The Impacts of Water-Saving Technologies on the Lives of Philippine Farmers

Ariana Shapiro

World Food Prize Borlaug-Ruan Intern

International Rice Research Institute

Los Baños, Philippines

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Introduction

I was completely unprepared for my life to change direction so suddenly. I was comfortably situated in Ithaca, New York, a small upstate college town. I had interests and thought I knew the direction in which I was heading. In retrospect, I can say I was blissfully ignorant, until an assigned paper on international development started me questioning everything about the world I had once meekly accepted.

I sat in a Cornell library one late summer night scanning report after report about a world incredibly foreign to me. The story was intricate and nuanced; grievances and opportunities intertwined at the forefront of a study called development. I was intrigued. I learned more and more – about hunger and poverty, agriculture, population, education and so on, and began to wonder if there was a place in the discussion where I belonged. I wrote a paper for the New York Youth Institute discussing the adverse effects of population and urbanization on Kenya's food supply. While the paper helped determine my results in the competition and was graded for school, I noticed that my drive to succeed in writing it came entirely from the satisfaction I felt as I learned monumental and expository things about the world. I was deeply invested in the topic.

Fortunately, I was chosen as a New York State delegate to the 2010 Global Youth Institute and corresponding Borlaug Dialogues in Des Moines, Iowa. The story of the developing world got a lot more real, as I heard first-hand accounts from the policy makers and researchers who authored the reports I had earlier studied. I spoke to smallholder farmers about their countries: still distant, unimaginable lands for me. In hopes of continuing my journey into their reality, I decided to apply for a Borlaug-Ruan International Internship.

A few short months later, I found myself sinking past my ankles in the warm mud of a rice paddy, delicately transplanting seedlings for a subsistence farmer in the rural Philippines. I placed each plant deliberately, knowing that in my hands I held a small part of a family's primary food supply. If these tiny plants failed, for whatever reason, that family would go hungry. The struggle for food security couldn't be more real.

In the two months I spent at the International Rice Research Institute in Los Baños, Philippines, I found what my distinctive role in international development could be, and through the process learned more than I ever imagined I could.

IRRI – The International Rice Research Institute

In the 1960s, widespread famine had a stronghold over Asia. Facing an increasing population and a tough economic situation, the Rockefeller and Ford Foundations collaborated with the Government of the Philippines to create a solution. They founded the International Rice Research Institute in 1960 with the goal of improving rice to avert the hunger crisis. The high-yielding, fertilizer-responding, short-stemmed variety of rice developed at IRRI was a key player in the Green Revolution that brought millions of Asians out of hunger and poverty. (IRRI)

Over 50 years later, IRRI's mission is to "reduce poverty and hunger, improve the health of rice farmers and consumers, and ensure environmental sustainability through collaborative research, partnerships, and the strengthening of national agricultural research and extension systems." (IRRI) IRRI continues work on developing new rice varieties and crop management techniques that ease the burden on struggling smallholder farmers.

IRRI is the oldest member of the 15 international research centers supported by the Consultative Group on International Agricultural Research (CGIAR) and the largest non-profit agricultural research center in Asia. Though it is based in the Philippines, IRRI has branches in fourteen countries, from Burundi to South Korea to Nepal. Funding comes from governments, philanthropic organizations, the private sector, international organizations, universities, and the CGIAR itself. (IRRI)

The Global Importance of Rice

IRRI's motto is "Rice is life". As a New York State resident who interacted minimally with rice, it took total immersion in Southeast Asia to realize the salient truth of this statement. Rice is the staple food for more than 3 billion people worldwide, over half of the global population. Because it is the only staple crop that can withstand flooding, it has historically flourished in Asia, where wet environments abound. In fact, Asian farmers account for 92% of world rice production. (IRRI)

In the Philippines, where I literally lived on rice for three meals a day, entrées are called *ulam*, accompaniment to rice. Driving past rice paddies for hours on end in different parts of the country, I noticed how the crop comprised much of the living biomass of the landscape. And through years and years of rice production and consumption, it has influenced much of the Philippine economy and culture. Rice truly is life.

And yet, many rice farmers are facing challenges. More than one billion of the poorest people in the world rely on rice as a staple crop. With a constantly growing population, world production of rice must increase by 8-10 million tons per year. But the rising sea level and intensified natural disasters brought about by climate change make it difficult for existing agricultural land to thrive. Prevalent water scarcity and reduced resources further complicate the mix. (IRRI)

Irrigation

I was assigned to work in the Social Science Division of IRRI on issues of irrigation. Irrigation is of paramount importance in rice production. It is estimated that 34-42% of the world's irrigation water, or 24-30% of the world's freshwater withdrawals, is used for the irrigation of lowland rice alone (Bouman et. al, 2007).

Rice farmers use a diversity of irrigation systems. One common method for individuals to irrigate their land is through a shallow-tube well, which draws water directly from a stream or other local source. Communities of farmers often pump water from a deep well, or they use a gravity system, which delivers water from a large source to individuals through gravity. Unlike a deep well pump, a gravity system incurs no fuel costs. A different large-scale style of irrigation is the diversion of water from a central reservoir or lake to farmers. (Bouman et. al, 2007) Although other irrigation systems exist and are important, I concentrated on these forms.

