
Data collection on maize growth during a field visit in Shan State, Myanmar



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Summary

Although maize yields in Myanmar has been more than doubled since the year 2000, productivity of maize growth is still low. In The SAM project 'Geodata for Agriculture and Water Facility', maize growers, organized in the Golden Paddy Platform, are supported to improve their farm management practices in order to optimize their yields and close the yield gap. Therefore, an in-app advice-rating system is developed for facilitating the farmers. During a field visit farmers were interviewed to collect baseline data to enable the monitoring of the effectiveness and impact of the tool.

The visits and data collection showed that farmers are aware of the importance of proper land preparation and fertilization and all farmers are motivated to improve their farm management practice, but no farmer logged its data. It was noticed, that yields varied considerably between farmers. Some yields were below the national average. It appeared, that most farmers did not provide the amount of fertilizer according to the recommendations of the Golden Paddy GAP booklet. Some farmers had identified the Fall army worm. It is recommended to ask farmers to log their farm management practices for empowering them by concrete figures and positive trends.

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Photo cover: Maize field in Shan State, Myanmar (M. Blom-Zandstra)



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1 Collection of baseline data for the Golden Paddy App

1.1 Introduction

Myanmar is a maize producing and exporting country among 163 maize producing countries¹ in the world. In this country, maize is the second mandate cereal after rice. Maize crop are produced regularly in Northern Shan State, Mandalay Region and Ayeyawaddy Region.

Productivity of the maize growth in Myanmar (3.8 tonnes/ha in 2018, according to FAOSTAT; 4.2 tonnes/ha according to USDA-Fas) is low in comparison to the neighbouring maize producing country Bangladesh, but it shows similar productivity with India and Thailand (Figure 1A). Yet, maize productivity has been more than doubled since 2000 (Figure 1B) indicating its potency for improvement. In The SAM project 'Geodata for Agriculture and Water Facility', maize growers are supported to improve their farm management practices in order to optimize their yields and close the yield gap.

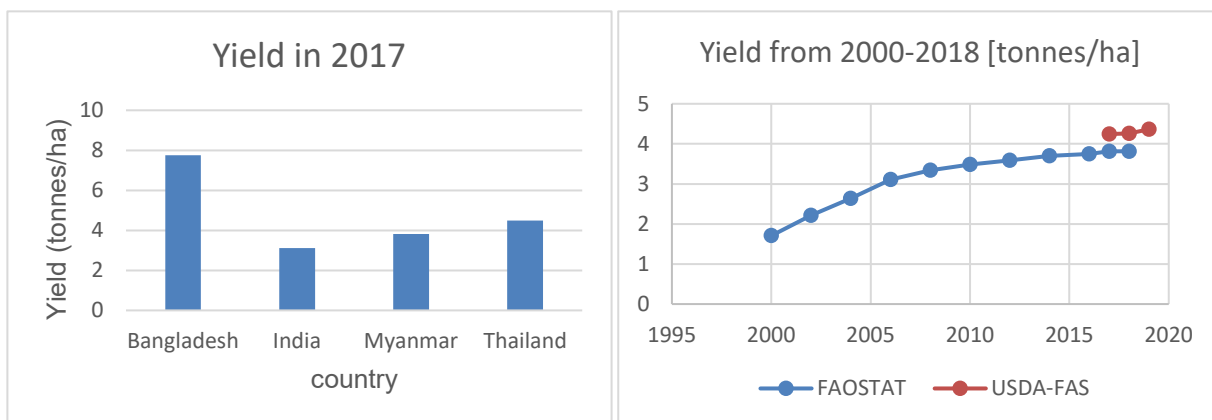


Figure 1. A. The yields (tonnes/ha) of maize in 2017 in Bangladesh, India, Myanmar and Thailand (Source: FAOSTAT); B. The yields in Myanmar from 2000 until 2018 (sources: FAOSTAT and USDA-FAS)

In this innovative SAM project, an in-app advice-rating system is developed in order to support and facilitate farmers, organized in the Golden Paddy platform, in making appropriate decisions on their farm management practice (e.g. on fertilization dose and timing, etc.). So, maize growers in Shan State are provided by knowledge and build up expertise to enhance their farm management practice towards Good Agricultural Practices and accredited certification (GAP-certification).

For an adequate development of this in-app advice-rating system, baseline data has to be collected as a starting point and to be able to monitor the effectiveness and impact of the tool. Therefore, farmers are interviewed on their common field management practices, use of fertilizers and chemicals, and their yields.

¹ <http://www.mpbsma.org/products/maize>

1.2 Field trip

From May 13th until May 16th a field trip was organised in Shan State in which we visited 8 farmers growing maize within the region depicted by the yellow circle in the map (Figure 2). The concrete aim of the visit was to observe the farmers' practices, to advise simple affordable soil testing kit and conducting soil samples, to come up with recommendations for improvement maize yields and to train the agronomy staff how to assist farmers and planning an fertilization program. During the field visits we focussed on:

- Farm visits to observe current practices and interviews with select farmers (focusing on practices important to combatting FAW such as spacing, intercropping, etc.)
- Soil sampling and showing IT staff easy method to sample
- Retailer visits to see common products available (if time permits)

