

**ALLELOPATHIC EFFECTS OF LANTANA (*Lantana camara* L.) LEAF  
EXTRACT ON BARNYARD GRASS (*Echinochloa crus-galli* (L.) Beauv.)**

**College of Agriculture and Natural Resources  
BOHOL ISLAND STATE UNIVERSITY  
Zamora, Bilar, Bohol**

**JUNRY M. NASPA**

**June 2022**

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A Thesis  
Presented to the Faculty of the  
College of Agriculture and Natural Resources  
BOHOL ISLAND STATE UNIVERSITY  
Zamora, Bilar, Bohol

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In Partial Fulfillment  
of the Requirements for the Degree of  
Bachelor of Science in Agriculture

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Junry M. Naypa

June 2022



## APPROVAL SHEET

This thesis entitled "**ALLELOPATHIC EFFECTS OF LANTANA (*Lantana camara* L.) LEAF EXTRACT ON BARNYARD GRASS [*Echinochloa crus-galli* (L.) Beauv.]**", prepared and submitted by JUNRY M. NAYPA, in partial fulfillment of the requirements for the degree Bachelor of Science in Agriculture has been examined and recommended for acceptance and approval for oral defense.

### THE THESIS COMMITTEE

  
**NIDA B. RATILLA, M.Sc.**  
Adviser

  
**GLADYS R. CABELIN, M.Sc.**  
Expert

  
**RIANCESAR N. BORDIOS, M.S.**  
Statistician

  
**DENNIS O. POLINAR, M.Ed.**  
Editor

  
**WILSON U. LLEGUNAS Jr., Ph.D.**  
Chairperson


  
**NOEL T. LOMOSBOG, Ph.D.**  
Dean

Approved by the examining panel during the Oral Examination conducted on June 09, 2022 with a rating of 1.3.

### EXAMINING PANEL


  
**MARIETTA C. MACALOT, Ph.D.**  
Chairman

  
**WILSON U. LLEGUNAS Jr., Ph.D.**  
Member

  
**NOEL T. LOMOSBOG, Ph.D.**  
Member

Accepted and approved as partial fulfillment of the requirements for the degree of Bachelor of Science in Agriculture.

**June 09, 2022**  
Date of Oral Defense

  
**MARIETTA C. MACALOT, Ph.D.**  
Campus Director



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## TABLE OF CONTENTS

TITLE PAGE	i
APPROVAL SHEET	ii
ACKNOWLEDGMENT	iii
TABLE OF CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF APPENDICES TABLES	xi
LIST OF APPENDICES FIGURES	xv
ABSTRACT	xvi

### CHAPTER

#### 1 THE PROBLEM AND ITS SCOPE

Rationale	1
Literature Background	2

#### THE PROBLEM

Statement of the Problem	6
Hypothesis	7
Significance of the Study	7

#### RESEARCH METHODOLOGY

Procedures	12
Design	14

	Environment	15
	Statistical Analysis	15
	<b>DEFINITION OF TERMS</b>	18
<b>2</b>	<b>PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA</b>	
	Agronomical Characteristic	19
<b>3</b>	<b>SUMMARY, CONCLUSION AND RECOMMENDATIONS</b>	
	Summary of Findings	33
	Conclusions	34
	Recommendations	34
	<b>REFERENCES</b>	35
	<b>APPENDICES</b>	38
	<b>RESEARCHER'S BIODATA</b>	60

## LIST OF TABLES

Table	Title	Page
1	Rating system for plant health	17

## LIST OF FIGURES

Figure	Title	Page
1	<i>Echinochloa crus-galli</i> (A) Seed Collection, (B) Sun-drying and (C) Labeling and Storing	9
2	<i>Lantana camara</i> Leaves (A) Collection and (B) Air-drying	9
3	Soil Medium Preparation (A) Soil Sterilization (B) Moistening and (C) Sowing of Barnyard Grass Seeds	10
4	(A) Soil Gathering (B) Potting Bags Filled with Soil Weighed and (C) Area with Pots	10
5	(A) Initial and (B) Final Soil pH Testing	11
6	(A) Twenty-One Days Old Barnyard Grass Seedlings (B) Barnyard Grass Seedlings Transplanted in their Individual Pots	11
7	Treatment Preparation (A) Weighing of the Leaf Powder (B) Adding 200 ml of Water to the Leaf Powder (C) Preparation Covered with Black Cellophane (D) Allowing the Extract to Drain Using Coffee Filter (E) Extract Stored in Dark Container and (F) Application of the Treatment to the Plants	12
8	(A) Misting and (B) Watering of the Barnyard Grass Seedlings	13
9	Lay-out of the Experiment Using Completely Randomize Design (CRD).	14
10	Experimental Area (A) Outside and (B) Inside the Screenhouse	15
11	Effects of Different Concentrations of <i>Lantana</i> Leaf Extract on the Height Increment of Barnyard Grass in Screenhouse Condition	19
12	Effects of Different Concentrations of <i>Lantana</i> Leaf Extract on the Number of Leaves of Barnyard Grass in Screenhouse Condition	21