Water-Saving Technologies

The destructive effects of climate change on the supply of fresh water do not bode well for a growing population that demands a corresponding rise in rice production. It is estimated that 15 to 20 million hectares of irrigated rice may suffer some degree of water scarcity by 2025 (Bouman et. al, 2009). Since we can't increase the land area or water supply to meet agricultural demand, we must instead work to better allocate the limited resources that exist. One way to "share" water better, so as to equitably increase area for irrigated rice, is through the employment of a water-saving technology called Controlled Irrigation or Alternate Wetting and Drying (AWD). AWD was the central theme of my research.

Alternate wetting and drying is the process of flooding a rice paddy a certain number of days after the disappearance of ponded water. In other words, the field is alternately flooded and dried, a change from the traditional practice of continuous flooding. Farmers wait between 1 and 10 days to irrigate, letting the field drain in the interim. A field water tube, made of bamboo or plastic, helps them assess if it is time to irrigate (Figure 1). If the water level drops more than 15 cm below the surface in the dry season (20 cm in the wet season), as assessed by the field water tube, it is recommended that farmers flood their field again to a depth of 2-5 cm above the surface (in contrast to 5-10 cm in traditional practice). This cycle continues except for a period of continuous flooding during the flowering stage to prevent sterility. (Bouman et. al, 2007)

Figure 1: Engr. Evangeline Sibayan of PhilRice describes how to use a field water tube

AWD can reduce water consumption by 15 – 30%, and is widely accepted as having little effect on yield. It therefore seems like a clear and easy way to allocate scarce water supplies so farmers have sufficient irrigation for existing and new rice farms. Yet, it is vital that researchers test this claim, by looking into the impact that AWD may have on numerous factors including yield, farm area, weed growth, tillering, farm practices, labor, household income, farmer conflict, gender roles and general livelihood.

I sought out these social, economic, and environmental impacts on AWD-practicing farmers in two regions of the Philippines, Bohol and Tarlac (Figure 2). These farmers are only several of hundreds of thousands in South and Southeast Asia who have adopted AWD.

Studying AWD is important for the continued development and extension of the technology, especially after the Philippine Department of Agriculture issued an Administrative Order in 2008 that will enable the mainstreaming and institutionalizing of AWD. (Lampayan et. al, 2010)

Figure 2: Map of the Philippines

Case Study -- Bohol

Introduction

Bohol is a province located in the south central Visayas, the group of islands that comprises the center of the Philippines. The terrain is mostly hilly, although the central and northern lowlands are ideal for agriculture. Bohol has a Corona climate type IV, meaning that rainfall is nearly even all year round; there is no distinct wet or dry season (Mondoñedo 2008). For the rice farmers that constitute the majority of Boholanos, this means irrigation water is equally needed throughout the year.

Figure 3: Malinao Dam in Pilar, Bohol

The Bohol Integrated Irrigation System (BIIS) covers 10,260 hectares and contains three major irrigation systems, each with one dam. Of the two largest dams, the Bayongan Dam relies primarily on the excess water flowing from the Malinao Dam (Figure 3). Therefore it is essential that the Malinao Dam is highly efficient. A study conducted in 2005 by the Japan Bank for International Cooperation found that rice farms in areas served by both dams were not receiving sufficient irrigation due to scarcity and mismanagement of water. Farms in downstream regions and the "tail-end" of Irrigation Areas (IA) were particularly affected. (Mondoñedo, 2008)

In 2006, the National Irrigation Association (NIA) introduced an irrigation schedule for the BIIS that counters this challenge by enforcing AWD. The schedule has evolved through the years to become viable and effective for as many farmers as possible. Now, the rotation of water is divided between upstream and downstream. Downstream farmers receive water first so they can plant ahead by about a month. Both downstream and upstream farmers are on an every other week schedule, which effectively enforces AWD because each farmer has irrigation water for 3 days, then none for the next 10-12 days. In order to receive water at all, each IA must collect 60% of irrigation service fees (ISF). Although AWD demonstration fields have been established in Bohol, and NIA has led information campaigns and farmers' field days, not all farmers have participated and thus some still have no awareness of AWD.

Five years ago, the schedule was put in place and a thorough study was conducted, but there have been no further studies since. Thus, one of the goals for the study in Bohol was to evaluate the efficacy of the NIA schedule and to assess unexpected or negative impacts that have arisen. The other main objective was to do a general assessment of the impacts of AWD on farmers, households, and communities. Bohol has the potential to be a model for other rice growing regions looking to counter water scarcity through water-saving technologies.

We hypothesized that there was a net positive institutional impact of AWD: that the area of irrigated rice land in Bohol has increased in the last 5 years. We expected individuals would have a mixed response based on their location. Upstream farmers, who are no longer receiving continuous irrigation water, could be displeased with the schedule because they potentially could see a decrease in irrigated area or yield. On the other hand, downstream and tail-end farmers are receiving more irrigation now and would likely express satisfaction with the NIA schedule.

Methods

Eleven IRRI researchers traveled to Bohol to complete comprehensive qualitative and quantitative studies. The quantitative study consisted of thorough input-output surveys and Knowledge, Attitudes, and Practices (KAP) surveys. I worked toward a more qualitative understanding of the farmers and farming systems, and my focus was on irrigation water use.