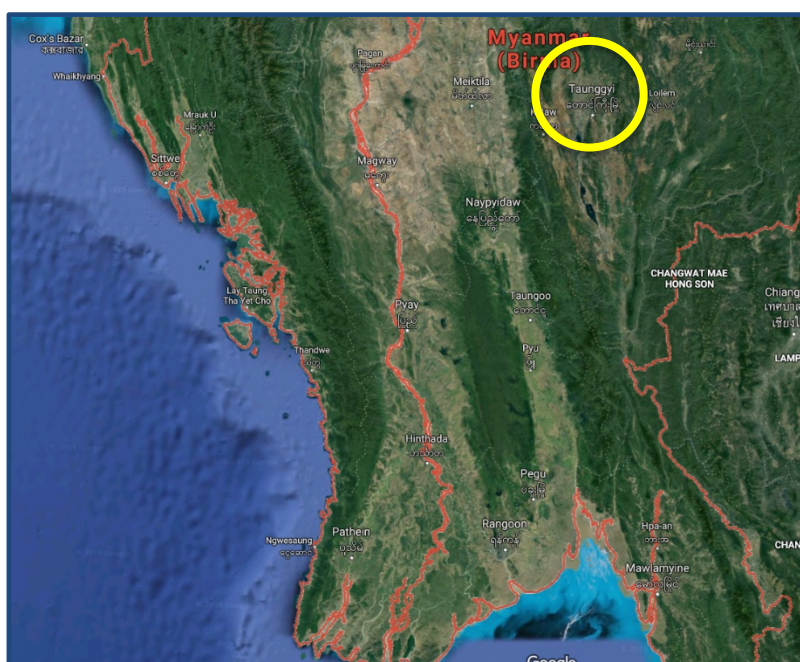


Figure 2. Region in Shan State in which farmers were selected for the visit (Map: Google maps)

2 Methods

2.1 Field visit farmers

In total 8 farmers were selected for the interviews. All farmers belonged to the Golden Paddy Platform and were connected to the Golden Paddy App. The farmers we visited and their location are summarized in Table 1.

Table 1. Farmers selected for the visit and their residence.

Farmer	Name	Location
1	Ko Sai Khan Htee	Than Te village within Than Te Village Tract
2	Ko Khan Lone	Than Te village within Than Te Village Tract
3	Ko Aung Thu	Hle Toe Village, Pin Pyit Village Tract, Yatsaunk Township
4	Ko Mya Lwin Oo	Inn Mee Village, Hway Village Tract, Yatsaunk Township
5	Ma San San Yee	Sin Thay Village, Myin Taung Village Tract in Yatsaunk Township
6	Ko Khun Than Lay	Kyauk ka Char Village, Sam Hpu Village Tract in Ho Pone Township
7	Ko Naing Win Htun	Yatsaunk Village, Yatsaunk Township
8	Ko Kyaw Win Zaw	Ah Lel Chaung Village, Yatsaunk Township

Farmers were interviewed by a semi-structured interview method and asked about:

- Land preparation
- Planting (spacing, cultivars)
- Weeding
- Fertilizer use
- Scouting pest and diseases, with special attention to Fall Army Worm
- Harvesting (yields 2018)

If possible, the fields were visited (Figure 3) to see the status of the soil. Samples were taken roughly in the middle of the field by digging a whole of about 10-15 cm depth. At that depth a soil sample (the amount of a handful) was taken for soil analyses on N, P, K and pH. Soil samples were analysed at the farm while the course of action was shown to the farmer(s) using a simple soil test kit. For explanation: see below.



Figure 3. Visit of the plot intended for maize production

2.2 Soil test kits

Soil acidity or alkalinity influences how easily plants take up nutrients from the soil. The standard pH for soils usually ranges between 4.0 and 8.5. Most garden plants favour soil which has a pH between 6.5 and 7 because this is the level where nutrients and minerals naturally thrive.

For farming according to GAP it is very important to know soil pH and the availability of N, P and K in the soil. Based on these data, recommendations can be given on the addition of lime and fertilizers.

For analysis of pH, N, P and K, a simple Garland soil test kit (Figure 4) was purchased online² and is available from several resellers including Amazon.



Figure 4. Garland Soil test kit

The soil test kit provides qualitative information on soil status and is easy to use. Simply, mix a soil sample with water in a jelly jar and shake for about 1 minute. Let the solution settle for a few minutes. Then, transfer with the pipette the indicated quantity of the solution into the test tube (Figure 5, included in the test kit). Add a pinch of the powder from the matching colour capsule (included in the test kit), and wait while the accompanying colour of the solution develops. After 5 minutes, the colour of soil solution has to be compared to the colour reading charts described in the guidelines (Figure 6, included in the test kit). For N-P-K test results, the nutrient levels are indicated on a scale from 0 (depleted) to 4 (surplus); pH test results are indicated on a scale from 4.5 to 7.5.



Figure 5. Tubes for soil analyses



Figure 6. Colour reading chart for quick analyses of respectively pH, nitrate, phosphorus and potassium (from left to right)

² https://www.tuincentrumlopik.com/bodem-npk-ph-test-kit-60-tests.html?gclid=CjwKCAiA98TxBRBtEiwAVRLQuyaOgnUfhIvWj7UdjyglhXL96HCBp2SNgrf8V4OzkvmiSpCGKMaRDDBoCjTKQAvD_BwE

3 Results

3.1 Visits of the farms

The time needed to visit the 8 farmers could be scheduled in 3 days. In the interviews the farmers provided information on plot sizes, their farm management practice and yield. Most farmers had done their land preparation already, but no farmer had yet applied fertilizer. The minutes of the interviews are displayed in Annex 1.

3.1.1 Main characteristics farm management

The farm sizes mentioned by the farmers in acres are summarized in Table 2 and converted to hectares for comparison with the international standards. Farm sizes varied considerably. Generally, the farmers had several plots, differing in size. For some farmers the plots were a long way apart, requiring much travelling time (several hours) for the farmer to reach it.

Table 2. Farm sizes and the amount of plots of the visited farmers.

