GROWTH OF VETIVER *(Chrysopogon zizainiodes)* GRASS UNDER DIFFERENT SOIL **TEXTURAL** CLASSES AND CHEMICAL COMPOSITION

Melchora V. Abonal, PhD
Philippines

INTRODUCTION

- Vetiver Grass *(Chrysopogon Zizainioides)* belongs to the Poaceae or Gramineae family.
- It has a perennial lifespan. In the Philippines, vetiver is referred to as "moras." It is native to India and well known for growing in bogs and other low, wet environments.
- The vetiver is therefore capable of withstanding being buried in water for more than a month. It is recognized for controlling erosion and degradation (Oshunsanya and Aliku 2017).
- Vetiver is a non-evasive grass with sterile seeds that grows well as a hedge or as a decorative plant in tropical or semi-tropical regions. It helps maintain moisture in the soil and prevents soil erosion. (http://vetiversenegal.blogspot.com/).

INTRODUCTION

- The Vetiver Grass Technology (VGT is a low-cost, simple technology that uses living vetiver plants to conserve soil and water and safeguard the environment.
- Vetiver grass has a vast, well-structured root system that grows 3-4m within a year of planting. Its vast root structure strengthens the soil and prevents high-velocity flows from dislodging it (Truong, 2000).

Specifically, the study aimed to

1). determine some chemical properties of the soil before and after the experiment

2) determine the growth performance of vetiver grass grown in various soil types.

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MATERIALS AND METHODS

Experimental Site

The experiment was set up at the Central Bicol State University of Agriculture (CBSUA) in Pili, Camarines Sur, Philippines . It has a coordinates of 13°58’16”N and 123°26’19”E.

Description of the source of potting Media

Clay (T1). This soil type was obtained in the field production site of CBSUA, San Jose, Pili, Camarines Sur, Philippines (with normal upland conditions previously planted with corn.

Clay Loam (T2). A type of soil obtained from a garbage/ sanitary landfill, the Dump Site at Bagong Sirang, Pili, Camarines Sur, Philippines.

Loam (T3). A soil obtained from the Binasagan Riverbank at San Jose Pili, Camarines Sur, Philippines

Sandy Clay Loam (T4)- A soil derived from the Lakeshore at Buhi, Camarines Sur, Philippines.

Loamy Sand (T5). The soil was obtained from the Beach shore at Nato, Sagnay Camarines Sur, Philippines.

Collection of Growing Media and Analysis

- Composite soil samples of various soil types were collected to a depth of 20 cm before and after the study. The Field Production Site (Clay, T1), Bagong Sirang dumpsite (Clay loam, T2), Binasagan River (loam, T3), Buhi Lakeshore (sandy clay loam, T4), and Beach shore (loam sand, T5) served as the potting media of the study. Then, a kilogram of a soil sample from each site was air-dried, pulverized, and mixed thoroughly before being brought to the DA-Regional Soils Laboratory in Del Rosario, Naga City, for analysis.

Test Plant

- The variety used was (*Chrysopogon zizanioides)* as a test plant. Planting materials were collected from the clumps of grasses at the CBSUA Production Area, San Jose, Pili, Camarines Sur.

Determination of Soil Chemical Properties

- **Hydrogen Ion Concentration (pH).** The hydrogen ion concentration was determined using an electrode or 1:1 soil water (Davies, 1943).
- **Available Nitrogen.** The colorimetric method. method was used to determine the total nitrogen in plants through organic ammonium (Datta et. Al, 1962).
- **Available Phosphorous.** The Olsen method was used to determine the amount of available phosphorous (Irving and McLaughlin, 1990)
- **Exchangeable Potassium.** The ASS (Atomic Absorption spectrophotometer) method determined the exchangeable potassium (Van Loon, 2012).
- **Organic Matter.** The colorimetric method was used to determine and measure the organic matter content (Datta et. Al, 1962).

Experimental Design and Treatments

Experimental Design and Treatments

- The Complete Randomized Design (CRD) was used in the experiment with five (5) treatments and four (4) replications (Figure 1).