The "qualitative team" traveled to Bohol from July 3 through July 11, 2011. We assessed impacts in two municipalities: Pilar and San Miguel. The study was comprised of four focus-group discussions and ten key informant interviews with local farmers, and one interview with the superintendent of irrigation for the National Irrigation Administration of Bohol.

We spoke with farmers who have been trained through Farmer Field School and those who haven't; farmers upstream and downstream; farmers who have had success with AWD and those who don't know much about it. The rest of the participants were randomly chosen based on their location, availability, and willingness to speak with us.

Since the nature of my study was so qualitative, it was not possible for me to give numerical data, but instead overarching sentiments. Ideally a study like this should be paired with a quantitative review.

Results

Farmers' Perceptions of AWD

AWD had limited effects on the lives of the farmers, but they perceived it in a generally positive light. The farmers' perceived impacts of the NIA schedule and AWD can be broadly summarized as follows:

(1) An increase in the land area of irrigated rice

(2) More consistent irrigation water

(3) Difficult to attribute changes in yield or income to AWD

(4) More tillers

(5) No tangible change in farm inputs, labor, or gender roles

(6) More weeds OR less weeds

(7) Conflict over irrigation water

(8) Improved livelihoods

An increase in the land area of irrigated rice

The overwhelming response from farmers was that practicing AWD has led to an increase in the area of their farms and the total service area of their IAs. Although several farmers reported no change in their farm area in the last five years, since the implementation of the NIA schedule, some saw radical changes because of new area that could be reached by irrigation water. For instance, one farmer reported that his farm area grew from 1 ha to 3 ha. Another saw a 5% increase in the area of his IA (Solid-G). Three women farmers in a focus group discussion said the NIA water has helped them establish small farms (less than .25 ha) on a previously rain-fed area, so now they gain their income through rice farming.

More consistent irrigation water

Both upstream and downstream farmers are generally pleased with availability and supply of irrigation water from NIA. They are able to plant without waiting for the rain, and think that the stream of water through the canals is stronger. However, farms in the tail end of Irrigators Associations are still receiving insufficient and inconsistent water, which leads to losses in yield. Farmers understand that there just isn't enough water to reach all the farms. They also attribute the problem to siltation in canals, which was still a problem before the implementation of AWD. Farmers in the tail end use shallow-tube wells, pump water from the river, or wait for rainfall.

No yield or income changes that can be attributed to AWD

Farmers were reluctant to attribute changes in yield in the last five years to only one factor, such as AWD or the NIA schedule. Only one farmer said the increases in yield were a result of increased water availability. Other common reasons for increased yield included attending training programs like Farmer Field School (FFS), using certified hybrid seeds, or improving fertilizer application. Farmers attributed yield reductions to climate change, heavy rains, and increased cost of fertilizer. Since yield and income are strongly correlated, it was similarly difficult to pinpoint the effects of AWD on farmer income.

More tillers

Several farmers reported that AWD improves tillering in their plants compared to continuous flooding, because it provides better aeration to the plant, leaving more room for tillers to grow.

No tangible change in farm inputs, labor, or gender roles

Fertilizer is apparently solely dependent on available funds, and thus was not impacted by the irrigation schedule in the last five years. Hiring labor is similarly dependent on available money, although one farmer saw an increase in labor to combat the extra weeds that resulted from AWD.

Gender roles were not perceived to change at all, probably because irrigation management has traditionally been a male responsibility.

More weeds OR less weeds
Some participants responded that AWD increased the amount of weeds on their farms because the weeds were no longer suppressed by ponded water. Others perceived that the process of alternately wetting and drying the soil has actually helped them control weeds. Others still saw no change in the weeds on their farm in the last five years. In six key informant interviews in which weeds were discussed, two farmers reported increased weeds, three reported decreased weeds, and one reported no change.

Conflict over irrigation water
A very common sentiment was that conflict has arisen between farmers who are not aware of the principles of AWD and those who have been trained. Farmers without knowledge of AWD become scared that their plants will suffer when the ground is dry and cracked, and accordingly they try to hoard water. Water grabbing, or diverting water from the irrigation ditches to individual farms out of schedule, is commonly observed. One woman we interviewed even has to stay in her field at night to guard her water. Other conflict arises when farmers aren't planting synchronously. For instance, if a farmer is transplanting late, he may inadvertently flood other fields and wash away fertilizer. The conflict usually results in verbal disputes.

Improved livelihoods
Despite some gripes that farmers expressed about AWD, nearly all maintained that it has a positive impact on their livelihoods and that they are thankful for the NIA schedule. This came up unprompted in conversation numerous times. The sentiment was expressed particularly in the tail-end regions that once faced serious water shortages or were not conducive to rice cultivation at all.

Transplanting seedlings following an interview

<u>Institutional Impacts</u>

After hearing numerous reports from farmers about their perceived impacts of AWD, I was curious to hear the opinion of the policy-makers who implemented the schedule in the first place. On July 8, 2011, I interviewed Engr. Olimpio Galagala Jr., an Irrigation Superintendent at NIA and the head of the Bohol Integrated Irrigation System (BIIS).

