A Physical Guide to Better Soil & Crop Management based on their Profiled Levels of N, P, K and pH

A Research Proposal Presented to the

Barangay Real and Barangay Balibago Calatagan, Batangas

In Partial Fulfillment of the Requirements

for the Capstone Project

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CHAPTER 1: INTRODUCTION

The municipality of Calatagan is located in the southwestern most part of Batangas. Majority of its topography are expansive plains, with a few coastal and mountainous areas in between.

Figure 1.1: Existing land uses in Calatagan, Batangas

LAND USE CLASSIFICATION	AREA In Hectares	PERCENTAGE OF TOTAL (%)
Built-up Areas	391.6375	3.72%
Urban	(60.1824)	
Rural	(331.4551)	
Tourism	197.9243	1.88%
Agricultural	6,698.0766	63.62%
Industrial	40.0000	0.38%
Roads	143.3610	1.36%
Planned Unit Development	871.0806	8.27%
Swamps, Fishponds and Bodies of Water	417.2529	3.96%
Open Grasslands	1,768.5561	16.81%
TOTAL	10,527.8890	100%

Source: Assessor's Office/Office of the Municipal Planning and Development Coordinator

The municipality is agricultural in nature, utilizing its different types of soil to grow a myriad of crops. Based from the pre test interviews, majority of people living in Barangay Real work as farmers or jobs relating to agriculture. In Barangay Balibago however, not as much people farm as the area is more known for fishing. As seen in figure 1.1, Calatagan is composed of 10,527 hectares of land. Among this, 6,698

hectares is used for agricultural purposes, making up around 63.62% or almost ⅔ of the land in this community. With this, it can be observed that agriculture serves as the dominant form of livelihood to the people of Calatagan, Batangas.

Figure 1.2: Type of soils present in Calatagan, Batangas

TYPE OF SOIL	LAND AREA IN HECTARES	LOCATION
Calumpang Clay Loam	1,063.3168	Balibago, Biga, Carretunan, Lucsuhin, Real, Sambungan
Taal Sandy Loam	282.1475	Shoreline along South China Sea
Sibul Clay Loam	9,182.4247	All Barangays
TOTAL	10,527.8890	

Source: Bureau of Soils, Batangas Provincial Office

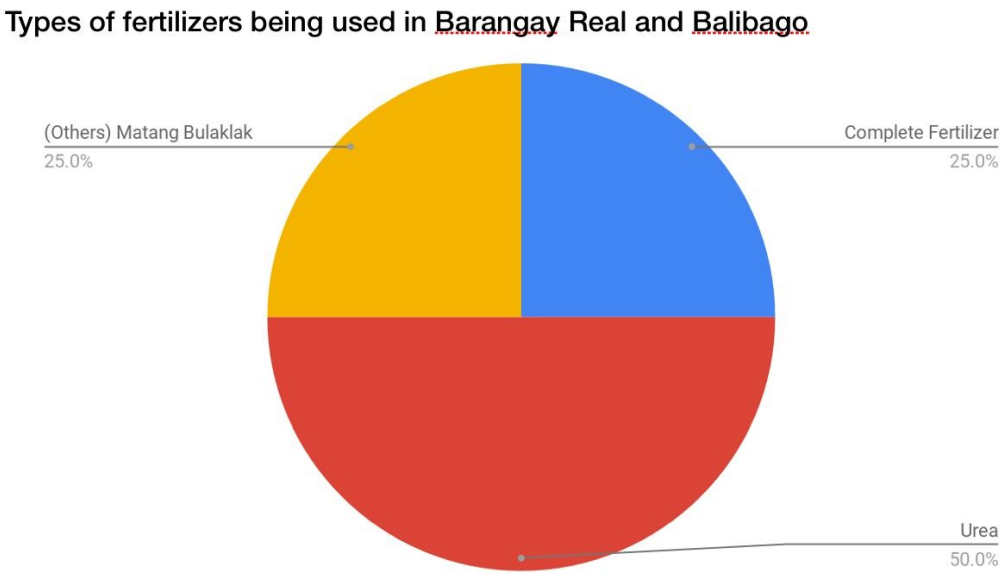
There are 3 main types of soil present around the community of Calatagan, Batangas. As shown by Figure 1.2, Calumpang Clay Loam can be found in Barangay Balibago and Barangay Real, and has a brownish gray color. Taal Sandy Loam can be found in the shoreline along South China Sea, and can be described as having a grayish hue, and is observed to be somewhat dry compared to Calumpang Clay Loam.

Sibul Clay Loam can be found in all communities of Calatagan, Batangas, and can be described as damp and sticky when wet.

Based from online studies, many glaring issues exist that impedes agricultural growth such as the erosion and lack of fertility at land class “De”, poor growth of some plants/crops due to the possibly infertile soil, and lesser expected yield of sugar cane growth on loamy soil . Aside from this, there are also several more that are arising, for instance, possible groundwater depletion, and the unoptimized use of soil in relation to crop yield (Greenpeace, 2007; Socio-economic profile of Calatagan, Batangas, 2016).

