Assessment of land productivity through soil analysis at San Jose Matulid: An initiative toward the development of the University of the Assumption Community School-based Farm

Khalid F. Sunggod
Sanne Ray Soro
Arnel T. Sicat
Ma. Theresa F. Angeles
Bernard P. Valencia

ABSTRACT

Precision and sustainable agriculture necessitate the need for baseline data for crop growth development. The study assessed the land productivity of the University of the Assumption (UA) community farmland at Brgy. San Jose Matulid, Mexico Pampanga to pilot community school-based farming. Through soil analysis, it determined the specific plants and crops to be planted and their suitability toward sustainable school-based farming. Ten soil samples were collected from the lot of the untilled UA farm. The technical support of the Department of Agriculture (DA) results of soil laboratory testing revealed strong viability for plant and crop production based on its dense texture, good standing pH values, and a high content of potassium and phosphorus. Nine basic crops were recommended, and nitrogen fertilization is needed to enhance the composition of the soil. Observance of crop diversification and administration of organic and inorganic fertilizer input based on the result of soil tests were highly recommended.

Key words: precision agriculture, soil testing, nitrogen, phosphorus, and potassium

INTRODUCTION

In the early 90s, it was forecasted that by the year 2050, the global requirement for food would expect to rise by 2.5 to 3.0 times in the present situation (Crosson, 1993). Despite unprecedented changes in the agricultural landscape over the past 20 years, the world population has doubled to more than 6 billion people. It was resolved by a two to three-fold increase in food production through the agricultural sector's science and technology, such as the green revolution and introduction of high-yielding varieties. Though food availability is no longer a concern in industrialized countries, persistent poverty and food insecurity still linger among half of the world's population. The United Nations estimated that some 840 million people on earth are still hungry, and close to three billion people live below the poverty line (Agriculture & Agriculture, 2017). The present understanding of agriculture management stems from the use of land, water, plant history, weather conditions, and other resources. Its leading global thrust is not just to accommodate the future macro requirements at sufficient economic and environmental outlay and to preserve the natural resources but also to prolong and maintain the resources even at the micro-level. The National Academy of Sciences of the United States of America (NAS-USA) forecasted a 100-110% increase in global crop demand from 2005 to 2050 (Tilman, Balzer, Hill, & Befort, 2011). For almost three decades, investing in capability training and innovation on agricultural management and environmental issue to broaden the ideas have sustained the prospective food requirements of the global community (Crosson, 1993; Nieuwenhuis, 2002; Rossi, 2017).

According to the United Nations Framework Convention on Climate Change (UNFCCC), global warming is already seen and felt. The intensified occurrence of storms and cyclones, harsh heat waves, more prolonged droughts, excessive rain, and sudden climatic shifts have been observed. Despite there are countries that signed the "Paris Agreement" to mitigate their carbon contribution, the world is estimated to be 3 to 4 degrees warmer, given the current trajectory. The Paris Agreement's lower limit for warming of 1.5 degrees is set to be breached (Intergovernmental Panel on Climate Change, 2018).

Due to climate change, the weather conditions in the Philippines has transformed tremendously. Before the Philippines has two weather types, the dry and wet season, but due to climate change, it has changed its weather conditions adding two streams, namely, extremely dry and extreme wet season. Moreover, storms have become stronger, which can destroy even sturdy structures. Therefore, crops are not safe from the harsh weather. All of these are attributed to what is commonly known as "Global Warming" (Casper, 2010). Due to the extremities of the weather, it causes the non-productivity of crops, and the value goes down. It causes a lower rate in the farming sector, which hurts most farmers (White, Hoogenboom, Kimball, & Wall, 2011). Mitigation (Chesney, Lasserre, & Troja, 2016) and adaptation (Smit & Wandel, 2006) to climate change are now the advocacies of many countries around the world.

The Philippines is experiencing two climate phenomena, El Niño and La Niña. The country experienced a deep fall in agricultural production during the season of El Nino; however, on El Nina, and an increase in rice and corn production was recorded only due to favorable rain conditions. When typhoons and storms hit the country, millions of pesos are lost due to crop destruction. Accordingly, the highest damage seen was 1.17% and 4.21% on agriculture (Virola, Estrella, Glenita, & Edward, 2008)

The Philippines experiences severe changes in climate that seems to have one common denominator: repeated teeming rains, which creates landslides and flash floods. As a result, it can kill people, destroy properties, and damage the environment. With these risks, the Philippines was positioned in the fourth rank on the Global Risk Index in 2006 by Germanwatch Global Climate Risk Index (GGCRI). It identifies the countries which mostly affected by extreme weather events based on its four indicators: number of deaths, 100,000 deaths per inhabitants, losses in millions USD purchasing power parities, and losses per unit in GDP percentage (Virola et al., 2008).