Mr. Galagala was extremely optimistic about AWD. He believes it has led to less water shortages and correspondingly less crop damage. In addition, farmers' irrigated area and yield have increased. These factors translate to increased income, which farmers can use to send their children to good schools and to build concrete houses, which he states have become more prevalent in recent years.

According to Mr. Galagala, the total irrigated area in the Malinao Dam region has been increasing (Table 1), as have those areas beyond the region that rely on the efficiency of the Malinao Dam. In addition, the total production in Bohol has seen an increase (Table 2).

Table 1: Irrigated Area in the Malinao Irrigation System, 2006-2011

Year	Crop Season	Design Area (ha)	Firmed Up Service Area (ha)	Irrigated Area (ha)	Annual Total (ha)
2006	Wet	4973.6		2681.6	5567.5
	Dry	5198.7		2885.9	
2007	Wet			2748	5716
	Dry	4973.6		2968	
2008	Wet	4973.6		2962.7	6266.9
	Dry		4740.8	3304.2	
2009	Wet		4740.8	3300.5	6520.4
	Dry		4740.8	3219.9	
2010	Wet		4740.8	3165.6	6409.5
	Dry		4740.8	3243.9	
2011	Wet		4740.8	3354.7	

Data from Mr. O. Galagala Jr.

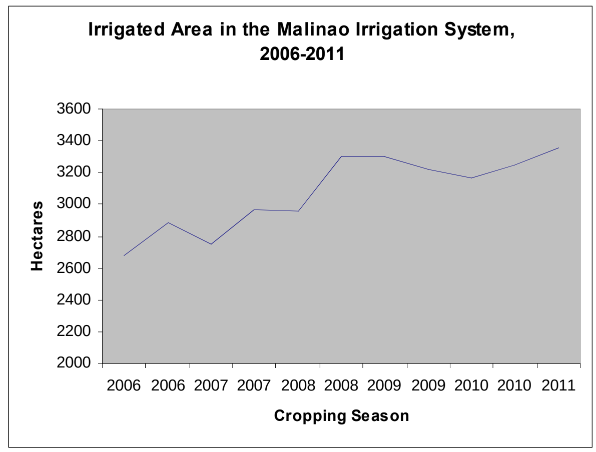
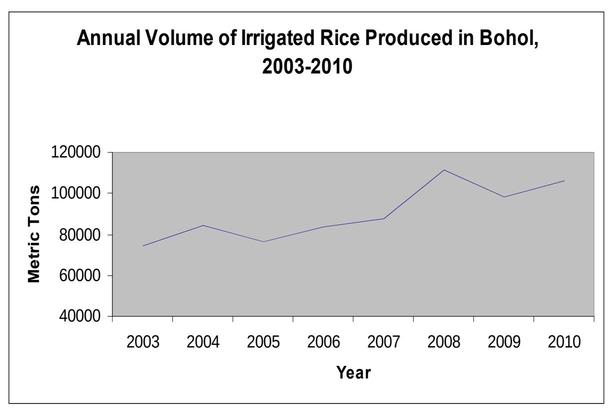


Table 2: Volume of Irrigated Rice Produced in Bohol, 2003-2010

Year	Semester 1 (metric tons)	Semester 2 (metric tons)	Annual (metric tons)
2003	35859	38451	74310
2004	41669	42927	84596
2005	37134	39348	76482
2006	42502	41431	83933
2007	36030	51618	87648
2008	53902	57447	111349
2009	49025	49237	98262
2010	47803	58471	106274

Data from Philippines Bureau of Agricultural Statistics



When NIA first implemented the schedule, farmers had a negative reaction because they didn't understand AWD. But now, since trainings have been held, farmers are more accepting of the schedule. Mr. Galagala further states that since farmers are satisfied with the water they receive, they are less worried about crop failure, have higher production, and are more willing to pay the Irrigation Service Fee. Consequently, NIA has seen a slight increase in ISF collection rates.

NIA's plans for the future include gradually turning over control of irrigation to the IA leaders, who will be responsible for collecting ISF, maintaining farm ditches, and managing water delivery at the farm ditch level as equitably as possible. In addition, part of NIA's budget goes toward cementing farm ditches to prevent seepage of water as it flows through. This is something that many farmers told me would help improve their farms and irrigation supply.

Discussions and Recommendations

The geography and climate of Bohol are such that water scarcity is a recurring problem. Even though there are three large reservoirs that provide the irrigation water for the rice farms on the island, the water contained simply isn't sufficient to provide each farmer enough to irrigate in the traditional style. This key crisis is the reason that alternate wetting and drying was introduced in 2006. Through focus group discussions and key informant interviews with farmers and NIA officials, I have ascertained that:

- AWD has countered water scarcity by significantly conserving water in rice farming
- As a result, downstream and tail-end areas are more consistently reached by the irrigation water
- New areas are now being opened to irrigated rice farming

The general consensus is that AWD has no striking effect on yield, farm inputs, gender roles, or household income. Meanwhile, it is possible that AWD changes weed growth (and consequently, labor required to weed), but since the responses were contradictory, it is necessary to research this aspect further.