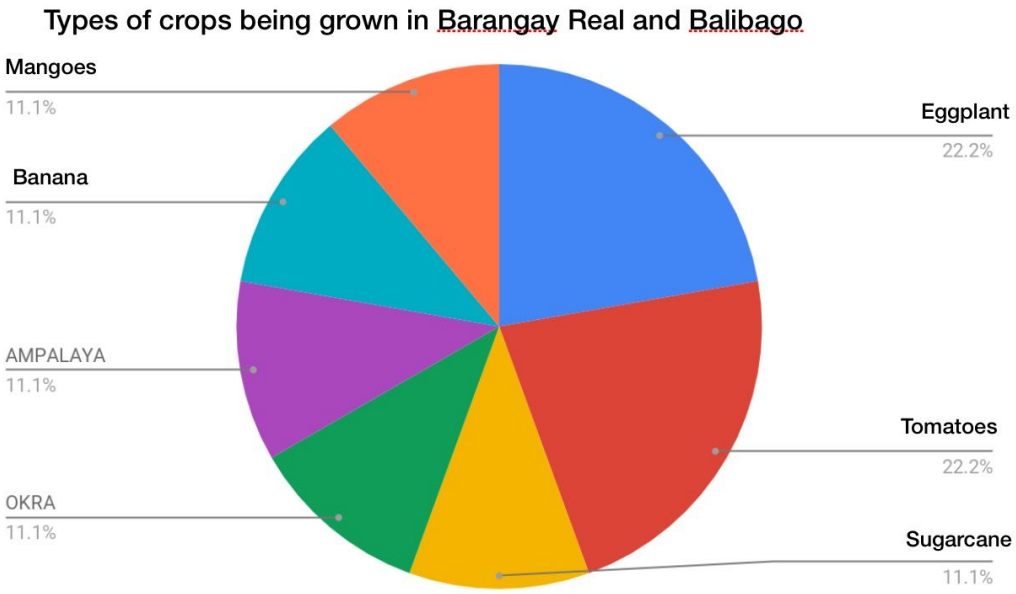
Several interviews were also conducted around the community of Calatagan in order to gain more insight on their current issues regarding soil and crop quality. According to the responses recorded from farmers in Barangay Real and Balibago of Calatagan, the overall soil quality is poor, thus having difficulties in growing crops, especially during extreme weather conditions such as droughts and typhoons. Even with the aid of fertilizers, the soil quality is still not suitable for crop growth as mentioned by a farmer from Brgy Balibago. Based from the interviews, the farmers mainly use 3 types of fertilizers: urea (50%), complete fertilizer (25%) and Matang Bulaklak (25%).

Figure 1.3: Types of fertilizers being used in Barangay Real and Balibago of Calatagan, Batangas



Eventually, even when the soil is considered “dead” or barren, farmers continue to use this soil. According to one farmer, the same type of soil is used for growing different types of plants. They grow a specific type of crop in one type of soil until that crop dies. They then plant a different type of crop, reusing the soil. This is perplexing, however, as the farmers mentioned generally, they do not know exactly what type of soil they use when questioned.

Figure 1.4: Types of crops being grown in Barangay Real and Balibago of Calatagan, Batangas



The crops grown include okra, sugarcane, tomatoes, ampalaya, pepper, sitaw, and leafy greens. When the farmers ask for support from local authorities, they receive supplies such as seedlings or fertilizers. However, farmers who do not ask for help do not receive such, as the local authorities do not help them voluntarily. From the interviews, despite all these issues, farmers still continue to grow crops as it is their main source of livelihood given their location.

With these issues present in this agriculture-based community, it is essential to provide possible solutions in improving both soil and crop quality.

CHAPTER 2: PROPOSAL TO THE PROBLEM

2.1 Background of the Proposal

Given the results of the previous research entitled “The Effects of Ramgo Complete Fertilizer Towards the Chemical Composition of Different Types of Soil”, the researchers plan to utilize these findings as a basis on ensuring proper soil quality for the specific plants being used in the communities of Calatagan, Batangas. As a summary, the results from this research mainly indicated that there were generally significant differences in terms of how sand, loam and clay soil reacts chemically to the fertilizer, as each had varying cation exchange capacities. With this, it was concluded that despite their differences, the most ideal soil may not be determined, as the soil efficiency is dependent as well on the type of plant being used. Knowing this, the researchers were able to propose a simple project targeting soil and crop management on the community.

This community is known to have 3 types of soil, namely, Calumpang Clay Loam, Taal Sandy Loam and Sibul Clay Loam. Each currently being used to grow certain types of plants such as sugarcane, rice, sorghum, coconut, fruit trees and vegetables. However, certain circumstances such as the infertility of the soil and the insufficiency of certain nutrients the soil must provide as preconditions to accommodate with a specific type of crop may have substantially significant negative effects to the yield of such

crops. Thus, it is vital to understand and study the conditions within the community to propose a solution aimed to optimize such complications.

2.2 Proposal to the problem

With that, the proposed activity aims to analyze soil quality in terms of its nutrients (NPK and pH) of the three different types of soil present in the community and how this information can further be used to improve crop yield and plant growth.

Given the information provided, the researchers aim to create and administer coherent guides, such as a booklet or brochure, that provide understandable, summarized and useful data accustomed to the land's environmental conditions that would help farmers choose and manage the soil appropriate for their crops to lead to a more optimized and maximized yield.

Figure 2.1: An example of the proposed product

The researchers hope that this proposed produce may significantly improve the soil and crop management of the area, and will be helpful to farmers struggling with growing their own plantations.

CHAPTER 3: METHODOLOGY

This proposal aims to identify the specific plantation suitable for the soil samples collected in Calatagan, Batangas, and with this, create a coherent and summarized guide that may be accessible to the farmers. The researchers will identify the chemical composition of the three types of soil, specifically its phosphorus, nitrogen, and potassium content. The methodology consists of various elements that are discussed in order to establish a proper way of collecting data. Description regarding the setup, procedure, and methods of data collection in an organized manner is present in the methodology as it acts as the framework for the data.

