water from many rivers and streams in the area

without any limitation on quantity and the pumps are owned by one or more farmers.

4.1.2 Location of AWD demonstration sites and sample farmers

Kyar Hone and Pyar Mut Shaw Chaung village tracts were chosen as demonstration sites for the AWD method. Ten farmers from four villages (5 from Padekaw, 3 from Kyee Chaung and one each from Teteku and Kyahone)participated in the AWD demonstration trial. Five of these farmers were invited to Maylamyaing Gyun Department of Agriculture office for a group interview. . The interviewed farmers own 5-8 acres of land where demonstration plot sizes measuring 0.5 acre and 1.0 acre. In the year following the IRRI project, they expanded the area cultivated using AWD method up to 2 - 3 acres, on their own land where conditions were suitable.

4.1.3 Reasons why the key farmers in Pa Dae Kaw village tract of Mawlamyine Gyun expand AWD technology in their own land

a) Level Land in rice fields

The land in the demonstration plots in Pa Dae Kaw village tract of Mawlamyine Gyun was level enough to permit effective practices of AWD. Much of the farm lands in the saline prone areas of this township are relatively level because it was a mangrove forest prior to becoming rice fields 20 years ago. Although those lands are now under rice cultivation, they are still forest land according to land registration.

Even in level land area of rice field, there is one issue that it has still 6 inches gradient. To utilize the AWD effectively, the laser leveling technology should be applied. However many of the ricefields cannot be reached by large farm machines due to lack of access roads and the field are surrounded by small streams. Therefore, only the laser leveling using small light tractor was utilized to overcome the levelling problem

b) Water Availability (ref: IRRI project reports, especially 170)

Sufficient fresh water is available throughout the growing season. Up to the vegetative stage, the water can be irrigated with the natural flow. After the vegetative stage, the irrigation water has to be pumped up from the streams and river. Sites compared - IRRI 170: fresh / brackish / saline, map

c) Economic Incentive

The normal cost of fuel for pump irrigation varies from 12000-20000 Ks. per acre for the whole season under continuing flooded. The farmers reported that

they can save almost half of the pumping cost by using the AWD method. The permanent flooding practice need at least 12 pumping hours per acre. However, under the AWD method it needed only 3-6 hours of water pumping per acre depending on the distance of the filed from the water resource.

d) Other Strengths and Opportunities

Varieties: Lack of Salt tolerant varieties

Drum-seeder: the farmers in Mawlamyinegyun told YAU that they were interested in adopting the practice of wet direct seeding using the drum-seeder demonstrating in IRRI project. Traditionally, during the summer rice cultivation they use 5-8 baskets of seed per acre for broadcasting method. By the drum-seeder, the farmer only used 1 basket of seed per acre.

Pest and Rodent: Farmers did not report problems with pests and rodents.

Post-Harvest: see appendix (xx) of IRRI 150.

Other varieties: The project provided the new promising rice varieties such as CSR 36, 10T, 108, 109, and 111 which are very suitable to grow in less water field conditions. The average yield of the rice variety is 94 baskets per acre, which is relatively lower than the popular summer rice variety "Theehtat Yin". The average yield of Theehatat Yin was 104 baskets per acre. Although the yield is lower the farmers got the price of 6300 Ks. per basket for the new varieties. However, they received only 3800 Ks. per basket for Theehtat Yin.

4.2 Case II: Labutta Township

4.2.1 Summary:

Land leveling is the most important criteria to adopt the AWD method in rice cultivation in Labutta township. Although there was sufficient water available throughout the dry season in Latbutta township, salt water contamination occurred in the area from March to May. However, most of the farmers can adjust the time of sowing to avoid the contaminated salt water to irrigate in their rice field.

The cost of pumping irrigation varies with distance to the water source. The farmers use diesel pumps to irrigate the field. In practicing AWD the cost of pumping can be reduced by half. This provides a substantial economic incentive to farmers. To practice AWD successfully, the rice land should be level to control the water in their field.

4.2.2 Location of AWD demonstration sites and sample farmers

Among the twelve (12) representative farmers, (6) six respondent farmers (3 from Gone Nyin Tan village, 1 from Hse Chaung village and 2 from Kone Htaw

village) were selected for the survey of success or failure of the AWD method. All the sample farmers own 10 ac or more rice field.

They started using AWD techniques in the summer rice seasonof 2013, as part of IRRI projects. During the project period, they practiced these techniques to only 0.5 acre of land. They stopped adapting the AWD practice after the end of the project. The farmers from that township are willing to use AWD method if their land is level.

4.2.3 Reasons why the key farmers in Labutta cannot expand AWD technology in their own land

There were two major conditions that hampered the success of the AWD technology successfully. . According to the discussion with key farmers from that township, uneven land level was the most serious barrier for all of the key farmers. The contamination of fresh irrigation water by saline water when the field had to be irrigated was the second constraint to achieve the AWD benefit successfully.