Farmer	Farm size		Number of plots
	acres	ha	
1	8	3.2	3
2	12	4.9	4
3	27	10.9	4
4	14	5.7	2
5	30	12.1	4
6	5	2.0	2
7	5	2.0	1
8	8	3.2	1

Four farmers mentioned that they had grown other crops as precursor for maize and used the residues as green manure. Following precursor crops were mentioned: beans, potato, garlic, chickpea and pigeon pea. Two farmers also grew Mango. Some farmers based their farm management on advice from family, neighbours or friends. Others followed the advice of extension officers.

3.1.2 Land preparation

Most farmers prepared the soil by ploughing manually with a spade, some of them several times, while only three farmers used machinery (rented or in own possession) for soil preparation (Figure 7). All farmers applied fertilizer before planting, but the amounts differed between farmers.



Figure 7. Farmers ploughing manually (left) or with tiller machine (right)

3.1.3 Planting (cultivars, spacing)

The farmers used different cultivars. The cultivar CP 808 was selected most (4 farmers). Other cultivars used were: CP 888, CP 282, AK 111, GT 722, NK 625 NK 621, 139 or Thai 555. The motivations for the selection differed between farmers and can be seen in Annex 1.

Plant spacings were rather similar between farmers and rather well corresponded to the recommendations in the Golden Paddy GAP booklet (Row: 2.4 feet (= 28,8 inches or 73,18 cm); Plant distance: 0.5 feet (= 6 inches or 15,24 cm).

3.1.4 Weeding

Generally, the weeding was done two times, a few days after planting and just before fertilization. Half of the interviewed farmers did the weeding manually, while 3 farmers used herbicides.

3.1.5 Soil tests

The fertility of the soil was tested at 6 farms. The results from the soil tests are shown in Table 3.

Table 3. Results from soil analyses of pH, nitrogen, phosphorus and potassium determined by colour chart.

Farmer	Plot	pH	N	P	K
1	1	> 7.5	low	medium	medium
	2	> 7.5	low	medium	medium
2	1	> 7.5	medium to low	medium to low	medium to low
	2	> 7.5	medium to low	medium to low	medium to low
	3	> 7.5	very low	medium	medium
	4	> 7.5	low	medium to low	medium to low
3	1	> 7.5	very low	medium	medium-low
	2	> 7.5	very low	low-medium	medium
4	1	>7.5	low	medium-low	low
5	1	>7.5	low	low	low
	2	>7.5	low	low	low
6	1	>7.5	medium	-	medium

In all samples, pH was high and the availability of the nutrients NPK was medium or low. The values of pH correspond with the relatively high values for the Shan State region, depicted at Soilgrids³. At high pH the iron metal (Fe) will be released from the soil-particle-complexes and damage by Fe toxicity may occur. However, no such damage was seen on the plants in the neighbouring field where maize was already growing.

3.1.6 Fertilizer use

Almost all farmers applied fertilizer (both NPK and urea) two times: at planting and around 45 days after planting. Generally, they used 1 bag/acre, except for 1 farmer who started with 4 bags/acre. Two farmers used cow manure before planting. For further details: see annex 1.

3.1.7 Scouting pest and diseases, with special attention to Fall Army Worm

In many leaves the effects of glutton were seen (Figure 8). The frequency of scouting of pests and especially the detection of Fall Army Worm are shown in Table 4. Clearly, 5 farmers were aware of the possible outbreak of pests and diseases and paid attention to it. Three farmers mentioned to have detected the Fall Armyworm, but they had not yet taken measurements to combat them.

³ https://soilgrids.org/#/?lon=96.8269218&lat=20.7187712&zoom=14&layer=ORCDRC_M_sl3_250m&vector=1&showInfo=1

Table 4. Frequency of scouting, detection and control measure performed by the visited farmers.

Farmer	Scouting for pests	Detection FAW	Control
1	Two times a week	+	-
2	Two times a week	+	-
3	No	-	-
4	No	-	-
5	No	-	-
6	One time a week	+	-
7	Everyday	-	-
8	One time a week	-	-



Figure 8. Maize affected by glutton

3.1.8 Harvesting (yields 2018)

The yields over 2018 that were mentioned⁴ by the farmers are shown in Table 5. As can be seen, the yields varied considerably between the farmers and also between plots at the same farmer. At 50%, the yields were lower than the national average (3.8 tonnes/ha⁵, see chapter 1).

Table 5. Mentioned maize yields at the farms/plots in 2018.

Farmer	Plot	Yield	
		Viss/acre)	Tonnes/ha
1	1-3	1650	6.66
2	1-4	1300	5.25
3	1	960	3.87
	2-4	1478	5.96
4	1	587	2.37
	2	1205	4.86
5	1	714.3	2.88
	2	700	2.82
	3	533	2.15
	4	880	3.55
6	1	1250	5.04
	2	0	0.00
7	1	800	3.23
8	1	1500	6.05

3.1.9 Recommendations made to the farmers

Based on the recommendations, described in the Golden Paddy GAP booklet, we noted that almost all farmers applied a suboptimal quantity of fertilizer. However, the farmers indicated that the recommended fertilizer applications from the Golden Paddy GAP booklet were too expensive and too risky because of a possible outbreak of Fall Armyworm. So, our recommendations during this visit (see Annex 1) did not fully meet the necessary crop demand, but were connected to the farmers' normal habit., A switch to the required fertilizer application rate is currently too risky for farmers.

⁴ Yield data were based on the farmers' memory, as they were not logged

⁵ Source: FAOSTAT

3.2 Relationships

To study the variation in crop yields in more detail, we zoom in on the relationship between 1. Yield and land preparation, 2. Yield and cultivar and 3. Yield and fertilizer application. Unfortunately, due the low number of data and the lack of replicates, we are not able to perform statistical analysis and only weak trends might be seen.