With these extremities, farmers cannot tolerate the changes in climate anymore. Because of this, farming practices should be aligned with a warmer world, an example of which is hybridization (Chunco, 2014). Filipino farmers are urged to become more “techie” and scientific, stated by Dr. Vicky Espaldon from the School of Environmental Science and Management of University of Philippines Los Banos (UPLB, 2018). According to Antes, Espaldon, and Sarai (2018), farmers can pro-actively respond well to these problems of climate change through “Precision Agriculture,” a computational crop modeling that gives information requirements for the cultivation of crops. It is an attempt to make science and technology work hand in hand for agriculture (Antes et al., 2018). Precision farming starts with an accurate analysis of fertility using grid or zone soil sampling, which tests for macronutrients, micronutrients, ph level, salinity, etc. Through these samplings and testing, it brings a possibility of lesser cost in fertilizer but increases the yield more due to correct crop management, it also promotes mutual protection for humans and to the environment because of the correct application of products, it promotes healthier farming, and helps preserves the environment (Field, n.d.).

Concomitantly, the Department of Agriculture (DA) launched the nationwide “Coded Guide Map” for farmers and fisherfolks. It equips Filipino folks on subnational information on soil characteristics, water availability, climate type, etc. (Arcalas, 2017). It promotes the correct fertilization practices to preserve the environment and protect the health of farmers. The DA advocates the importance and promotion of soil analysis as preliminaries to effective farm building and crop management.

As a higher education institution, the University of the Assumption (UA) made an initiative to develop its one-hectare untilled land toward green agriculture and a sustainable community school-based farm. It needed baseline data that would facilitate and develop a sustainable farming mechanism. By addressing this knowledge gap in partnership with the

DA, new ideas on crop management and preliminaries on technology and eco-tourism for a community-school farm building may emerge.

The study primarily assessed the soil quality of the untilled land of the UA and its viability to different kinds of high-value crops for school-community-based farming. Specifically, it sought to 1) identify the soil quality of the untilled land, and its missing properties to enrich the quality of the soil, 2) recommend suitable plant species that can adapt to the assessed soil; and, 3) offer proper fertilization of the soil and integrate farming techniques for better crop yield. The proposed method in achieving the objectives is through the use of a scientific method called soil analysis. The researchers identified the properties of the soil and determined the viability of farm inputs and crops to ensure a sustainable harvest in the future.

Hopefully, it would create an impact on the community by building substantial social capital through farming. It seeks to mitigate possible plant to soil incompatibility, which might result in plant mortality.

On the micro-level, it hopes to inspire university stakeholders, particularly the students, on opportunities regarding green farming and making part of the inclusive growth of Philippine agriculture. Moreover, it may also contribute to climate mitigation on the macro level.

METHOD

Soil Analysis

This test procedure provides vital information about the physical conditions, fertility (nutrition status), and chemical properties that affect soil's sustainability of growing plants (Walworth, 2008). There are four steps in soil testing, namely: 1) soil sample collection, 2) laboratory analysis, 3) interpretation of results, and 4) fertilizer or other management and recommendations.

The subject of the Study

The subject of study is the property of the Univeristy at San Jose Matulid, Mexico, Pampanga. It is an untilled land with a high potential for agricultural yield that can support the school's adopted community in terms of crop harvest. Currently, the land has been planted with crops for consumption occurrence of settlers, but it is not comprehensively utilized for community crop production. To date, this 10,478 square meter lot of UA is observed to have permanent structures of permitted stewards that thrived the vicinity for four decades.