Overall it seems that AWD has improved the lives of farmers both upstream and downstream. Mr. Galagala of NIA reinforced this statement, and provided data to show an increasing trend in terms of total irrigated area and production. While these improvements must be attributed to many factors, it is safe to assume that AWD has played a role.

The only clear negative impact that could be partially attributed to AWD is the proliferation of farmer conflict. Most farmers asserted that the solution is education to assuage fear of dry soil. Farmer Field School, weekly seminars, and demonstration fields have been effective trainings in the past and they also aid farmers in optimizing their farming practices. Since collective action is necessary for the large-scale adoption of AWD, once the majority of farmers understand and implement the technology properly, they will receive more significant water savings and economic return.

Case Study -- Tarlac

Introduction

Tarlac is a province located in Central Luzon, about 70 km north of Manila. Central Luzon, a region comprised of six other provinces, produces most of the rice in the Philippines, earning it the title "Rice Bowl of the Philippines". Around 75% of Tarlac is plains, and the rest is mountainous area. The economy is, predictably, dominated by agriculture, particularly rice and sugarcane.

In 1972, the United Nations Development Programme began to construct the first irrigation systems in the province. However, due to technicalities, some of the projects were left unfinished. In 1997, the National Irrigation Association (NIA) completed the Tarlac Groundwater Irrigation System Reactivation Project, which restored and constructed 72 deep well pumps, providing irrigation to 3,372 hectares in the provinces of Tarlac and Nueva Ecija (NIA website). Restored pumps have the prefix "P" (e.g. P-38), while new pumps have the prefix "TG" (e.g. TG-09). After an ISC pays 30% of the amortization of the pump, the farmer leaders are given full ownership and control of it. Further costs are for individuals who must pay for the fuel used to pump water to their fields.

But these deep well pumps have fallen into disuse in recent years as farmers opt for irrigation from other sources. The UPRIIS (Upper Pampanga River Integrated Irrigation System) and Casecnan gravity systems are popular because they are drastically less expensive than the pumps. Farmers also perceive the water in the gravity system contains beneficial nutrients, which reduce the need for fertilizer. Between the gravity system and shallow tube wells, farmers are covered for most of their irrigation needs. Of the original 72 deep well pumps, only 56 are still in operation, and are used infrequently, usually during seedbed preparation. To mark this transition, Irrigation Service Cooperatives (ISC) of farmers supplied by one pump are starting to be called Irrigators Associations (IA), which implies that irrigation water comes from a communal source.

But NIA plans to centralize and update Tarlac's irrigation system with the Balog-Balog Multipurpose Project. This project involves the construction of a 113-meter high dam and a system of irrigation and drainage canals, increasing the service area in eight municipalities of Tarlac from 8,000 hectares to 34,100 hectares. Once the project is completed (construction begins September 2011), all affected farmers will be assured irrigation water year-round. Irrigation from this dam will be distributed on a schedule adhering to AWD.

Tarlac was actually the original pilot site of AWD in the Philippines in 2001, when IRRI, NIA, and the Philippine Rice Research Institute (PhilRice) collaborated on a program called the Technology Transfer for Water Savings. This program tested AWD with farmers using deep-well irrigation systems. A case study was done with the P-38 Irrigation Service Cooperative

(ISC) in Canarem, Victoria, Tarlac in the dry seasons of 2002-2003. Farmers planted two plots of 500-1000 m^2, one for continuous flooding and one for alternate wetting and drying, to test the differences. The results of the study suggest that farmers experienced no change in yield, while they saved a lot of water, time, labor, and money. They noticed heavier and bigger grains, more tillers, and less insect pests (Palis et. al, 2004). Three years after AWD was piloted in P-38, it was introduced into other regions of Tarlac. Farmers were selected to participate based on their willingness and their farm location. Since all farms in deep well systems are on a rotating schedule, participating AWD farms were provided with 30-40% less water than non-AWD.

More commonly utilized; though, is the gravity system, which imposes no fuel cost and provides ample water. Therefore farmers tend to flood their fields continuously, and, according to the Irrigators Development Officer Mar Alvior, a minimal number of farmers in Tarlac are even aware of AWD. But as NIA unveils the Balog-Balog Project, it will revive AWD in Tarlac, and increase farmer awareness through trainings and demonstrations.

My objective in Tarlac was to see the impacts of AWD in a radically different system than Bohol's to provide points for comparison.

Methods

The following data was collected from July 25 to July 27, 2011 in the municipality of Victoria in Tarlac. The study was comprised of four focus group discussions with the members of the P-38 ISC in Canarem; the TG-09 ISC in Calibungan; the TG-01 IA in Canarem; and the TG-13 IA in Masalasa III.

To assess the institutional impact of AWD and to obtain detailed information about the Tarlac irrigation system, I conducted key informant interviews with the Irrigation Superintendent of the NIA in Tarlac, Engr. Ted Norte, and the Irrigators Development Officer Mariano Alvior. Finally, I spoke with Engr. Evangeline Sibayan, the project leader for the development of water-use-efficient technologies at PhilRice.

Results

Farmers' Perceptions

The first focus group discussion was with farmers in the P-38 Irrigation Service Cooperative, the area where AWD was first piloted in 2002. These farmers are extremely knowledgeable about AWD and described the numerous ways it has affected their lives and cultures. The next three FGDs could not be more different! The farmers I spoke to have little or no awareness of the technology, and do not intentionally practice it. I believe the vastly contrasting opinions enriched my understanding of the impacts of AWD and the challenges to its acceptance.

