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Abaca Waste Compost as Organic Fertilizer to Upland Kang Kongs

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ABSTRACT

Fertilizers are nutrients containing valuable minerals to make plants grow and develop. There are a number of minerals that plants need. The most important of them are the NPK (nitrogen, phosphorous, and potassium) since plant needs them in relatively big amounts. The NPK are needed in various different functions of plants: in the maintenance of life, growth, reproduction, and manufacture of plant food in the form of starch, fats, and protein.

Key words: *Anaemia; Chronic kidney disease; Recombinant human erythropoietin; Thalassemia*

Introduction

Bautista et al. cited that a good fertilizer program strives to maintain or increase the current supply of nutrients to optimum levels and in correct proportions for economical production. Many small-scale growers are turning more and more to farm refuse and manure to supply the nutrient needs of the plants. Chinese farmers are among the heaviest users of organic material as fertilizer. They use as much as 200 tons per hectare in terms mainly of compost and night soil [1]. For hundreds of years, farmers particularly in countries like China, Korea and Japan have been able to produce sufficiently from their farms to support the needs of their population. Apparently one of the keys to the agricultural sustainability in these countries and perhaps in others is the regular and extensive recycling of a wide array of organic wastes and residues. Abaca (Musa textilis Nee.), is indigenous in the country and its fiber is known worldwide as Manila hemp. The fiber obtained from the leaf sheaths of the abaca plant is similar to banana in appearance. At present, there are only two countries commercially producing abaca fiber, the Philippines and Ecuador. The abaca varieties in Ecuador originally came from the Philippines particularly in Mindanao.

During the last five years, the Philippines produced an annual average of about 68,000 metric tons of abaca fiber. Of the total 76 percent were produced locally into pulp, cordage, and fiber crafts, mostly for exports. The remaining 24 percent were exported in raw form. Abaca grows almost anywhere in the Philippines from Sorsogon, Leyte, Southern Leyte, Catanduanes, Davao Oriental, Northern Samar, Lanao del Sur, Sulo and Surigao del Sur. Abaca fibers coming from Leyte and Southern Leyte are known to be the most durable. The abaca industry plays a vital role for the Philippine economy since it earns $76 million annually and employs 1.5 million people. As recorded in the Municipal Agriculturist Office (MAO) of Municipality of Burauen, 23, 040.86 hectares of land are devoted for agriculture. Almost 3,000 hectares of it or 7.68 percent of the total agricultural land are allotted to abaca production. Over 2, 657.93 hectares of abaca (Inusa) are intercropped in coconut trees. This hectarage of abaca land produces 1000 kilograms of abaca fiber and a thousand of kilograms of waste annually. In fact, 26 of the 72 barangays of the municipality are involved in the abaca production. Since 1996, 44, 099 hectares of land in Eastern Visayas have been planted with abaca. Over the last ten years, the region has been leading producer of quality abaca fiber, with annual average production of 27, 640 metric tons, or about 40% of the country's fiber supply. But Leyte's abaca industry is threatened by the bunchy-top and abaca mosaic viruses. Close to 10, 000 hectares of abaca farm areas in Leyte Island are infected by the disease. According to Daniel Layon, team leader of FIDA Burauen project, there were six severely affected villages of the town of Burauen that have been given treatment and is expected to finish giving treatment to other affected barangays before the end of 2010.

Fiber Industry Development Authority (FIDA) Region VIII reported that abaca fiber output in the region had posted an 11% growth from January to October 2010 as farms in Leyte Island have started to recover from the devastating abaca disease. As of October 2010, the region recorded a 10, 700 metric tons (MT) output, up than the 9, 639 MT for the same period in 2009. Despite the disease threat and inconsistent abaca buying price, the official of FIDA Regional Office VIII believed that farmers will still plant abaca because it had already established a sustainable market abroad.

In fact, the stripping waste of abaca has also many uses. It may be used as a growing medium for mushroom culture, raw material for handmade papers, compost and alcohol production, while the residue from the alcohol extraction may be processed into waxes and used in making organic fertilizers. However, because of the high bulk density of wastes generated by the abaca farmers in Burauen, the researcher attempted to conduct the study. The primary reason is to reduce the waste accumulated from abaca farming via conducting extensions and information dissemination about the potential of abaca waste applied as organic fertilizer through composting. One more reason to consider is the very high cost of commercial in-organic fertilizers and its harmful effects on enhancing soil acidity that leads to soil degradation when applied continuously which may results in reduced crop yields. So far, no study has been conducted yet on the use of abaca waste compost as organic fertilizer for upland kangkong. Hence, the utilization and application of abaca waste compost becomes an option.