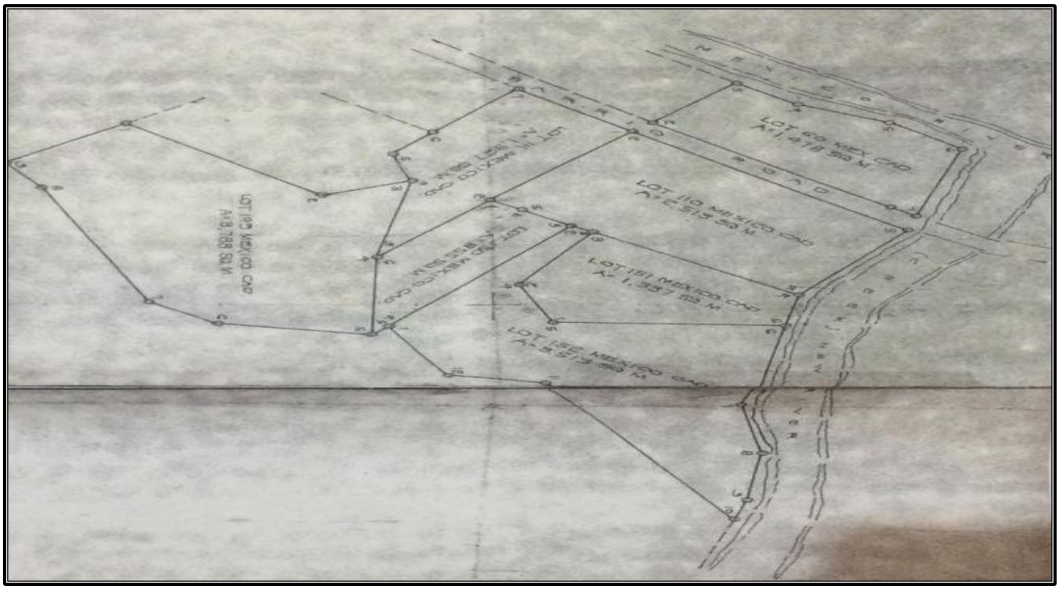

Figure 1: ***Actual map of farm land of the University of the Assumption at San Jose Matulid***

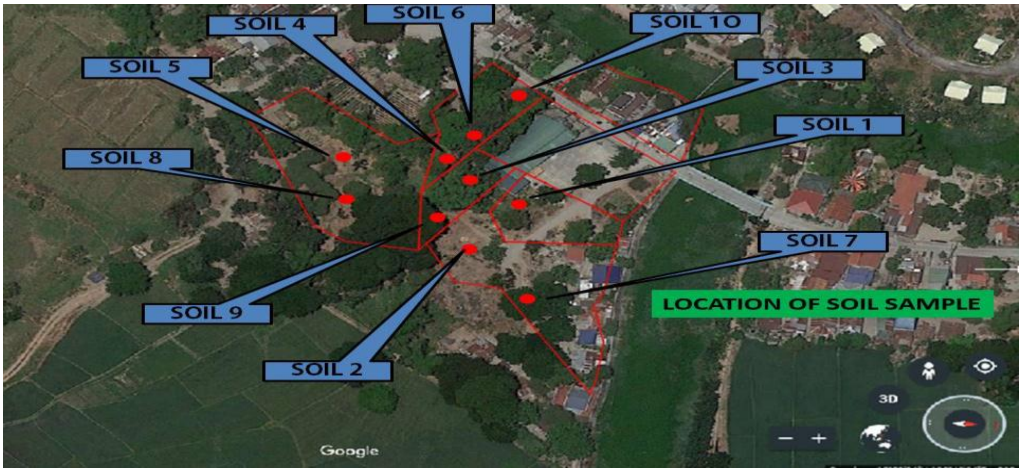

Figure 2: ***Location of Soil Sample***

Gathering of soil samples or soil sampling is the critical stage to determine the nutrient of the existing soil condition (Pohlman, 2016). Soil sampling uses chemical analysis, and results are projected for a large quantity of soil, the accuracy of soil testing depends mainly on proper soil sampling. Based on the size of the farmland, ten soil samples were strategically taken in proportion with the area of the lot.

The initial step in soil sampling is the creation of a farm map (See Figure 1), which shows the sampling areas. Soil analysts divide the farm into sampling areas (See Figure 2). Each sampling area should be more or less uniform in cropping history, fertilizer treatment, slope, degree of erosion, soil texture, sampling areas should not be more than five hectares.