P-38 Irrigation Service Cooperative
The service area of the P-38 ISC is 51 hectares. The majority of farmers within it are owner-cultivators, who get additional income from cultivating mangoes and mung beans and fishing.

According to them, 70% of the area in the ISC is too flooded to plant during the first cropping. The problem is so severe that they have contacted their politicians, but have received no assistance.

The P-38 deep well pump was the site of IRRI's case study on AWD in 2002. Since that time, the irrigation schedule has evolved considerably. Currently, it dispenses water to farmers for seven days with weeklong intervals for the field to dry. The ISC is split into six groups: three in the east and three in the west. At any point in time, one group from the east and one from the west are being irrigated. Farmers are also permitted to get emergency irrigation for two hours in the morning if they need it. 100% of farmers plant synchronously because of pests and the need to self-organize to end disputes. They all have an ample supply of water.

Because it has been enforced for so long, AWD has become ingrained in the culture and practices of farmers. For instance, IRRI and PhilRice hold weekly seminars that receive 100% attendance because farmers are very interested. With their knowledge of AWD, P-38 farmers, sponsored by the Department of Agriculture and IRRI, traveled to Bohol to lead trainings. And, this year, farmers celebrated the second ever harvest festival featuring the water-saving technology.

Throughout the focus group discussion, farmers spoke very positively about the impacts of AWD on their lives. They trust that their yields will remain stable, since they participated in the IRRI-led experiment in 2002 and saw no yield difference between the continuously flooded plot and the controlled irrigation plot. They notice a drastic decrease in how much they are paying for fuel, as well as considerably less conflict between farmers. Weed growth has not been impacted, according to the farmers. They prefer AWD to traditional practice because they believe the cracked soil helps plants grow better, with more tillers and heavier grains. Rice grown traditionally was categorized as Class B or C, while AWD rice is Class A, and thus sells for a higher price. One farmer estimated that his income has increased by 40% as a result of these factors (notably reduced fuel cost). He is using his inflated income to invest more in fertilizer and animals. Overall, P-38 farmers are thankful for the AWD schedule because "it is a good schedule and there is less conflict".

TG-09 ISC and TG-01 IA

These two farmer cooperatives have service areas of 48.1 and 50.1, respectively. Both areas experience deleterious flooding that drastically reduces the planted area during the wet season. 95% of the TG-01 service area was flooded at the time I spoke with local farmers. Synchronous cropping is not practiced, as the general opinion is that all farmers receive ample water in the wet season.

These two cooperatives are similar in that the deep well pumps are still operational but are used very infrequently. Before 2006, TG-09 (Figure 4) dispersed irrigation water on a schedule. However, after 2006, farmers could get water from the deep well pump as long as they had money to pay for fuel. Since fuel is very costly, the pump was used less and less, and now is only used to irrigate during seedbed preparation and in the upstream area that is unreachable by the gravity system. Roughly 30 hectares of the TG-09 ISC can receive water from the gravity system, and do not need to pay for fuel. Thus, they practice continuous flooding. Farmers much prefer using the gravity system, and strategize to make the water reach their farms if they are upstream, because they will save so much money. For example, one farmer used to pay P 20,000 for fuel to irrigate 1.2 ha, and now, with the gravity system, he pays only P792. The TG-01 IA similarly uses the deep well irrigation only for seedbed preparation, and then switches to the gravity system because it is cheap and located closer to farms.

Figure 4: TG-09 deep well pump

Figure 5: Community water tank

Most farmers are simply unaware of the principles behind AWD, and believe that lack of irrigation and cracks in the soil hurt their plants. They say that ample water is a requirement for high yields and good tillering. Furthermore, it is necessary to keep water ponded to kill weeds. The farmers believe that one benefit of a schedule would be to reduce conflict, which currently ranges from water grabbing to violence. In the TG-09 ISC, farmers are grateful for the NIA water because they can divert it to a water tank for household use (Figure 5), but in the TG-01 IA the water is not considered clean for use within the home.

The farmers have not received trainings recently. In the TG-01, the last training, regarding Integrated Pest Management, was held in 2000. 70% of the TG-09 ISC attended an IRRI training in 2004 that taught about AWD, but only one of six farmers in our FGD went to that training.

TG-13 ISC

The most striking difference between this FGD and the previous two is that the deep well pump is officially not operational in this area of 42.8 hectares. NIA classifies the ISC under the category “Not operational: Using shallow tube well and covered by Casecnan.” They have accordingly shifted from being called the TG-13 ISC to the Balingog-Masalasa Kapuso IA.

Farmers have access to irrigation water whenever they want it. Sometimes they have excess and need to tell the official to turn the water off. They believe it is bad for their plants to always be flooded, so they let the water drop to 3cm above the surface before irrigating again. This helps control snails and weeds, but still maintains good crop stand and plant growth.

Two farmers are aware of AWD because NIA held seminars in 2003-2004 and a training program in 2009. They additionally receive weekly training packages from NIA. They think that AWD would lead to good crop stand, healthy plants, and increased yield, but they don't practice it. An AWD schedule would have no effect on conflict because water grabbing occurs in the canals that supply the whole IA with water.

