Project of Fact Finding Survey for Poverty Reduction and Sustainable Agricultural Development in Myanmar

Project Report



March 2017

Japan Association for International Collaboration of Agriculture and Forestry

JAICAF

Japan Association for International Collaboration of Agriculture and Forestry

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Foreword

Japan Association for International Collaboration of Agriculture and Forestry, JAICAF, implemented this project with financial support from the Ministry of Agriculture, Forestry and Fisheries of Japan aiming at prevention of post-harvest loss of rice in Myanmar.

One of the most important staple crop for Myanmar is rice, which occupies more than half of farmland area. Myanmar government is said to aim at increase of export and quality improvement of rice.

Based on this background, we have been dispatching experts to Myanmar since Fiscal Year 2014 in order to cooperate for the sustainable development of rice production and post-harvest processing. For the past two years, we have been actively working on the improvement of post-harvest handling of rice mainly in Naypyidaw area. This year, as well as to continue our activities in Naypyidaw, we decided to disseminate our project achievement to other regions such as Ayeyarwady region. This report describes the activities and results of the project in FY 2016. We hope that this report will be useful to other rice projects in Myanmar.

The project would not have succeeded without support and advice of the dispatched experts and member of Evaluation and Review Committee. Also we would like to express our gratitude to Ministry of Agriculture Livestock and Irrigation of Myanmar for their generous support to provision of important information, arrangement of field visit and escort of experts. We also appreciated JICA Myanmar Office, JICA's project on Development of Participatory Multiplication and Distribution System for Quality Rice Seeds and Embassy of Japan for their cooperation.

Finally, please note that this report was prepared by JAICAF and does not necessarily represent the position of the Ministry of Agriculture, Forestry and Fisheries of Japan or the Japanese Government.

March, 2017

Dr. Ryuzo NISHIMAKI President, Japan Association for International Collaboration of Agriculture and Forestry



Photo 1 Drying on a ridges



Photo 2 Drying on a road



Photo 3 The member provided guidance at a rice mill



Photo 4 Visiting a seed farmer





Photo 5 Large rice mills in Pathein

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Photo 6 The results of moisture meter are recorded in two rice mills in Tatkon and Lewe



Photo 7: Seminars held in Nay Pyi Taw and Pathein

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Chapter 1. Project Outline

1. Purpose of the Project

This project aims to support the reduction of poverty and the promotion of sustainable agriculture in Myanmar by directly instructing farmers and agriculture-related people about production, sales, and processing techniques of agricultural products by utilizing Japan's advanced technology, experiences, and know-hows.

1) Outline of the 2016 Project

For the past two years, we investigated and provided technical guidance mainly in Naypyidaw. The surveys of rice mills conducted in 2015 revealed that four rice mills out of 11 rice mills we visited had a flatbed rice dryer. These rice mills using the flatbed rice dryer mentioned that the use of the dryer increases the number of cracked gains. It was because the wind temperature was set to 60°C, which was too high. We suggested setting to proper temperature at below 45°C. The surveys also revealed that they did not know adequate frequencies of turning over to prevent uneven drying. These results point out the importance of providing technical guidance as needed by reinvestigating situations prior to actual operation. In addition, for other seven rice mills without a dryer, it is necessary to have them understand the usefulness of dryer and the importance of drying process. In Myanmar, the introduction of combine harvester is becoming widespread and the drying capacity needs to be increased with an improvement in harvesting operation and efficiency. This calls for the dissemination of dryers and technical guidance.

In 2016, we investigated the moisture content of paddy, grain temperature and the number of damaged grains, which have a profound effect on qualitative loss of rice. However, the farmers do not have sufficient understanding on the importance of moisture control. Even though rice millers know the significance of moisture control, the condition of paddy brought in to the rice millers varies by farmers. Without proper moisture control of paddy by farmers, the rice millers must take the risk of yellowed rice and mold, which lead to reduce the cost of paddy. In order to raise farmers' incomes and reduce poverty, it is critical to raise farmers' awareness of quality improvement, as well as to show rice millers that farmers use same standards to control moisture. When rice millers and farmers work together to improve quality, it becomes possible to realize market-oriented agriculture production that also brings rice exports into view.

Even so, the data collected through surveys is limited to the periphery of Naypyidaw, and it is necessary to verify whether the results can apply to all areas in Myanmar. Even in other areas, by actively sharing useful information, we can expect to see an improvement in post-harvest treatment technique rice farmers across the country, which eventually contributes to increased incomes. In this year, we continue to provide technical guidance in the Naypyidaw area and share past achievements in the Ayeyarwady area with an aim to address the following items:

- (1). We teach rice millers using a rice dryer how to use it properly to prevent quality loss. We share case studies on rice mills that have introduced rice dryers to show how much quality loss can be decreased by using the rice dryer. By presenting the usefulness of rice dryers to rice millers who have not set up a rice dryer, we will promote awareness toward the dissemination of rice dryers.
- (2). We mainly study how farmers carry out post-harvest operation of rice to teach how to manage paddy properly. In particular, by sharing the moisture control standards with rice millers, rice brokers and competent government agencies including extensions, we aim to raise the awareness of the importance of using same standards among farmers and rice miller for moisture control of harvested hulls.
- (3). Also in the Ayeyarwadi area, we conduct moisture studies to transfer survey technique to disseminate the outcomes obtained in three years from 2014.

Furthermore, this project is expected to bring about the following ripple effects:

- (1). Criteria for quality of rice as a product becomes clear, and specific goals can be set up at the production and distribution stages.
- (2). This project will contribute to the improvement of rice quality in the entire country.

2) Target Areas

The target areas for the 2016 project are Naypyidaw and the Ayeyarwadi, which is a major rice-producing area. For the last two years in 2014 and 2015, we investigated and provided technical guidance in Naypyidaw. For the 2016 project, we continue to follow up and complement the previous outcomes in Naypyidaw as a target area for surveys and technical guidance. In addition, by sharing the outcomes of the project in a major rice-producing area of Ayeyarwadi, we aimed to increase the awareness of rice quality across the country.

2. Project Content

We conducted a survey to obtain the actual conditions of agricultural production and farm management in target areas, especially post-harvest treatment situation of rice. We also implemented a workshop where experts provide technical guidance on agriculture production to local farmers and people involved in agriculture, guidance on improving distribution and sales, and for disseminating techniques. Moreover, by introducing Japan's technology, knowledge, and know-hows, we aim to support the reduction of poverty and the promotion of sustainable agriculture in Myanmar.

1) Fact-finding Survey on Agricultural Production and Farm Management

We implemented a fact-finding survey on agricultural production and farm management surrounding the target areas. According to the guidance content in the last two years, we surveyed the condition of rice harvest and storage, as well as the occurrence of weedy red rice, to select specific rice mills to provide guidance.

Dispatched members	Survey period	Survey content
Eiji MATSUBARA	29 th May to 4 th June	1. Research of summer cropping rice harvest and
(Technical Advisor of		storage condition in the target district.
JAICAF)		2. Selection of target rice mills.
Mari TANAKA		3. Follow-up for the 2014 and 2015 projects.
(Researcher of		
JAICAF)		

2) Technical guidance for the reduction of poverty and the promotion of sustainable agriculture

The following experts are dispatched:

Assigned area	Dispatched expert	Dispatched period	Technical guidance content
Rice cultivation	Ryoichi IKEDA	5 th to 14 th	Prevention of the mixing of weedy
and farm		September	red rice.
management		20^{th} to 29^{th}	Proper time for harvesting rice.
		November	Workshop: Sharing the achievement
			of this three-year-project.
Agricultural	Iwao	Same as above	Guidance to farmers on proper
machineries	MATSUMOTO		management of paddy immediately
			after harvesting.
			Acquisition of rice quality data
			(OJT)
			Guidance on how to use a rice dryer
			property.
			Workshop: The importance of
			moisture control and the usefulness
			of rice dryers.
Marketing	Mari TANAKA	Same as above	Guidance to rice millers mainly on
			reinforced moisture control system.
			Workshop: Gender analysis method
			in agricultural extension.

Equipment utilized in this project

Туре	Method used for guidance	Guidance content
Moisture meter	Used for measuring the moisture content of	Acquisition and analysis of rice
(Oga Electric)	paddy and confirming performance of	quality data.
	moisture meters used on site.	

3) Guidance content

- (1) How to use a rice dryer and its usefulness (for rice millers)
 - \checkmark Guidance on how to properly use a rice dryer for rice millers who are already using it.
 - ✓ Dissemination of the usefulness of rice dryers through economic comparison for rice millers who have not introduced one.
- (2) How to use a moisture meter and the importance of moisture control (for farmers)
 - ✓ Guidance on numerical control using a moisture meter: Rice millers, brokers, farmers and extensions use a same moisture meter to control moisture by checking together.
- (3) Verification and dissemination of survey results obtained in Naypyidaw
 - ✓ Verification of the results obtained in previous surveys to see if they apply to other rice-producing areas.
 - ✓ By sharing useful information for other rice-producing areas, it will cause ripple effects to rice-producing areas in Myanmar.

Chapter 2. Fact-finding Survey on Agricultural Production and Farm Management

1. Dispatched Members

Eiji MATSUBARATechnical Advisor of JAICAF Mari TANAKA Researcher of JAICAF

2. Survey Details

- 1) Research of summer rice harvest and storage condition in the target district.
- 2) Selection of target rice mills.
- 3) Follow-up of the 2014 and 2015 project activities.

3. Survey Schedule

	Date	Activity content	Place of stay
1	Sun, 29th May	Depart Narita and arrive in Yangon.	Yangon
		Travel from Yangon to Naypyidaw.	Naypyidaw
		Meeting with a director of the Promotion Section, the	
2	Mon, 30 th May	Department of Agriculture, the Ministry of	
		Agriculture, Livestock and Irrigation (MoALI)	
		Preparation for surveying rice mills and farmers.	
		Meeting with Tatkon T/S	Naypyidaw
3	Tues, 31 st May	Interview surveys at rice mills	
		Farmer surveys	
		Meeting with Pyinmanna T/S	Naypyidaw
1	Wed, 1 st June	Interview surveys at rice mills	
4		Farmer surveys	
		A courtesy visit to the mayor, Zee Phyu Pin	
5	The 2nd Leve	An interview survey at Lewe T/S rice mill	Naypyidaw
3	Thu, 2 June	Farmer surveys (two farmers)	
		Meeting with the post-harvest treatment division,	Overnight
	Fri, 3 rd June	DAR.	flight
6		Meeting with the extension dept., DOA.	
		Depart Naypyidaw at 7:30 p.m. (PG772T) \rightarrow Arrive	
		in Bangkok at 10:30 p.m.	
7	Set 4th Leve	Depart Bangkok at 12:30 a.m. (NH808H) → Arrive	
/	Sai, 4 June	Narita at 8:40 a.m.	

The next section provides the report of activities implemented by the dispatched members.

4. Survey Results

1) Field survey results

In this survey, the dispatched members visited the relevant authorities of the Ministry of Agriculture, Livestock and Irrigation (MoALI) listed in Table 1.1. to provide an overview of this survey and requested their cooperation. In addition, with the support of the Extension Section., the Department of Agriculture, MoALI (DOA), they interviewed rice millers and farmers in three townships (T/S) in the Mandalay area based on a survey slip. The results of survey at each place visited are as follows:

Table 1: Relevant authorities visited and field survey target areas

Relevant authorities visited	Field survey target areas
The Extension Section, the Department of Agriculture, the Ministry of Agriculture, Livestock and Irrigation (MoALI) (Naypyidaw) Tatkon T/S Office Pyinmanna T/S Office Post-harvest Section, Department of Agriculture Research (DAR) MOALI Research Agency	Tatkon T/S, Mandalay area Pyinmana T/S, Mandalay area Lewe T/S, Mandalay area

Survey in the Tatkon T/S district

DOA Tatkon T/S

We met with a director, Shit Swe Oo, at the DOA Tatkon T/S office. The following is the content of discussion.

JAICAF: We explained about the purpose of survey.

T/S: Many rice mills at Tatkon T/S purchase paddy from farmers through brokers. Some farmers bring paddy directly to rice mills. Since brokers collect paddy from their village, they have a good grasp of the situation of farmers. For the interviews of farmers in this survey, we suppose brokers know about drying method, storage method and where they buy paddy from. Rice mills hire brokers from villagers. Rice mills prepay funds for purchasing paddy, and brokers purchase paddy during harvest by checking the price trend. When brokers purchase from farmers, they check the condition of paddy and if the moisture content is high, they do not buy it and ask them to dry again until the next time they visit. Brokers know farmers' abilities and the condition of land and soil, as well as how to distinguish good and poor paddy from their experiences.

JAICAF: Although we thought the rice mills ask the farmers to control moisture numerically, we found out that it was more realistic to think the rice mills ask the farmers through brokers. Because moisture measurement requires training, it would be efficient to offer training for brokers at rice mills where they purchase paddy from farmers.

T/S: T/S can gather brokers to offer training. They will cooperate at that time.

JAICAF: Moisture control varies by harvest method. We think the use of combine harvesters becomes popular in the future. What is the use situation of combine harvesters at Tatkon? Also, what is the implementation situation of field maintenance for the mechanization of farming?

T/S: Farmers increasingly use combine. While the cost of manual harvesting is 70,000 kyat/ acre (ac), the cost using combine harvesters is half at 35,000 kyat/ ac. The flat land of Tatkon allows combine harvesters to go into 50% of farmland. The rate of field maintenance is one of the worst, which is around 0.02% of the farmland area.

JAICAF: When using combine harvesters, do they carry paddy after harvesting directly to rice mills?

T/S: After harvesting with combine harvester and husking, they pack in bags and dry the rice inside the field or on the premises of their home prior to storing in a storage. Farmers sell the rice to brokers when the price becomes desirable. In Tatkon, most farmers own storage.

Rice mills in Tatkon

As guided by the staff at the DOA Tatkon T/S, we visited Aung Mingalar Rice Mill and met with the owner, Mr. Hla Win Aung. We interviewed him according to a survey slip. As a result, we found out that this rice miller is highly motivated and is considering making active investments with an aim of improving rice quality to the international standards and expanding the scale.

Since the rice mills purchase paddy through brokers, only brokers know the circumstance of farmers. Brokers are from the village where they purchase paddy and have a full grasp of the circumstance of farmers and the field situation of each year. We assume it is possible to address the improvement of rice quality at producers through brokers. For that reason, we decided to gather the DOA Tatkon T/S, rice millers and related brokers to offer training of moisture measurement. We also decided to identify a model for broker and a village where the broker purchases to test numerical moisture control. For the testing, because we heard that it would be desirable to conduct testing at the end of September when rice harvest begins during the rainy season (October to November), we planned on doing training during that season. We request the DOA (DOA Tatkon T/S, etc.) for the follow-up of testing (moisture measurement).

The following is the main content of interviews.

We have a dryer that we use as needed. The capacity is 200 baskets/day. We introduced in 2008 and used for eight years. There are two milling machines and the capacity of the Myanmar-made (introduced in 2000) is 8 tons/day and the Chinese-made is 18 tons/day. They preferably use the Chinese-made one and use the Myanmar-made one when the volume is higher. The color sorter (introduced in 2015) is owned by his younger brother. They share tasks between brothers. Younger brother oversees sorting and packaging. The capacity of color sorter is 50 tons/day. They have a storage in different location and its size is 80 sq. feet.

Since 2015 was the year of drought, they did not sell any paddy. During the dry season, they normally sell from 20,000 acres. During the rainy season, they sell paddy from 40,000 acres. By

types, Manawthukha and Sinthukha account for 75%, Ayeyarmin accounts for 15%, and Palethwe accounts for 10%. Last year, they accepted 500 baskets/day for eight months, meaning 120,000 baskets annually (only rice during the rainy season). The shipment range is normally 15 miles to 20 miles and 25 miles for the furthest. When the rainfall is less, they can sell in the neighborhood, which is the range of 10 miles to 15 miles. However, in the case of a shortage of paddy, they must expand the range of purchase. We assume the number of farmers who sell paddy is from 200 farmers to 300 farmers.