3.1 Research Design

With the purpose to identify the chemical composition (N,P,K and pH) of the three various soil types in Calatagan, Batangas, this study used the Experimental research for its framework. According to Barnes & Dearing (2015), the purpose of the experimental design is to “test hypotheses and explain how an independent variable influences a dependent variable”. As stated by Ross (2005), the design follows standardized procedures wherein the other variables excluding one is constant, one is experimented on. This ensures valid data results to decrease bias based from Tappen (2011).

3.2 Research Locale and Set up

The soil samples were collected from Barangay Real and Balibago of Calatagan, Batangas. There were 6 samples collected: (1) clay sample, (3) sandy samples, (1) loam sample, and (1) unfertilized (loam) soil sample. The location of the experiment has an average humidity of 75% with the average temperature of 27 ^{0}C (cite).

In terms of collecting the levels of pH, N,P and K from each sample, the experiment was done in De La Salle Zobel - Vermosa Chemistry laboratory.

3.3 Research Instruments/Materials

UPLB Soil Test Kit

This kit is used to assess the chemical composition as well as the pH levels of soil. The soil test kit includes the following:

5 test tubes	Eye dropper
1 test tube rack	Tin strips
Solutions: B, C, C1, D, D1, E, CPR, BTB, BCG, lime requirement, distilled water	Instruction manual

Types of Soil

The experiment was initially to be conducted on the following (3) three types of soil from Calatagan, Batangas.

Calumpang clay loam - A compact type of soil and is brownish gray in color.

Taal sandy loam - A loose type of soil also with a brownish gray color.

Sibul clay - A granular type of soil and is close/sticky when wet.

However, the researchers were not able to specifically label the 6 collected soil samples into these 3 types, so instead, they were generally classified as either: loam, clay or sandy.

3.4 Data Collection Procedure

Soil samples for each type of soil will be collected around the farming areas of the Barangay Balibago and Real. Upon retrieval of the six soil samples, the researchers will also be surveying the condition of the area and the plantations currently being

grown under each type of soil. The six soil samples' chemical composition shall then be measured 3 times to ensure more valid and consistent data. This will be done using a soil testing kit, and shall provide categorical data for the levels of Nitrogen (specifically in the form of ammonium), Phosphorus (in the form of phosphates), Potassium (Potassium ion) and pH.

(Refer to appendix for corresponding color chart)

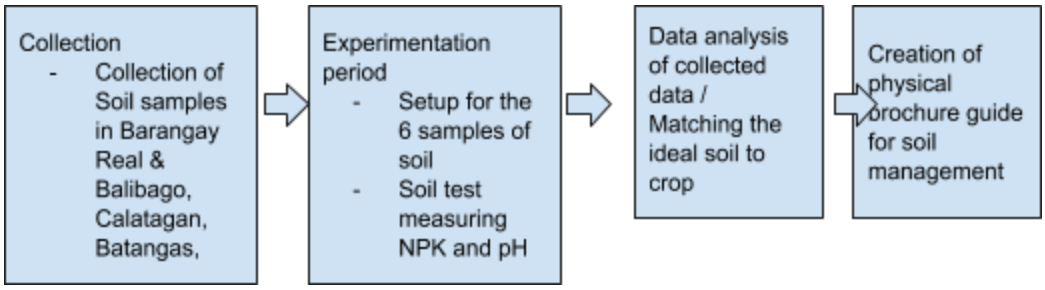
NITROGEN (N)	**PHOSPHORUS (P)**
1. Fill the test tube with soil sample up to scratch mark 2. Add 16 drops of solution B 3. Mix well by swirling the tube 30 times 4. Rest for 5 minutes, and then repeat step 3 5. Let sample stand for 30 minutes	1. Fill the test tube with soil sample up to scratch mark 2. Add 16 drops of solution C and 2 drops of solution C1 3. Mix well by swirling the tube for 1 minute 4. Rest for 3 minutes, and then repeat step 3 5. Let sample stand for 5 minutes 6. W/o disturbing the soil, stir the solution slowly with the tin strip for 2 minutes
POTASSIUM (K)	**SOIL pH**

1. Fill the test tube with soil sample up to scratch mark 2. Add 16 drops of solution D and 4 drops of solution D1 3. Mix well by swirling the tube for 1 minute 4. Rest for 3 minutes, and then repeat step 3 5. Let sample stand for 5 minutes 6. Insert a dropper with 0.6 ml of solution E (2 cm above the solution) and slowly add the solution one drop at a time. DO NOT SHAKE 7. Let stand for 2 minutes a. Distinct cloudy yellowish layer on top of the orange layer indicates sufficient K. b. No distinct cloudy layer on top of the orange layer indicates deficient K.	1. Fill the test tube with soil sample up to scratch mark 2. Add 7 drops of CPR 3. Mix well by swirling the tube 20 times 4. Rest for 2 minutes, and then repeat step 3 5. Let sample stand for 5 minutes a. If soil is greater than 6, repeat steps 1-5 using BTB instead of CPR b. If soil is less than 5, repeat steps 1-5 using BCG instead of CPR

Source: University of the Philippines Los Banos (UPLB) - Soil Testing Kit Booklet

The results will then be analyzed and categorized to identify the suitable plant for each type of soil. A guide provided by UP Los Banos shows the N,P,K and pH recommendations for various crops, and will serve as the main reference, together with guidance from an expert, in aligning the soils to their ideal crop in terms of their chemical composition. With this information, a physical guide will be made summarizing such results to serve as a farming reference to the farmers of the community.