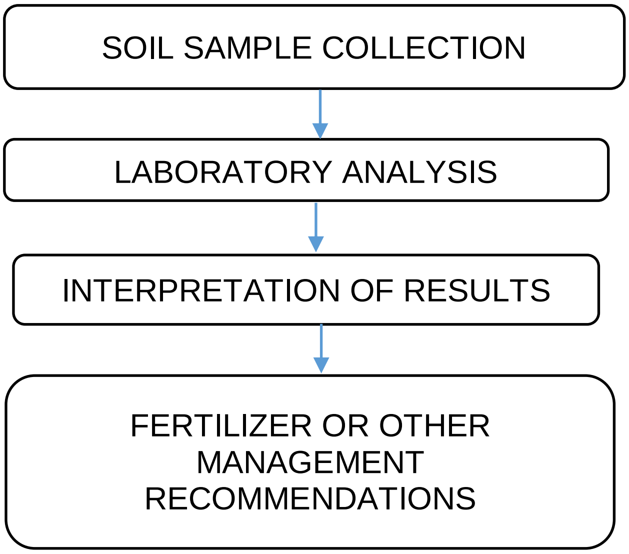

Figure 3. ***Soil Analysis Flowchart***

Figure 3 shows a flow chart from soil sampling collection to fertilizer recommendation. After the identification of sampling areas, the researchers dug five to ten pits and collected spot soil samples. The number of soil spots depended on the size of the sample area. Soil spots followed the following procedures: 1) the soil samples should be clear of surface litters and vegetation; 2) after clearing using a spade or shovel dig 20 to 30 centimeters and from one vertical side of the pit, a slice of 2 to 3 centimeter-thick with a single downward thrust of the spade was done; and, 3) the proponents used a knife or trowel to slice the soil on both sides to 3 to 4 centimeter-width, to form a soil bar which represents one soil spot; 4) after gathering the soil sample, it was placed in a suitable clean container like clean plastic bag; 5) after collecting all ten soil samples from particular specified sampling area, the samples were pulverized and were mixed thoroughly and stones, leaves and any possible litters found in the container were removed; 6) a composite soil sample about ½ or 1 kilo was taken which will represent the entirety of the farm land; 7) after putting the composite dried soil sample, analysis followed by sending the it to soil testing laboratory with pertinent label of the requester and information area of the land; 8) it should be noted if the gathered soil is partially humid or wet, the researchers placed the samples in a table under room temperature with free air circulation. As much as possible, placing the soil samples at high temperatures and no direct sun drying was avoided. Exposure to high heat and direct sunlight might remove substantial nutrients organisms, and it can affect the accuracy of the soil test result.

After gathering the soil samples, the excess moisture in the soil evaporated through room drying before sending it to the laboratory for testing. If the samples sent to the laboratory in a high amount of moisture, the test cannot be conducted since some of the methods apply an H_20 ratio of one is to one for pH and putty-like substance on the feel method (See Table 1 in result and findings for illustration).

Subsequently, one week for room drying, and the samples were ready to be sent to the Bureau of Soil and Water Management (BSWM), a sub-agency of the DA. The researchers waited for two weeks before gathering the result.

Permits, proper endorsements, and a formal request to conduct soil analysis were submitted by the researchers in collaboration and partnership with the DA, BSWM, and UA School Plant Office. UA and DA's thrust to involve educational institutions on farm-development was realized through this project.

Soil Testing/Analysis

Information on soil physical status, nutrient capacity, and chemical substance can identify the appropriateness of plants to grow in a specific area (Walworth, 2008). After gathering and submitting samples to the laboratory, the following procedures were used to analyze the soil test data:

1. The soil samples underwent soil texture analysis or feel method, which is a process of determining the soil texture by feel. A small portion of water was added to the soil to obtain a putty-like consistency. Feel method is a standard procedure of measuring soil moisture in the field (Thien, 1979; Vos, Don, Prietz, Heidkamp, & Freibauer, 2016).

2. The pH testing was done through one-is-to-one soil to water ratio (1:1 Soil: H_2O) This is a method that synthetically salinized the soil to estimate the saturated paste electrical conductivity and ion concentration of soil (Perry, 2003; Sonmez, Buyuktas, Okturen & Citak, 2008).

3. Walkley Black Method assessed the bulk of organic matter present in the soil. The method measures the amount of carbon in plants and animal debris in the soil, including soil humus but not charcoal or coal (Department of Sustainable Natural Resources);

4. Olsen's Method predicted the bio viability of ortho-phosphate (PO4-P) in soil by extraction using alkaline sodium bicarbonate (pH 8.5) solution and found out the P concentration in extract colorimetrically. It is relevant to soils that are gently acidic to alkaline pH and to correlate crop response to fertilizer on calcareous soils

(Hamarashid, Othman & Hussain, 2010) This method was developed by Olsen (1954) and Lilia Molina (2004).