The purchase price of paddy is 5,500 to 6,500 kyat/basket of Manawthukha, and 9,000 to 10,000 kyat/basket of Ayeyarmin depending on grades. The categories of high grade, medium grade and low grade range in price of about 500 kyat/basket. The indicators of determining the quality of paddy are moisture content, different rice type, weedy red rice, stones, impurities and insects in that order. They also check to see if the rice was harvested during an appropriate season. Total purchase amount of paddy is about 5 million kyats to 10 million kyats. They also offer commissioned rice polishing and 25% of the cubic capacity is taken by the factory. They entrust brokers to purchase paddy. Brokers can appraise rice quality by the color, length and thickness of paddy. Since brokers sell rice purchased from farmers to rice mills, they must be liable for the quality and the appraisal results must be trustable. They cannot work as a broker if they cannot appraise rice quality.

Rice mills sell polished rice to wholesalers and do not sell at stores. Two brothers also work as a wholesale agent and sell to other wholesalers. They sell it to anyone as long as they purchase at a desirable price. Two years ago, exporters came to purchase Palethwe. The exporters did not come this year. The selling price of polished price is 24,500 kyat/bag (1 bag = 1.5 basket) of Manawthukha without color sorting and 24,500 kyat/bag (1 bag = 1.5 basket) for color sorted rice. In Ayeyarmin, the price is 33,000 to 40,000 kyat/bag and 22,000 kyat/bag of Palethwe (The price is lower for Palethwe since they do not use color sorter.)

The milling yield of polished rice is about 50% (the capacity is calculated. The rice went through a color sorter.) The priorities of quality judgment for polished rice are transparency and the color of the germ (to see if it has any color) in that order. When the rice is clear, it is hard, suggesting there are less cracked rice and high milling yield. This type of rice has less weedy red rice and different rice type with same-size grains. Because excellent rice is apparent at the stage of fields, brokers check fields and report to a rice miller. Total sold amount of polished rice is their share, which is about 10 million kyats. Brothers also take some shares, which are unknown.

Most difficult challenges are capital and technique. Although they want to increase the quality of polished rice to international standard, they know they need a Japanese-made machine. However, they do not have enough capital. With changing rice price, the price of machine is certainly not cheap in consideration of incomes.

They want to expand the scale in the future. Also, they want to form a group with other excellent farmers. By making a shift to high-priced rice, they want to expand the scale and do everything they could to improve quality. The current goal is to increase the quality to the standards of ASEAN at the least.



Photo 2.1: Meeting at DOA Tatkon T/S office. The director is at the left rear.



Photo 2.2: An interview survey with a rice miller in Tatkon. The owner is the third person from the right.



Photo 2.3: A group photo of the Tatkon survey. The fourth and fifth persons from the left are partner farmers.

Besides, the DOA asked two partner farmers of the rice mill to come to the rice mill. We interviewed the farmers about farm management situation based on a survey slip. They are a medium-scale farmer with 10 acres of owned land and a small-scale farmer with 4 acres of owned land. They both use the entire area as rice paddies and grow beans during dry season. They currently sell 3 million kyats to 5 million kyats of agricultural and livestock products. They want to secure the income of 5 million kyats or more in the future. For farming equipment, they own a power tiller, irrigation pump and sprayer, and ask acquaintances who own power threshers for threshing. Drying method is the sun. For the future, they want to engage in protected horticulture. However, the problem is a water shortage during dry season (a shortage of water in the dam.) The survey results of the rice mill are provided in Annex 1 and the survey results of farmers are provided in Annex 2.

Survey in the Pyinmanna district

DOA Pyinmana Township (T/S) Office

We visited DOA Pyinmana T/S office and met with a director, Mr. Hlaing Wunna, to explain about the content of this survey. The director contacted Zee Phyu Pin village to arrange a meeting with rice millers to support as the Pyinmana T/S.

Rice mills in Zee Pyu Pin

We interviewed a rice miller in Zee Pyu Pin. This rice miller offers rice polishing for the village and is positioned as a small-scale rice mill. The rice mill only has one milling machine and mainly polishes rice for self-consumption within the village.

The following is the content of the interview:

The area of owned farmland is 50 acres and uses 20 acres during the rainy season and 30 acres during the dry season.

They do not have a dryer and only has a milling machine (daily capacity is 200 baskets), which

was replaced 14 years ago. The rice mill was established by their grandfather 38 years ago. As for farming equipment for rice cultivation, the rice miller recently purchased a tractor and has an old power tiller. There is one storage with the capacity of 2,000 baskets to 2,500 baskets of paddy, which was built when it started its operation.

The rice mill mainly offers commissioned rice polishing for self-consumption. The shipment volume of paddy is 7,500 baskets of Manawthukha during the rainy season and 5,000 baskets of Thaigaut during the dry season (an early-maturing variety, which was described 90 days in the past report), as well as 3,000 baskets of Palethwe.

The shipment range is from 4 miles to 5 miles. The number of farmers purchased from are about 70 farmers. The purchase price of paddy is 4,000 to 7,500 kyat/basket for Manawthukha, 4,500 to 7,000 kyat/ basket for Palethwe and 5,000 to 7,000 kyat/ basket for Thaigaut. The categories of quality for high grade, medium grade and low grade have 1,000 kyat/basket or more of price difference among grades. For the quality judgment of paddy, they attach weight on whether the rice has any stones and other impurities, as well as moisture content. While the rice miller pays attention to the moisture content of paddy brought in immediately after harvest, they do not pay attention afterwards. Since farmers do not store for that long, no insects were confirmed. Total purchase price of paddy is about 5 million kyats to 10 million kyats.

The volume of polished rice sales is 4,000 bags for Manawthukha, 2,000 bags for Thaigaut and 1,500 bags for Palethwe. The method of selling is bagged rice and they sell to a wholesaler in Pyinmanna. Although we heard that wholesalers export at times (especially Thaigaut), this rice miller does not export rice. The price of polished rice is 17,000 to 24,000 kyat/bag for Manawthukha, 18,000 to 23,000 kyat/bag for Thaigaut and 16,000 to 22,000 kyat/bag for Palethwe. The quality judgment of polished rice is based on cracked rice, yellowed rice, and weedy red rice in that order. However, not much yellowed rice is mixed in. The sales price of polished rice is about a thousand to two thousand kyats (sells 300 bags daily.)

The rice miller's management problem is low milling yield and a difficulty in making much profits. There are other problems mentioned by the rice miller. However, since they have electricity, they do not pay for fuels and have no debt related to the rice mill. They sometimes cannot collect a receivable. Since the rice miller also sells beans (black gram, etc.), they use it to pay back a loan for tractor.

The milling yield (calculated capacity) is below 50% in average. They consider 45% or more as a good milling yield and currently have about 38% (6 pyi/ 16 pyi =1 basket). For the future, they want to expand to the size that meet the village's demand to satisfy self-consumption of polished rice for the village. They cannot think of decreasing the scale. It would be difficult to come together as a collective with excellent farmers due to the circumstance of farmers. From the experience, they can only make small profits by working collectively. After dividing, their profits decrease further, suggesting that individual management is more ideal. In addition, when working collectively, members' efforts vary from member to member. This generates a sense of unfairness if the profits are divided uniformly. For the future, they wish to improve the quality and sell rice by putting the name of rice mill (Phyi Aung Soe) on a bag. They have not thought about exporting, but wish to

reduce losses and introduce new equipment and technology.

For farming policies, they require the maintenance of infrastructures, particularly the maintenance of farm roads. Since there is no farm road, they cannot grow rice during the dry season. They maintain fields using their own method one acre at a time. This village is not included in the field improvement (303 acre) implemented by IFAD. Although they are not interested in group buying, they want to realize all of the contents listed in a survey slip. They particularly wish to learn a new post-harvest treatment technique, and make the entire village more convenient.

Combine harvesters are increasingly used in the village, and nearly 50% harvest using combine harvester by renting it from AMD. For the dry season cultivation, July is the month for harvest.

This rice miller mainly polishes rice for self-consumption within the village and falls under one of over 15,000 small-scale village rice millers located across the country. Unlike a large-scale rice producing region in the delta area, Pyinmanna will have a rice mill equipped with a new type of modern facilities to expand the shipment range, which drives small rice millers to discontinue. However, even when they can maintain their business, there is a small possibility of expanding sales channels to increase the volume of sales. Even with improved quality, its effect is limited. Because this survey aims to improve rice quality at the production and treatment phase, this rice mill is not appropriate as a target model.

For this rice mill, we invited three partner farmers to interview about their farm management. They are a small-scale farmer who owns 6 acres of farmland (4 acres of rice paddies and 11 acres of fields) and a medium-scale farmer who owns 19 acres (18 acres of rice paddies and one acre of fields), and a medium-scale farmer who owns 21 acres (10 acres of rice paddies and 11 acres of fields.) Due to its geography situated near mountains, all farmers own fields for growing beans and oil cake crops besides rice paddies. Both of the medium-scale farmers own a tractor and irrigation pump. The small-scale farmer only has a sprayer. The figures on annual sales are 700,000 kyats for a small-scale farmer, and 20 million kyats and 60 million kyats for medium-scale farmers. All three farmers entrust others to harvest rice using a combine harvester. After drying in the sun, they keep paddy in a storage and polish rice at the rice mill for sales and self-consumption. For the future, they wish to switch to modern farming. The small-scale farmer wishes to make one million kyats or more and the medium-scale farmers wish to make three million kyats or more as an income.

While the small-scale farmer wishes for agriculture policies that lead to raising incomes and living standards, the medium-scale farmers have a strong desire for better seeds and the supply of low-interest loan. In Naypyidaw, lectures and training sessions are held by the Myanmar Rice Federation (MRF) and the Myanmar Agribusiness Public Corporation (MAPCO). Some farmers from this village also participated and said they gained useful information. Although no rice miller in this area is a member of MRF, MRF plans on promoting unified production, treatment and sales and suggests contract cultivation for farmers. Farmers take an inactive stance toward contract cultivation due to previous forceful planned cultivation and contribution system.







Photo 2.4: A milling machine (Myanmar-made) of a rice miller in Zee Pyu Pin.

Photo 2.5: A group photo taken with rice millers of Zee Pyu Pin. The third and fourth persons from the right are farmers, and the fifth person is the owner of rice mill.

Photo 2.6: A courtesy visit to the mayor.

Survey in the Lewe T/S district

In the pilot field maintenance district implemented by JICA, we met with a director of DOA Lewe T/S office. After explaining the content of this survey, we moved to a rice mill (Yadana Rice Mill) in Lewe T/S and interviewed an owner Ms. Phyu Shein based on a survey slip. This rice miller is highly motivated in making management improvements and provided help to this survey. We decided to experiment numerical moisture control. This rice miller purchases 50% of paddy from brokers and 30% on their own, suggesting their familiarity with farmers' situations. As with Tatkon, we gathered DOA Lewe T/S. rice millers and brokers in late September to provide training for measuring moisture content of rice to identify model brokers and farmers to plan numerical moisture control testing. We decided to request subordinates of Ms. May Zer Myint from DOD headquarters for the follow-up of testing (moisture measurement.)

The following is the main content of interview.

Since the rice miller does not have a dryer, they lay a plastic sheet in a drying space on the premises to dry rice. They do not even have a color sorter. They have a milling machine (introduced in 2013) and its capacity is 700 baskets per day. The previous machine was purchased in 1988. They have a storage facility for paddy with the scale of 30×60 feet, which was built 21 years ago in 1955.

As for the purchase method of paddy, 50% is from brokers, 30% from their own, and 20% for commissioned rice polishing. The purchase prices of paddy for the rainy season cultivation are 3,000 baskets for Manawthukha, 1,000 baskets for Pawsan, 500 baskets for Yadanathu, and 500

baskets for Palethwe (5,000 baskets in total). For the dry season cultivation, the prices are 2,000 baskets for Thaigaut and 1,000 baskets for Yadanathu (3,000 baskets in total.) Normally, the shipment range is 18 miles to 25 miles. The number of farmers they purchase from are 100 farmers to 200 farmers. The purchase prices for paddy are 4,400 kyats/basket, 4,000 kyats/basket, and 3,500 kyat/ basket for the high grade, medium grade and low grades of Manawthukha respectively, and 3,300 kyat/ basket, 3,000 kyat/ basket and 2,500 kyat/ basket for Palethwe and Yadanathu. For Pawsan, 6,500 kyat/ basket, 6,000 kyat/ basket and 5,800 kyat/ basket. For Thaigaut, 5,500 kyat/ basket, 5,300 kyat/ basket and 5,000 kyat/ basket. For Yadanathu, 5,300 kyat/ basket, 5,000 kyat/ basket. The indicators of determining the quality of paddy are moisture content, different types of rice, discoloration rice, stones and impurities in that order. No insects were observed. They accept rice with higher moisture content because they dry on their own. Total purchase price of paddy is about 50 million kyats to 100 million kyats.

When the milling yield of polished rice is about 45% as a preferred result. While a hundred baskets of paddy generate 30 bags (45 baskets) of white rice, it is normally about 28 bags to 29 bags. They sell polished rice to wholesalers (90%). They also sell directly at a shop. They do not export their rice. Other rice polishing companies come to purchase white rice to fill a deficit. The rice mill also sells rice to a producer of mohinga (rice noodles). Selling prices of polished rice are 25,000 kyat/bag, 24,000 kyat/bag and 22,000 kyat/bag for Manawthukha respectively for the high grade, medium grade and low grade, 22,000 kyat/bag, 21,000 kyat/bag, and 20,000 kyat/bag (during the dry season, 20,500 kyat/bag, 20,000 kyat/bag for Pawsan, 20,500 kyat/bag, 20,000 kyat/bag, and 19,000 kyat/bag for Thaigaut. The priorities of judging the quality of polished rice are weedy red rice, yellowed rice (90%) and the rate of cracked rice. Because rice with high moisture content cannot be polished, the rice is dried in the sun on their own prior to polishing. Total sales figures of polished rice are about 50 million kyats to 100 million kyats.

Since the price of polished rice changes, we cannot say the price is low. They have no choice but to buy paddy brought in by regular partner farmers even when the quality is poor. Although not much paddy has an inclusion of weedy red rice, they do not reject the rice with weedy red rice, but buy at lower price. Not much yellowed rice is also observed. They have a shortage of labor at times. They make some profits and do not have to pay hefty amount of repair costs for equipment. While the interest of loan is not high, after they finish harvesting from December to February, they receive a temporary loan to purchase paddy from farmers. Because the period of loan is a year, they pay back by polishing rice. For this reason, they always have a debt to pay back. After February, farmers store paddy and sell when the price goes up.

They wish to expand the scale in the future. There are rice mills that supply good quality white rice, and they want to reach the same level. They visited a rice mill known for good quality of rice and saw their facilities. Because they want to produce high quality rice and sell at high price, they want to introduce a color sorter. However, they are not interested in working with coalition with excellent farmers. Due to a difference in opinions among individuals, they cannot easily agree with making capital instruments. They are thinking about selling rice in a bag with the name of rice mill to create a brand. By introducing new equipment and technology, they wish to improve quality and

reduce losses.

For agriculture policies, it would be helpful for rice millers to implement a project that contributes to the improvement of farm management and cultivation technique for farmers so that farmers produce good quality rice. For rice millers, they expect to see an advancement in the grants for introducing equipment, export promotion measures and the introduction of new post-harvest treatment technology. They also shared their opinion to request support for equipment maintenance and new technology.

After interview surveys, we explained the model of moisture control for this survey to rice millers and proposed measuring the moisture content of paddy using moisture meter to this rice miller and brokers or farmers to conduct testing of transaction based on the data. The rice miller readily agreed to cooperate the testing. For that reason, as with Tatkon, we gathered DOA Lewe T/S, rice millers, brokers or partner farmers to provide training on how to use a moisture meter around the end of September and identified a model broker or farmer to conduct testing.

As for the milling yield of polished rice, since they calculate based on cubic capacity in Myanmar, the weight calculation differs from normal method. For rice polishing, the volume weight differs by types, level of rice polishing and washing. While the international trading uses weight, there would be a problem to use the measurement of capacity that changes weight. Myanmar has set out to make changes to the SI System; International System of Units. The 2014 survey results indicated that the following simple values were suggested for paddy and polished rice (JAICAF 2015).