Institutional Impacts

Engr. Ted Norte, Superintendent of Irrigation for NIA Tarlac

The most notable benefit of AWD, according to Mr. Norte, is that it reduces fuel consumption by 25-30% without changing yield. It has also reduced farmer conflict in the form of water grabbing, and has strengthened farmer organizations since farmers must cooperate for everyone to get irrigation water. NIA has a better relationship with the farmers since they implemented this technology. Mr. Norte asserts that the total farm area in Tarlac has increased by 30%, but he is still waiting on data to prove it. NIA couldn't provide historical data regarding total service area and irrigated area.

When asked about negative impacts of AWD, Mr. Norte replied that some farmers have conflict when they don't understand the technology.

Engr. Mar Alvior, Irrigators Development Official for NIA Tarlac

Mr. Mar Alvior is an Irrigators Development Official (IDO). He acts as a link between NIA and farmers, facilitating trainings, monitoring organizations, and sometimes collecting fees. In recent years he has been trying to support farmers by visiting them more frequently. This is in response to complaints that IDOs only visit farmers to collect ISF.

Mr. Alvior says that AWD was implemented to combat water shortages in the dry season. He believes it has no effect on yield, plant or grain quality, and only a slight positive effect on irrigated area. Even though AWD is very efficient, farmers are reluctant to adopt it unless they see that they aren't the only ones.

Engr. Evangeline Sibayan, scientist at the Philippine Rice Research Institute

Ms. Sibayan is the head of the Rice Engineering and Mechanization Division of the Philippine Rice Research Institute (PhilRice). She is the project leader in the development of water-use-efficient technologies, and considered an expert on AWD.

She reiterated the common statements about AWD in Central Luzon – that it reduces fuel consumption by 15-30%, expands irrigated area, doesn't affect yield, and strengthens farmer cooperatives. She added several other interesting points. Since AWD makes the soil tougher, she says, it allows for more mechanization and lowers costs of postharvest operations because it is easier to carry the harvest out of the field. AWD furthermore is shown to tremendously reduce greenhouse gas emissions from rice paddies, by up to 60%.

Engr. Sibayan didn't know of any definitive disadvantages of AWD, although studies in microclimate are being conducted to verify this. One potential disadvantage is that AWD plots may be more susceptible to insect pests.

Discussions and Recommendations

Tarlac is indeed radically different than Bohol. Due to differences in climate and rainfall, flooding (Figure 6) is more of a problem in Tarlac than water scarcity. Therefore, the incentives for implementing water saving technologies such as AWD are different. The most beneficial effect of AWD is economic savings since the pump need not be operated so often. In addition, the general consensus is that AWD reduces conflict by strengthening farmer cooperatives.

Figure 6: Flooded rice field in Tarlac

But as for the other factors that AWD influences, a large gap in opinions exists between those who know about the technology and those who don't. Educated officials and farmers in the P-38 ISC, who have been practicing AWD for many years, could see barely any negative impacts. They perceive that AWD reduces fuel consumption, expands irrigated area, doesn't affect yield, and improves plant growth and grain quality.

Farmers who rely on the gravity system and traditional irrigation practices, and have no awareness of AWD, believe nearly the opposite. They think that keeping their fields continuously flooded is necessary for good plant growth, high yields, and minimal weeds. They fear lack of irrigation and cracked soil. They experience mild to severe conflict over the water resources.

Under the Balog-Balog multipurpose project, many of these farmers will once again receive their irrigation water on a schedule that incorporates AWD. NIA should take measures to equip as many farmers as possible with understanding about AWD, to influence collective action that facilitates widespread adoption and success with AWD. Hopefully other regions in Tarlac can be as successful as P-38 in implementing AWD.

Conclusion

Problems of water scarcity today could lead to a future of reduced rice production when an increased human population needs more rice on its plate. Water saving technologies such as alternate wetting and drying provide a way to change practices to improve the livelihoods of many rice farmers right now, as well as to anticipate future challenges to the food supply. For Asia, a continent where "rice is life", it is of vital importance and urgency to study the impacts of AWD and to work on disseminating the technology to smallholders.

The differences in Tarlac and Bohol may provide insight into areas where AWD would be needed and successful. Since the two regions are radically different in terms of climate, water availability, and irrigation infrastructure, AWD has been implemented differently and has satisfied different concerns. In Bohol, where water scarcity is common and nearly all irrigation is sourced from three dams, AWD has helped take a limited supply of water and make it last longer and reach farther. The most salient impacts have been the expansion of irrigated area and increased reliability of irrigation to areas in the tail-end and downstream of Irrigators Associations. In the deep well systems of Tarlac, AWD has addressed concerns of high fuel costs. Farmers have seen a direct positive correlation with their income since they adopted the technology.

But is there an incentive for farmers in Tarlac who aren't sourcing their water from deep well pumps to adopt AWD? I think that AWD does bring empirical benefits to all rice farmers, regardless of their source of irrigation, location, or farming practices. In different circumstances, saving water saves money, the environment, labor, and time. AWD has either no effect on yield, plant growth and grain quality, or a positive effect. And a water schedule, once established and fine-tuned, can foster cooperation within farming communities instead of conflict. With water scarcity a current and worsening problem, farmers have nothing to lose by adopting water-saving technologies like AWD, and potentially a lot to gain.