5. Hot H_2SO_4 (Sulfuric Acid) Method is a process of deriving potassium from soils by the use of sulfuric acid. The method was established to furnish a stable index to "plant – available" K soils. This method hypothetically provided a means of constant releasing of non-exchangeable K due to the breakdown of primary and secondary minerals as well as exchangeable K from a particular soil (Hunter & Pratt, 1957; Guo, 2009).

6. Lastly, the inquiry concluded with the nutrient proposal of crops based on the three main factors needed by a plant to develop fully. These macronutrients are classified as Nitrogen (N), Phosphorus (P), and Potassium (K), commonly known as NPK (Tilley Nikki, 2011). Nitrogen is responsible for leaf growth, while phosphorus is vital for root and fruit maturity. At the same time, potassium is a nutrient that supports the overall operation of a plant to perform correctly; without any one of these nutrients, a plant will fail (Care, Help, Nikki, & Bulb-o-, 2018).

The above procedures were conducted and analyzed by trained technicians and expert personnel of the BSWM and the DA. However, some procedures were not fully disclosed by the technician as part of the guidelines of the laboratory testing center. Also, a natural fertilization and application procedure of inputs are well presented.

FINDINGS

After three weeks of laboratory observation and soil testing, the following results were obtained:

Table 1
Result of soil test from collected soil samples

Lab No.	Texture	pH	OM %	P, ppm	K,ppm
	(Feel Method)	(1:1:Soil: H20)	(Walkley Black Method)	(Olsen's Method)	(Hot H2SO4 Method)
1H Mex-Pamp	Heavy	6.63	1.63	43.89	340

The soil samples indicate a "heavy" result in texture method, and it primarily means that the soil typing is "clay." If the soil cannot be formed into a ball shape or ribbon form, it is sandy or silt (Thien & Steven, 1979). The finding resulted that the soil formed into a ball that identified it as a lump of clay.

For the pH which is measured based on the ratio of one is to one (Soil: H_2O, the result shows a good standing of 6.63 where a pH of 7 is neutral, and the optimum pH range for plants in clay soil is 5-7 (Perry, 2003).

P, Ppm for phosphorus and K, Ppm for potassium show a high amount of element content while on Walkley black test for organic substances show a lesser amount of nitrogen in the soil.

Table 2
Actual results of selected crops based on soil sample at UA farmland

Crop/s	Nutrient Recommendation, kg/ha		
	Nitrogen (N)	Phosphorus (P)	Potassium (K)
Garlic	90	0	0
Onion	90	0	30
Cacao (seedling)	0.055	0	0
Ampalaya	60	0	0
Okra	90	0	0
Pechay	150	0	0
Tomato	90	0	0
Egg Plant	90	0	0
Chili	90	0	30

Note: for further information and fertilizer requirements per crop, please refer to Table 3.

Based on the chart under nutrient recommendation, the farmland of the University is viable for plant production due to its high content of phosphorus and potassium, indicating zero (O). It means that the soil does not need further inorganic fertilization, such as phosphorus and potassium, since it already has high content.

One of the benefits of conducting soil analysis is to preserve the richness of the soil through intelligent and proper fertilization inputs. Based on the data, the undisturbed or untilled land manifests richness in soil nutrients. If the University follows the nutrient & fertilization procedures and protocols given in the result of the laboratory test, then the farm would be able to preserve its soil nutrients and becomes very viable for farming. It would most probably yield good production in the future.

Nine crops were selected and identified with their corresponding fertilizer requirement. However, out of nine recommended plants, two of them identified as onion and chili, which still need a little amount of potassium support. After the seminar conducted by the DA, the University preferred “Cacao” as one of the potential crops to be planted because of its promising economic return.