One basket of paddy = 22 kg One lone of polished rice = 250 g One pyi = 8 lone = 2 kg

In addition, the result of surveying polished rice at a rice polishing factory showed that when the unit has a larger capacity, the filling rate is believed to be lower. We suggested the following simple corresponding values for polished rice:

One basket = 16 pyi = 31 kg One bag = 1.5 basket = 24 pyi = 46 kg One pyi of grains = 8 lone = 2.05 kg One pyi of rice bran = 8 lone = 0.97 kg

The milling yield of national statistics is set to about 50%. However, the national statistics have weak evidence because the capacity calculation is common. (JAICAF 2015)



Photo 2.7: Drying space at Lewe T/S rice mill. A sheet is rolled up to keep rice from rain because there was a chance or rain.

Photo 2.8: Interview survey at Lewe Rice Mill.

Photo 2.9: Retail sales of rice polisher and rice millers in Lewe. The large basket is one pyi and small can (condensed milk can) is one lone.

We invited two partner farmers to this rice mill to ask about their farm management situation. Both are small-scale farmers with an owned land of 3.5 acres and 6 acres for rice paddies. During the dry season, they grow beans and oil cake crops. For farming equipment, they use a plow for plowing by cow and sprayer. The farmer with six acres of land has a power tiller and irrigation pump. Sales figures of agricultural products is 250,000 kyats and six million kyats (they grow rice, beans and oil cake crops each year). For rice harvest, they both entrust others to harvest rice using combine harvester. The farmer with 3.5 acres of land sells rice as-is without drying. The farmer with six acres of land store paddy after drying in the sun and polish at rice mill for sales and self-consumption. For the future, they wish to expand the farmland and obtain three million kyats or more of agricultural incomes.

Meeting with MOALI

Meeting at the DAR Post-Harvest Section

We visited the DAR Post-Harvest Section and reported a director, Dr. Tin Ohnmar Win (Ms.), about the content of this year's project and rice mills and farmers we interviewed this time. We asked her for advice. Dr. Tin Ohnmar Win oversaw the survey by JAICAF for the last two years and transferred to the current job a half year ago.

The following is main content of meeting.

The delta region (three areas of Ayeyarwady, Bagoo and Yangon), which is major rice production area, has a high level of farming technology after receiving various types of farming training by a host of NGO came in after the major disaster, Cyclone Nargis in 2008. Rice mills have dryers. With an advancement in the development of new type dryers, there are flatbed rice dryers sold at 2,000 USD, which have a processing ability of 50 baskets of paddy per day. Although this dryer requires

human power to stir rice to avoid uneven moisture content, it helps reduce time and labor compared to drying in the sun. Solar bubble dryer developed with IRRI costs lower at 1,100 USD.

Even though the farmers in the central dry area understand the importance of moisture control, they do not have enough capital. Many Japanese corporations come to this area. Three months ago, Kett Electric Laboratory visited and surveyed using a moisture meter. If a moisture meter is about 80 USD, we assume farmers want to buy it.

In terms of sharing a dryer, there are failed cases and successful cases in the past. Although dryers were introduced in several villages in the Gya Pin Kauk T/S, located in the west of Bagoo, farmers in one village stopped using a dryer immediately and it broke down. It required work and labor costs to carry paddy to a dryer location and to bring back polished rice to home. Another factor is that no one managed it responsibly because it was for a shared use. On the other hand, in a successful village, a dryer was donated to a rice mill. It was successful because the rice mill was responsible to manage the dryer.

From 2011 to 2012, we conducted surveys in three areas in the delta. In most cases, brokers determine the purchase price of rice, suggesting brokers are more involved in determining price than rice mills. We believe that farmers have more negotiation power if they control quality numerically using a moisture meter.

For rice mills for survey, we recommended including Min Set San (Pyinmana T/S) beside Aung Mingalar (Tatkon T/S). It would be better to select at least two rice mills respectively for comparison of mills with or without dryers.

It would be a good idea to provide training targeting middle-scale farmers (about 10 acres) and brokers. Awareness raising is important for fair purchasing. Not only for rice mills and brokers, it would be better to train key farmers and rent moisture meters. If key farmers become able to make full use of moisture meters and make achievements, moisture meters will disseminate among other farmers.

Meeting at DOA

We met with a deputy director, Mr. Htin Aung Shein, and a director, Mr. Thura Soe at the room for the director of the Department of Agricultural Extension to report the survey results for this project and talked about the procedure of M/M (Minutes of Meeting).

2) Measures for improving farmers' incomes

The survey results suggest the following problems of rice quality among farmers according to the rice purchased from farmers by rice millers.

- · Mixing of impurities other than rice.
- Mixing of different types of rice such as weedy red rice.
- · Changes of rice quality due to mold and yellowed rice.
- Damages caused by grain-storage insects in stored rice.
- · Un-attainment of proper time for harvesting rice due to a shortage of labor

Mixing of impurities other than rice is caused during harvesting, drying and thrashing. Many farmers use a thrashing machine after harvesting rice. They mostly thrash rice by beating rice plants with a tool after drying in the sun, which are piled on a waterproof sheet. This causes stones and impurities to mix in, causing low quality after polishing rice, failed milling machine and replacement of parts. To reduce the mixing of impurities at a farmer level, they can make improvements by changing from drying in the fields, ridges and roads to drying in other areas not contacting a ground such as using rice plant racks, and the use of power thrasher, as well as the handling method of paddy after thrashing. However, with the current situation where the quality of paddy is not reflected on the farm price sufficiently, it is extremely difficult to improve traditional method that has established with low labor and at low cost.

For the prevention of weedy red rice, although the upgrade of seeds is effective, the production cost increases when they are used each time. It requires removing variants carefully by weeding, this will also increase labor costs.

Molds and yellowed rice are caused by insufficient drying of paddy. Particularly for dry season rice, it rains often during a harvesting period, causing insufficient drying. Because farmers cannot rely on only drying in the sun to dry sufficiently, they need to introduce dryers and pay for fuel. In addition, farmers check the dryness of rice based on their experiences such as by biting, touching, breaking and listening, actual figures remain unknown.

For the storage or rice, storing paddy at regular temperature is effective for preserving quality again mold and insects. However, the current situation is that they cannot use their cash to storage as much as they want because they need cash. Additionally, compared to the storage of brown rice, the capacity is larger by nearly 30%. The storage for rice is a building made of wood and bamboo. Unless rice is stored for a long period, they can reduce the damage from grain-storage insects by storing paddy.

For proper time for harvesting rice, it is most effective to introduce a combine harvester (CH). CH causes less quantitative losses than harvesting by hands. Today, due to a decline in the workforce and increased wages, commissioned harvesting using CH is about the same or more economical than harvesting by hands. However, with a small absolute number of CH without unmaintained roads and fields, rice paddies that CH can enter are limited. Also for CH, 25% of moisture is left in harvested rice ears and 30% of moisture is left at the base, requiring quick drying of paddy (JAICAF 2015).

Using the measures above, to increase the quality of rice at the farmer level, additional costs are required except for the storage of rice. For that reason, it will be effective to assume the combination of most effective measures through cost analysis. By comparing increases in costs and sales price due to quality improvement, farmers can determine the possibility of introducing technology.

Rice mills list determining factors of purchase price from farmers as (1) type, (2) categories of new and old rice, (3) dryness, (4) inclusion of weedy red rice, (5) inclusion of yellowed rice, (6) ripening level (premature or over-mature), and (7) the length and shape of rice grain. Since rice is not categorized into grades based on objective indicators, they rely on experiences when it comes to deciding prices. For farmers and rice millers to gain profits by improving the quality of rice, the

best way is to group or organize farmers and rice millers with middle-scale rice miller with capital strength at the core with the aims of producing and processing under clarified transaction conditions.

3) Policies of this survey

In this survey, we visited target DOA offices in three T/S and rice millers to ask about their management. In addition, farmers that sell paddy to rice millers were invited to the rice mill to interview their farm management situation.

As a result, the rice mills purchase paddy mainly from brokers, and they do not often buy paddy for rice polishing for sale directly from farmers. When the rice millers make a direct contact with farmers, it is mainly the case when farmers bring in paddy to do commissioned rice polishing. On the other hand, since the brokers who deliver paddy for sale are responsible for the quality of paddy, which has a direct effect on the quality of white rice, they observe rice plants in the fields at various stages of development and report to rice millers. They discuss together and select farmers to buy from. Because brokers who receive advance payment from rice millers to purchase paddy take risks, they have a high level of judging the quality of paddy. In addition, brokers are from the village they buy from and fully know the management situation of farmers. The purchase price set by rice mills vary by types and seasons. Using the middle grade quality as a base, there re difference in the race of ± 4 to 25% top and bottom (± 5 to 10% for major type). (Table 4.1)

Township	Varieties	High grade (MMK/ basket)	Middle grade (MMK/ basket)	Low grade (MMK/ basket)
Tatkon	Manawthukha	6,500	6,000	5,500
	Ayeyarmin	10,000	9,500	9,000
Pyinmanna	Manawthukha	7,500	6,000	4,500
	Paletwe	7,000	5,800	4,500
	Thaigaut	7,000	6,000	5,000
Le Way	Manawthukha	4,400	4,000	3,500
	Paletwe	3,300	3,000	2,500
	Yadanato(Rainy season	3,300	3,000	2,500
	Pawsan	6,500	6,000	5,800
	Thaigaut	5,500	5,300	5,000

Table 2: Purchase price of paddy by grades by rice mills

Source: Survey team

As described above, compared to farmers carry out numerical moisture control, it would be ideal for brokers to measure moisture content on the spot at the time of purchasing paddy, and if the moisture content is larger, they ask the farmers to choose between drying the paddy till next visit or selling low-quality paddy on the spot by low price. Compared to a number of farmers carry out numerical control individually, it is more efficient for brokers to serve as a representative to measure moisture content. For this reason, after discussion of DOA and rice millers, we decided to set a model for numerical moisture control as from rice millers, brokers to farmers. Since the number of moisture meters provided by JAICAF is limited, of three areas we visited, the testing would be conducted in two townships of Tatkon T/S and Lewe T/S except for Pyinmanna T/S, which is mainly does commissioned rice polishing by farmers at small-scale rice mill in the village.

In addition, the commissioned harvesting work using combine harvester is becoming popular in recent years. With farmers' moisture control by drying in the sun, drying becomes effective using a dryer at rice mill. When farmers sell paddy harvested using CH under commission directly to rice mills, rice mills are responsible to carry out moisture control. The price of purchasing from farmers follows common practice.

If farmers store paddy harvested using CH and carry out numerical moisture control on their own, it becomes possible to sell to brokers at advantageous prices. However, if the farmers do not intend to sell and carry out numerical moisture control to maintain the quality of self-consumption rice, it leaves a room of examination whether to obtain benefits that meet the purchase cost of moisture meter.

Chapter 3. Technical guidance for the reduction of poverty and the promotion of sustainable agriculture

1. Dispatched experts and assigned area

Ryoichi IKEDA (Technical Advisor of JAICAF): Rice cultivation and farm management Iwao MATSUMOTO (Technical Advisor of JAICAF): Agricultural machineries Mari TANAKA (Researcher of JAICAF): Marketing

2. Operation content

1) Guidance objectives

- (1) We teach rice millers using a rice dryer how to use it properly to prevent quality loss. We share case studies on rice mills that have introduced rice dryers to show how much quality loss can be decreased by using the rice dryer. By presenting the usefulness of rice dryers to rice millers who have not set up a rice dryer, we will promote awareness toward the dissemination of rice dryers.
- (2) We mainly study how farmers carry out post-harvest operation of rice to teach how to manage rice hulls properly. Particularly, by sharing the moisture control standards with rice millers, rice brokers and competent government agencies including extensions, we aim to raise the awareness of the importance of using same standards among farmers and rice miller for moisture control of harvested hulls.
- (3) Also in the Ayeyarwadi area, we conduct moisture studies to transfer survey technique to disseminate the outcomes obtained in two years from 2014.

2) Guidance content

- (1) How to use a rice dryer and its usefulness (for rice millers)
 - \checkmark Guidance on how to properly use a rice dryer for rice millers who are already using it.
 - ✓ Dissemination of the usefulness of rice dryers through economic comparison for rice millers who have not introduced one.
- (2) How to use a moisture meter and the importance of moisture control (for farmers)
 - ✓ Guidance on numerical control using a moisture meter: Rice millers, brokers, farmers and extensions use a same moisture meter to control moisture by checking together.
- (3) Verification and dissemination of survey results obtained in Naypyidaw
 - ✓ Verification of the results obtained in previous surveys to see if they apply to other rice-producing areas.
 - ✓ By sharing useful information for other rice-producing areas, it will cause ripple effects to rice-producing areas in Myanmar.
- 3) Adjustment of guidance method

According to local survey conducted in advance at a specific rice mill, training for moisture meter was provided to T/S extension staff, rice millers, brokers and farmers who requested under the attendance of DOA staff. Although the plan was to lend moisture meters to rice millers and brokers, when we discussed with DOA staff during technical guidance, they requested that T/S extension staff manage moisture meter and go around brokers and farmers to provide training. With this, the guidance for moisture meter at rice mill is provided to rice millers and T/S extension staff to encourage them to provide guidance to brokers and farmers. In addition, when brokers and key farmers participated in a second seminar during the second visit for guidance, the three parties of rice miller, broker and farmers share the same consciousness for moisture control In addition, we took effort to sustain the previous outcomes by providing guidance repeatedly regarding the problem of weedy red rice and insects, which we provide for the last two years.

(1) 11	i st	
	Date	Activity content
1	Mon, 5 th September	Depart Narita → Arrive Yangon
2	Tues, 6 th September	Travel from Yangon→ Naypyidaw. Meeting with the director of the Department of Agricultural Extension, MOALI (DOA), etc. Preparation for visiting rice millers and farmers.
3	Wed, 7 th September	Visit a rice mill in Tatkon T/S. (Guidance on moisture control and ask for cooperation in quality data collection)
4	Thu, 8 th September	Visit a rice mill in Lewe T/S. (Guidance on moisture control and ask for cooperation in quality data collection)
5	Fri, 9 th September	Report at DOA. Request cooperation to the workshop held in November.
6	Sat, 10 th September	Travel Naypyidaw→ Yangon
7	Sun, 11 th September	Travel Yangon→ Ayeyarwady (Pathein)
8	Mon, 12 th September	Visit rice mills in Pathein (two locations)
9	Tues, 13 th September	Visit a rice mill in Myaung Mya T/S (one location) Depart Yangon
10	Wed, 14 th September	Arrive Narita

4) Dispatch period

(1)	First
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(2) Second

	Date	Activity content
1	Sun, 20 th November	Depart Narita \rightarrow Arrive Yangon

2	Mon, 21 st November	Travel to Naypyidaw. Meeting for a workshop at the Department of Agricultural Extension, MOALI. Visit a rice mill in Lewe.
3	Tues, 22 nd November	Visit a rice mill in Tatkon.
4	Wed, 23 rd November	Workshop in Naypyidaw.
5	Thu, 24 th November	Travel to Yangon.
6	Fri, 25 th November	Travel to Pathein. Workshop in Pathein.
7	Sat, 26 th November	Conduct a survey and provide guidance at a seed production farmer.
8	Sun, 27 th November	Travel to Yangon.
9	Mon, 28 th November	Activity report at the Japanese Embassy. Depart Yangon.
10	Tues, 29 th November	Arrive Narita

See Annex 3 for the detailed activities.

5) Guidance results

(1) How to use a rice dryer and its usefulness (for rice millers)

Experts were dispatched to two rice mills selected at the preliminary survey in the Naypyidaw area in September and November. In the rice mill, the importance of moisture control and over-drying becomes the cause of cracked grain. Since the rice mill prioritizes on shortening the time for drying operation, we pointed out that directly sending high-temperature hot wind causes cracked grains and the odor and attached tar due to shell burning of paddy, diminishing the quality of rice. In addition, because making the moisture content at a certain level at the time of shipment helps shorten the drying time and reduces uneven dryness, we taught the importance of implementing moisture content measurement using a moisture meter at the time of shipment. We shared the content of previous surveys in the Naypyidaw area when we visited a rice mill in the Ayeyarwady region.