Fertilizer is the kingpin for increasing productivity in agriculture. For every tone of fertilizer nutrient put into the soil there is an increase of 8 to 10 tons of food grains, other things remaining equal, it has been estimated that about 70 percent of the growth in agricultural production can be attributed to increase fertilizer use. The middle of the nineteenth to the twentieth century was a time during which progress was made in the understanding of plant nutrition and crop fertilization. Among the men of this period whose contribution loom huge was Jean Baptiste Boussingault, carried out experiments. Boussingault employed the careful techniques of de Saussure in weighing and analyzing the manures he added to his plots and the crops he harvested. He maintained a balance shut which shiveredhow much of the various plant-nutrient elements came from rain, soil, and air, analyzed the composition of his crops during various stages of growth, and determined that the best rotation to that added in the manure [2]. One of the common practices used by farmers to maintain soil fertility and to attain high crop yield is the application of fertilizers, either organic or in organic fertilizer materials. Continued application of organic manures is well known to increase soil organic matter. Data from long-term manorial experiments in India. Nambiar, et al. stated only three out of eight centers was there a decrease in soil organic matter with fertilizer application; at the other five centers there was an increase in soil organic matter due to fertilizer application.

Nevertheless, the increase in soil organic matter was most when FYM (farmyard manure) was applied along with chemical fertilizer [3]. Gupta confirmed that one of the constituents in soil fertility is nitrogen. Nitrogen is the most important nutrient needed by all. It derives mainly from decaying organic matter, and also from air via root nodules or legumes. It is the responsible for shoot and leaf growth and development [4]. Theoretically, the mineralization of organic nitrogencompounds taken place in essentially three step by step reactions: ammonization, ammonification and nitrification. The first two are affected through the medium of heterotrophic microorganisms and the third is brought about largelyby autotrophic soil bacteria [5]. The efficiency of fertilizer nitrogen in tropical and subtropical environments is very low. In a field experiment at the International Rice Research Institute, 29 to 40 % of applied urea N was taken up by rice grain and straw [6]. Fertilizer nitrogen efficiency, in most crops, is generally greater at lower fertilization levels than at higher levels and decreases considerably when N rates increases beyond the optimum [7]. However, due to high doses of nitrogen or other fertilizers, the so called micronutrients or trace elements becomes less available to crops. Plants need only very little amounts of these micronutrients, like, zinc, iron, copper, manganese, boron, and molybdenum. Although there are usually enough of these mineral in the soil, they are not available for the plants since they are limited into new chemical compounds. Lack of these nutrients can have negative effects on plant health. It can, for example, predispose plants to viral diseases. Plants raised with insufficient supply of micronutrient can affect the consumer of the crops as well [8]. There is an urgent need to develop farming techniques, which are sustainable from environmental, production, and socioeconomic points of view. The shift away from organic recycling practices served to reemphasize the value of, and need for, organic amendments for short and long term improvement of cultivated soils and maintenance of soil productivity as explained by. Composting is one way in which some of the problems associated with the utilization of various organic wastes can be resolved. Digested agricultural waste/manure should be applied at rates to supply adequate nutrients for crop needs. Villareal however, theorized, that the difference between crop requirements and the soil capability for supplying it indicates the amount of fertilizer to be supplied to the soil. Field experimentations, soil testing, plant analysis and expression of deficiency symptoms are employed, singly or in combination, to solve problems in fertilizer practices and soil fertility. Theoretically, the study leaned on the system analysis which uses the input – process – output - model. This system theory tells us that every production activity affects, in varying degrees, the resultant effort or output as cited by Stoner, J.R., Freeman, and R. Gilbert. This is shown in Figure 1.