Experimental Design and Treatments

- The treatments were as follows:
- T1- Clay
- T2- Clay Loam
- T3- Loam
- T4- Sandy clay loam
- T5- Loamy Sand

Cultural Management and Practice

- **Preparation of Potting Media.** The growing medium was collected from different sites and prepared based on the experimental design and treatments.
- **Planting.** In each pot, three tillers of vetiver grass were planted. Planting materials were cut to 20 cm in length and planted late in the afternoon. When the plants were established, they were thinned by leaving one tiller per pot. Polyethylene bags measuring 19 x 19 x 27 inches were used for the potting container.
- **Fertilizer,Water, and Pest Management.** No fertilizers were applied . Plants were watered as needed throughout the entire growth phase of the plant. Each pot received an equal amount of water. Weeds and pests were controlled by hand.

Growth Parameters

- **Plant Height.** The plant height was measured from the roots' base to the longest leaf's tip. A meter stick was used to measure the plant height. This was done at 15^{th}, 30^{th}, 45^{th}, 60^{th}, 75^{th}, 90^{th}, 105^{th}, 120^{th}, 135^{th} and 150^{th} days after transplanting (DAT). It was expressed in centimeters (cm).

- **Number of Tillers.** The newly developed number of tillers per plant was counted and recorded. The total number of tillers was counted per pot at 15 days intervals.

Data Analysis

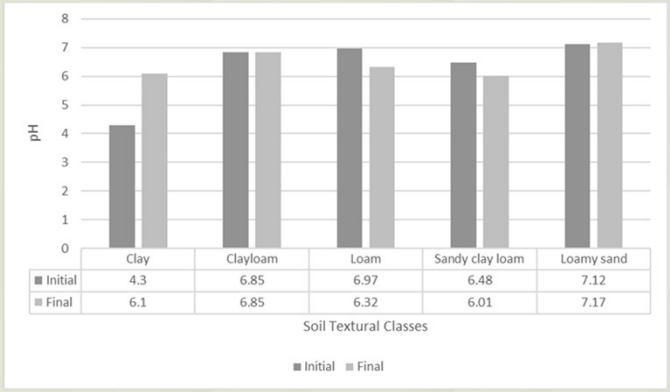
- The data were analyzed using Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD). A further test was done using the Least Significance Difference (LSD) to test the differences among treatments.

RESULTS AND DISCUSSION

Chemical Properties

<u>Potential Hydrogen (pH)</u>.

- Results revealed that Clay texture had changed the pH value from *intensely acidic* to *slightly acidic*.
- This means that planting vetiver grass neutralizes the pH content of the soil in agricultural field conditions.
- In comparison, it remained *slightly acidic*, slightly alkaline, and neutral in sandy clay loam, Loamy Sand, and Clay Loam, respectively. At the same time, the loam texture after being planted with vetiver grass

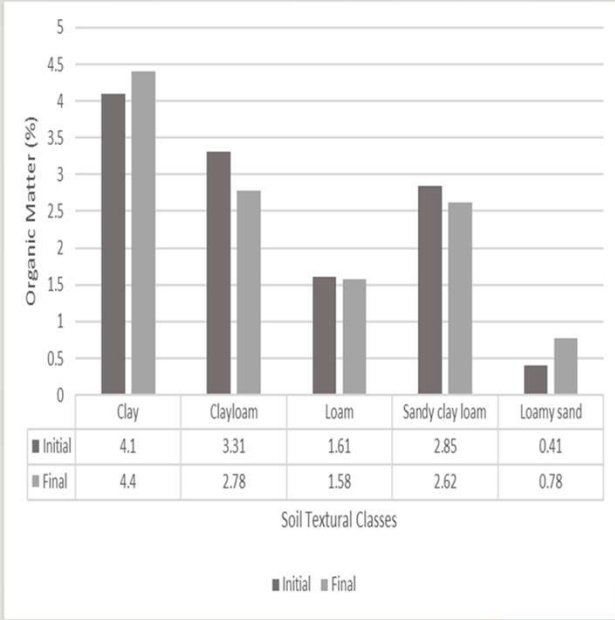


RESULTS AND DISCUSSION

Chemical Properties

Organic Matter

- The findings revealed that loamy sand had an increase in OM content of 90.24 percent, and clay-textured soil had an increase of 7.31%. This shows that the OM matter concentration was enhanced after being grown with vetiver grass. This might result from the sediments that build up on the loamy sand on the beach shore. In contrast, soils with a fine texture are considered to have a high level of nutrient retention, such as clay (T1). Soil Organic Matter (SOM) supplies nutrients through the process of mineralization. It is a crucial component for nutrient availability, cation exchange capacity, water holding capacity, and soil structure (Spargo et. al. 2013).