(2) How to use a moisture meter and the importance of moisture control (for farmers)

As for the moisture control of rice, although we provided guidance in the last two years, we invited farmers, brokers and T/S extensions mainly in rice mill especially in this year.

At the preliminary local survey, we provided training at a specific rice mill under the attendance of DOA staff, and invited T/S extensions, rice millers, brokers and farmers who requested to teach how to use a moisture meter. Although the plan was to lend moisture meters to rice millers and brokers, after a discussion with DOA staff at the time of visiting for technical guidance, they wanted T/S extensions to manage the moisture meters and go around farmers with brokers to provide guidance. We taught rice millers and T/S extensions on how to use moisture meters at rice mill and asked them to teach brokers and farmers. In addition, brokers and key farmers took part in the seminar held during the second visit for guidance. In this way, three parties of rice millers, brokers and farmers shared a consciousness toward moisture control.

(3) Verification of survey results obtained in Naypyidaw and its dissemination

In Naypyidaw and Ayeyarwady, we held a workshop aimed at sharing the outcomes in the past three years.

Workshop held in the Naypyidaw area

Location: Herbal Garden, MOALI, Naypyidaw Date: 23rd November, 2016 Number of participants: 24 (5 women, 18 men and 1 person who did not answer) Participants: DOA staff, T/S extensions, rice millers, farmers, brokers and others.

Workshop held in the Ayeyarwady area

Location: DOA, Ayeyarwady Division Office, Pathein, Ayeyarwady Date: 26th November, 2016 Number of participants: 33 (7 women, 25 men and 1 person who did not answer) Participants: DOA staff, T/S extensions, rice millers, farmers, brokers, the Myanmar Rice Millers Association, business owners, staff from the Ministry of Commerce, and others.

At the workshops, the following three presentations were given to share information concerning post-harvest efforts with a question and answer session. (Annex 4)

*Summary of the findings from "Project of Fact Finding Survey for Poverty Reduction and Sustainable Agricultural Development in Myanmar" (Sharing the outcomes for the past three years)
*How to Prevent Post-Harvest Loss by Controlling Moisture (Prevention of post-harvest loss by moisture control)

*Gender Analysis and Agricultural Extension

In addition, as teaching materials for dissemination, we created an A4-sized, two-sided laminated card, which was designed to carry around in fields, to provide a summary of post-harvest treatment and pest control. We distributed at the workshop. (Annex 5)

Chapter 4. General Overview

1. A summary of previous guidance content

In 2014 and 2015, we carried out projects with the main theme of post-harvest treatment of rice in the Naypyidaw area. For the 2016 project, we focused on moisture control to provide technical guidance and conduct a survey. In addition, with the aim of sharing previous outcomes of technical guidance with other areas, we implemented a workshop in two locations of Naypyidaw and Pathein, Ayeyarwady. The following provides a summary of techniques taught in the last three years.

Skill: Removal of weedy red rice

Target: Farmers

Activity: We lectured the structure of how weedy red rice occurs. To prevent weedy red rice, we instructed the necessity of updating seeds at least once every three years and removing variants from fields.

Outcome: Although they were aware of the problem of weedy red rice, they did not know the structure of occurrence and effective measures. It was a good opportunity to mention these points. Remaining challenge: Although the update of seeds is effective preventive method, the production costs increase due to the cost of seeds. The removal of weedy red rice must be addressed by a unit of settlement, requiring building a cooperation system within the community. The production of excellent seeds is essential.

Skill: Seed pretreatment technique (raising seedling)

Target: Farmers

Activity: To uniform seedling raising, we taught the importance of using better paddy. We introduced the seed selection with salt solution for rice plant seeds. If the seed selection with salt solution is not possible, we taught using seed selection with water.

Outcome: Improvements in germination rate, uniform germination rate and increased seedling quality can be expected. With uniform germination and initial growth, farmers can obtain consistent seedlings.

Skill: Proper time for harvesting rice

Target: Farmers

Activity: We provided guidance on proper time for harvesting rice. (The ideal timing is about 85% to 90% instead of waiting the entire ears of paddy turn ripe color. It is better to harvest a few days earlier than now.)

Outcome: The farmers understood the importance of proper time for harvesting rice and began proper time for harvesting rice within a possible range.

Remaining challenge: One of the causes of not being able to harvest at the appropriate time is a shortage of combine harvester. It is not easy to secure workforce for harvest, and even though they know the appropriate timing, they cannot harvest at the appropriate time in many cases.

Skill: Moisture control

Target: Farmers, DOA staff, T/S extensions, rice millers and brokers.

Activity: To prevent the loss of quality such as yellowed rice and mold, we taught the importance of moisture control. By teaching the standards of safe moisture content, we explained about how to use a moisture meter and effective use of dryers. In addition, we lectured moisture absorption from the environment and equilibrium moisture content.

Outcome: Although they used to measure moisture by assuming the moisture contain of grains using senses, they understood the importance of using a moisture meter to control numerically. Three parties of farmers, rice millers and brokers share the same consciousness toward moisture control.

Remaining challenge: Financial assistance for purchasing dryers and moisture meters. Incentives such as an increase in purchase price when proper moisture control is implemented.

Skill: Proper use of dryers.

Target: Rice mill

Activity: We taught how to use dryers properly. We set up a net for removing foreign substances inside a grain charging hopper, replacement and repair of wire mesh, adjustment of duct location, and introduction of color sorter and the improvement of rice polishing process.

Outcome: Rice millers became able to prevent cracked grains, select cracked grains, remove foreign substances and remove weedy red rice and yellowed rice.

Skill: Survey of grain-storage insects and insect pest control

Target: Farmers, DOA staff, DAR staff and rice millers

Activity: While investigating the occurrence situation of insect pest during storage, they taught how to investigate. They taught a survey method of grain-storage insects, how to use pheromone trap and adhesive trap, consideration of directionality of grain-storage insect studies, cooperation for developing research plans, and how to distinguish insect pests.

Outcome: The participants understood how to investigate grain-storage insects and the importance of insect pest control. They also understood the existence of insect pests in grain storage, which leads to quality loss of rice.

Skill: Quality analysis technique

Target: DOA staff

Activity: We provided a lecture and training on analysis technique to evaluate quality. The quality evaluation items include moisture content and whiteness, as well as a mix rate of damaged grains, cracked grains, yellowed rice, colored rice (including weedy red rice), cracked grains in rice bran. By conducting the measurement of grain temperature and current values, we created a rice polishing control chart to understand the condition of polished rice. We handed out English manual indicating how to judge the condition of polished rice.

Outcome: DOA staff who participated in the training understood the overview of quality evaluation. The training nurtured staff who could measure several quality evaluation items on their own such as moisture control measurement.

ANNEX
Annex 1: Survey results of rice mills

No	Question	No. 1	No. 2	No. 3
	Date	May 31, 2016	June 1, 2016	June 2, 2016
	Township name	Tatkon	Pyinmana	Lewe
	Village name	Myamaddy quarter	Zee Phyu Pin	No3quater
	Rice mill name	Aung Mingalar Rice Mill	Phyo Aung Soe	Yadana Rice Mill
	Owner name	Mr. U Hla Win Aung	Ms. Soe Soe Khaing	Ms. Daw Phyu Phyu Shein
	Gender	Male	Female	Female
Q1	Employee	Male seasonal workers: 900	Regular male workers: 300	Regular male workers: 330
		person-day	person-day	person-day
			Male seasonal workers: 280	Male seasonal workers: 270
			person-day	person-day
Q2	Farmland area		Owns 50 acres	
	owned and planted		(Rainy season: 20 acres)	
	area in the last year		(Dry season: 30 acres)	
Q3	Facilities and	Dryer: 1, Milling machine	Milling machine: 1, Storage	Milling machine: 1, Storage
	equipment owned	2, Color sorter: 1, Storage	facility: 1	facility: 1
		facility: 1		
Q4	Shipment volume	120,000 baskets	15,500 baskets	26,666 baskets
	of paddy in the last			
	year.			
Q5	Shipment range of	Within 40 km radius	Within 10 km radius	Within 40 km radius
	paddy			
Q6	Number of farmers	200 to 300 farmers	Below 100 farmers (70	100 to 200 farmers
	purchasing paddy		farmers)	
	from			
Q7	Average unit	7,166 kyat/baskets	5,833 kyat/baskets	4,372 kyat/baskets
	purchase price of			
	paddy			
Q8	Judgment method	- Moisture content	- Mix of foreign substances.	- Mix of discolored paddy,
	of paddy	- Mix of variant paddy and	- Moisture content (for new	variant paddy and foreign
		foreign substances	rice only. For old rice, they	substances.
		- The amount of insect pest.	do not concern about	
		- Whether the harvest	moisture content.)	
		timing is appropriate.		
Q9	Purchase amount of	5,000,000 to 10,000,000	50,000,000 to 100,000,000	50,000,000 to 100,000,000
	paddy in the last	kyats	kyats	kyats
	year			
Q10	Sales volume of	120,000 baskets	11,250 baskets	3,600 baskets
	polished rice in			

	the last year			
Q11	Average unit sales price for polished rice	19,166 kyat/basket	13,333 kyat/basket	13,608 kyat/basket
Q12	Judgment method	- Transparency.	- The amount of cracked	- Mixing of different types
	of polished rice	- Discoloration (black	rice.	of rice and yellowed rice.
		germs are unacceptable.)	- The mixing of yellowed	
			rice.	
Q13	Sales price of	10,000,000 kyats	10,000,000~20,000,000	50,000,000~100,000,000
	polished rice in the		kyats	kyats
	past year.			
Q14	Management	The dissemination of new	- Low polished rice price, -	- Low polished rice price, -
	problem	technology and capital for	Low quality of paddy	Low quality of paddy
		introducing new	- Low quality of polished	- Low quality of polished
		technology.	rice	rice
			High amount of weedy red	- Mixing of weedy red rice
			rice.	- A shortage of labor during
			- A shortage of labor during	busy season
			busy season.	- High transportation cost
			- High transportation cost.	during rainy season
				- Cannot reduce debts.
Q15	The direction of	- Scale expansion	- Scale expansion	- Scale expansion
	management in the	- Building a community	- Improving the quality of	- Improving the quality of
	future	with excellent farmers to	polished rice for local	polished rice.
		increase financial power.	farmers.	- Branding
		- Transition to high-priced	- Branding	- Introduction of new
		rice.	- Reduction of losses	equipment and
		- Selling rice at higher price	during rice polishing.	technologies.
		by improving the quality.	- Introduction of new	
		- Branding	equipment and	
		- Reduction of losses	technologies.	
		during rice polishing.		
		- Introduction of new		
		equipment and		
		technologies.		
Q16	Target income	10,000,000 kyats	2,000,000 kyats	As much as possible
Q17	Farming policies	- Maintenance of	- Maintenance of	- Low-interest loan.
	for the future	irrigations, farm roads,	irrigations, farm roads,	- Subsidies for introducing
		fields, and distribution	fields, and distribution	fertilizers and farming
		processing facilities.	processing facilities.	equipment.
		- Low-interest loan.	- Low-interest loan.	- Promotion of exports of

			-	-
		- Clarification of safety	- Clarification of safety	farm produce.
		standards and quality	standards and quality	- Dissemination of
		standards.	standards.	post-harvest treatment
		- Dissemination of	- Dissemination of	technology.
		fee-based idea.	fee-based idea.	- The need for the support
		- Subsidies for introducing	- Subsidies for introducing	for introducing equipment
		fertilizers and farming	fertilizers and farming	and technologies
		equipment.	equipment.	
		- Promotion of exports and	- Promotion of exports and	
		agricultural processing.	agricultural processing.	
		- Collaborative purchase of	- Introduction of new	
		agriculture materials.	technologies	
		- Introduction of new		
		technologies		
Q18	Opinion	They hope to reach	It is difficult for farmers to	To obtain good quality
		international standards, or	implement something on a	paddy, the dissemination of
		at least the ASEAN level.	conjoint basis. Farmers'	good quality seeds and
			effort varies and it is not	cultivation technology.
			easy to divide small profits.	

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No	Question	No 1	No 2	No 3	No 4	No 5	No 6	No 7
	Date	May 31, 2016	May 31, 2016	June 1, 2016	June 1, 2016	June 1, 2016	June 2, 2016	June 2, 2016
	Township name	Tatkon	Tatkon	Pyinmana	Pyinnana	Pyinmana	Lewe	Lewe
	Village name	Myamaddy quarter	Myamaddy quarter	Zee Phyu Pin	Zee Phyu Pin	Zee Phyu Pin	Kyaungkone	Kyaungkone
	Householder name	U Soe Naing	U San Lwin Aung	U Tin Ka	U Khin Maung Tink	U Kyaw Myint	U Than Wai	U Zaw Win
	Gender	Male	Male	Male	Male	Male	Male	Male
QI	Household member	Male: 2, Female: 3	Male: 2, Female: 2	Male: 4, Female: 2	Male: 4, Female: 5	Male: 3, Female: 1	Male: 3, Female: 2	Male: 1, Female: 3
Q2	Household member under age 15	Male: 0, Female: 0	Male: 1, Female: 1	Male: 1, Female: 0	Male: 1, Female: 1	Male: 0, Female: 0	Male: 0, Female: 1	Male: 0, Female: 2
63	Household member age	Farming: 2, Food sales:	Farming: , Other than	Farming: 1,	Farming: 1,	Farming: 1,	Farming: 1,	Farming: 1,
	15 or older	1, Teacher: 1, Retired 1	farming:	Homemaking 2, Student:	Homemaking 3, Store: 2	Homemaking 1, Student:	Homemaking 1, Student:	Homemaking 1
				1, Other: 2		2	1, Other: 1	
<u>Ą</u>	Agricultural workforce	Regular male workers:	Male seasonal workers:	Regular male workers:	Regular male workers:	Male seasonal workers:	Regular male workers:	Regular male workers:
		300 person-day	15 person-day	200 person-day +	360 person-day	180 person-day	200 person-day	300 person-day
		Male seasonal workers: 1	Female seasonal	Male seasonal workers:	Male seasonal workers:	Female seasonal	Male seasonal workers:	Male seasonal workers:
		person-day	workers: 60 person-day	40 person-day	90 person-day	workers: 360 person-day	30 person-day	360 person-day
		Female seasonal			Female seasonal		Female seasonal	Female seasonal
		workers: 40 person-day			workers: 750 person-day		workers: 70 person-day	workers: 900 person-day
QS	Farmland area owned	Owned rice paddies: 4	Owned rice paddies: 10	Owned rice paddies: 4	Owned rice paddies: 18	Owned rice paddies: 10	Owned rice paddies: 3.5	Owned rice paddies: 6
	and planted area in the	acres	acres	acres	acres	acres	acres	acres
	last year	(Rainy season: 4 acres)	(Rainy season: 10	(Rainy season: 4 acres)	(Rainy season: 18	(Rainy season: 10	(Rainy season: 3.5	(Rainy season: 6 acres)
			acres)	(Dry season: 4 acres)	acres)	acres)	acres)	
				Owned farm fields: 2	(Dry season: 13 acres)	(Dry season: 10 acres)	(Dry season: 2 acres)	
				acres	Owned farm fields: 1	Owned farm fields: 11		
				(Rainy season: 2 acres)	acre	acres		
				(Dry season: 2 acres)	(Rainy season: 1 acre)	(Rainy season: 11		
					(Dry season: 1 acre)	acres)		
						(Dry season: 11 acres)		
96	Farming equipment	Plow: 1, Farm tractor: 1,	Plow: 1, Farm tractor1,	Sprayer: 1	Plow: 1, Irrigation pump:	Plow: 1, Irrigation pump:	Plow: 2, Sprayer: 1	Plow: 1, Farm tractor: 1,
	owned	Irrigation pump: 1,	Irrigation pump: 1,		1, Sprayer: 2, Tractor: 1	1, Sprayer: 1, Tractor: 1		Irrigation pump: 1,
		Sprayer: 2	Sprayer: 2					Sprayer: 1