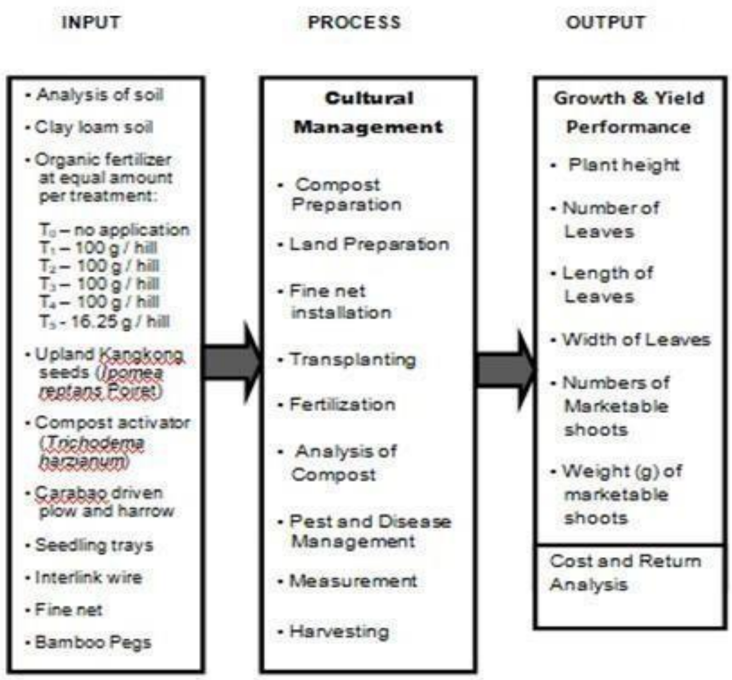

Figure 1: Schema Representing the Conceptual Framework of the Study.

The model shows abaca waste compost mix with animal manures as organic fertilizer applied at equal levels. The six levels of fertilizers, type of soil, cultivar, and compost activator served as the research inputs. The cultural practices and management utilized to achieve results was the process. On the other hand, the growth and yield performance of upland kangkong (Ipomea reptans Poiret) served as the output. It was indicated by plant height, number of leaves, and length of leaves and width of leaves, up to the harvesting period and number of marketable and non-marketable shoots, weight of marketable and non– marketable shoots, and total yield. Generally, the application of organic fertilizers will supplement the deficient nutrients and minerals of the soil needed for the growth and development of the plant. Furthermore, it will enhance the fertility of the soil and increase the yield and growth of vegetable crops.

The research study aimed to determine the growth and yield performance of upland kang kong (Ipomea reptans Poiret) as affected by abaca waste compost.

Specifically, this study had the following objectives:

1. To determine the nutrient content of the abaca waste compost, abaca waste–hog manure compost, abaca waste–chicken manure compost, and kaka ate leaves compost in terms of:

    - Nitrogen
    - Phosphorous
    - Potassium
    - Organic Matter
    - pH

2. To determine the growth and yield performance of upland kangkong (Ipomea reptans Poiret) under the different treatments at 7, 14, 21, 28 days after transplanting in terms of:
    - Plant height
    - Number of leaves
    - Length of leaves
    - Width of leaves
    - Yield

3. To determine if there is a significant difference on the growth and yield performance of upland kang kong underdifferent treatments.

Materials and Methods

The Randomized Complete Block Design (RCBD) was employed in the study. This experimental design was used because the field was slightly sloping and was used before as project area of the agricultural students. The area was divided into three blocks making each block uniform. The experiment was replicated 3 kg of abaca waste and chicken manure for T3 at a ratio of 3:1for T2 and T3 respectively, and 50 kg of kakawate leaves (Glicirdia times with six treatments sepium) for T4 in a plot size of 1m x 5 m x 1 m Bamboo platforms.

The study was conducted at the experimental station of Eastern Visayas State University-Burauen, Leyte. The area was fenced temporarily with interlink wire and a tunnel type structure of fine neat was constructed and used to secured the plants from a stray animals and other external forces. The experimental area was 184.254 square meters, and was divided into three blocks. Each block was subdivided into six plots of 2.1 x 1.8 meters each. An alleyway of 1 meter was provided between the blocks and plots to facilitate farm operations and management. The random assignment of treatments was laid out in three experimental blocks, where each block, represents the number of replications that was utilized in the study. This is showed in Figure 2.