(a) Level of Land

In Myanmar, some of uneven rice fields are leveled by farm machine. However, in the township of Latbutta, they have no access to farm machineries and only use cows and buffalos for plowing and harrowing their field. Thus, the farm lands have a slope of 9 to more inches which makes the water level rise to about 2-3 inches. Land reform and systematic irrigation and drainage canal should be done to practice the AWD method.

(b) Water Availability

The irrigated water source is from the streams in Latbutta Township. Except for the months of March and April, irrigation water can be pumped from the streams.

During March, April and May, sea water intrusion makes the streams more saline and cannot be used as irrigation water because it results in high percentage of unfilled grains. Once irrigation water becomes brackish, the farmers do not want to apply it to the fields. So, farmers have to start growing rice earlier, during November – December, to avoid pumping brackish water into the fields during flowering time for the dry season rice.

(c) Economic Incentive

The irrigation for AWD method reduces 1/2 to 1/3 times when compared to traditional method of rice growing. Moreover, the amount of water to irrigate is only 2-3 inches in AWD method. While in traditional method the farmers have to

irrigate full amount of water in their field. Therefore, traditional method took a longer time to use pumping machine and fuel. So, comparing with traditional planting method, AWD method can reduce amount of water and fuel cost for pumping.

(d) Other Barriers in Labutta Township

By practicing AWD method, the amount of seed used can also be reduced. However, there is more weed problem in the field in AWD practice when compare to traditional method of rice growing. Farmers tend to oversupply herbicides which caused the burning of rice plant. Thus, trainings on effective and efficient use of herbicide is needed for the farmers. Another problem is the prevalence of rodents. During drainage, rodents eat the rice plant which resulted to the reduction of yield. Another problem in Latbutta Township is the scarcity of farm labor for transplanting and weeding. Moreover, access to drum seeder is also limited in this township. So, most of the farmers are using broadcasting method to grow the rice.

4.3 Case III: Bogalae Township

4.3.1 Summary:

There were three major constraints to practice AWD technology successfully, in Bogalae Township. According to the discussion with five key farmers from that township, uneven leveling of the rice field was also the constraint for adopting AWD. In most of the rice field in demonstration sites were not level enough to utilize the AWD method effectively. And saline water contamination on irrigation was a serious constraint for all of the key farmers in this area. Moreover, Economic disincentive was the second barrier to achieve AWD benefit successfully.

4.3.2 Location of AWD demonstration sites and sample farmers

There are 10 AWD demonstration plots in Bogale township, in which four (4) plots are located in SabelKone village under DarChaung village track and seven (7) plots are in ThazinKone village under AKalChaung village track. AWD practice was introduced in these two village tracks by IRRI in 2013 summer rice season.

To conduct the case study on success and failure of AWD, Kye informant interview was done with five (5) key farmers with AWD demonstration sites. As per key informant interview, two out of five farmers continued to practice AWD on their demonstration plots, following the conclusion of the IRRI projects.

In the sample farmers, 4 key farmers were from SabelKone village and (1) from Thazinkone village. The AWD method was introduced to all the farmers by IRRI in the summer rice season of 2013. Although they practiced these techniques

0.5 ac of their own land, 3 farmers out of 5 respondents did not use that technology anymore and the rest two also did not expand AWD practice in his land.

They said two out of four farmers from one village tract continued practicing AWD on the same demonstration plots in following seasons. We interpreted this finding as their willingness to continue AWD practice after the end of IRRI project because they can access fresh irrigation water when necessary and the field are relatively level.

4.3.3 Reasons why the key farmers in Bogalae do not expand AWD technology in their own land

(a) Land is not level enough to practice AWD

In Bogalae Township, most of rice fields have not been levelled. The rice fields are surrounded by small creeks or river and it is not easy for farm machinery to access. To practice AWD technology, most of rice field are found as uneven land leveling and they cannot control the water level for about 2-3 inches. It makes more pumping cost than that of the even land level.

(b) Water Availability

All of the rice fields are irrigated from rivers and streams in Bogalae Township. In that case, there are two types of irrigation, natural irrigation and pump irrigation.

Natural irrigation is the irrigation to rice field when the water level of the streams or river is higher than the irrigation canal of that field as the tide come up to the river. When the tide come up, the fresh water flow of the river and the sea water of the tide are mixed. Therefore, there is some percentage of saline water in the irrigation water for the rice field. The percentage of saline water depended on the season. During the dry season, a high percentage of saline water (about 75-100 %) occurs in January and February.

The dry season rice growing period is from November to March in Bogalae, so that the natural irrigation is only available in the first two months. After the vegetative stage of rice production, the farmer cannot utilize the natural irrigation and he has to irrigate his rice field by using the diesel pump, to avoid the saline water in irrigation, when there is no tide.

(c) Economic Disincentive

In normal rice production, after vegetative stage of rice, the farmers stored large amount of water in his field that no additional irrigation is needed until seed setting. He just needs to irrigate one time in his field. However, in AWD practice, the farmers need to irrigate multiple times after vegetative stage. In the meantime, the only water source is pump irrigation from the steams when there is no tide. This

means that the farmers practicing AWD have a cost for pumping while the farmers under traditional practice had no cost for pumping.