Q7	Total cultivation area for	Paddy rice: 4 acres	Paddy rice: 10 acres	Paddy rice: 4 acres	Paddy rice: 18 acres	Paddy rice: 10 acres	Paddy rice: 3.5 acres	Paddy rice: 6 acres
	sales	Beans: 4 acres	Beans: 10 acres	Beans: 4 acres	Grains: 1 acre	Grains: 11 acres	Beans: 1.5 acres	Beans: 6 acres
					Beans: 18 acres	Beans: 21 acres		Oil cake crops: 6 acres
					Oil cake crops: 18 acres			
Q8	Number of livestock	Goats: 60, Swine: 12	Swine: 2, Poultry: 40 to	Draft cattle: 3, Poultry:		Draft cattle: 2, Swine: 4,		Draft cattle: 2
			50	20		Poultry: 20		
60	Farming work entrusted	Raising seedlings, rice	Rice planting,	Raising seedlings,	Raising seedlings,	Raising seedlings,	plowing and puddling,	Raising seedlings,
	in the past year	planting,	harvesting/thrashing	weeding,	plowing and puddling,	plowing and puddling,	weeding,	plowing and puddling,
		harvesting/thrashing		harvesting/thrashing,	Rice planting, weeding,	Rice planting, weeding,	harvesting/thrashing	rice planting, weeding,
		(Regular and seasonal)		drying/wind winnowing.	harvesting/thrashing,	harvesting/thrashing,		harvesting/thrashing,
					drying/wind winnowing.	drying/wind winnowing.		drying/wind winnowing.
Q10	Sales of farm produce	3,000,000 kyats or more	5,000,000 kyats or more	700,000 kyats	20,000,000 kyats	60,700,000 kyats	250,000 kyats	6,000,000 kyats
Q11	Accepted farm work on							1,000,000~1,500,000kya
	trust							ts for plowing
Q12	Post-harvest treatment	Hand-harvesting, drying	Hand-harvesting, drying	Combine harvester,	Combine harvester,	Combine harvester,	Combine harvester (sell	Combine harvester,
	ofrice	in the sun in the fields,	in the sun in the fields,	drying in the sun in the	drying in the sun in the	drying in the sun in the	immediately without	drying in the sun in the
		power thrashing/wind	power thrashing/wind	fields, rice hulling and	fields, rice polishing at	fields, rice hulling and	drying)	fields, wind winnowing,
		winnowing, rice hulling	winnowing, rice hulling	polishing at rice miller,	rice miller, storing paddy	polishing at rice miller,		storing paddy
		and polishing at rice	and polishing at rice	storing paddy		storing rainy-season		
		miller, storing paddy	miller, storing paddy			paddy, no storage for		
						summer rice		
Q13	Situation of farming by	A relative will succeed	Do not know because	Their child will succeed.	Their child (son) is	Their child is already	Child will succeed. (son)	Their child is already
	a successor	because they have no	their children are	(uos)	already engaged in	engaged in farming.		engaged in farming
		children.	small.		farming.			
Q14	A successor for the			Son will continue as a	Son will continue as a	The successor will	The successor will	The successor will
	future			main successor.	main successor	continue as a main	continue as a main	continue as a main
						farmer.	farmer.	farmer.
Q15	Future agricultural	Will continue in the	Will continue in the	Will continue in the	Will continue in the			
	management	future. (relative)	future.	future.	future.	future.	future.	future.
Q16	Agricultural	- Low quality of seeds.	- Low quality of seeds.	- Low quality of seeds.	- Looking forward to the	- Cheap farm produce.	- Expensive fertilizers	- Cheap farm produce
	management problems	- Small supplies.	- Small supplies.	- Expensive fertilizers.	modernization of	- The modernization of	and pesticide costs.	- Low quality of farm
		- Drought	- Drought	- A shortage of labor	farming.	farming and	- A shortage of labor	produce.
		- Water shortage	- Water shortage	during busy season.		technologies.	during busy season.	- Pest insects.

- Drought - Water shortage - A shortage of labor during busy season.	- Farmland expansion. - Labor-saving by mechanization.	3,000,000 kyats or more	 Irrigation maintenance Field maintenance Low-interest farming loan. Aid for fertilizer costs. Dissemination of new cultivation techniques. Dissemination of new post-harvest treatment techniques. 	Need technology, tractor, combine harvester, post-harvest treatment equipment, irrigation facilities and water.
	 Farmland expansion. Increased production for sales. Make more money by improving the quality. 	3,000,000 kyats or more	- Aid for introducing farm equipment.	Need to increase income.
	- Farmland expansion.	3,000,000 kyats or more	 Maintenance of distribution processing facilities. Low-interest farming loan Aid for introducing farm equipment. Dissemination of new cultivation techniques. 	Need new technologies, financing and equipment.
	 Labor-saving by mechanization. Increased production of farm produce for exports. 	3,000,000 kyats or more	- Aid for introducing farm equipment.	The modernization of farming, mechanization and irrigation maintenance.
	- To engage in modernized and mechanized farming.	1,000,000 to 1,500,000 kyats	Dissemination of new farming techniques	Improving incomes and living standards are important.
- Cannot reduce debts.	 To engage in protected horticulture (vegetables and fruits) Transition to high yield types. 	5,000,000 kyats or more	Low-interest farming loan.	Elimination of water shortage. (Not enough water in the Cindy Dam)
	 To engage in protected horticulture (vegetables and fruits) Transition to high yield types that match the climate. 	5,000,000 kyats or more		Financing and the securement of water resource.
	Direction of future agricultural management	Future goal for agricultural income	Future agricultural policies	Opinion
	Q17	Q18	Q19	Q20

Annex 3. Activity report for rice cultivation and farm management

Implementation of technical guidance: First visit

Tuesday, September 6th

Department of Agricultural Extension, Ministry of Agriculture and Irrigation:

We made a courtesy visit to the Department of Agricultural Extension and met with Mr. U Htin Aung Shein, Deputy Director of the Department of Agriculture. We made the arrangements for surveys from the next day and requested them to arrange guides while we were in Pathein on the 12th and Myaung Mya on the 13th.

Wednesday, September 7th

Ms. May Zar Myint of the Department of Agricultural Extension took us to a rice mill by way of the Tatkon T/S office.

Aung Mingalar Rice Miller: The owner is Mr. Hla Win Aung.

Managed by three brothers, we continued to survey this mill from last year. At first, we saw a new milling machine and an adjacent color sorter. The machine can polish 30 tons to 40 tons of rice daily. Next, we saw an old wooden milling machine placed at a factory next

door. It was polishing Manawthukha. It can polish 18 tons of rice from 7:30 a.m. to 6 p.m. Using the old milling machine, the workflow is that they do rice hulling and polishing, as well as rice polishing. After separating cracked rice, they use the milling machine and color sorter to only re-polish polished rice.

 They buy 75% of paddy from brokers and 25% from farmers. The quality of farmers' paddy is better. Brokers do not pay much attention to the quality of rice.



Color sorter placed next to a new milling machine.



Old wooden milling machine

At the time of purchasing paddy, they check moisture content and color. After using a Myanmar-made moisture meter to check moisture content, they purchase rice with the range of 14% to 16%. There is a separate route for soiled paddy. Rice with moisture content below 14% tends to be cracked. They also do not purchase 16% or more. The paddy at below 16% decreases in moisture content by 1% in three days after storing for a week. From dry season

from February to March, the rice dries easily during a storage period. However, rice retains much water until the middle of January. Even bagged rice loses much moisture after a while other than bags placed directly on a concrete floor. The price difference between the moisture content of paddy is up to 500 kyat/bag. If the color of brown rice is different after hulling sample rice, they lower the purchase price. The size of grains differs by color.



Interview

- ←This is a mix of weedy red rice or different varieties.
- We requested a broker to purchase paddy. The broker advertises by showing desired requirements for purchase. The broker visits farmers and brings in. Although the broker bites
 - paddy to measure moisture content prior to bringing in, he/she would never bring rice in after failing once.
- They polish four types of varieties. They also handle rice for China from February to June.
 (← We assume it is a F₁ hybrid variety, Palatoe.)
- Cracked rice is used for mohinga (rice noodles), rice vermicelli and feeds. They sell polished rice to traders or at retail stores directly.



Explaining how to use a moisture meter.

- The duration from making paddy to polished rice is up to 15 days and the days for rotation are three to four days normally.
- Three brothers engage in a network of supply chain, which is when the broker who purchases paddy from farmers and brings in to rice mill is same as a trader who purchases polished rice from rice mill and sells in markets.
- The rice mill does not have any paddy in storage at that time. For harvesting in March and April (dry season), they do not store any paddy because the rice is dried for three days prior to bringing it in to a rice mill. Even during the rainy season, the rice dries up after placing it under the floor of high-floored farmer's house for a week to ten days.
- Although farmers can control rice quality, they cannot suppress mice and birds.
 <u>Mr. Matsumoto and Ms. Tanaka:</u> Explained how to use a water meter. After checking the moisture content of paddy sample, we observed large variations from 10% level, 12% level and 10% level, indicating unstable moisture content. The owner of the rice mill also tried.

Although he brought a tabletop moisture meter later, we did not compare the data. Other sample indicated 13.7%, 14.0%, and 13.0% for brown rice with the average of 13.5%. This result also showed variation. For polished rice, on the other hand, the data was 13.6%, 14.3%, and 14.2% with the average of 14.9%.

 \leftarrow We assume that the reason why the polished rice has higher moisture content than brown rice is that polished rice absorbs moisture more.

- When we check the temperature of paddy in a storage bag, it was 33°C, and 34°C for the first bag and 32°C for next bag, which are almost same as an ambient temperature.
- Other rice samples indicated that the moisture content of paddy was 12.4% and the moisture content of brown rice was 13.4%. When the owner asked that of paddy, brown rice and polished rice, which rice he should measure moisture content, we answered that because the type he purchases is paddy, he should measure the moisture content of paddy. He replied that the moisture content of 12% level is too low for paddy, it would be accurate to add 2%. He said that the data of the moisture meter we brought showed about 2% lower than normal. The data was adjusted after Oga Electronic drew a standard curve based on the rice samples of Myanmar in Japan. We can certainly agree to his opinion that if the moisture content of paddy brought in is 12%, the damaged paddy has higher moisture content.

Tatkon T/S Office: Although there is no major weedy red rice problem in seed production, we observed a mix of weedy red rice in a considerable amount at the rice mill we visited in the morning. There are 50 villages in Tatkon T/S with a population of 220,600 and 14.379 rice farmers. Farmers have five acres of cultivation area on average and about 2-ha. They mostly grow rice by transplant production. They employ workers for transplant production and use a combine harvester for harvest.

Thursday, September 8th

Lewe T/S office: We interviewed Mr. U Saw Win, who is T/S Manager.

- Lewe has a population of nearly 280,000 and 580,000 acres of land. For rice production, there are potentially 83,000 acres. There are 261 small villages and 67 rural communities. In the area where irrigation water is available, farmers cultivate rice for two seasons and beans. More specifically, rainy-season rice is cultivated from June to September, beans from October to January and summer rice from February to May. Actual rice cultivation areas are about 60,000 acres and of them, there are about 20,000 acres available for irrigated rice paddies and about 40,000 acres for rain-fed rice paddies. Of the two acres, above, there are 5,000 acres of areas with irrigated water, which are available for three cultivations, including rice production for two seasons and beans.
- Varieties: Rainy-season rice such as Manawthukha, and Palatoe. Summer rice such as Shwethweyin, 90-days and Palatoe. Compared to 145 tin/acre for Palatoe and 90 tin/acre for Manawthukha for rainy-season rice, summer rice is about 100 tin/acre, which are167 tin/acre for Palatoe. There are over 100 small to large rice mills in the area.

- Although the average areas of farmers are unknown, the largest farmland is 20 acres and five acres for the smallest. For plowing operation, human power and animal power are fifty-fifty. For harvesting operation, human power is 25% and machine is 75%.
- The measures against weedy red rice are insufficient due to labor shortage and seeds. Although good seeds are less problematic, the price is twice as much as farmers when purchasing seeds from a seed company. The moisture content of paddy is checked by biting, suggesting a so-called hunch is used instead of measurement device.
- Although there are small-scale financial institutions in the area, the problem is a difficulty in disseminating new technologies. There are currently South Korean-made transplanting machines, which cost \$25 per acre to transplant. In comparison, it costs \$65 per acre for human power.

Yadana Rice Mill: The owner is Ms. Daw Phyu. It is a rice mill we visit three years in a row.

- The rice mill polishes 600 tins of paddy daily. For summer rice, they dry it in the sun. While the purchase price of 100 tins of dry unhull rice for 530,000 kyats, the price of undried paddy is 500,000 kyats. The moisture content of paddy is checked by listening to the sound of paddy thrown on a floor and biting.
- Summer rice has higher moisture content because harvesting is done during rainy season. They ask a large rice mill with dryer to dry summer rice. There are two rice mills in the district. The cost of drying is 200 kyats for each tin, which is about \$20 for 100 tins. Machines are mostly used for harvesting and thrashing.
- Rainy-season rice, which is harvested in November to December, is stored until next August to sell at a high price. When buying



A moisture meter is used to measure the moisture content of paddy.

paddy, the color of brown rice is checked and if there is a high proportion of weedy red rice and yellowed rice, the purchase price increases. This rice mill directly purchases paddy from farmers and directly sell polished rice at markets.

- At present, the rice mill polishes rainy-season rice harvested in December of previous year. They keep themselves busy by polishing rainy-season rice from November to December and harvest summer rice from June to July. Prior to harvesting, they negotiate with farmers in the fields to make decisions.
- We offered on-the-job training for a moisture meter. The moisture contents of paddy are 10.5%, 10.9%, and 10.6%, which is 10.6% on average, and 11.5%, 11.2%, and 11.5%, which is 11.4% on average, for polished rice. The variations are relatively small and stable.
- The shells of paddy are used at restaurants as fuel or for making bricks.

Taw Win Htik Htak Rice Miller: The owner is Dr. Maung Maung Aye.

<u>Interview with the owner's son:</u> The efficiency of rice polishing is 500 tins daily. The rice polishing machine was not in operation because they did not have any orders.

 The purchase of paddy: They visit farmers to buy dry paddy only. The moisture content of paddy is checked by biting. The Naypyidaw district only.



Milling machine



Owner

• Three varieties including Manawthukha are grown and very few Palatoe. Weedy red rice is rarely seen. It has been a year since the operation has begun. They oversee the entire flow from farming, rice miller to a market. Although they have birds, they are on guard for mice.

• <u>Interview with the owner</u>: Equipment was introduced from china and engineers were also called to start their rice polishing business. Rice bran is removed by refining. The number of orders increases in summer (Around March to April). They

offer rice polishing by receiving orders. They also receive many orders from farmers and consider purchasing another milling machine.

- Manawthukha is slightly harder and Paw san is soft. Since people in Yangon prefer softer rice, Paw san is shipped to Yangon. Manawthukha is shipped to China.
- The milling machine was \$3,000. They also have a generator. Rice bran is used for making distilled spirit and as feeds. The shells of paddy are used for bricks and people visit to purchase them.
- The paddy is stored up to ten days and sold immediately after polishing in September to October. The proportion of rice polishing orders is nearly 100%. It is currently in an experimental period.

Friday, September 9th

Department of Agricultural Extension, Ministry of Agriculture and Irrigation:

Tanaka, Matsumoto, Ikeda and an interpreter reported their activities up to the previous day to Director, Mr. U Myint Oo and Deputy Directors, Mr. U Htin Aung Shein, Ms. May Zar Myint, of the Department of Agricultural Extension.

Yezin Agricultural University: They visited JICA's technical project, Yezin Agricultura University

Upskilling Project.

Market visit: They visited a rice market in Pyinmana.

Monday, September 12th

DOA of Ayeyarwady District office: We interviewed deputy director, Mr. U Thay Lwin.

<u>Tanaka</u>: She explained the overview of JAICAF and this project and asked about the area's farming, especially information about rice production. She then requested to see a rice mill.