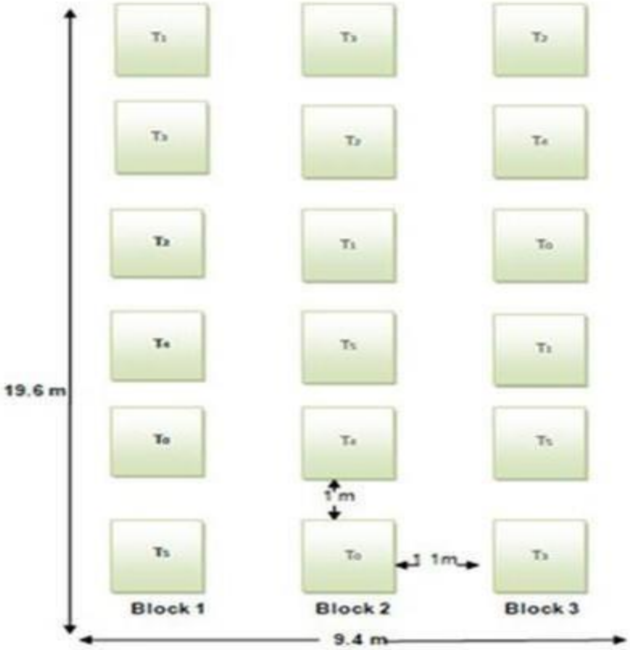

Figure 2: Experimental layout.

The aerobic composting and rapid method of composting was adopted in the study, because it has little risk of phytoxicity, it generates more heat hence, the process time is shorter and it destroys many human and plant pathogens as well as weeds seeds. In order to hasten or accelerate the decomposition process of the organic material for 7 weeks, a fungus activator *Trichoderma harzianum* was added into the compost pile at a proportion of 1% of the substrate or 1 kg of the activator per 100 kg of substrate.

For the intent of the study the following procedures were considered for the attainment of good compost that served as organic fertilizer. The abaca waste and kakawate leaves (Glicirdia sepium) were chopped and moistened for easier decomposition. A shaded and well - drained area was adopted and four plots were constructed to accommodate 50 kg of composting material for abaca waste for T1, abaca waste and hog manure for T2, 50 kg of abaca waste and chicken manure for T3 at a ratio of 3:1for T2 and T3 respectively, and 50 kg of kakawate leaves (Glicirdia sepium) for T4 in a plot size of 1m x 5 m x 1 m Bamboo platforms were constructed in order to provide aeration. The composting material was piled in uniform layers and different levels alternately at 20 cm thick, three parts of abaca waste to one part of animal manure followed by spraying a compost fungus activator (CAF) the *Trichoderma harzianum* at about 32 g per Liter solution or 500 kg of 16 liters of solution for each treatment (T1, T2, T3, and T4). The pile was covered by plastic sheet and used sack to reduce water evaporation and ammonium volatilization, prevent too much water into the pile which could leach the nutrients (http:www.usu.edu), and also maintain the heat of decomposition. The compost materials were ready for harvest after 7 weeks of establishments. The Analysis of Variance (ANOVA) on single factorial experiment in Randomized Complete Block Design was utilized to treat the data. Test on means was done to find out which treatment gives the best result. Least Significant Difference (LSD) was utilized in finding out differences between pairs of treatment means.

Results and Discussion

Based on the results of compost analysis Table 1, kakawate leaves compost (T4) contained the highest total percent of nitrogen (N) at 2.876, potassium (K) of 3.559, and organic matter (OM) of 60.119 and pH of 7.18. The results would indicate that the compost yielded good results in terms of shoot yield. On the other hand, abaca waste + hog manure compost contained a total 1.774 percent of nitrogen (N), 0.325 percent of phosphorous (P), 2.721 percent of potassium(K) and 47.099 percent of organic matter (OM) that favored much for the growth and development of treatment plants. Therefore, a significant results that are comparable to treatment four (T4) was incurred. However, abaca waste compost (T1) contained a total 1.476 percent of nitrogen (N), 0.246 percent of phosphorous (P), 3.475 percent of potassium (K), 48.447 percent of organic matter (OM) and 9.27 of pH.

Table 1: Total Nitrogen (N), Phosphorous (P), and Potassium (K), Organic Matters (OM) and pH of compost.