RESULTS AND DISCUSSION

Chemical Properties

- The amount of available nitrogen increases by 80% in loamy sand, 10 % in clay, and a decreased of 12.50% in clay loam, 7.14% in sandy clay loam, and retained in loam soil. The N content of sandy clay loam remained at 0.08% before and after the study was conducted.
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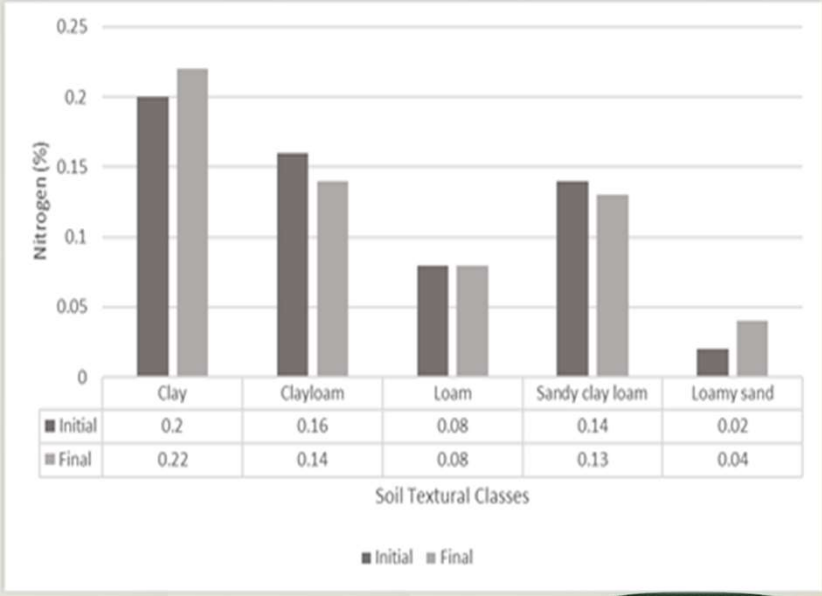
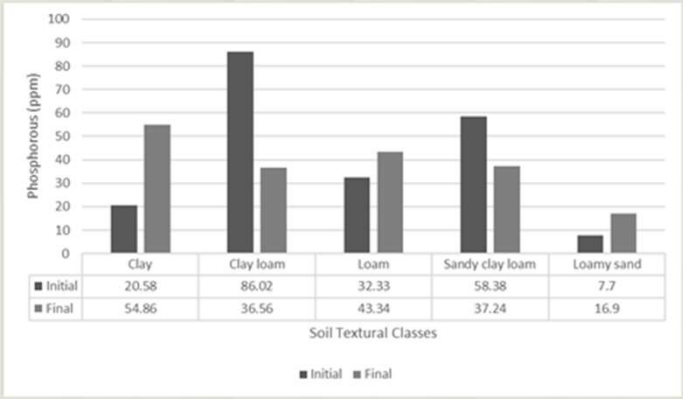


RESULTS AND DISCUSSION

Chemical Properties

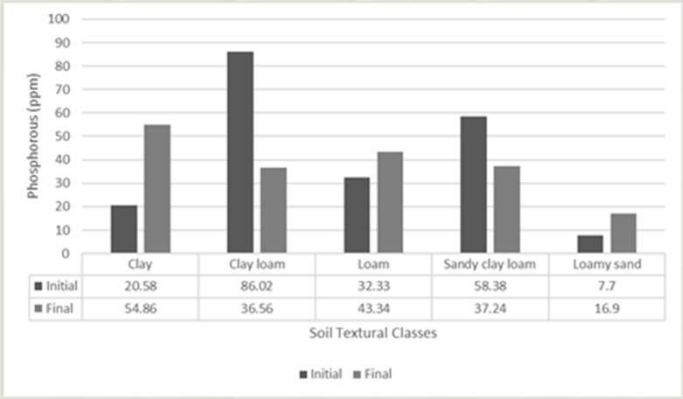
- **Available Phosphorous.** Figure 5 shows the preliminary and final results of the phosphorus concentration in various soil types. The increase in the readily available phosphorus was 166.28% in clay, 34.06% in loam soil, and 119.48% in loamy sand. The phosphorus in soil comes in a variety of forms. Some Phosphorus is a part of the organic matter in the soil, and access to the organic materials makes it available to plants (Spargo et. al., 2013). Phosphorus is relatively immobile in the soil, and the optimum soil test level for phosphorous is 25-35 ppm (Horneck et. al., 2011).