<u>U Thay Lwin</u>: There are 24 townships in the Ayeyarwady region. They share information at a meeting held every two months. They also hold an irregular meeting as needed.

- For rice production, there are 37 million acres for summer rice and 13 million acres for summer rice. In addition, there are 240,000 acres only for summer rice production. There are 15,000 acres of rice paddies that can use irrigation water from a dam.
- Varieties include Paw San, Manawthukha, Shwewartun, Sinthwelatt, Ayeyarmin, Kyawzeya, and Thedatatyi.
- They recognize that JICA's seed experts are making achievements in Myaung mya, Lapta and Hinthada, and wish to amplify thee techniques in the entire region of 26 townships.
- Weedy red rice is caused due to wild species and it can be eliminated by updating seeds. A high-yielding variety, HYV, is fine, but large amount of weedy red rice is caused due to floating rice and deep flooded rice. There are 550,000 acres of areas with frequent floods (water depth of six-story) and 260,000 acres of areas with deep flooded rice (water depth of three-story to four-story.
- Actual problems include (1) farmers cannot transplant due to high water level during the rainy season, (2) they do not have money for fertilizers, (3) lack of budgets, (4) labor shortage, (5) lack of farm equipment, and (6) unstable rice market, etc. Although there is insect damage, there is less disease damage, which is not a problem. ← Are these true?
- The Assistant Director of Ministry of Commerce, U Tun Tun (Rice Miller), joined.

<u>Ikeda:</u> When he asked about his prospects in the Ayeyarwady region, Mr. U Tun Tun said it is the shape of rice grains.

- Rice in Thailand and Vietnam is long and thin, but the grain length of rice in Myanmar is short. Sinthwelatt, which is rainy-season rice, and Thedatatyi, which is summer rice, are long and thin and easy to export. The only problem is an export country is limited to China.
- A limiting factor for exports is the rice is not organic and the problem is arsenic.

 \leftarrow Are there such places? Also, is the demand for organic rice that high?

• Myanmar has a weak post-harvest technique. There are insufficient number of harvesters and dryers. The harvest season of summer rice is in the rainy season and there is a problem of drying. Twenty-seven percent of rice in Myanmar is produced in the Ayeyarwady region.

<u>Ikeda:</u> When he was asked about key points for increasing marketability, he answered that the key was to consider the process of determining rice price. The quality management of rice is critical.

The quality of rice is determined by appearance and taste. It is important to eliminate mixtures and properly control moisture of paddy.

Diamond Crown Rice Mill: It is a large-scale rice mill established in 2011 and the owner is Mr. U San Aung. This rice mill stores 50kg of paddy per bag. Polished rice is shipped to northern and central Myanmar.

- The efficiency of rice polishing is five tons per hour. Nine hours of operation daily produces 45 tons of polished rice. About 75,000 bags can be stored, and the average is 55,000 bags. The price of a Chinese-made milling machine is \$130,000 including a color sorter.
- Mostly paddy is purchased from brokers and directly from farmers in some cases.
 Polished rice is shipped to the market on their own. About 5,000 bags are loaded on a ship each time.



Large rice mill

- When purchasing paddy, a Chinese-made water meter is used. Moisture content of 14% to 15% is purchased without problems. For 15% or below, paddy is purchased at lower price and dried with a dryer. They have a good circulation-type dryer. When the moisture content of paddy exceeds 16%, they purchase by reducing 102 tins to 100 tins.
- Six rice varieties are handled.
- Comparison of a Chinese-made moisture meter and a Japanese-made moisture meter: A same bag of paddy is used for measurement (see below table).

Moisture	Tomp	Temp.	Moisture	e content	of paddy		Pomoriza
meter	remp.	a bag	1	2	3	Average	Kemarks
Chinese-made	32°C	32°C	15%	14.3%			Insets a sensor into a different location.
Japanese-made	31°C	31°C	13.7%	13.8%	13.3%	13.6%	Three samples are taken from a same location.

• The shells of paddy are used for making bricks. Cracked rice is used for (1) confectioneries and inexpensive rice, (2) feeds, and (3) alcohol drinks. Rice bran is used for fish feeds. Agents come and get the paddy shells and rice bran.

There are two large milling machines introduced in 2011 and 2015, and the new one was in operation. We also saw the CCTV equipment. Each corner of the rice mill can be checked from a control room. There are two large circulation-type dryers in another building, which are from China and South Korea.

Myochid Rice Mill: The owner is Mr. U Tun Tun described earlier. The rice mill was established in 2007. The performance of rice polishing is 4t/h. His partner is Mr. U Maung Maung Win.

Farmers mostly bring in paddy directly and not many brokers do so. A Chinese-made moisture
meter is used at the time of purchasing paddy. They carry polished rice directly to Mandalay
and a Chinese border. Although it takes two weeks by ship and two days by car, ship fare costs
less. This rice mill also has a Taiwanese-made circulation-type dryer.

As for varieties, they handle eight varieties such as Shinthukha and Thedatatyi, as well as a



A large rice mill in Pathein.

Understanding the operation situation using a

glutinous rice variety.

•

- It has a Myanmar-made and a Chinese-made milling machines. The reason why it is not in operation is that the rice price is low and they wait until the price goes up.
- Fuel for the Taiwanese-made circulation-type dryer is made from the shells of paddy.

<u>Matsumoto:</u> Using the shells of paddy leaves the odor to rice without complete combustion.

• There are about 40 rice mills in Pathein.



Circulation-type dryer

Tuesday, September 13th

Thitsar Rice Mill: Mr. U Myint Wai is the manager. Situated along a river, the location is convenient for the transportation of paddy and polished rice.

<u>Tanaka</u>: She provided a description of JAICAF and the purpose of this project.

The building was built in 1972 and purchased by the current owner in 2000.

 Farmers bring paddy by ship. Most of the farmers have a minimum of five acres to a maximum of 100 acres with the average of 80 to 100 acres. Moisture content is measured at the time of purchasing paddy. He owns three moisture meters; a Chinese-made and two Japanese-made meters (Kett Electric Laboratory and Oga Electronics).

The standard level used is 15% of moisture content. He has no problem with high moisture content because he uses a dryer. Rather, he asks the farmers to bring rice without drying. This helps dry rice evenly. If not, cracked rice is caused due to over-drying in some locations.

 Compared to the Chinese-made moisture meter, he thinks the Japanese-made is more accurate.
 Even so, the Chinese-made is more convenient because it can measure quickly just by inserting in a bag.



The above is a Kett-made and the bottom is Chinese-made.



Color sorter

- People from northern and central Myanmar come and buy polished rice. For Yangon, he sells rice to a broker.
- The efficiency of rice polishing is 700 to 800 bags per hour, meaning 3,000 to 3,500 tins of paddy, which is equivalent to 700 to 800 bags. It operates 24 hours daily. From here, the manager acted as a substitute to accompany the minister and the owner accommodated us from hereon.

The owner purchases 16% to 17% of paddy from farmers and uses a dryer to dry rice. He says he instructs the farmers to do so. Paddy dried by



A broiler's kettle opening for the shells of paddy as

farmers is uneven and drying in a dryer altogether allows uniform quality. He purchased a Myanmar-made circulation-type dryer five years ago and considers updating it. <u>Matsumoto:</u> He asked about the weedy red rice problem.

<u>Owner:</u> Although about 15% to 30% of weedy red rice is mixed in, a color sorter is used to remove it and even when a small amount is left,



With an owner of the rice mill



A large-scale rice mill in Myaung Mya.

increased rice polishing accuracy enhances the appearance of rice. However, he thinks it is important to upgrade seeds.

Description: The improvement of rice quality is the market and consumers decide in the end. In other words, for farmers who bring paddy to rice mills, the rice mill is their market. For rice mills that sell polished rice to a rice market, the rice market is the market. This means that if the market has strict quality criteria, the

quality increases itself, which means that if the rice mill has strict quality criteria, the production farmers have strict criteria. If the rice market has strict criteria, the rice mill make the effort to improve the quality to meet the criteria.

<u>Owner:</u> Farmers and the rice mill exchange information and provide necessary suggestions and advice for seed upgrade. This leads to better business.

- While a tin of beans is 50,000 kyats, a tin of rice is 20,000 kyats, suggesting that bean production is more attractive to producers.
- Paddy shells after rice polishing are used at a raw sugar factory (built on the premises of the rice mill). Cracked rice is used for making rice vermicelli and confectioneries. Rice bran is sold at 1 pound = 143 kyats. The rice mill effectively utilizes byproducts to eliminate waste.



A Myanmar-made circulation-type dryer

The rice mill handles more than ten varieties. To polish varieties with different grain shapes, the operation portion of rice polishing is adjusted.

- No measures are taken against mice and birds.
- · When Mr. Matsumoto asked if there was any problem during operation for many years, the

owner said he did not have any problem.

- The rice mill has a color sorter and receives orders for rice polishing. Rice eliminated by the color sorter is given to staff for free. He uses a combustion broiler for paddy shells. The charcoals from paddy shells are used to wash dish and brush teeth.
- His Myanmar-made circulation-type dryer was \$10,000 and was made by Myanmar engineers. The fuel for this dryer is paddy shells.
 - The right photo shows a Myanmar-made circulation-type dryer that uses paddy shells as fuel. We have seen three types of circulation-type dryers made in China, Taiwan and Myanmar.

Summary: The comparison of rice mills in the Naypyidaw region and the Ayeyarwady region indicates different scales and the rice mills in the Ayeyarwady region are predominantly larger. In addition, all the rice mills in the Ayeyarwady region have at least Chinese-made moisture meters, as well as a circulation-type dryer.

The following is an attached appendix table of a comparison of rice mills surveyed.

			Rice	Paddy collection	E			Rice polishing			Storage period of	
Area	T/S	Rice miller	polishing	Purchase of	Moisture content	Price	Drying	Color contor	Number of	Shipment of	paddy to polished	Remarks
_			capacity	paddy	measurement	difference		COLOT SOFIET	varieties	polislieu rice	rice	
		Aung		Brokers: 75%	14% to 16% Made	Max 500		Made in			Normally from	Has a supply chain to purchase
_	Tetkon	Mingalar Rice	30 to 40t/D	Farmers: 25%	in China	kyat/bag	Air dry	China	4	On their own	Three to four days.	paddy and sell rice in a lump
_											of many on Jo	
Nav				Negotiate	Hunch such as	30.000	Sun dry.					
		Yatanar Rice	C/ -:+ 007	with farmers	biting and	1	Request drying	Mouro	c	Directly to a		*Drying fee:
ryı T		Miller		directly in the	listening the	kyals lof 100 4:20	during the rainy	DIION	,	market.		200 kyat/tin
Iaw	Lewe			fields.	sound of dropping	100 1115	season*					
_		Taw Win		Requests	11h					Dustan (Also		*MAnnaharan Kanalaran
_		Htik Htak	300 tin/D	farmers for		Purchase only	paddy	None?	ż		Up to ten days	. Malawulukula aluu Falauce,
_		Rice Miller		rice polishing	biting.					ship to China)		etc.
				Mostly		001F- d	A					
_		Diamond	:	brokers and	14% to 15% Made	Keduce 102	Chinese-made	Made in		Directly to a		"Has a South Korean-made
_		Crown Rice	5t/h, 45t/D	slightly	in China	tins as 100	circulation-type	China	9	market		one separately. Also, has
_		MIII		farmers.		tins	dryer*					CC1 V equipment.
_	Pathein			Modly			A		Non-glutin			
_		Muschid Dise		formarc and			Taiwanese-mad		ous rice:	Dimothy to a		*When not polishing rice,
Ayarwa			4t/h		Made in China		e	None?	8,			they wait until the rice price
ddy		MIII		slightly			circulation-type		Glutinou	market		goes up to polish rice.
_				brokers.			dryer		s rice: 1			
_			700 to 800			Undrying is	A	Made in China.				*Has two Japanese-made
_	Myaung	Thitsar Rice	bags/h,		15% as standards.	encouraged	Myanmar-made	Also, accepts				moisture meters. Effective
_	mya	Mill	Operate	Farmers	Made in China	=> Batch	circulation-type	orders for rice	10 or more	ć		and direct use of cracked rice
_			24h a day			dry	dryer	polishing.				at sugar factory, etc.
				_								

Implementation of technical guidance: Second visit

Operation content:

• This three-year-long project began two years ago narrowed its focus on the post-harvest losses of rice by making the rounds of rice farmers and rice millers to survey the actual situation of post-harvest treatment and storage control, aiming to clarify problems and provide countermeasures. This time, we held workshops in Naypyidaw and Pathein to conclude the previous activities to sum up the results of operation over the last three years.

Specific activities

<Sunday, November 20th>

We departed Narita and arrived at Yangon. We met with a long-term dispatched expert of the JICA Seed Project, Mr. Okada, who has been supporting us from the preparation phase of this project, and Mr. Fujii and Mr. Miki, who are experts of the same seed project, and heard a story regarding the current situation of rice production in Myanmar.

<Monday, November 21st>

• Traveled from Yangon to Naypyidaw by car.

The Ministry of Agriculture, Irrigation and Livestock

We talked with an expert, Mr. Kobayashi, who is on temporary assignment from JICA. Currently, JICA is preparing several projects in Myanmar, and considering a next project in Shwebo after the current seed project. A briefing will be held at the JICA headquarters in near future.

We made a courtesy visit to the director of the Department of Agricultural Extension, DOA.

After explaining the project's objectives, Tanaka asked the director again to talk about the recent efforts made toward post-harvest losses of rice in Myanmar (tentative name) at a workshop, which we asked him prior to the dispatch this time (Tanaka). However, the director answered there was no such a plan. We explained that this project is a collaborative project of Japan and Myanmar and not only the Japan side but also the Myanmar side needs to make presentations (Ikeda), and we obtained his understanding.

We joined Professor Yamamoto of YAU; Yezin Agricultural University, at the Lewe T/S office and headed to a rice mill.

A courtesy visit to

Yadana Rice Mill

The owner used the moisture meter we provided at the previous visit and left extensive records of the moisture content of each variety of paddy and white rice daily. The analysis of this record surely provides accurate knowledge on the changes of moisture contents of paddy and white rice in storage.

an alguat	1 All I
0.9. 10.6 3 1.6 205 12.2 J 1.6	
0.9. 10.3 7 2 20\$ 12.5 J 2	
0.94 10.4 g 1.4 20 f 11.8 g 1.4	
0.9, 12.1, 201 13.6] 1.5	
	5. ybry o.g. 10.6 g 1.6 205 12.2 1.6 o.g. 10.3 g 2 o.g. 10.4 g 1.4 o.g. 11.8 g 1.4 o.g. 12.4 o.g. 12.4 nf 13.6 g 1.5

The record of moisture content.

However, the moisture contents of paddy and white rice are 10.6% and 12.2% respectively, which seem low across the board. When we visited the rice mill in Tatkon, we used the same moisture meter to measure the moisture content of paddy, which was low at 12%. We heard the owner saying it would be close to a correct value if 2% is added. We thought that there might be a problem with the adjustment of the moisture meter at that time.

<Tuesday, November 22nd>

Ms. May Zar Myint took us to Tatkon. Professor Yamamoto of YAU and Dr. Umeda, a professor emeritus of Kyoto University who was visiting YAU, came along with us. We greeted the director of the Tatkon T/S office.

Aung Mingalar Rice Mill

The rice mill also used a moisture meter to measure and record the moisture content of paddy. The notebook contained date, the name of farmer, variety, ambient temperature and moisture content (average of three values). Again, although the moisture content was low at about 12%, all data was for paddy with a longer storage period after harvest. On the other hand, the paddy, which a farmer brought in recently, indicated 15.8%, 15.6% and 14.8%, suggesting that this moisture meter is not incorrect. He said he would not buy the paddy sample of this farmer because it has high moisture content.

Although he said the mixing of weedy red rice decreased recently, when we visited this rice mill with an expert, Mr. Fujiya, last year, we saw a considerable amount of weedy red rice.

This rice mill purchases nearly 75% of paddy from brokers and purchases the remaining rice directly from farmers. They also receive rice polishing orders from farmers. The minimum amount of rice polishing orders is ten baskets or more. Also, the unit of each bag for exporting to China is 108 pounds, and 105 pounds a bag for domestic. The reason is "108 pounds equal to 50 kg" (Mr. Matsumoto).