Compost	Total Percent (%)				pH
	N	P	K	OM	
T1- abaca waste compost	1.476	0.246	3.475	48.447	9.27
T2- abaca waste + hog manure compost	1.774	0.325	2.721	47.099	8.56
T3- abaca waste + chicken manure compost	1.102	0.339	1.943	37.107	9.24
T4- kakawate leaves compost	2.876	0.162	3.559	60.119	7.18

After 28 days of establishment Table 2, experimental plants applied with kakawate leaves compost (T4) and abaca waste + hog manure compost (T2) incurred significant results with a mean of 30.09 and 29.61, respectively. Control plants (T0) and plants applied with urea (T5) obtained comparable results with a mean average of 22.836 and 22.84, respectively. Plants applied with abaca waste compost (T1) obtained a mean average of 20.93 while abaca waste + chicken manure compost (T3) gained 23.73 mean average.

Table 2: Plant height (cm) of upland kang kong 28th day after transplanting as influenced by equal levels of compost period.

Treatments	Replications			Mean
	1	2	3	
T0	21.55	23.06	23.90	22.83b
T1	27.49	15.96	19.34	20.93b
T2	29.76	29.46	29.61	29.61a
T	26.02	19.02	26.15	23.73
T4	31.14	29.07	30.06	30.09a
T5	23.92	19.56	25.04	22.84b

CONCLUSIONS

The study was conducted at the experimental station of Eastern Visayas State University-Burauen, Burauen, Leyte from January 18, 2011 to February 14, 2011. The experiment was laid out in a Randomized Complete Block Design (RCBD) replicated three times with the following treatments:

- T0-control (no fertilizer)
- T1-abaca waste compost
- T2-abaca waste + hog manure compost
- T3-abaca waste + chicken manure compost T4-kakawate leaves (Glicirdia sepium)
- T5–Urea (commercial fertilizer)

Soil samples were collected, composited and air - dried for initial analysis of total Nitrogen (N), Phosphorous (P=Potassium (K), Organic Matter (OM), and pH. The organic residues and materials were piled and composted at a ratio of 3:1. In order to hasten the decomposition process a fungus activator, *Trichoderma harzianum* was added to the compost pile at a proportion of 1% per 100 kg of substrates. The compost pile was allowed to decompose for 7 weeks to achieve good and matured compost. Samples of compost was taken for analysis for total nitrogen (N), phosphorous (P), potassium (K), organic matter (OM), and pH at Central Analytical Services Laboratory of PhilRootcrops at Visayas State University, Visca, Baybay, Leyte. The equal levels of compost were incorporated to the experimental plots one week before transplanting in order to allow time for decomposition and mineralization of nutrients. A mixture of 1:1:1 garden soil, sand and compost was used as germination medium. This was screened for any un- decomposed materials and stones. The mixture was heat sterilized to kill some harmful microorganisms and was placed in the individual cells. The soil was allowed to cool before the seeds were sown.

About 2 seeds of upland kangkong (Ipomea reptans Poiret) the Tsina LP variety were sowed in each cell in the propagation tray or about 1080 seeds. A temporary shed was constructed where the trays were placed and arranged systematically to facilitate care of the seedlings. One week after germination and hardening the seedlings were transplanted into prepared plots. Plants were watered after transplanting to maintain moisture and watered thereafter as needed up to harvesting period.

The application at equal levels of organic fertilizers significantly increased the horticultural characteristics of the test plants. Plants applied with kakawate leaves compost (Glicirdia sepium) and abaca waste + hog manure compost produced taller plants, broad leaves, and green to dark green colors of stems and leaves compared to the rest of the treatments. On the other hand, the yield and yield components was also significantly affected due to the application of organic fertilizers. The application of kakawate leaves compost (Glicirdia sepium) (T4) obtained the heaviest weights of marketable shoots and the total yield. Plants applied with abaca waste + hog manure compost (T2) produced marketable shoots and weights that were comparable to treatment five (T4). Based on the findings of the study, the following conclusions were drawn:

a) Kakawate leaves compost (T4) contained the highest total percent of Nitrogen (N), Potassium (K), and Organic Matter (OM).Therefore, it is a good source of organic fertilizer. On the other hand, abaca waste compost, and mixture of abaca waste + hog manure compost (T2) is also a promising source of organic fertilizer considering that it incurred significant results in the non-soil analysis.

b) Growth and yield characteristics of upland kang kong in terms of plant height, number of leaves, length of leaves, and width of leaves at 7^{th}, 14^{th}, 21^{th}, and 28^{th} days after transplanting was enhanced and significantly affected by equal amounts of organic fertilizer applications.

c) Significant differences were observed on the growth and yield performance of upland kang kong as affected by equallevel of compost application.

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