3.2.1 Yield - land preparation

Table 6. Yields (in 2018) at different farms/plots and farm management on these plots.

Farmer	Yield (viss/acre)	Plot	Land preparation	Extra
1	1650	1-3	ploughed, and again after rain	possibility for irrigation, extra N-application, no pesticides HOWEVER ACETOMIPRID (insecticide)
2	1300	1-4	tractor (harrowing and planting)	no irrigation, use of herbicides and insecticides preventive and higher dose if disease present
3	960	1	big tractor	Use of herbicides, no insecticides
	1478	2-4		
4	587	1	ploughed	uses false weed beds, no herbicides
	1205	2		
5	714.3	1	?	
	700	2	?	
	533	3	?	
	880	4	?	
6	1250	1	harrowing	
7	800	2	harrowing	no fertilizer at planting
8	1500	1	?	

From table 6, it can be concluded that the use of machinery does not appear to result in higher yields than harrowing manually. Use of biocides appears to have an effect.

3.2.2 Yield – cultivar

Table 7. shows the choice for different cultivars in 2018 and their yields. Some farmers selected different cultivars for different plots (Figure or even combinations of cultivars (farmer 5). It can be seen that Cultivar CP 808 (marked green) appears to achieve the best, followed by AK 111.

Table 7. Yields (2018) at different farms/plots and the different maize cultivars, grown on these plots.

Farmer	Plot	Yield (viss/acre)	Cultivars
1	1	1650	CP 808
	2		CP 808
	3		139
2	1	1300	AK 111
	2		AK 111
	3		GT 722
	4		CP 888
3	1	960	NK 625

	2	1478	CP 808
	3		CP 808
	4		CP 808
4	1	587	Thai 555
	2	1205	CP 808
5	1	714.3	NK 625, NK 621, CP 808 and 282
	2	700	NK 625, NK 621, CP 808 and 282
	3	533	NK 625, NK 621, CP 808 and 282
	4	880	NK 625, NK 621, CP 808 and 282
6	1	1250	CP 808
	2		CP 808
7	1	800	288 , CP 808
8	1	1500	?



Figure 9. Seeds of different maize cultivars

3.2.3 Yield – fertilizer

In Table 8 the yields are compared with the fertilizer application, both the amount and the strategy. Farmer 1, who provided most fertilizer at his first plot, had the highest yield. Unfortunately, no yields are further specified per plot. So, the differences in application between the plots stay unrevealed. In any case, it is difficult to conclude from the table whether the amounts of the fertilizer has effected the yields positively: The differences between farmer 1, farmer 3 (plot 2) and farmer 8 are small. The application of manure also showed no clear effect on yields, nor did the NPK ratio. Unfortunately, a statistical analysis cannot be done as more data and replicates are necessary for such analysis.

Table 8. Yields (2018) at different farms/plots and the application of fertilizer on these plots

Farmer	Yield (viss/acre)	Plot	Manure	NPK ratio	Application	
					NPK	Urea
1	1650	1	green remains	16:8:8	4 bags/acre at planting	1 bag urea/acre after 45 days
		2	cow dung + green remains		1 bag/acre ⁶ at planting	1 bag/acre after 45 days
		3			1 bag/acre at planting	1 bag/acre after 45 days
2	1300	1			1 bag/acre at planting	1 bag/acre after 45 days
		2			1 bag/acre at planting	1 bag/acre after 45 days
		3			1 bag/acre at planting	1 bag/acre after 45 days
		4			1 bag/acre at planting	1 bag/acre after 45 days
3	960	1		15:7:8	1 bag/acre at planting	1 bag/acre at tasselling
	1478	2		15:7:8	1 bag/acre at planting	1 bag/acre at tasselling
		3		15:7:8	1 bag/acre at planting	1 bag/acre at tasselling
		4		15:7:8	1 bag/acre at planting	1 bag/acre at tasselling
4	587	1		15:15:15	1 bag Armo/acre at planting	-
	1205	2		15:15:15	1 bag Armo/acre at planting	-
5	714.3	1		20:10:5	1 bag/acre at planting	1 bag/acre at tasselling
	700	2		20:10:5	1 bag/acre at planting	1 bag/acre at tasselling
	533	3		20:10:5	1 bag/acre at planting	1 bag/acre at tasselling
	880	4		20:10:5	1 bag/acre at planting	1 bag/acre at tasselling
6	1250	1		20:10:5	1 bag/acre at planting	1 bag/acre after 45 days
		2		20:10:5	1 bag/acre at planting	1 bag/acre after 45 days
7	800	1	cow manure (on 4 acres)	20:10:5	1 bag/bag seed (= 1.2 bag/acre) at planting	1 bag/acre after 45 days
8	1500	1			1 bag ARMO/acre at planting	1 bag/acre after 45 days

⁶ Farmer applies less in this field as he considers the soil being good.

4 Discussion

The visit of farmers (Figure 10) provided a good insight their usual farm management and the underlying motivation. The farmers were willing to give information on their farm management, yields, bottlenecks and income. Moreover, they all were open minded for enhancement of their agricultural practices. Farm management practices varied between the farmers. Some of the interviewees based their decisions on the Golden Paddy GAP booklet as indicated by extension officers, others followed the advice of neighbours, friends or family.



Figure 10. Farm visit

4.1 Farm management practice

A clear conclusion can be drawn about the cultivar choice. The cultivar CP 808 achieves bests and is worthwhile to be recommended as preferred cultivar.