Figure 3.1: Summary of proposal procedure



CHAPTER 4: RESULTS AND DISCUSSION

The following data consists of the profiled levels of NPK and pH of the various collected soil. The collected results were further analyzed by Ms. Joana Vergara, a soil scientist, who provided key information on the nature of each soil type, and interpretations and recommendations on how to further improve each type for the betterment of it's crop.

Table 4.1: Classification of collected soil samples

Location	Soil type	Current plantations present
Balibago	Sandy	None, regular beach plants
Balibago	Sandy	Corn
Real	Sandy	Sugarcane
Real	Loamy	Tomato
Balibago	Clay	Rice
Real	Plain/unfertilized (possibly loamy)	None

As shown in table 4.1, 3 samples of sandy soil, 2 of loam, and 1 of clay were collected from either Barangay Real or Balibago of Calatagan, Batangas. Each of the collected

soil type contained a specific plantation/crop, except for the beach sand (contained only the naturally occuring beach plants) and unfertilized loamy ground soil (contained no plants).

Table 4.2 : NPK and pH content of Unfertilized Loamy Soil

Loamy (No plants)	pH	N	P	K
Unfertilized Soil	6.4	Low	High	Sufficient
Unfertilized Soil	6.4	Low	High	Sufficient
Unfertilized Soil	6.8	Low	High	Sufficient
Average	**6.53**	**Low**	**High**	**Sufficient**

Table 4.2 shows that the unfertilized loamy soil has low amounts of nitrogen, high amounts of phosphorus and a sufficient amount of potassium. The pH of the soil is slightly acidic with a level of 6.53 on average.

Table 4.3: NPK and pH content of Sandy Soil (Beach plants)

Soil Sample Sand	pH (4.0- 7.6)	N (Low, Medium, High)	P (Low, Medium, High)	K (Sufficient, Deficient)

(Beach plants)				
S1.1	7.6	Low	Low	Sufficient
S1.2	7.6	Low	Low	Sufficient
S1.3	7.6	Low	Low	Sufficient
Average	**7.6**	**Low**	**Low**	**Sufficient**

Table 4.3 shows that the fertilized sandy soil for beach plants has low amounts of nitrogen, low amounts of phosphorus and a sufficient amount of potassium. The pH of the soil is slightly basic with a level of 7.6 on average.

Table 4.4: NPK and pH content of Sandy Soil (Corn)

Soil Sample Sand (Corn)	pH (4.0- 7.6)	N (Low, Medium, High)	P (Low, Medium, High)	K (Sufficient, Deficient)
S2.1	6.6	Low	Medium	Deficient
S2.2	6.6	Low	Low	Deficient
S2.3	6.6	Low	Medium	Deficient
Average	**6.6**	**Low**	**Medium**	**Deficient**

Table 4.4 shows that the fertilized sandy soil for corn has low amounts of nitrogen, medium amounts of phosphorus and a deficient amount of potassium. The pH of the soil is slightly acidic with a level of 6.6 on average.

Table 4.5: NPK and pH content of Sandy Soil (Sugarcane)

Soil Sample Sand (Sugarcane)	pH (4.0- 7.6)	N (Low, Medium, High)	P (Low, Medium, High)	K (Sufficient, Deficient)
S3.1	6.6	Medium	Low	Sufficient
S3.2	6.6	Medium	Medium	Sufficient
S3.3	6.6	Medium	Medium	Sufficient
Average	**6.6**	**Medium**	**Medium**	**Sufficient**

Table 4.5 shows that the fertilized sandy soil for sugarcane has medium amounts of nitrogen, medium amounts of phosphorus and a sufficient amount of potassium. The pH of the soil is slightly acidic with a level of 6.6 on average.

Table 4.6: NPK and pH content of Loamy Soil (Tomato)

Soil Sample Loamy (Tomato)	pH (4.0- 7.6)	N (Low, Medium, High)	P (Low, Medium, High)	K (Sufficient, Deficient)
L1.1	7.2	Medium	High	Sufficient

L1.2	7.2	High	High	Sufficient
L1.3	7.2	Medium	High	Sufficient
Average	**7.2**	**Medium**	**High**	**Sufficient**

Table 4.6 shows that the fertilized loamy soil for tomato has medium amounts of nitrogen, high amounts of phosphorus and a sufficient amount of potassium. The pH of the soil is slightly basic with a level of 7.2 on average.

Table 4.7: NPK and pH content of Clay Soil (Rice)

Soil Sample Clay (Rice)	pH (4.0- 7.6)	N (Low, Medium, High)	P (Low, Medium, High)	K (Sufficient, Deficient)
C1.1	7.8	Low	High	Sufficient
C1.2	7.8	Low	High	Sufficient
C1.3	7.8	Medium	High	Sufficient
Average	**7.8**	**Low**	**High**	**Sufficient**

Table 4.7 shows that the fertilized clay soil for rice has low amounts of nitrogen, high amounts of phosphorus and a sufficient amount of potassium. The pH of the soil is slightly basic with a level of 7.8 on average.

Data Analysis

As mentioned by Vergara, NPK represents each the three primary nutrients of each soil type, namely, Nitrogen, Phosphorus and Potassium, all of which are essential in crop growth. It is recommended that each type of soil has generally high levels of each nutrient, as all serve important roles in a plant's development. Nitrogen is responsible for the overall growth of a plant, as well as its color. Phosphorus is responsible for developing the root system of the plant. Potassium is responsible for the reproductive stages of the plant, as well as boosting the plant's resistance to disease (Uchida, 2000). Based from the data, there is a visible pattern showing how sandy soils tend to have less nutrients as compared to the clay or loam. This is understandable given how sand is known to have a poor nutrient and water retention capacity (CEC), while clay is known to boast a higher capacity (McCauley, 2005).