Currently, the price of Manawthukha is 5,000 kyats per basket. Paddy produced last year is 6,500 kyats. However, the normal price is 7,000 to 8,000 kyats. In some reason, the rice produced last year was traded at lower price this year (We were told it was due to weather disasters, but the cause is unknown.). The old rice mentioned here is the rice that was harvested six months ago or more.



The center is the Aung Mingalar Rice Mill's owner.

The black board at the rice mill showed the

number of bags for paddy plus the number of bags for white rice along with pounds after the decimal point. It suggests that 18.4 means 18 bags of white rice plus four pounds.

There are 18 rice mills in Tatkon T/S and five of the rice mills are equipped with a color sorter.

The rice miller uses pavement surface of a two-way wide public roadway leading to the President's Office was used to dry paddy (Photo 5 and 6). Foot or tools are used to mix paddy every 30 minutes and dried for three days. We could agree that the moisture content of paddy, which was described above, is from 10% to 12%. It is in the dry season and days are favored by good weather, which are good for drying.

<Wednesday, November 23rd>

We held a workshop at herbal garden. Overall, it was successful, but the general discussion placed a disproportionate emphasis on a certain matter.

The workshop was joined by participants such as a manager of Yadana Rice Mill, a rice mill in Lewe we visited two days ago, two brothers, who are the owners of Aung Mingalar rice mill in Tatkon, and the owner of Taw Win Htik Htak Rice Miller, a rice mill owned by a former military doctor we visited during the previous project. To start, the director of the Department of Agricultural Extension made the usual greetings.

Greetings from the director of the Department of Agricultural Extension:

- As Myanmar aims to secure food safety, increase farmers' incomes and improve international competitiveness, we are putting a great deal of effort in cultivating various dominant varieties as well as the development of post-harvest technologies. High quality rice and food safety are a must in the global market. In this way, post-harvest is an extremely crucial agenda. Today, there is a post-harvest technology training center established in cooperation with South Korea in Tonbo, near Mandalay, and a total of 1,152 people took part in the 40-session training course so far. The staff of each district also received training and we are planning on disseminating the technologies across the farmers.
- Myanmar has been making a strong effort to cultivate ten crops including rice plants, corn, peanut, sesame, sun flower, black gram, green gram, pigeon pea, cotton plant and sugarcane. Besides the cultivation and production of crops, post-harvest control technique is farmers' important tasks.

The surveys in three regions indicated that there were harvest losses of 9% to 15% in Yangon, 13.4% to 20.9% in Ayeyarwady and 8.6% to 14.8% in Bagoo. These losses are caused due to piling bundles of rice plants on a row for drying after harvest, during thrashing and rice polishing process. Also, because farmers cultivate beans immediately after rice production (rainy-season rice), there is no time for putting away bundles of rice plants and farmers have no choice but to dry rice on the bank. In recent years, with



A record board of polished rice at the rice mill.

the popularization of combine harvesters, the harvest losses are certainly decreasing. Not only for rice but also for beans, the training center above train farmers to ensure efficient harvest, thrashing, transport and drying, by taking advantage of the post-harvest treatment technology.

In consideration to sustain food safety, maintain and improve international competitiveness and preserve the environment at all times, we have set model farmers who grow good varieties and maintain good health.

I appreciate JAICAF for spending three years to conduct a survey on post-harvest losses. Today, JAICAF will make presentations. I encourage you to share your opinions on current problems and ask for consultation. I would also like to work together to proceed with the management of food quality. I hope to receive the cooperation of JAICAF in the days to come.

- **Ikeda:** Following a separate material, he briefly talked about the key activities for the last three years. He pointed out the current situation of rice production and rice exports in Myanmar by comparing nearby countries such as Thailand and Vietnam. In addition, by summing up the past activities, he explained about the countermeasures against weedy red rice in the end.
- **Matsumoto:** Per a separate material, he provided detailed explanation of the maintenance and management of high-quality rice at rice mills. He mentioned that there were invisible losses, and in the end, he concluded that instead of ending by saying "I know", they should say "I can do it" and "I will do it".
- **Tanaka**: She explained using a separate PowerPoint material. She began by explaining about definitions that gender is not just gender yet a social concept.

General discussion:

- A question by the deputy director: (1) The selection with salt solution helps identify weedy red rice because it changes its color to black. Also, rice mills have color sorter that can eliminate weedy red rice. Even so, does weedy red rice remain as a problem? (2) About the safety of farm produce, how does Japan take measures? (3) What is the current situation of hybrid rice?
- As for (1), perhaps, red weedy rice did not have a chemical reaction with salt solution, and wet paddy becomes translucent and the internal brown rice color can be identified from the outside of paddy. If so, it requires time and effort to remove it in the end. Also, the color sorter is used for polished white rice, not brown rice. Needless to say, it is better that red weedy rice does not get mixed in from the beginning. As for (2), Japan has the food safety standards established officially, and the government determines right and wrong according to the standards. For (3), although there are hybrid rice varieties developed by some private companies in Japan, the production is limited. In addition, only a few other varieties are put to practical use. He explained that the reasons were hybrid rice is not so high-yield as expected, costly to produce seeds, and its difficulty in combining parent rice to make hybrid rice that has taste preferred by the Japanese.

<Thursday, November 24th>

Moved to Yangon by car.

<Friday, November 25th>

Moved to Yangon and Pathein.

On the way, we said farm fields where bundles of rice plants after harvest are lined in a row along a ridge and ears are alternatively piled back and force for each level. The bottom bundles of rice plants were touching the soil. Also, a considerable amount of time had passed after harvest and sprouted beans for the next season were in the fields.

We saw rice harvesting operation in another location. The variety was Ayeyartoe. Although it was quite earlier than proper time for harvesting rice, the rice plants had long stems and were collapsed. The farmer had to plant seeds for beans, which was a subsequent crop, and was harvesting the rice. It was quite a high level cutting. The farmer said the stubbles were burned before planting seeds for beans.

We had a meeting with a director of the Ayeyarwady Regional Office in Pathein, Mr. U Tun Aung Kyaw, a deputy director, Mr. U Thay Lwin, and Mr. Daw Nwet Nwet Win (assistant director who prepared for the workshop after being contacted by Mr. Okada, an expert of the seed project) about the day's workshop. The workshop was joined by ten farmers, ten rice millers, four managers from townships, and a director, which is 25 participants in total. The chairperson was Daw Nyien Nyien Toe (Staff Officer, DOA Ayeyarwady). It started at 1:49 p.m.

Greetings from the deputy director: Myanmar is a farming nation with rice as a major crop. Since the quality rice (high-quality rice) is crucial, we are putting a strong effort along with the production of excellent seeds. JAICAF has conducted a survey on post-harvest techniques for the last three years, and they will make presentations of the results. I ask that participants ask various questions.

Ikeda used the PowerPoint files used previously to provide an explanation. Next, Mr. Matsumoto made presentations. Without having breaks, Ms. Tanaka continued to talk.

Question (1): How do you check for harmful substances such as arsenic contained in rice?

Answer: In Japan, there are food safety standards and public institutions conduct an analysis of ingredients of farm produce. Without passing the test, the food is not permitted.

Question (2): I heard that there is a drug for increasing natural predators. What is it?

Answer: Although there is an idea of using natural predators as a natural drug, we have never heard of using a drug to increase natural predators. There might have been some misinterpretation.

Question (3) (Farmers distributing rice plants): What should we do if weedy red rice is mixed in in the fields?

- Answer: It is difficult to identify not only variants but also weedy red rice in the fields that distribute rice plants. In this case, the only measure is to upgrade seeds.
- **Question (4):** (A woman from the seed project): The quality loss is caused when paddy samples are stored in a plastic bag sent for seed testing. What should we do?

Answer: Use paper bags, or mesh bags are better. Rice breathes air, so humidity stays trapped in the bag when sealed tightly and gets filled with Co₂, leading to quality loss. Air permeability is important for safe storage of seeds. (According to the expert, Mr. Okada, this seed storage does not have any temperature control and dehumidifier, which are root causes.)

The workshop ended at 4:37 p.m. The participants were 33 people.

<Saturday, November 26th>

The expert, Mr. Okada, of the seed project took us to two seed production farmers in the Ngwe Saung T/S.

Farmer (1) Madaukkune village: Within 20 acres of rice paddies, a seed production was done using 1.5 acres during the dry season. The variety brought in by OISCA from the Philippines is Pakhanshwewah. The farmer used to sell a basket of seeds for 8,000 kyats and the current price is 8,500 kyats. The yield was 80 baskets/acre. Two farmers from Myaung Mya brought 30 baskets respectively and a farmer from the Lebena state brought 45 baskets and a farmer from

Pathein brought five baskets. A moisture meter obtained from JICA is used to measure and sell at 13%. (The seed project recommends 13% for the moisture content of paddy.)

During the dry season, while Theedatyin was a main variety, this variety, Pakhanshwewah, is said to be better. The DOA also instructs them to do transplant production. The farmer obtained seeds from this guide, Mr. U Madaukkune Khage. Although Theedatyin has almost



The Pakhanshwewah variety we saw at the seed production farmer.

the same maturity season and culm length, Pakhanshwewah is more resistant against collapsing. The price of seeds differs by 2,500 kyats per basket. The yield of Theedatyin is 60 baskets per acre. Since it is the first year for this variety, the yield is unknown. However, the ears are slightly longer and the number of light paddy is many and ripening is quite well. This suggests the yield of Pakhanshwewah is higher. This variety is also popular in the rice market. People from the Delie state came and bought 250 baskets. The grains are thin and long and cooked rice is soft and does not get harden when cool. The main variety for dry-season production possibly switches to this variety. Additionally, this variety is cultivated during the rainy season and dry season.

- For this variety, FS was brought from DAR in 2015 and 2016. Farmers in three townships in Ayeyarwadi also grow this variety. One bag of white rice is sold at 23,500 kyats. *The paddy of Sinthukha is 4,600 kyats for 50 pounds = 22.7kg.
- This farmer used to produce Sinthwelatt seeds under a contract with a seed company and because of poor original seeds, they failed. The seed regulations were established in Myanmar last year and seed companies must be



The Paw Sam yin variety's standing crop in the farmer's fields.

registered. We took photos of Paw Sam Yin in the farmer's rice paddies.

Farmer (2) Kway village tract, Tha Yat Wan Pu village: We talked to three farmers who gathered there. Mr. U Saw Bahkay has three acres (seed production in the entire area), Mr. U Saw Tapale has 1.5 acres (within the 10 acres), and Mr. U Nay Mya has one acre (within six acres) for seed production and cultivation. Also, here, the variety is Pakhanshwewah. They produce seeds as instructed by DOA. The problem is a difficulty in securing labor. It takes a day to harvest one acre of rice with 15 people. The wage for harvest is 3,500 kyats for a person per day with a meal. Although the dryness level of paddy was checked by biting, the extension center brought a moisture meter recently to check. One basket is sold at 8,500 kyats. For normal paddy, depending on varieties, the price is 4,000 kyats to 5,000 kyats. The rice mill in the Delie state lends a combine harvester and with contract cultivation in mind, they purchase a large quantity of seeds. The seed production here is done for the first time this year. They obtain original seeds from DOA and received guidance on the seed selection with salt solution, how to produce nursery beds and transplanting, as well as information on seed buyers.

Japan's Manda Fermentation Co., Ltd. lends 200,000 kyats per acre to farmers for free and in Ayeyarwadi, the total amount is 2.6 million kyats for a total of 1,300 acres. In addition, Manda Fermentation distributed a bottle of liquid fertilizer, Manda No. 31, to farmers. They explained about the importance of farmyard compost, but they seemed to misunderstand it as the compost of paddy straws. For the elimination of variants, they go around a total of four times from transplanting to harvest. This suggests it is a total of four times from (1) after seedlings take root after transplanting, (2) around the first ear emergence, (3) the period when ears tilt, and (4) immediately before harvest. There are both field inspection and indoor test for seed production. When we said that the former was especially important, the expert Mr. Okada said that it is already implemented by limiting 50 acres. The table on the right shows the comparison of normal rice production and seed production and cultivation. However, what is beyond our comprehension is the yield of seed production

Cultivation	Transplanting	Harvest	Yield
		operation	
Normal	8 workers	10 workers	40 to 50
cultivation	o workers	10 WOIKEIS	baskets
Seed	15 workers	15 wontrong	08 hagirata
production	15 workers	15 workers	98 Daskets

is twice as much as the yield of regular cultivation. We could fully understand if the numbers were opposite.

<Sunday, November 27th>

Traveled from Pathein to Yangon.

<Monday, November 28th>

From 10:00 a.m., we made an activity report to a secretary Kazuyoshi Suzuki at the **Japanese Embassy** and obtained information on the current overall condition of rice production and the situation of rice in Myanmar. The secretary shared his high hopes for shifting to distribution next and add contents that meet Myanmar people's preference and demand so as to correspond differently for each area with the final goal of making policy proposals.

Departed Yangon.

<Monday, November 29th>

Returned to Japan.

8. General overview

① Promotion of proper time for harvesting rice

Since farmers know the proper time for harvesting rice, there are other factors that they cannot harvest at a proper timing. For example, even they plan on using a combine harvester, due to various reasons such as poor climate, they cannot harvest because they cannot borrow it as scheduled. In addition, if rice fields are located in the back, the farmers work on the rice fields after finishing the harvest of rice fields in the front, causing them to miss proper time while waiting and ended up harvesting by hand. Additionally, in areas without farm roads,



Liquid fertilizer, Manda No. 31, was distributed to farmers.

they move a combine harvester beyond fields. In this way, structural problems remain still.

② Clarification of challenges in post-harvest treatment and available measures to be implemented

	Losses after harvest	Quantitative factor	Losses due to harvesting method, while drying bundles of rice plants in the fields, during thrashing, losses from losing grains during transportation and losses while drying paddy.
Post-harvest losses (Overall)		Qualitative factor	The mix of different types such as weedy red rice, frequent immature rice due to harvest before proper time, cracked grains due to overheating and overdrying.
	Losses while in storage	Quantitative factor	Pest damages from mice, birds and grain-storage insects, damages due to molds and pathogenic bacteria.
		Qualitative factor	Molds, discoloration, abnormal grains (yellowed rice) due to high moisture content in paddy or white rice.

Table: Conceptual categories of post-harvest losses

Post-harvest losses of rice are divided into losses during harvesting and storage. In addition, these losses are divided into quantitative losses and qualitative losses (see right table.)

Given quantitative losses during harvesting, the discrepancies in harvesting method are large. Using a combine harvester, harvesting and thrashing can be done at once and then to drying. On the other hand, harvesting by hand requires harvesting, banding together, drying in the fields, transporting to a thrashing location, or transporting to a thrasher immediately after harvesting and drying after thrashing. Although hand-harvesting requires drying bundles of rice plants in the fields prior to thrashing and transportation, the use of combine harvester does not require these steps. This creates a major discrepancy. Shedding varieties in particular create more losses during transportation. There was a report that about 7% of losses are generated during transportation. After drying in the fields, workers carry the bundles of rice plants in their shoulders or load them on a cow carriage to transport them to an area for thrashing, ears fall off on the way or the grains shed, causing losses. For that, although farmers take measures by placing ears in a bag or covering with a sheet, they still have losses. For drying, setting aside when bundles of rice plants are dried by placing upright in the fields, if the bundles of rice plants are piled flat on the bank, the bottom stocks of paddy are difficult to dry, creating a cause of quality loss. In this way, quantitative losses can be improved considerably by changing from hand-harvesting to using a combine harvester. However, some pointed out that a large amount of paddy is released from the blowing

opening of a combine harvester, suggesting the necessity of improving a combine harvester itself in this case.

On the other hand, the qualitative losses during harvesting are caused mainly due to the mixing of different types such as weedy red rice. In addition, other causes are the frequent occurrence of immature grains because of inability to harvest rice at a proper time and cracked grains due to overheating and over-drying.