RESULTS AND DISCUSSION

Chemical Properties

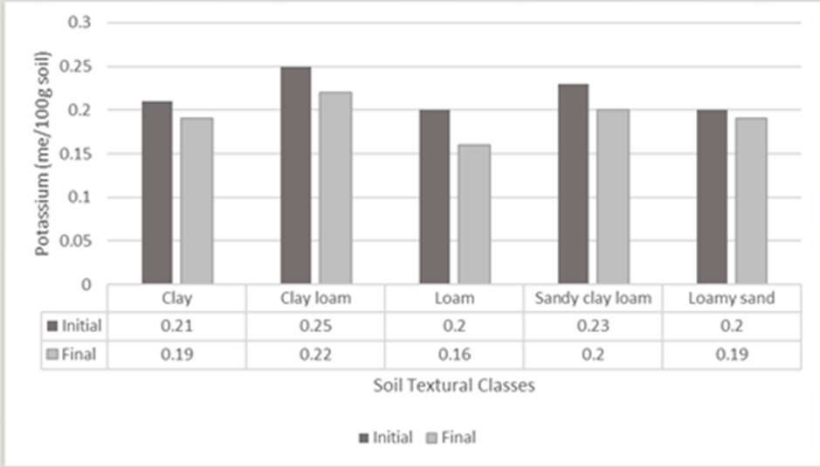
- Results showed that phosphorus levels in all soil types were preserved both before and after planting vetiver grass. This suggests that the vetiver grass utilized not all of the soil's P level. Also, this suggests that vetiver grass may not compete with other crops for the phosphorus content in the soil.
- Moreover, vetiver grass has been said to have a high tolerance for extremely harsh conditions, including heavy metal toxicity, making it suited for rehabilitating heavy metal-contaminated soils. This might result from some of the unique characteristics that make it a perfect species for sustainable agriculture and environmental conservation. Some of these traits include a massive, highly structured root system, strong resilience to pests, diseases, and fire, high efficiency in absorbing dissolved N and P, and a quick recovery rate from adverse conditions (Oshunsanya & Aliko, 2016).



RESULTS AND DISCUSSION

Chemical Properties

- **<u>Exchangeable Potassium (K)</u>.** The potassium contents of the soil were *sufficient* in clay loam and sandy clay loam (Figure 6). This can be due to the potential characteristics of vetiver grass in trapping both fine and coarse sediments in runoff water. These sediments constitute the bulk of most agricultural lands' fertile layer (top soils), which is critical for crop cultivation.