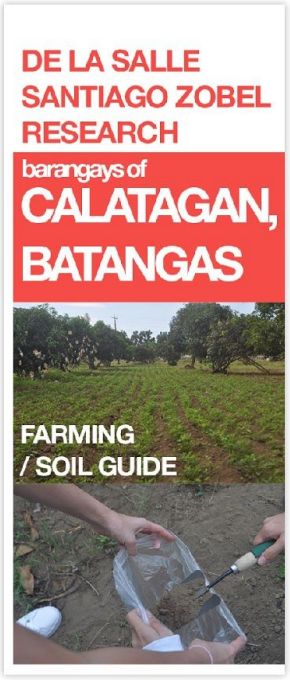
As it is tedious and impractical to make major changes in the soil to accommodate each plant (ex. replacing sand with clay), Vergara stated that it is better to focus on the addition of both organic and inorganic fertilizers to compensate for the lacking nutrients in the soil. The amount and frequency of fertilizer, however, will depend on the soil type. Sandy soil generally do not hold nutrients too well and considers the salinity level of the soil especially in nearby water areas. While it is still capable of growing plants such as corn and sugarcane, sandy soil will have to be fertilized at small and frequent amounts of urea fertilizer for steady plant growth, as well as to avoid nutrient leaching. Loamy soil is a balanced type of soil, and is capable of

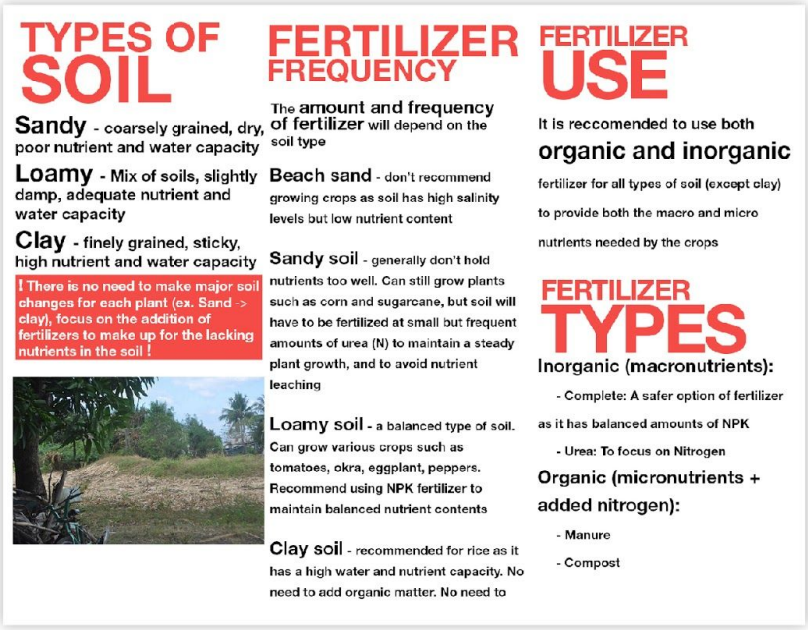
growing multiple types of crops such as tomatoes, okras, eggplants, and peppers. Such as of tomatoes, where in the soil is low in N and is recommended to add organic matter to improve the structure of the crop. It is also recommended that NPK fertilizers are used for loamy soil to maintain its balanced content and help with the water holding capacity. Clay soil is recommended for rice crops as it has high water holding and nutrient capacity. There is no crucial need for the addition of fertilizer, as clay can naturally hold nutrients with ease (Barton, 2013).

It is recommended that both organic and inorganic fertilizers are used in tandem with each other in order to provide the macro and micronutrients needed by crops. Specifically, inorganic fertilizer, such as urea or complete fertilizer, provides most of the macronutrients such as nitrogen, phosphorus, and potassium. Urea fertilizer is divided and applied throughout the process of crop growth and focuses more on nitrogen levels. As for other individual fertilizers, Phosphorus is applied first to establish the root system while for Potassium the fertilizer Potash is divided into two and is used for the flowering, reproductive stage of the crops and resistance to pest and disease. Meanwhile, complete fertilizer focuses more on the overall balance of the NPK levels. Organic fertilizer provides micronutrients, and additional levels of nitrogen. This usually comes in the form of manure or compost.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

Using the results obtained from the soil test experimentations, the researchers, together with the guidance and expertise of their consulted soil scientist, were able to determine how to possibly improve the current quality of the soil and crops of the community. As part of the proposal, key findings such as soil-to-crop alignments, fertilizer types and recommendations, and overall suggestions were summarized into a prototype brochure:





The researchers aim to distribute this brochure (English and Filipino version) to the community members, especially farmers, in order to provide new knowledge and understanding on how to efficiently grow their crops. With this as a simple guide,

farmers of the area may hopefully find a way to redesign their farming methods to maximize the quality of the soil to its crop.

Recommendations

Aside from creating a brochure, the researchers aim to integrate additional long term proposals to help better the soil and crop quality at a larger scale:

1. In-depth seminars on soil management
    a. As mentioned, the farmers in the community have little to no knowledge regarding the soil they use for planting; rather, they utilize whatever land they have at present with no regards to optimization. One solution for this is to conduct seminars on proper soil management targeted towards not only the farmers, but the community as a whole.
2. Suggest/Formulate a crop rotation schedule
    a. The farmers in the community stated that they continuously use the same soil for farming, even when the soil used is no longer fit for planting. One solution for this is the practice of crop rotation, wherein different crops are planted in the same soil every season/harvest. The idea behind this is that different plants have different needs, thus requiring different nutrients from the soil. As opposed to only planting one type of plant and eventually having the soil becoming infertile at a much faster rate, a crop rotation

schedule can help mitigate or lessen the effects of poor soil quality by maximizing the nutrients found in the soil.