The yields varied considerably between farmers. Some yields were below the national average (3.8 tons/ha), others above (up to 6.7 tons/ha). However, it is difficult to draw clear conclusions with respect to the relationships between crop yield and 1. Land preparation and 2. Fertilizer application. All farmers (except for farmer 1, plot 1) applied less fertilizer than recommended for maize and advised in the Golden Paddy GAP booklet (e.g. 4 bags/acre for the whole season), which is needed to meet the crop's demand for optimal growth (see references). In the soil samples the amount of nutrients turned out to be low, confirming that soil nutrient status was poor. So, fertilizer supply had been suboptimal as were the yields. Therefore, we recommended during the visits to increase nutrient supply as much as possible according to the farmer's financial capacity.

Farm management practices on weeding (manually, mechanically or use of biocides) also did not relate clearly with yields and does not perform clear insights in whether the way of farm management recommended by the Golden Paddy GAP booklet turned out to be beneficial.

The monitoring of success in relation to yield at smallholder farms is very difficult as long as the amount of farmers is limited (no sound statistics possible), the plot sizes are small (no added value of mechanical land preparation and weeding, except for time consumption) and all information was qualitative and based on farmers' memory, while no data logging has been done (reliability of data based on memory).

4.2 Fall armyworm

Three farmers mentioned the detection of the Fall armyworm and showed to be aware of the threats of this invasive, epidemic pest. Outbreak of Fall armyworm may be disastrous and may quickly destroy the whole crop. However, detection of the Fall Armyworm and being able to distinguish it from the native and less damaging Asian stem borer and Spotted stalk borer are sometimes difficult and needs knowhow and careful analysis (see references). The poster (Figure 11) shows some characteristics of the three different type of stemborers.













	Fall armyworm	Asian stem borer	Spotted stalk borer
Scientific names	(<i>Spodoptera frugiperda</i>)	(<i>Ostrinia furnacalis</i>)	(<i>Chilo partellus</i>)
Appearance Eggs			
Appearance Larvae			
Appearance Pupae			
Appearance Mots			
Main food sources	Maize, rice, sorghum, sugarcane, vegetable crops, cotton	Maize, bell pepper, cotton, millet, sugarcane, sorghum, ginger	
Natural enemies	Ants, earwigs, bugs	Tachinid flies, braconid, and ichneumon wasps, earwigs	wasps
Intercropping	Cassava, napier grass, brachiaria grass, beans, peas	Beans, eggplant and lemon grass	Sorghum, Cassava, napier grass, desmodium
Biocontrol	Litovir, spodovir		Extra Nitrogen fertilizer

Figure 11. Characteristics of Fall armyworm, Asian borer and Spotted stalk borer

4.3 Recommendations

The visits and data collection showed that farmers are aware of the importance of proper land preparation and fertilization. All farmers are motivated to improve their farm management practice and are open minded to comply with the recommendations of the Golden Paddy GAP booklet. Some farmers even followed trainings.

The application of fertilizer is a point of attention. Most farmers did not provide the amount of fertilizer according to the recommendations of the Golden Paddy GAP booklet and an increase of the fertilizer application may increase their yield substantially.

Also the farmer's attention to crop development and the scouting for pests and diseases are important issues to be taken into account. Some farmers pay attention to their maize crop regularly (or weekly), others do not visit the plot at all.

For proper control of crop development, farmers should be asked to log the amounts and applications of fertilizer/pesticides/herbicides, working hours and yields. So, crop development, costs and revenues can be visualized and trends can be identified. Generally, farmers can be empowered by concrete figures and motivated for improvement or innovation. As a method, it can be recommended to select a big group of farmers from the Golden Paddy Platform and organize them in different groups (> 10 farmers per group) based on comparable soil types and environment (hills or flat land). Ask the farmers to follow crop growth on basis of a protocol, periodical measurements on growth and scouting for the coming up of diseases and concrete weighing of the yields and to log their farm management operations in a simple table:

- Dates of sowing, weeding, application of fertilizer, scouting application of biocides, harvest
- Use of equipment
- Selected cultivars
- Types of fertilizer and pesticides, amounts of application
- Time investment
- Yields and selling prices

Data analyses on these figures give insight in the benefits of controlled farm management and can be used by extension officers to convince the farmer of advantages of the use of enough of fertilizer, to scout for pests and diseases and to save time by mechanization.

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Annex 1 Interviews

Day 1: Monday, 13 May

Farmer 1: Ko Sai Khan Htee (8 acres of maize, a relative of Ma Nwe), used to be the village leader but resigned for health reasons.

Location: Than Te village within Than Te Village Tract.

156 households in the village, all are farmers

120 have their own farms, the rest rent land or are laborers

Most between 35-40 years

Most men do the harrowing and ploughing

Females do planting, weeding, harvesting

70-80% of women are farmers

Seed: CP 808 on two plots, Armo 139 on 2 acres

Planting date – waiting for the rain; last week of May/first week of June

Q: How much rain?

A: When the soil is wet enough

Q: What happens if it doesn't rain after you plant?

A: Can irrigate if rain stops

Planting by hand in rows (26-28 inches between) and 6 inches between plants

(NB. GAP recommendation: 2.4 feet between rows and 0.5 feet between plants)

Farmer uses this spacing to be able to weed and for pest management

Farmer has received a lot of training from other companies and NGOs

Farmer has had 20 years of experience, has tested different types of spacing and says if the leaves touch between plants they will turn yellow

Table 9. Field information of farmer 1.