Table 3

Fertilizer requirement of selected crops

Crops	Application	Fertilizer Requirement (bags/ha)	Time & Method
Garlic	1st	8 bags and 29 kg/ha Ammonium Sulfate (21-0-0) and 10 bags/ha of Organic Fertilizer	Broadcast the recommended fertilizer immediately before the leveling operation of the field to effect thorough incorporation into the soil
Onion	1st	4 bags and 14 kg Ammonium Sulfate (21-0-0); 10 bags/ha of Organic Fertilizer and 1 bag/ha Muriate of Potash (0-0-60)	Broadcast the recommended fertilizer immediately before the leveling operation of the field to effect thorough incorporation into the soil
	2nd	4 bags and 14 kg/ha Ammonium Sulfate (21-0-0)	Side dress recommended fertilizer at the banking time
Cacao (seedling)	1st	122 g/tree Urea (45-0-0) and 4 kg/ha Tree Organic Fertilizer	Mix Topsoil with the recommended fertilizer and transplant to a hole 30-50 cm deep made 3-4 cm larger than the ball of earth around the roots of the seedlings
Ampalaya	1st	1 bag and 17 kg/ha Urea (45-0-0) and 10 bags/ha of Organic Fertilizer	Mix with soil at planting time
	2nd	1 bag and 17 kg/ha Urea (45-0-0)	Side dress when sets of fruits begin to form
Okra	1st	2 bags kg/ha Urea (45-0-0) and 10 bags/ha of Organic Fertilizer	Apply 2-3 inches to the side and 2 inches below the seed at sowing
	2nd	2 bags kg/ha Urea (45-0-0)	Side dress when fruits begin to form
Pechay	1st	4 bags and 38 kg/ha Urea (45-0-0) and 10 bags/ha of Organic Fertilizer	Apply the recommended fertilizer 8-14 days before transplanting.
	2nd	9 bags and 26 kg/ha Urea (45-0-0)	Top Dressing 2-5 weeks after planting
Tomato	1st	2 bags/ha Urea (45-0-0) and 10 bags/ha of Organic Fertilizer	Apply 3 inches away from the base of the plant and 3 inches deep from the root system immediately before or at planting
	2nd	2 bags/ha Urea (45-0-0)	Side dress when the plant starts to bloom or when there are small fruits developing
Egg Plant	1st	2 bags/ha Urea (45-0-0) and 10 bags/ha of Organic Fertilizer	Apply the furrows at transplanting time

Table 3 continued…

	2nd	1 bag/ha Urea (45-0-0)	Side dress (a month after transplanting)
	3rd	1 bag/ha Urea (45-0-0)	A second side dressing is made immediately after the second picking of marketable fruits
Chili	1st	2 bags and 33 kg/ha Urea (45-0-0); 1 bag/ha Muriate Potash (0-0-60) and 10bags/Ha Organic Fertilizer	Mix with the soil at planting time
	2nd	1 bag and 17 kg/ha Urea (45-0-0)	Side dress when the set of fruits begin to form

Based on the nutrient recommendation (see table 2), the fertilization requirement is mainly needed by the plants is urea or (45-0-0). Urea is a consumable and volatile element component of plants. Nitrogen primarily comes from the decomposition of manure. When decay happens, it slowly releases nitrogen and consumed by plants. Since the researchers were able to identify that the land was untilled, no inorganic or organic inputs were added to the soil before. That is why the study mainly demands nitrogen fertilization.

DISCUSSION

The fertilization map of the country will soon be disclosed to the Filipino farmers. The University is one step ahead in prioritizing the science behind precision agriculture. Through soil testing, farm owners would be able to answer the question, “what are the lacking nutrients in the soil and what farm inputs should be provided?”

The Philippine fertilization map was conducted 40 years ago, which concludes that the fertilization protocols are outdated. With the newly released National Color-Coded Agriculture Guide Map (NACCAG), farm owners will be able to understand more about the soil health of farmlands (Arcalas, 2017).

Soil is an essential factor that determines productivity (Pohlman, 2016). It is the foundation to attain the desired yield. Farm owners should consider soil testing to determine the suitability of plants, organisms and to properly treat the soil with the right amount of farm inputs.

Primarily, the benefit of conducting soil analysis in a school-owned farm is to narrow the knowledge gap on fertilizer application and mishandling of soil that might result in the loss of its rich nutrients. While the motivator to conduct soil analysis is its potential to increase the yield of plants and its correlation in an increase of profit (“The Benefits of Soil Testing,” 2014). The rationale is when too little fertilizer is applied to the crops, and then it produces a lower volume of harvest. While when there is an excessive application, it will also result in a waste of time, money, and worst is its environmental damages due to nutrient runoff.