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Appendices

Appendix A: Raw data of soil test

S1 - Beach
S2 - Regular Sand (Corn)
S3 - Sugarcane

L1 - Tomatoes

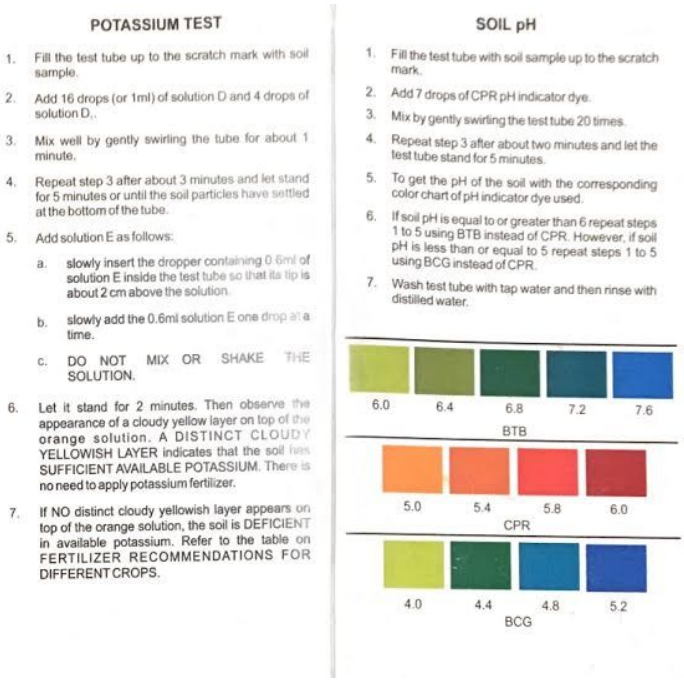
C1 - Rice

Soil Sample	pH (4.0- 7.6)	N (Low, Medium, High)	P (Low, Medium, High)	K (Sufficient, Deficient)
S1.1	7.6	Low	Low	Sufficient
S1.2	7.6	Low	Low	Sufficient
S1.3	7.6	Low	Low	Sufficient
S2.1	6.6	Low	Med	Deficient
S2.2	6.6	Low	Low	Deficient
S2.3	6.6	Low	Med	Deficient
S3.1	6.6	Med	Low	Sufficient
S3.2	6.6	Med	Med	Sufficient
S3.3	6.6	Med	Med	Sufficient
L1.1	7.2	Med	High	Sufficient
L1.2	7.2	High	High	Sufficient
L1.3	7.2	Med	High	Sufficient
C1.1	7.8	Low	High	Sufficient
C1.2	7.8	Low	High	Sufficient

C1.3	7.8	Medium	High	Sufficient

Unfertilized	6.4	Low	High	Sufficient
Unfertilized	6.4	Low	High	Sufficient
Unfertilized	6.8	Low	High	Sufficient

Appendix B: Color chart of soil testing kit



POTASSIUM TEST

1. Fill the test tube up to the scratch mark with soil sample.
2. Add 16 drops (or 1ml) of solution D and 4 drops of solution D..
3. Mix well by gently swirling the tube for about 1 minute.
4. Repeat step 3 after about 3 minutes and let stand for 5 minutes or until the soil particles have settled at the bottom of the tube.
5. Add solution E as follows:
   a. slowly insert the dropper containing 0.6ml of solution E inside the test tube so that its tip is about 2 cm above the solution.
   b. slowly add the 0.6ml solution E one drop at a time.
   c. DO NOT MIX OR SHAKE THE SOLUTION.
6. Let it stand for 2 minutes. Then observe the appearance of a cloudy yellow layer on top of the orange solution. A DISTINCT CLOUDY YELLOWISH LAYER indicates that the soil has SUFFICIENT AVAILABLE POTASSIUM. There is no need to apply potassium fertilizer.
7. If NO distinct cloudy yellowish layer appears on top of the orange solution, the soil is DEFICIENT in available potassium. Refer to the table on FERTILIZER RECOMMENDATIONS FOR DIFFERENT CROPS.

SOIL pH

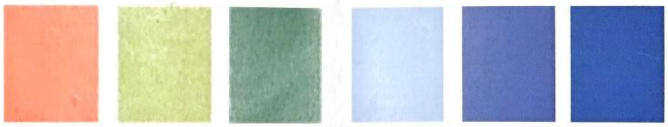
1. Fill the test tube with soil sample up to the scratch mark.
2. Add 7 drops of CPR pH indicator dye.
3. Mix by gently swirling the test tube 20 times.
4. Repeat step 3 after about two minutes and let the test tube stand for 5 minutes.
5. To get the pH of the soil with the corresponding color chart of pH indicator dye used.
6. If soil pH is equal to or greater than 6 repeat steps 1 to 5 using BTB instead of CPR. However, if soil pH is less than or equal to 5 repeat steps 1 to 5 using BCG instead of CPR.
7. Wash test tube with tap water and then rinse with distilled water.