Plot	Acres	Seed	Manure	Precursor crops	Soil	Fertilizer
1	4	CP 808		Beans grown, plants used as green manure	pH > 7.5 N: low P: medium K: medium	4 bags/acre + 1 bag urea/acre
2	2	CP 808	Cow Dung	Potato grown before, plants used as green manure	pH > 7.5 N: low P: medium K: medium	1 bag/acre + 1 bag urea/acre
3	2	139	No		pH	1 bag/acre + 1 bag urea/acre

Fertilizer use: CP 16:8:8 (34,000 MMK/1 bag – 50 kg), Urea (27,000 MMK/1 bag – 50 kg) – already purchased

Q: Why 16:8:8

A: Sister works for CP and recommended this for CP seed. The farmer applies extra nitrogen after 45 days in the form of urea. In plot 2 and 3, he applies less nitrogen as he believes that the soil is good

Land Preparation

Ploughed and will plough again after the rain

Weeding

Two times in the season:

- 45 days after planting just before the application of fertilizer

-
- At time of fruit setting (3 months after planting)

Pest Management

Spacing, no pesticide used in the field

Neighbour saw aphids and used pesticide

Farmer has used seed treatment for potato (in the soil mixed with fertilizer)

For potato, farmer scouts every morning and evening

Yield

CP 808 (8 acres) = 1,600 – 1,700 Viss/acre = 2,560 – 2,720 kg/acre (6.3 – 6.7 tonnes/ha)

Sold

6,000 Viss wet (Oct), 370 MMK/Viss

3,000 Viss dry (Nov), 410 MMK/Viss

Soil Quality

Has tested pH in the past with other companies and NGOs

pH is about 4.6; farmer knows that this is acidic. The company advised him to use Gypsum (lime) to adjust pH

Retailer

Nyaung Shwe

Bayer product (Acetagro, Acetamiprid 20% SL)

Farmer got input on Facebook from a friend who works for Bayer

Notes

- He ploughs and applies fertilizer when the rain stops and the soil is wet enough
- Farmer owns and rents out a big tractor to 50 farmers (25,000 MMK/hour). The tractor can plough about 6 acres in one day; there are 4 tractors in the village
- The government has provided funds loans to purchase tractors. The tractor was purchased in 2018 and needs to be paid in 4 years.
- Farmer uses weather forecast (general weather on the phone with 15 day forecast, weather forecasting app and listens to the radio)
- Weather is unpredictable
- Germination is about 14 days
- The farmer is part of a Facebook group

Recommendations

Double urea for field 2 and 3

Field 1 (4 acres): 4 bags NPK, 1 bag urea

Field 2 and 3 (4 acres): 4 bags NPK, 2 bags urea

Farmer 2: Ko Khan Lone (12 acres of maize)

Location: Than Te village within Than Te Village Tract

Land Preparation

Farmer rents tractor for planting and harrowing (22,000 MMK/acre)

Makes rows by hand held tractor (that he owns)

Seed: Farmer plants 6 bags per 4 acres (7.5 kg/acre)

Rows made by tractor

Row spacing: 27-78 inches

Plant spacing: 6-8 inches

In this village most farmers follow this spacing, which started because of contract farming with CP
CP contract farming started in 2004 and stopped in 2010 because the yield became low
CP wanted to use sprinkler for irrigation but it was too expensive for farmers for production costs

Farmer doesn't know how to test for germination

Table 10. Field information of farmer 2.

Plot	Acres	Seed	Precursor crops	Soil	Fertilizer
1	2.5	AK 111; will plant when the rain starts	Grew garlic	pH > 7.5 N: medium to low P: medium to low K: medium to low	1 bag/acre + 1 bag urea (if needed)
2	4	AK 111; will plant when the rain starts	Grew lab beans; one time irrigation to prepare the land because the soil is dry	pH > 7.5 N: medium to low P: medium to low K: medium to low	1 bag/acre + 1 bag urea (if needed)
3	5.5	GT 722; hasn't purchased yet (40,000 MMK+) Will plan 2 acres in the next few days with irrigation	Grew chickpeas	pH > 7.5 N: very low P: medium K: medium	1 bag/acre + 1 bag urea (if needed)
4	2	CP 888; leftover seed; will plant when the rain starts		pH > 7.5 N: low P: medium to low K: medium to low	1 bag/acre + 1 bag urea (if needed)

Weeding

Just one time around 30-45 days after planting and before fertilizing

Sometimes by hand, sometimes with herbicide (1 bottle = 6-7,000 MMK, need 2 bottles/acre)

Labour (4 people/acre, 1 person = 4,000 MMK)

Will most likely use herbicide

Yield

1,300 Viss/acre = 2,080 kg/acre = 5.14 MT/ha

Cultivars used last season

GT 722: farmer didn't like this variety because the lifespan is longer (38,000 MMK)

GT 029 (5 acres): had lower yield than the others (200 Viss/acre lower) (32,000 MMK)

CP 888 (2 acres)

Fertilizer

All fields: Mya Ka Bar (Farmer doesn't know what ratio, 38,000/MMK)

1 bag compound/acre at planting

1 bag urea/acre (46:0:0, 28,000 MMK) at 45 days

Pesticide

Used a pesticide for a worm (unknown)

AWBA Cyclone 50 days after planting (2 months even without pests) (10,000 MMK/1 bottle – 100cc)

5-10 cc/acre if no pest + 1 cup of urea

20-30 cc/acre if there is a pest + 1 cup of urea

Application is based on advice from a friend

Recommendations

Not discussed with the farmer

Day 2: Tuesday, 14 May 2019

Farmer 3: Ko Aung Thu (33 acres of maize)

Location: Hle Toe Village, Pin Pyit Village Tract, Yatsaunk Township
27 acres, 4 plots

Farmer rents the rest of his land out to another farmer (9 acres)

Table 11. Field information of farmer 3.