Soil analysis is essential, especially for people who wish to venture into farming. In the context of a university, it guides management and stakeholders with the insightful information to develop a sustainable community school-based farm that is fertile ground to education (Beery, Adatia, Segantin, & Skaer, 2014). In a community school-based farm, one has to start doing the right thing to program farm initiatives that would produce a substantial harvest for the community. Based on a comparison between sampling events, the maximization of soil fertility index is needed (Mäder et al., 2002) There should be consistency in the different areas such as location, season, soil type, and sampling depth to maintain proper soil test interpretation. It should be noted that any inconsistencies in any of these areas of soil sampling collection will lessen the interpretation value of soil tests. Along with consistency, soil samples should reflect past soil and fertilizer/amendment management of a given field. Following these guidelines will allow soil tests to be used more effectively for nutrient management of crops.

With the right scientific information, the untilled land of UA can become productive. With UA's collaboration with the DA and other partners, suitable plants may be selected and purchased. Moreover, linkages with other farms may provide a benchmark on farming techniques that can be introduced to bring better yield in the future.

Soil analysis plays a vital role in crop and nutrient management of plants (Reid, 2006). At the start of the endeavor, the researchers gathered ten (10) random samples on possible areas suitable in raising crops (see fig. 1 and fig 2 for visual representation). Some areas for soil sampling near the houses of permitted settlers were omitted since it was susceptible to an outlier effect in the soil analysis due to the debris of trashes that can leak or produce chemical sediments. During the gathering of samples, litters such as dried leaves and other forms of vegetation were removed on the top of the desired soil spot. On the one hand, these forms of vegetation may be used for organic farming (vermin-culture), which can enrich the soil content and benefit biodiversity (Hole et al., 2005).

The findings in ten soil sample / 100 grams per sample showcase good and healthy soil, rich in a substantial amount of Phosphorus and Potassium (See Table 2 on nutrient recommendation). However, the result also shows that the untilled farmland of the University still lacks in nitrogen, as shown in the nine recommended crops, notably, eight high-value crops (vegetables) and one fruit-bearing tree. Results show a range of 60 to 150 kilograms of nitrogen per hectare on high-value crops and with 0.055 grams nitrogen requirement per seedling for fruit-bearing identified as cacao. Going on a 60 to 150 kilograms per hectare-nitrogen range were identified, where ampalaya, which has the least nitrogen requirement of 60 kilograms per hectare and "*pechay*" with the most needed amount of nitrogen of 150 kilograms per hectare. Thus urea is need since it a natural product of nitrogen and protein metabolism and predominantly found in the urine and animal waste (Korrapati & Mehendale, 2014). By way of conservation agriculture (CA), that is maintaining retention of crop residues and ensuring crop diversification would reduce soil degradation and likewise improve agricultural sustainability (Powlson, Stirling, Thierfelder, White, & Jat, 2016).

Also, bitter gourd (ampalaya) was identified with the least number of inorganic fertilizer bags to be consumed a total of one bag and 17 kilograms per hectare of Urea (45-0-0) while pechay consumes four bags and 38 kilograms per hectare of urea though they differ in inorganic fertilizer consumption. However, both crops consume a similar amount of organic fertilizer, amounting to 10 kilos (chicken manure, cow, or carabao dung). The reason behind the high requirement of *"pechay"* is that it is a leafy vegetable and requires the right amount of nitrogen since nitrogen is an element responsible for leaf development of plants (Korrapati & Mehendale, 2014).

It can be gleaned in Table 3-on fertilizer requirement, the University is now guided on the proper application of organic and inorganic fertilizer. Aside from the proper application, the number of bags of fertilizer to be put in the soil was determined, which precisely equates that there will be no wastage on fertilizer purchase, labor for application and thus mitigate the environmental risk of over-fertilization of the soil. Based on the data, proper application and procedure are dictated in the result for optimal results and yield for plants. The benefit of analyzing a particular soil is that there will be a cut on the cost of fertilizers that will be used since there are precision and accuracy on the number of fertilizer inputs. Moreover, there will be no over bombarding or acquisition of unnecessary soil fertilizers. It would be very beneficial not just to the health of the soil but also to the health of the farmer who applies the fertilizer. Moreover, this would contribute to increased sustainability and climate change adaptation, though not necessarily leading to consistently increased crop yields (Powlson et al., 2016).