NITROGEN TEST

1. Fill the test tube with soil sample up to the scratch mark.
2. Add 16 drops (or 1ml) of solution B.
3. Mix well by gently swirling the tube 30 times.
4. Repeat step 3 after about 5 minutes and let the test tube stand for 30 minutes.
5. Match the color of the resulting solution on top of the soil with the color chart below and take note if the soil is low, medium, or high in available nitrogen.
6. Refer to the table of FERTILIZER RECOMMENDATION FOR DIFFERENT CROPS.
7. Wash the test tube with tap water and then rinse with distilled water.

PHOSPHORUS TEST

1. Fill the test tube with soil sample up to the scratch mark.
2. Add 16 drops (or 1ml) of solution C and 2 drops of solution C_1.
3. Mix well by gently swirling the tube for about 1 minute.
4. Repeat step 3 after about 3 minutes and let the test tube stand for 5 minutes.
5. Without disturbing the soil, stir the solution slowly with the tin strip for one minute. Repeat this step after about two minutes.
   (Note: The tin strip attached to the plastic can still be used for another set of four samples provided that analyses are done on the same day. Rinse the tin strip with distilled water after each analysis.)
6. Match the blue color below and take note if the soil is low, medium, or high in available phosphorus.
7. Refer to the table on FERTILIZATION RECOMMENDATIONS FOR DIFFERENT CROPS.
8. Wash test blue with tap water and then rinse with distilled water.



LOW MEDIUM HIGH LOW MEDIUM HIGH

Appendix C: Fertilizer requirement chart

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Table 3. Fertilizer recommendations for field crops based on Soil Test Kit

Crop	Nitrogen			Phosphorus (P_2O_5)			Potassium (K_2O)
	Low	Medium	High	Low	Medium	High	Deficient
	Kilograms per hectare						
Cassava	60-100	30-60	0-30	60-100	30-60	0-30	40-100
Corn	60-90	30-60	0-30	25-30	20-25	0-20	20-30
Cotton	50-90	30-50	0-30	20-25	10-20	0-10	10-25
Mungo	40-50	30-40	0-30	30-50	20-30	0-20	20-50
Peanut	25-30	20-25	0-20	30-40	20-30	0-20	20-40
Rice							
Wet season	60-90	30-60	0-30	50-60	30-45	0-20	30-45
Dry season	75-120	45-75	0-45	50-60	30-45	0-20	30-60
Surgnum	50-60	30-50	0-30	30-40	20-30	0-20	20-30
Soybean	25-30	20-25	0-20	30-40	20-30	0-20	20-40
Sugarcane	100-170	50-100	0-40	75-120	40-70	0-30	75-240
Tobacco							
Burley	26-30	20-25	0-20	40-60	20-40	0-20	30-60
Turkish	10-15	5-10	0-5	25-30	20-25	0-20	20-45
Virginia	15-20	10-15	0-10	25-30	20-25	0-20	30-60
Cigar Filter	25-35	20-25	0-20	50-70	20-50	0-20	30-70
Cigar Wrapper	25-35	20-25	0-20	50-70	20-50	0-20	30-70

Table 4. Equivalent amount of fertilizer material in grams per plant (hill) per season based on the Soil Test Kit.

Crop	Ammonium Sulfate (21% N)			Superphosphate (18% P_2O_5)			Muriate of Potash (60% K_2O)
	Nitrogen			Phosphorus			Potassium
	Low	Medium	High	Low	Medium	High	Deficient
Ampalaya	14.3-28	7.1-14.3	0-7.1	19.4-47	8.3-19	0.-8.3	2.5-7.5
Beans, Lima	1.4-1.9	1.0-1.4	0-1.0	2.5-5.0	1.1-2.5	0-1.1	0.3-0.7
Navy	1.9-2.9	1.0-1.9	0-1.0	3.9-7.8	1.7-3.9	0-1.7	0.3-1.0
Snap, bush	3.8-4.8	1.9-3.8	0-1.9	6.7-13	3.36.7	0-3.3	0.7-1.7
pole	7.6-9.5	3.8-7.6	0-3.8	13.3-26	2.7-13.3	0-2.7	1.3-3.3
Wing	7.6-9.5	2.4-7.6	0-1.1	6.1-11.7	2.8-6.1	0-2.8	1.2-3.5
Broccoli	7.6-20.0	2.4-7.6	0-1.1	6.1-11.7	2.8-6.1	0-2.8	1.2-3.5
Cabbage	12.8-34	44-12.8	0-4.3	10.0-20	5.0-10.0	0-5.0	2.0-6.0
Carrot	0.4-0.6	0.2-0.4	0-0.2	0.5-1.1	0.2-0.5	0-0.2	0.07-0.2
Cauliflower	9.0-23	2.8-9.0	0-2.8	7.2-14	3.3-7.2	0-3.3	1.3-4.2
Chinese cabbage	12.9-34	4.3-12.8	0-4.3	10.0-20.0	5.0-10.0	0-5.0	2.0-6.0
Cowpea	1.0-1.2	0.2-0.4	0-0.5	1.7-3.3	1.1-1.7	0-1.1	0.2-0.4
Cucumber	7.6-12	2.8-9.0	0-3.8	8.9-21.1	3.9-8.9	0-3.9	1.2-3.4
Eggplant	14.3-29	7.1-14.3	0-7.1	16.7-36.1	5.6-16.7	0-5.1	2.5-8.0
Gabi	10.7-16	5.2-10.7	0-5.2	12.5-19	6.1-12.5	0-6.1	1.8-5.7
Garlic	0.7-1.6	0.3-0.7	0-0.3	0.5-0.6	0.2-0.5	0-0.2	0.1-0.2