RESULTS AND DISCUSSION

- **Growth Parameters**
- **Plant Height.** Figure 8 displays 15-day plant height increases. On loam soil, plants reached 130.75cm, followed by 122.08 cm in clay. The lowest was 97.05 cm in Sandy clay loam. The 30th, 45th, 60th, 135th, 90th, 105th, 120th, and 150th DATs showed highly significant differences across treatment means.
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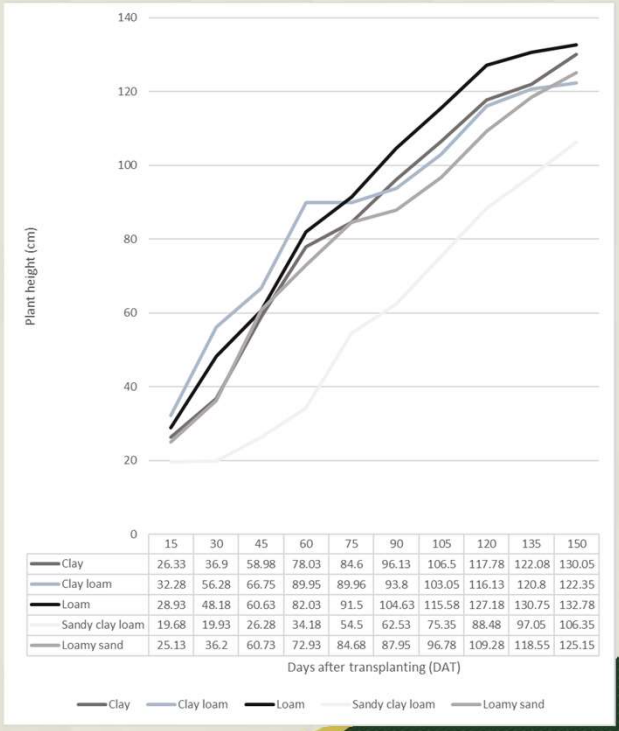
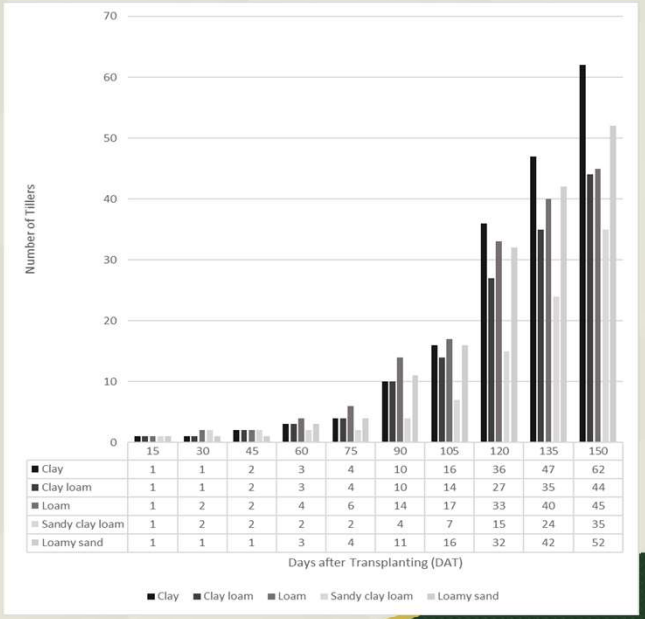
- The 15th and 75 DAT showed no significant changes. Clay and loam have similar plant heights. This



	15	30	45	60	75	90	105	120	135	150
Clay	26.33	36.9	58.98	78.03	84.6	96.13	106.5	117.78	122.08	130.05
Clay loam	32.28	56.28	66.75	89.95	89.96	93.8	103.05	116.13	120.8	122.35
Loam	28.93	48.18	60.63	82.03	91.5	104.63	115.58	127.18	130.75	132.78
Sandy clay loam	19.68	19.93	26.28	34.18	54.5	62.53	75.35	88.48	97.05	106.35
Loamy sand	25.13	36.2	60.73	72.93	84.68	87.95	96.78	109.28	118.55	125.15

RESULTS AND DISCUSSION

- **<u>Number of Tillers</u>.** Figure 9 shows soil type-specific tiller counts. The largest number of tillers was 62 in Clay, followed by 52 in Loamy Sand, and 35 in Sandy Clay Loam. Analysis of variance showed significant differences on the 90th and 105th DATs. No significant changes were found during 15th, 30th, 45th, 60th, 75th, 120th, 135th, and 150th DAT.



	15	30	45	60	75	90	105	120	135	150
Clay	1	1	2	3	4	10	16	36	47	62
Clay loam	1	1	2	3	4	10	14	27	35	44
Loam	1	2	2	4	6	14	17	33	40	45
Sandy clay loam	1	2	2	2	2	4	7	15	24	35
Loamy sand	1	1	1	3	4	11	16	32	42	52

Conclusion

- Vetiver grass improved the OM, N, P, and pH value of clay, the OM, N, and P contents of loamy sand, and the K contents of clay loam and sandy clay loam. The best plant height was produced in loam soil.

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- Vetiver Sénégal Pépinière Naac Baal, BP 51, Sebikotane, Sénégal. Tel (00221) 77-451-3907 – e-mail : tonycisse@hotmail.com