Plot	Acres	Seed	Precursor crops	Soil	Fertilizer
1	7.5	NK 625 (42,000 MMK); hasn't purchased yet	Pigeon pea planted at the same time; 5 corn rows, 1 row pigeon pea to use for personal consumption (no yield from pigeon pea)	pH > 7.5 N: very low P: medium K: medium to low	15:7:8; 1 bag/acre at planting and second application depends on crop growth. At tasselling, applies urea if plant looks like it needs it
2	5.5	CP 808 (41,000 MMK); wants to try CP 111 (38,000 MMK)	Mango - 450 trees	pH > 7.5 N: very low P: between low and medium K: medium	15:7:8
3	2.5	CP 808; wants to try CP 111			15:7:8
4	2.5	CP 808; wants to try CP 111			15:7:8

Last year's yield

7,200 Viss for 7.5 acres (CP 808) = 1,536 kg/acre = 3.79 MT/ha
15,000 Viss total for other three farms (10.5 acres) = 24,450 kg/10.5 acres = 2,328 kg/acre = 5.75 MT/ha

Land Preparation

Rents a big tractor (25,000 MMK/hour) when it starts raining for harrowing/tillage
Farmer plows 10 days after using hand held tractor

Spacing

Rows: exact spacing unknown, around 32 inches
He tested this, tried 90 inch rows and decided 32 inches is better
Plant spacing: 6 inches

Weeding: by machine when plant is 1.5 feet

After 1st weeding, will use herbicide (Attack, 6,500 MMK)

Seeding

1 bag/acre

Pesticide

Did not use pesticide
At harvest he saw armyworm in 2.5 acre plot (not sure what kind of armyworm)

Sold

320 bags, stored 100 bags and 400 bags with the trader
In Dec, sold at 385 MMK/Viss

Seed

Thai 222
Buys every year

Seven other farmers joined the meeting

Recommendations

Not discussed with the farmer

Farmer 4: Ko Mya Lwin Oo (13 acres of maize)

Location: Inn Mee Village, Hway Village Tract, Yatsaunk Township

Table 12. Field information of farmer 4.

Plot	Acres	Seed	Before or Intercropping	Soil	Fertilizer
1	5.2 (2 miles from home and near town)	Thai 555		pH > 7.5 N: low P: medium to low K: low	CP Armo 15:15:15 (30,000 MMK); 1 bag/acre This year, planning to use CP 20:10:5; 1 bag/acre
2	7.5 (4 miles from home and at the base of a mountain)	CP 808 (38,000 MMK); has already purchased 7 bags of seed			CP Armo 15:15:15 (30,000 MMK); 1 bag/acre This year, planning to use CP 20:10:5; 1 bag/acre

The farmer has 10 years of experience with corn planting

Land Preparation

Harrowed in December after cutting corn
 23,000 MMK/hour for renting big tractor
 Waiting for rain for ploughing
 Will wait 15-20 days after rain to let weeds grow and then plough
 1-2 days after ploughing the farmer will plant (called False Weed bed)
 25-30 days after planting farmer will weed again
 Hand weeding, no use of herbicides

Fertilizer

Last year used CP 15:15:15 (30,000 MMK)
 Planning to use 20:10:5 (30,000 MMK)
 CP agent told the farmer if he wants to buy CP seed, has to also buy CP 20:20:5

For 5.5 acre farm, farmer doesn't know whether to grow corn or do contract farming. Is considering trying to grow Job's Tears. Shan Moe Me is aware of the FAW issue this season and wants to give farmers an alternative crop. The company is selling seed at 5,000 MMK/1 kg bag

Yield

7.5 acre plot (CP 808)
 1205 Viss/acre = 1.9 MT/acre (4.8 MT/ha)

5.5 acre plot
 3230 Viss total
 3230/5.5 = 587 Viss/acre = 956.81 acre = almost 1 MT/acre (2.3 MT/ha)

Recommendations

Not discussed with the farmer

Day 3: Wednesday, 15 May 2019

Farmer 5: Ma San San Yee (30+ acres of maize)

Location: Sin Thay Village, Myin Taung Village Tract in Yatsaunk Township, more than 2 hour drive without a fully paved road. 12 farmers living in the sub village – good opportunity to see if these farmers will work together this season to help each other scout/control for Fall Armyworm. There are 200 households living in the village – all are maize farmers. They intercrop with mango, pigeon pea and avocado. We found FAW in one of the corn fields in the main village. The closest retailer is in Yatsaunk (Aung Da Gone).

Table 13. Field information of farmer 5.

Farmer	Acres	Seed	Precursor crops	Soil	Fertilizer
1	14	NK 625, NK 621, CP 808 and 282		pH > 7.5 N: low P: low K: low	20:10:5; 1 bag compound at planting; 1 bag urea before tasselling
2	10	NK 625, NK 621, CP 808 and 282		pH > 7.5 N: low P: low K: low	
3	30	NK 625, NK 621, CP 808 and 282	Mango		
4	12-13	NK 625, NK 621, CP 808 and 282			

Seed

Haven't bought seeds yet.

Planting

This does not happen on all plots at the same time, farmers help each other and need one month to finish

Yield

14 acres, 10,000 Viss = 16,300 kg = 1.16 MT/acre

10 acres = 7,000 Viss = 11,410 kg = 1.1 MT/acre

In the field that is intercropped with mango (30 acres) = 16,000 Viss or 869 kg/acre

12-13 acres = 11,000 Viss = 17,930 kg = 1.4 MT/acre

No pests last year but at harvest, they heard about armyworm but did not see it in the area.