Limitation of the Study

Notwithstanding the result of soil analysis, the following were observed during the research which may affect and limit the study: 1) Some portion of the UA farmland was used as dumpsite area of the construction debris during the construction of a concrete bridge in the area; 2) Some embedded construction materials such as tie-wire, CHB, etc. were found during the gathering of soil sample; 3) Collection of some soil sample was taken during the minimal rainfall as may affect the soil properties and results of soil analysis; 4) Some structures such as vermicompost and warehouse were already constructed/ erected before the conduct of research; 5) Soil sample gathered (topsoil) is intended only for vegetable crops; and 6) Given Pampanga is a flood-prone province (Shrestha, Okazumi, Miyamoto, & Sawano, 2014), the university-owned farm at Jose Matulid, Mexico, Pampanga is not exempted from flooding, and therefore primary caution is considered during the rainy season.

Conclusion

The study was able to acquire vital information in addressing the missing components of UA farmland at San Jose Matulid in Mexico, Pampanga, through the process of soil analysis. The result also produced substantial information vital to the proper fertilization of the soil to become viable for farming. Crops were determined, and fertilization requirements to be in sync with the types of soil in the area. The following are the importance of soil analysis: reduction of plant mortality rate due to "hit and miss" type of planting; acquisition of proper information on fertilizer application, saving of time and cost of farm inputs; and lessening the destruction of soil stability and its nutrients.

In summary, the study found out that the untilled land of the university is very rich in potassium and phosphorus. However, it lacks nitrogen, which is needed for land enhancement. The study concludes that planting crops would be a more manageable undertaking since substantial information was generated for taking care of selected crops that are desired. Through this pilot study, it is hoped that a well-planned extension program may be instituted to develop the community school-based farm vi-a-vis mobilization of residents toward community productivity.

Recommendations

This pilot study on community school-based farm development proved to be a worthy endeavor. The following initiatives are recommended:

a. Observance of fertilizer requirements and the required nutrients per crop. It must be noted that the application does not guarantee a 100 percent increase in yield but a better return.

b. Integrated farming methods like crop diversification. It is a process of planting different plant varieties on a different plant family to (e.g., farmers' simultaneously combine ampalaya and tomato). It will not only lessen the occurrence of pest; moreover, it will also preserve capital inputs in every plant.

c. Continuous cultivation of the soil through slow-release fertilization or organic fertilizers to lessen the cost of inorganic inputs. Composting or vermicompost is ideal in organic fertilization.

d. Partnership and collaboration of UA management with other organizations related to agricultural farming (e.g., Gratia Plena Social Action Center Diocese of San Jose Nueva Ecija, Department of Agriculture Regional Field Office III and others).

e. Utilization and administration of organic fertilizers such as animal waste (e.g., cow, carabao, chicken dung) but with proper sun drying to eliminate unnecessary organisms properly.

f. Archiving and recording of history/data on crops (e.g., type of plants, months planted, type of pest, etc.). To date, no information in the area particularly the presence of pest and planting timing, it might affect the yield or harvest.

g. Engagement in Cacao production. If the university wishes to pursue in cacao production, the study suggests that the cacao trees will be set as perimeter fences, since cacao only blooms once or twice a year. Therefore, it is economically wise to plant “cash crops” like vegetables while waiting for the cacao to be harvested.

h. Periodic soil analysis. Conducting soil analysis should be done every two years to maintain and observe the soil’s health and its quality of soil.

i. Application of organic technology like “fish amino acid.” Fish amino acid (FAA) is a biofertilizer made from fish gills, head, bones, and fermented in molasses for one month. Its NPK ratio is (4-1-1) and acts as a quick nitrogen boost for plants and beneficial also for the microorganisms found in the soil.

j. Hiring an agriculturist or assigning a person knowledgeable in agriculture. The agriculturist will act as a farm supervisor, where he/she sets the direction of the farm and teaches his/her laborers about the proper cultivation of plants--- assigning laborers to till the land. Owning a farm is a viable business enterprise that needs workforce and labor. The university should hire or assigned two farm laborers who could work on the farm. Settlers in the land are the prerogative candidates.

k. Attendance to seminars and training. The DA periodically conducts agricultural workshops. By participating in these seminars, farm owners will be able to learn up-to-date technologies in agriculture. Opportunities and certifications can be attained, like turning farms to agricultural learning centers, farm tourism, or certified farms that may educate the populace on good agricultural and sound organic farming practices.

l. Community mobilization grounded on ‘Laudato Si.’ As a Catholic learning institution, a community extension program for the residents of San Jose that focuses on care for the environment may be considered. Through the seminars and training on ecology and agriculture, residents may be mobilized to engage in farming activities and innovative environmental projects in the community school-based farm. Later they may also develop their cooperatives for sustainable living.

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