To get fresh water when there is no tide, the farmer pumped up the irrigation water from the stream. However, after some time the water level gets low and incurs more cost. (i.e. more pumping hours, in next time, to get the same amount of irrigation water). There is no realized economic incentive for the farmers using AWD method in fact there is economic disincentive.

(d) Other Barriers

Soil Type and Perception of the farmers

In the demonstration sites of Bogalae Township, the soil type is assumed as clay soil. According to the discussion, the farmers never let their rice field dry during growing season of traditional production practice. Under the AWD technology, the field left dry until the soil surface was cracked. The farmers' perception was that the irrigation water would quickly percolate through cracked soil and so could not maintain the irrigation water in the fields long enough. The field required frequent irrigation so that there was not much difference in pumping hours between the traditional practice and AWD.

Weed Problem

When AWD was practiced, there was an increase of weeds in the field. To overcome this, some farmers used herbicide; however, they were not sure of the quantity of input and oversupplied it because they were afraid it would be ineffective. It caused burning of rice plant. So, they need the training on effective and efficient use of herbicide.

Rodent

Rodent is one of the problems especially at the stage of milking and the farmers cannot control it well. It makes significant losses in yield.

5. Summary and Conclusion

As per case studies of three townships, there are three main forces that could decide whether or not the AWD practice should be widely adopted. Those three issues are (i) water availability, (ii) economic incentive and (iii) leveling of the rice field.

Although the farmers in Mawlamyine Gyun Township expand their rice area under AWD technology, these issues are still important to resolve in order to widely adopt the AWD method in that township.

For the Bogale case, the demonstration sites were located in the higher land which is needed for pump irrigation and have uneven land level, although there may

be some suitable location which is level and can access natural irrigation. The reason choosing these demonstration sites may be to show how the cost of water can be saved. But due to this uneven land leveling problem, most of the farmers could not practice more. To practice AWD widely in the study area, these three issues need to solve to practice AWD in their rice land.

5.1 How the issues should be solved

i. Land is not sufficiently Level

Most of the rice fields are not levelled enough to practice AWD. Even land leveled using farm machinery may have a gradient of 6 inches or more from one side of the field to another. Increased efforts to level rice fields are needed to enable water conservation wherever farm machines can access. To practice AWD widely in that area, farm land development program including leveling the land, irrigation and drainage facilities, must be considered.

ii. Saline Water Contamination in Irrigation

Saline water causes the higher unfilled grain percent of the yield. According to the discussion, almost all of the respondents said they lost 40 to 60 % of their rice yield due to the unfilled grain, which means that although the harvested yield was about 60 to 80 baskets per acre, the effective yield was only as 30 baskets per acre. To overcome that problem, AWD should be practiced only before the contamination of salt water in irrigations. Nearly before salt water intrusion, the farmers have to change to their traditional practice, i.e. storage enough fresh water in the field for the remaining period of growing season. One possible solution is use of salt tolerant varieties in those areas.

iii. Economic Incentive

As economic incentive of AWD technology is saving water cost, in those cases saving pumping cost, farmer's irrigation management should be promoted to be efficient and effective manner. Therefore, the irrigation management project should be integrated in those areas.

6. Lesson learned

1. Importance of land leveling
   Cost of pumping is less if the land is level
2. Contamination of Salt water in Irrigation occurred in later part of the growing season
   AWD method should be practiced before saline intrusion.
   - don't pump after saline intrusion
   - use salt water tolerant varieties

7. Policy recommendation

7.1 Physical Issue

(1) It is needed to review the AWD trial in central dry zone, to get more understanding of the conditions that promote AWD practices widely.
(2) There is need for updated maps of areas cultivated to rice, both irrigated and rain-fed.
(3) There is need for AWD suitability maps for major rice cultivation areas.
(4) For irrigation project sites, land leveling, especially laser leveling, should be promoted and supported for maximum water use efficiency. It is needed to better coordination between irrigation department, agricultural mechanization department and department of agriculture.
(5) Land development policy included land leveling activities, but so far implementation has been limited to pilot sites. These activities need to be scaling up substantially. The priority areas for scaling up land leveling activities should include irrigated rice cultivation area of central dry zone, and upper Myanmar as well as those areas in the delta suitable for AWD.
(6) To promote AWD in Delta area widely, a systematic breeding program for salt tolerant rice varieties combined with an effective distribution system of tolerant seed is needed.

7.2 Socio-economic Issue

(1) The management of irrigation schemes should incorporate an economic incentive for users to conserve water, e.g. irrigation water should have a price and not be free and unlimited.
(2) Existing water taxing policy should be reviewed in order to promote the effective utilization of water.
(3) Irrigation scheme managers should receive training in how to manage water distribution for rice fields practicing Alternate Wetting and Drying (AWD).
(4) Water users association should be promoted to practice AWD method widely.