Challenges last year

Weather impact – 1 week after planting, not enough rain; seed couldn't germinate due to fungi

At tasselling state, if there is drought the maize can't pollinate well and there is no grain filling

If no rain, aphids can attack

Recommendations

1 bag compound fertilizer at planting

2 bags compound fertilizer at tasselling

Fits normal fertilizer practice and not completely required

Day 4: Thursday, 16 May 2019

Farmer 6: Ko Khun Than Lay (5 acres of maize) – 29 years old with four children

Location: Kyauk ka Char Village, Sam Hpu (Me Nei Taung) Village Tract in Ho Pone Township

Joined by 2 Sathapana Loan officers

3-4 farmers grow corn in the village; there are 500 households who live in the village, many are migrant laborers in Thailand, farmers grow cheroot, paddy, avocado, turmeric, coffee

The farmer found out about Golden Paddy through Facebook. Gets knowledge from GP for different crops: coffee, corn, cheroot and uses market prices (Aung Ban market, sells at Hopong). He is able to know the average price but when he contacts the trader, price is lower.

Table 14. Field information of farmer 6.

Plot	Acres	Seed	Before or Intercropping	Soil	Fertilizer
1	2	CP 808 because of neighbour	Nothing, no manure applied	pH > 7.5 N: medium P: inconclusive K: medium	20:10:5; 1 bag/acre at planting; 1 bag/acre urea
2	2	CP 808	Nothing, no manure applied	Ran out of material to carry out soil test?	20:10:5; 1 bag/acre at planting; 1 bag/acre urea

Planting

The farmer will wait for rain until soil is moist enough

No germination testing, no manure, harrowing in April with a big tractor (hired)

Spacing: not precise; 2 feet between rows, 1 foot between plants

Weeding

1 time weeding 45 days after planting by spraying herbicide

Scouting

Once every two weeks

Farmer thinks he saw Fall Armyworm at harvest in November, asked neighbour farmer who told him it was FAW but did not use any control because it was already time for harvest.

Yield

Last year's yield: 5,000 Viss for all four acres = $5,000 \times 1.63 = 8,150$ kg/4 acres = 2.0 MT/acre

Recommendations

1 bag/acre NPK at planting, 1 bag/acre NPK at day 25, 1 bag/acre urea at day 45

Regularly scouting

Day 5: Friday, 16 May 2019

Farmer 7: Ko Naing Win Htun (5 acres of maize)

Location: Yatsaunk Village, Yatsaunk Township,

Close to main road

The farmer has 20 acres at his disposal; he plans to use 10 acres for corn. In fact, the farmer owns 50 acres of land, but he cannot afford to plant on all of the land. So, he rented out 30 acres to the neighbour, but the neighbour refuses to pay rent for land and won't give land back.

Table 15. Field information of farmer 7.

Plot	Acres	Seed	Before or Intercropping	Soil	Fertilizer
1	10	288 (5 bags = 10 kg in a bag) already bought; CP 808 (5 bags)	Manure on 4 acres		Normally applies compound at planting time: 1 bag fertilizer per 1 bag of seed and 1 bag/acre of urea 45 days after planting. 12 bags of fertilizer for 10 acres

Seed: 288 is 38,000 MMK but 32,000 MMK if bought with cash; 42,000 MMK closer to planting time. CP 808 is 38,000. He received the Sathapana loan before he bought inputs. Farmer conducted germination test after reading Golden Paddy GAP booklet

Land Preparation: harrowing in January, used cow manure on 4 acres
 Last year farmers' farm management was based on advice from a friend (from DOA): farmer didn't apply fertilizer at planting time. As a result, he had poor germination and had to destroy the crop at tasselling stage to grow other crops (pumpkin) instead. He had planted CP 808 and 288.
 Farmer says he read the Golden Paddy GAP booklet and wants to follow recommendations for this year. Farmer is thinking about planting Napier grass – wants to know where he can get the seeds.
 CP offers input credit (seed + fertilizer, CP 808 & 20:10:5, 5% interest)

Weeding

The farmer wants to do weeding manually but there is labour shortage and it's expensive
 Plant Spacing: 6-8 inches
 Row Spacing: 2.5 feet

Yield: CP 808, 800 Viss/acre = 1.3 MT/acre
 Grew 288 before and got 1200 Viss/acre before

Recommendations

1 bag/acre (20:10:5) at planting and 2 bags/acre (20:10:5) one month after planting since 20:10:5 is what seems to be easily available.
 If there is no labour or machine available for the weeding, the farmer can cut weeds at the surface which will kill the seeds because they can't photosynthesize

Farmer 8: Ko Kyaw Win Zaw (8 acres of maize)

Location: Ah Lel Chaung Village, Yatsaunk Township

Farmer has five plots of land spread out.

There are 150 farmers in this village. Farmer works as a trader in the village, buys and sells input. We left a poster so they can train other farmers in their village.

Table 16. Field information of farmer 8.

Plot	Acres	Seed	Before or Intercropping	Soil	Fertilizer
1	5	No plan yet			1 bag ARMO (unknown ratio)/acre ARMO, 1 bag urea/acre 45 days after planting

Fertilizer

1 bag ARMO (unknown ratio)/acre ARMO, 1 bag urea/acre 45 days after planting

Weeding

1 month after planting by hand

Didn't go to the field after urea application, only at harvest

Yield

NK 621, 4 acres = 6,000 Viss, had pest infestation over 2 acres, 2 acres suffered from drought, plant growth was poor and had no yield

At harvest, they saw pest had infested the field but don't know what pest and didn't suffer yield loss

Recommendations

Same fertilizer as before: 1 bag/acre at planting, 1 bag urea/acre at 45 days

Regularly scouting for pests and diseases is important

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