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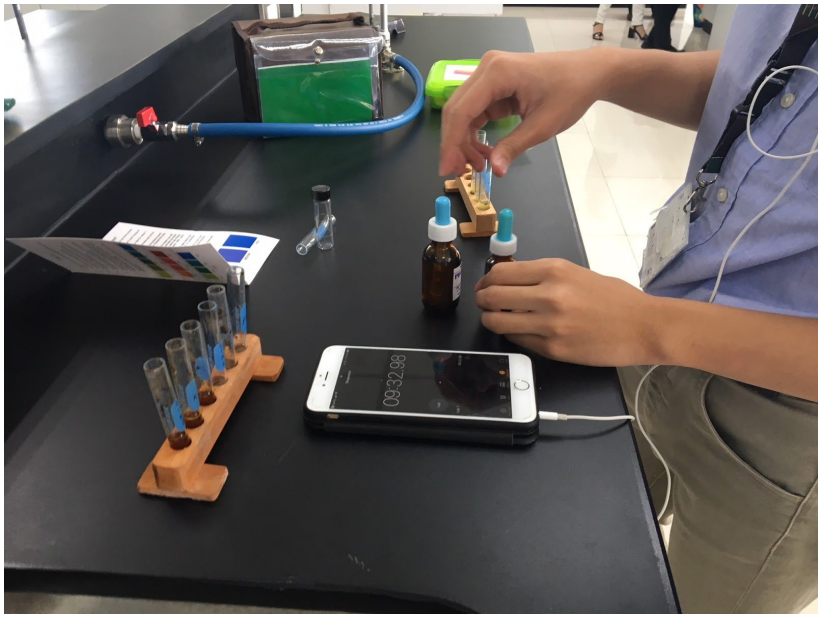
Appendix D: Documentations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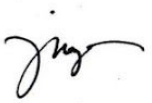
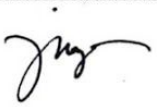
AM NO.	NAME 1:	CN:	NAME 4:	CN:	**De La Salle Santiago Zobel School** Ayala Alabang Village, Muntinlupa City SENIOR HIGH SCHOOL DEPARTMENT
	NAME 2:	CN:	NAME 5:	CN:	
	NAME 3:	CN:	NAME 6:	CN:	**GRADE 12 Practical Research 3** **3rd Term** **AY 2017-2018**
ON:	SUBJECT TEACHER: **MR. FRITZ M. FERRAN**	**F1: RESEARCH CONSULTATION FORM**			

earch Title:

	Date	Place	Remarks	Teacher/Expert's Name	Signature
	2/ 15/ 18	ASL, ASI-CAFS, UPLB, College, Laguna	Consultation on Basic Soil Science, Soil Productivity, Fertility and Analysis	**Joana Rose M. Vergara** University Researcher ASI-CAFS, UPLB	
				Joana Rose M. Vergara University Researcher ASI-CAFS, UPLB	

Grading Rubric

Criteria	Exemplary 5	Proficient 4	Acceptable 3	Developing 2	Beginning 1	Score	
Written Project Proposal 10 %	All the necessary pieces of information are clearly organized for easy used in solving the problem.	All the necessary pieces of information are organized for easy used in solving the problem.	Most of the necessary pieces of information are organized for easy used in solving the problem.	Some of the necessary pieces of information are organized for easy used in solving the problem.	There is no apparent organization of necessary information.	6 4.8 3.6 2.4 1.2	
Collecting and Analyzing Information 15 %	Students collect multiple information from multiple sources and analyzes the information in – depth.	Students collect adequate information and perform meaningful analyses.	Students collect adequate information and perform basic analyses.	Students collect inadequate information and perform basic analyses.	Students collect no viable information.	9 7.2 5.4 3.6 1.8	
Relatedness to the Scientific Research Paper 25 %	The application of their scientific research paper (methodologies, results, findings, and recommendations) is highly appropriate and evident.	The application of their scientific research paper (methodologies, results, findings, and recommendations) is generally appropriate and evident.	The application of their scientific research paper (methodologies, results, findings, and recommendations) is appropriate and evident.	The application of their scientific research paper (methodologies, results, findings, and recommendations) is not appropriate and evident.	The application of their scientific research paper (methodologies, results, findings, and recommendations) is not evident.	15 12 9 6 3	
Creativity 15 % **Average scores of the judges*	The project output is highly appealing.	The project output is generally appealing.	The project output is appealing.	The project output is generally dull and hurriedly done.	output is dull and hurriedly done.	9 7.2 5.4 3.6 1.8	
Proposed Solution to the problem 25 % **Average scores of the judges*	Students develop a clear and concise plan/proposal to solve the problem, and work it out in the final output. The recommendation is based on research.	Students develop an adequate plan/proposal to solve the problem, and work it out in the final output. The recommendation is based on research.	Students develop a marginal plan/proposal to solve the problem, and work it out in the final output. The recommendation is based on research.	Students develop a marginal plan/proposal to solve the problem, and did not work it out in the final output. The recommendation is based on research.	Students did not develop a coherent plan/proposal to solve the problem. The recommendation is based on research.	15 12 9 6 3	
Oral Presentation 10 % **Average scores from the judges*	The presentation is highly convincing. All presenters are very confident in the delivery. Preparation is highly evident.	The presentation is generally convincing. Most presenters are very confident in the delivery. Preparation is generally evident.	The presentation is convincing. Some presenters are very confident in the delivery. Preparation is evident.	The presentation is mediocre. Presenters are not consistent with the level of confidence/preparedness.	The presentation is poor. Presenters are not confident, and demonstrate little evidence of planning prior to the presentation.	6 4.8 3.6 2.4 1.2	