There are still unknown variables that need further research. Scientists should continue to explore the effects of AWD on plant growth, weed growth and yield, as well as the claim that AWD leads to a decrease in greenhouse gases emissions. If proven, this would be another compelling reason to propagate the technology, as rice paddies contribute much of the world's methane emissions.

In the end, it comes back to education. Smallholder or subsistence farmers may be understandably apprehensive of adopting a new technology that is in contrast with the traditional practices that have brought a certain yield for generations. But once they understand the facts and incentives to implement AWD for themselves, their communities, and the environment, they may be motivated to adopt it. Extension workers should disseminate scientific facts about AWD to farmers as they are discovered. The conversion of more and more farmers through this method will stimulate collective action, assuring their neighbors that AWD is safe and worth the effort to try.

Personal Reflection

I was so excited when I found out I was going to be a Borlaug-Ruan Intern in the Philippines. I had never before been immersed in a foreign nation, and I eagerly anticipated the new experiences I would have and the ways I would learn and grow. Before stepping on the plane, I set a goal for myself: to get as much as possible out of the summer. I wanted to get wet when it rained, if you will.

And did I get soaked. I was seeking knowledge and experience and indeed I learned an unbelievable amount. In the spirit of impact assessment, I'm still assessing the impacts my Philippine journey had on me.

Something wonderful is happening at IRRI, a vibrant little world sheltered by looming volcanoes and tropical greenery. IRRI is a mélange of diverse cultures and people who each add their unique mark to the place. Besides the Filipino friends I made, I spent time with people from England, Myanmar, Colombia, Nigeria, France, Germany, India, South Korea, Belgium, Peru, Bangladesh, Spain, Iran, the U.S., and more! I had so many stimulating conversations about our cultural differences as well as our common interest in global agriculture and food security.

To be fresh out of high school and suddenly dropped into the social science department of a prestigious international research center was rather shocking at first. When I entered the Philippines, I had no working knowledge of social science methods. But after observing and then conducting numerous focus group discussions and key informant interviews, I arrived at strategies to efficiently and effectively collect human data. Some of these strategies are simple tenets of social science research that I learned from my mentors at IRRI and through practice. But other strategies are more instinctual, less definitive. These lessons are only learned by getting out in the field, making mistakes or accidentally succeeding, and by always observing the little details.

The most illustrative example in my mind is the way I learned to use body language to fill the gap of verbal communication when I was in the field. I used nonverbal signs to show my genuine interest in what farmers had to teach, even though I had no idea what they were saying. Body language helped me break down the cultural barrier between traditional Filipino farmers and myself, so they weren't reserved about speaking authentically about their experiences. I entered their territory calmly; hands open by my sides, feet firmly planted. And, here's the key, I smiled. I am deeply indebted to the transcendent power of a smile, for I could see suspicion and xenophobia fade away as people understood that I had only good intentions and accepted my presence in their homes.

Leveling the field of a subsistence farmer with a caribao (water buffalo)

Thinking back on my internship, I've remembered one striking example that exemplifies how much I changed. During my first week, I had plans to meet somebody in Los Baños, but I was running late. I was feeling frustrated and anxious as I weaved my way through the crowd on the sidewalk. They were walking so slowly! I wished they would speed up or at least move out of my way. When I finally reached my friend, I was not only late, but I was angry and bitter.

Several weeks later I was in a similar situation: facing bustling streets but strapped for time. However, this time I didn't let my dilemma phase me. I let myself get carried along in the slow stream of pedestrians. I enjoyed the diverse storefronts and the flamboyant jeepneys (open-backed buses) honking as they passed by. I still arrived late, but I was relaxed and content. Besides, my delay didn't matter that much anyway.
Realizing how differently I handled these two situations revealed a lot. In the first situation, I was a typical American: trying to maximize the efficiency of time, favoring punctuality, and being very destination-oriented. The next time, I acted much more like a Filipino. I (literally) went with the flow. I was unhurried because I trusted that everything would work out just fine, even if it wasn't as I expected. It was the journey that mattered. Finding this balance between setting expectations and accepting what comes my way was one of the ways I tried on the life of a Filipino.

My ultimate fascination was to know what it was like to live as the 100 million residents of the Philippines do. I soaked in the culture as much as I could. I tried a variety of foods – from the extreme like dinuguan (boiled blood) and balut (fertilized duck egg) to the delicious like halo-halo (ice cream, cereal, rice, fruit, etc.!). I sang at a karaoke bar, soaked in the local hot springs, and climbed the immense Mt. Makiling.

One of my greatest joys was learning Tagalog. The effort I put in to learn the unfamiliar tongue paid off greatly as Filipinos – from farmers in the field to colleagues in the office – saw me as more relatable. Walking through IRRI, I would commonly be summoned by my Filipino nickname that I was given in acknowledgement of my curiosity about the language and culture. I'll never forget what my office mates inscribed inside a Tagalog primer they gave me:

"To Liwayway, Pilipina kana". (To Liwayway, you are a Filipina now).

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