Next, the quantitative losses caused in storage are caused by pest damage such as mice and bird damage such as sparrows, and damages caused by grain-storage insects cannot be ignored. Quantitative losses are also caused due to molds and pathogenic bacteria. In addition, the qualitative losses while in storage are caused due to changes in rice quality such as yellowed rice from insufficient drying of paddy after harvesting. If the moisture content of paddy can be regulated under 14%, these losses can be reduced significantly. If the moisture content of paddy is 14%, black molds caused to residual germs and yellowed rice after storing for long periods of six months or more, and the quality can be maintained. In addition, if the moisture content of paddy is 14%, even when the storage temperature is 20°C or 30°C, breathing can be suppressed, and quality deterioration is prevented. These points suggest that the key is how to check the moisture content at 14%. There is no problem with a moisture meter, it is still difficult for each farmer to own a moisture meter. Many farmers and rice millers check paddy by biting to determine by the feel, or using a wooden board to rub by pressing paddy placed on a desk to check dryness by the feel. The solution is to have each farmer and rice miller own a moisture meter.

To improve rice quality, the quality must be judged according to the nation's quality standards and use the standards to determine price in the market. Without doing these, it is difficult to understand as an actual feeling.

③ Introduction of seed pretreatment technique and uniform seedling raising

To uniform the raising of seedlings, it is important to use homogeneous excellent seeds. On that basis, the seed selection with water or the seed selection with salt solution should be implemented. Even when the wind winnowing of paddy is done after thrashing, because some includes paddy with poor grain filling, a group of enhanced seeds is realized by removing floating paddy by implementing the seed selection with water. In addition, by doing the seed selection with salt solution adjusted to the specific gravity of 1.13, better seeds can be obtained. By putting salt until a fresh egg floats on the water sideways, it creates the specific gravity of 1.13. When making salt solution without using a raw egg, add 2 kg of salt or 2.5 kg of ammonium sulfate in 10 liters of water.

<Summary>

It is crucial for farmers and rice millers to firmly recognize quantitative losses and qualitative losses as post-harvest losses. For example, when paddy in storage is eaten by birds and mice, they consider it as no major problem because they cannot grasp specific amount of losses. However, in fact, there should be a considerable amount of losses. It is easily assumed because numerous mice holes were seen around rice millers and baby mice were frequently caught in adhesive traps. On the other hand, quality deterioration increases under high temperature and humidity while in storage. By reducing moisture content to below 14%, the breathing of rice is suppressed to reduce quality deterioration. Although these matters are already well-known facts by some of researchers, research institutions and concerned people in the administrative system, we believe there is a structure issue in Myanmar today. They have information and necessary technologies, but these matters do not penetrate and disseminate in actual sites. Through the activities over the last three years, we had a strong sense that it is important to question underlying causes at first. The key is to make practical efforts in the future.

The following suggests extremely crucial points for improving rice quality in terms of weedy red rice.

- 1) The generation sources of weedy red rice in Asia have roots in the interspecific hybrid caused due to natural hybridization of the agricultural species of rice with wild relatives of rice (*Oryza rufipogon* and *O. nivara*) grown inside rice paddies, ridges, surrounding grassland and channels. Even perennial *O. rufipogon* and annual *O. nivara* are widely distributed in southeast Asia. Due to their high cross compatibility with an agricultural species *O. sativa*, it is easily crossed and the crossbreeds indicate sufficient fertility.
- 2) These weedy rice plants easily drop grains prior to grain filling and have a strong diapause and competitiveness. They also have a strong vitality and fecundity with great transmission capability, allowing for easy invasion.
- 3) Since many wild species are weedy red rice, the invasion of weedy rice plants increases weedy red rice and gets mixed in white rice. In addition, it is believed that the mix of weedy red rice seen in harvested rice is because the seeds of weedy red rice are mixed in or originated from crossbreed by natural hybridization with wild species prior to previous generations.
- 5) It is crucial to accurately understand the generation situation of weedy red rice. The discovery of when and which rice paddies weedy red rice is found, the generation situation of weedy rice plants around the rice paddies, whether or not there was a problem with original seeds, and other causes leads to immediate measures.
- 6) The problem of weedy rice plants and weedy red rice is in question around the world. To develop measures, other countries' information can be utilized.

Workshop

Project of Fact Finding Survey for Poverty Reduction and Sustainable Agricultural Development in Myanmar

Post-harvest losses of rice

November, 2016

JAICAF Ryoichi Ikeda

Spons	ored by MAF	F, G(Cl		
Year	District	T/S	Visited	Subject	Training
		_	Farmers	Yield loss	Farmers,
2014	Nay Pyi Taw	5	Rice millers	Grain quality	Rice millers, Extension workers
0045	New Dui Terri	_		Grain quality	Rice millers,
2015	Nay Pyi Taw	2	Rice millers	Insect pests	Extension workers
0040	Nay Pyi Taw	2	D:	0	
2016	Ayarwaddy	2	Rice millers	Grain quality	Rice millers

Rank	Country	2009	2010	2011	2012
1	Bangladesh	173.1	172.8	172.6	172.5
2	Laos	160.5	161.6	162.3	-
3	Cambodia	158.4	159.9	159.2	-
4	Viet Nam	144.8	145.4	145.3	141.7
5	Indonesia	129.9	131.8	133.0	134.4
6	Myanmar	121.4	124.5	125.1	129.6
7	Philippines	123.1	116.0	118.8	120.9
8	Thailand	117.7	114.0	112.1	114.6
9	Sri Lanka	108.7	111.8	108.7	108.3
10	Madagascar	103.6	104.2	103.4	102.7

Rice	e area harvested	(m.ha)		Rice production	(m.t)
1	India	43.3	1	China	188.4
2	China	29.2	2	India	141.9
3	Indonesia	12.5	3	Indonesia	60.1
4	Bangladesh	11.1	4	Bangladesh	44.4
5	Thailand	10.8	5	Viet Nam	38.4
6	Viet Nam	7.5	6	Thailand	32.0
7	Myanmar	7.3	7	Myanmar	27.7
8	Philippines	4.3	8	Philippines	15.8
9	Brazil	2.9	9	Brazil	11.8
10	Pakistan	2.6	10	Japan	10.8

















Quantitative losses

- Harvesting: timing, methods
- Transportation: human, animals, mechanical
- Threshing: ability of thresher, method
- Cleaning: winnowing
- Drying: location & space, methodStorage: not always well-equipped



















What is weedy rice?

They are variable in appearance and occur in all major rice-growing areas; America, Europe, the Caribbean, Africa and Asia.

The origin of weedy rice in Asia is as yet unclear, though it is thought that they are natural hybrids of cultivated (*Oryza sativa*) and wild rice species (*O. rufipogon* and *O. nivara*).

The characteristics are seed shattering, seed dormancy and competitiveness with cultivated rice.







How to prevent weedy rice?

- · Use "clean seed" from a "known source"
- Take care to thoroughly clean machinery
- · Canals should be cleared to infestations

Manual weeding is effects for reducing initial infestations of weedy rice.

Removal of weedy rice plants when the weed first infests a field can help prevent more serious infestations in future crops.

Summary

Post-harvest losses and quality deterioration

- 1. Quantitative losses of stored rice would be occurred by rats, birds, insect pests.
- 2. Quality deterioration of stored rice would be occurred by moisture contents higher than 14%, fungal diseases and insect pests.

Contamination of weedy rice

- 1. Weedy rice invades easily paddy field and crosses easily with cultivated rice.
- 2. Its characteristics are easy shattering, strong dormancy and high competitiveness.

How to prevent Post-harvest loss by controlling moisture



November 2016 Iwao Matsumoto IAICAE

Type of Losses

- Quality loss (Value loss) Red grains, Yellowish grains, Broken rice, Foreign matter (Other grains, etc)
- Quantity loss (Amount loss) Rats, Birds, Insect damage during storage



Value Loss of Rice

- High Moisture Content; Fermentation, Molds, Discoloration, Insect Damage
- Low Moisture Content;

Increase Cracked Kernel, Energy Loss



Post Harvest Handling Harvesting

- Appropriate harvesting time;
- Rate of green-colored paddy grain became 10-15%
- Inappropriate harvest time results;
- Earlier harvest; increase immature grain, Yield loss
- Late harvest; Increase Brocken rice, shattering loss, Lodging, Birds attacked



Post Harvest Handling Harvesting

- Moisture Content and Its Control
- At after harvest time grain contains 20-25% moisture
 Wet paddy must be treated within 24 hrs (do not keep in the bag or heap up wet grain)



- High Moisture Content; Immature grain (Earlier harvest), Exposure to rain, Submerged grain
- Low Moisture Content; Exposure to strong sunshine, High temp. of heated air

Post Harvest Handling Protection against deterioration

- By Hand
- Do not pile up wet straw, Keep Panicle upward
- Avoid just after rain, early morning (Avoid a difference in moisture contents)



- By Combine
- Do not keep wet paddy in the bag for long, heap paddy grain on the floor
- Avoid just after rain, early morning (high M/C, Separation device can not Perform well)



Post Harvest Handling Drying

- Incomplete drying, ineffective drying will reduce grain quality
- Heating Temperature: >40°C
- Drying rate; 0.8%/hr
- Do not mix different M/C <3%



Moisture meter











	Milled rice							
	Minimum	Minimum Maximum						
Grade	Shape quality	Moisture content %	Chalky and damaged kernel			Broken	Foreign grains and foreign materials	
			Total %	Dama Total	Coloured kernel %	kernel %	Paddy %	Excep paddy
İst	1st grade standard sample	15.0	10	1	0.0	5	0.0	0.0
2nd Sub-	2nd gr.s Sub-gr.s	15.0 15.0	20 25	2 4	0.2 0.2	10 15	0.0	0.1 0.2




Gender Analysis for Agricultural Extension

Project Name: Project of Fact Finding Survey for Poverty Reduction and Sustainable Agricultural Dev When : Nov 2016, Where : Myanmar Presenter : Mari Tanaka, JAICAF Contact : m.Tanaka@jaicaf.or.jp

Bad Examples from JAPAN

- Accessing to "household-representatives"
 - Only men come to the event/seminar/workshop
 Women do not have access to new technology and support system

Land owned by men

- Women cannot participate in decision making nor actively invest in land
 Mechanization
- Men dominate the operation of machinery and once they became disabled or absent, their wife nor daughter do not know how to operate the machine
- Machinery said to save labour, but this assumption is neglecting the increase in peripheral labour burdening women

What is Gender and Gender Equality?

 Gender*: <u>Socially</u> constructed characteristics of women and men

Norms, Roles, Relationships, ResponsibilitiesDifferent in cultures and generations

Gender Equality: Result of the absence of discrimination on the basis of a person's gender in <u>opportunities</u>, <u>allocation of resources</u>, <u>benefits</u> and <u>in access to services</u>

*Sex: Physical characteristics of women and men

What to look and how

What to look? :

- ► Who carries out which agricultural tasks?
- Who has access to and control over resources and services
- >What are the reasons behind these differences?
- ► Method:
 - Individual / Household interviews
 - ► Surveys and mapping
 - ► Focus group discussions

Gender analysis and its importance

- Gender analysis: Systematic analytical process used to identify, understand, and describe gender differences and the relevance of gender roles and power dynamics in a specific context
- Why important:
 - ►To find the best strategies and solutions to address the different needs and dynamics of women and men



	I ool 1: Activity Pr	ofile	
Activity	Women/Girls	Men/Boys	
Productive Activity			
Agriculture:			
Land clearnace	~	~	
Ploughing		~	
Seed selection		V	
Nersury making	~		
Planting	~		
Weeding	~		
Bird scaring	~		
Harvesting	~	V	
Threshing			
Drying			
Transporting			
Selling			
Non-agricultural:			
Managing shops			
Driver			
Teacher			AP A
Reproductive Activity			
Eood preparation			

Useful tools for extension officers 3

- Daily Activity Clock
- Minimize negative impact
- ✓ Technology introduction changes <u>who</u> spend time on <u>what</u>. You can identify how useful the new technology in terms of <u>time-saving</u> and <u>who</u> <u>benefits</u> from that technology
- Identify when is the best time to hold extension workshop

Time	Warner	DR.	
5.00	Wake up, boil water for milking, clean kitchen, milking, cooking breakfast		
6.00	Take breakfast, wach dishes, prepare children for school	Wake up, take breakfast	
7:00-12:00	Take children to school, work in farm	Feed livestock, work in farm	
12:00	Cook lunch, take lunch, wash dishes	Take lunch	
3:00-15:00	Work in farm	Work in farm	
15:00	Go to market, take children home	Community meeting	
16:00-17:00	Wash clothes, clean house, help homeworks		
18:00	Cook dinner	43251132	
19:00	Take dinner, wash dishes	Take dinner	12157
20:00	Bath children	Inspect livestocks	1
21:00	Take bath	Take bath	<u> </u>
22.00	Sleep	Sleep	

Useful tools for extension officers 2

- Access and Control Profile
 Identifies who can use and
- who <u>owns</u>
- Useful to identify
 If you can <u>use</u> land but does not own the <u>land</u>, difficult to encourage investment in the land (soil improvement, irrigation, etc.)

	10012	: Access and Contr	ol Profile	Cashal
	Women	Access Men		Vomen Men
Resources				
and	~	~		V
ertilizer	~	~	~	· · · ·
Seed	~	~	~	
ivestock	~	~		~
Machinery		~		¥
raining	~	~	~	
Credit		~		
Benefits				
Dutside income		~		2
Asset ownership		~		~
Basic needs	~	~	~	4
Education	~	~	~	~
Dalitical power	4	~	~	4

	Daily Activity Clock		1
Time	Women	Men	
5:00	Wake up, boil water for milking, clean kitchen, milking, cooking breakfast		
6:00	Take breakfast, wach dishes, prepare children for school	Wake up, take breakfast	
7:00-12:00	Take children to school, work in farm	Feed livestock, work in farm	
12:00	Cook lunch, take lunch, wash dishes	Take lunch	
13:00-15:00	Work in farm	Work in farm	

Tool	2: Access a	nd Contro	l Profile		
	Ace	Access		ntrol	
	Women	Men	Women	Men	
Resources					
Land	~	~		~	
Fertilizer	~	~	~	~	
Seed	~	~	~	~	
Livestock	~	~		v	A.
Machinery		~		v	
Training	~	~	V	~	
Credit		~		v	
Benefits					
Outside income		~		v	Ш.
Asset ownership		~		V	
Basic needs	v	~	~	v	
Education	v	~	v /	V	
Political power	~	V	v /	~	

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Annex 5. Extension Material **Post harvest Handling**



1. Harvest timing





Milling loss

2. Harvesting method & Threshing



Cutting bottom is recommended for easier threshing

2. Harvesting method & Threshing



Threshing machine can reduce threshing time & threshing losses



Rice quality can be improved by farmers



Fermentation makes rice quality poor



Mixing different varieties gives you poor milling recovery





Drying slowly with thick layer and frequent agitation

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66 Let us use tarpaulin to avoid stones in rice

Agitation







INSECT PESTS OF STORED RICE

INSECT PETS FOUND IN RICE STORAGE IN MYANMAR

Maize weevil

Sitophilus zeamais

1. Weevils





Rice weevil Sitophilus oryzae

3. Grain borers





Lesser grain borer Rhyzopertha dominica

2. Flour beetles



Rust-red flour beetle Tribolium castaneum

4. Grain beetles



Saw-toothed grain beetle Oryzaephilus surinamensis



Flat grain beetle Cryptolestes pusillus

5. Moths



Angoumois grain moth Sitotroga cerealella

6. Others



Siamese grain beetle Lophocateres pusillus

MANAGEMENT TECHNOLOGIES ON STORED RICE INSECT PEST

1. Chemical control: Safe and effective use of insecticides

2. Biological control: Natural enemies are expected as agents of stored rice insect pest control.

- 3. Physical control: Construction of rice storage
- 4. Ecological control: Environments difficult for rice insect pests to inhabit.
- 5. Advancement of the integrated pest management (IPM): Combine all the effective methods to control stored rice insect pests.



Damaged grain

Photos taken by Dr. Azusa Fuzjiie, in Myanmar, 2015

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