Figure	Title	Page
13	Effects of Different Levels of Concentrations of <i>Lantana</i> Leaf Extract on the Number of Tillers of Barnyard Grass in Screenhouse Condition	22
14	Effects of Different Concentrations of <i>Lantana</i> Leaf Extract on Overall Weekly Plant Health of Barnyard Grass in Screenhouse Condition	24
15	(A) Forty-Eight Hours Observation of Barnyard Grass (B) Showing Wilting, Browning and Yellowing of Leaves (C) 63 Days Old Barnyard Grass Affected by Different Concentration of Leaf Extract	25
16	Effects of Different Concentrations of <i>Lantana</i> Leaf Extract on the Number of Days from Transplanting to Maturity of Barnyard Grass in Screenhouse Condition	27
17.1	Panicle Weight of Barnyard Grass as Affected by <i>Lantana</i> Leaf Extract Concentrations in Screenhouse Condition	28
17.2	Panicle Length of Barnyard Grass as Affected by <i>Lantana</i> Leaf Extract Concentrations in Screenhouse Condition	28
18	Fresh and Dry Weight of Barnyard Grass as Affected by Different Concentrations of <i>Lantana</i> Leaf Extract in Screenhouse Condition	30
19	Effects of <i>Lantana</i> Leaf Extract on Soil pH	30

## LIST OF APPENDIX TABLES

Table	Title	Page
A	ANOVA Table Weekly Height Increment of Barnyard Grass	39
B-1	ANOVA Result on Weekly Height Increment of Barnyard Grass Week 1	39
B-2	Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 1	39
C-1	ANOVA Result on Weekly Height Increment of Barnyard Grass Week 2	39
C-2	Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 2	40
D-1	ANOVA Result on Weekly Height Increment of Barnyard Grass Week 3	40
D-2	Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 3	40
E-1	ANOVA Result on Weekly Height Increment of Barnyard Grass Week 4	40
E-2	Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 4	41
F-1	ANOVA Result on Weekly Height Increment of Barnyard Grass Week 5	41
F-2	Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 5	41
G-1	ANOVA Result on Weekly Height Increment of Barnyard Grass Week 6	41
G-2	Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 6	42
H-1	ANOVA result on weekly height increment of barnyard grass week 7	42

<b>Table</b>	<b>Title</b>	<b>Page</b>
H-2	Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 7	42
I	ANOVA Table Weekly Number of Leaves of Barnyard Grass	42
J-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 1	43
J-2	Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 1	43
K-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 2	43
K-2	Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 2	43
L-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 3	44
L-2	Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 3	44
M-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 4	44
M-2	Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 4	44
N-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 5	45
N-2	Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 5	45
O-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 6	45
O-2	Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 6	45
P-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 7	46

<b>Table</b>	<b>Title</b>	<b>Page</b>
P-2	Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 7	46
Q	ANOVA Table Weekly Number of Tillers of Barnyard Grass	46
R-1	ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 1	46
R-2	Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 1	47
S-1	ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 2	47
S-2	Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 2	47
T-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 3	47
T-2	Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 3	48
U-1	ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 4	48
U-2	Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 4	48
V-1	ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 5	48
V-2	Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 5	49
W-1	ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 6	49
W-2	Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 6	49
X-1	ANOVA result on weekly number of tillers of barnyard grass week 7	49

<b>Table</b>	<b>Title</b>	<b>Page</b>
X-2	Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 7	50
Y	Average Number of Days from Transplanting to Maturity	50
Z-1	ANOVA Result on Number of Days from Transplanting to Maturity of Barnyard Grass	50
Z-2	Least Significant Difference (LSD) Test Result on Number of Days from Transplanting to Maturity of Barnyard Grass	50
A.A	ANOVA Table of Panicle Weight and Length	51
A.B-1	ANOVA Result on Panicle Weight (g) of Barnyard Grass	51
A.B-2	Least Significant Difference (LSD) Test Result on Panicle Weight (g) of Barnyard Grass	51
A.C-1	ANOVA Result on Panicle Length (cm) of Barnyard Grass	51
A.C-2	Least Significant Difference (LSD) Test Result on Panicle Length (cm) of Barnyard Grass	52
A.D	Soil pH	52

## LIST OF APPENDIX FIGURES

Figure	Title	Page
A.E	Letter of Approval to Conduct Research Inside Campus Premises	53
A.F	Fourteen Days Old after Transplanting Barnyard Grass Height Affected with Different Concentration of Leaf Extract	54
A.G	Barnyard Grass Applied with 3.85% Concentration at 48 Hours Observation Showing Wilting after First Application	55
A.H	Barnyard Grass Applied with the Extract Showing Leaf Chlorosis after First Application	56
A.I	Barnyard Grass Applied with the Extract Showing Leaf Tip Browning after Second Application	57
A.J	Barnyard Grass Applied with the Extract Showing Weak Stem	58
A.K	Barnyard Grass Applied with the Extract Showing Shriveled or Necrotic Leaf	59

## ABSTRACT

*Echinochloa crus-galli* is considered the world's worst weed in rice paddies and is capable of reducing crop yields and removing up to 80% of the available soil nitrogen. This study evaluated the allelopathic effects of *Lantana camara* leaf extracts on barnyard grass using pot experiment at the Screenhouse of Bohol Island State University – Bilar Campus from February to May 2022. The study used Complete Randomized Design (CRD) with four treatments, namely 1.92%, 2.88%, and 3.35% extract concentrations, and tap water as control with four replications. Data were analyzed using the Analysis of Variance and Least Significance Difference Test. The result showed that the *Lantana* leaf extracts were significantly detrimental to barnyard grass in terms of plant height, number of leaves, number of tillers, number of days from transplanting to maturity, panicle length, and fresh and dry matter weight. The control exhibited the tallest plant, highest number of leaves and tillers, healthiest plants, longest and heaviest panicles, and heaviest fresh and dry weight until the experiment's eighth week. Shortest panicle length, least number of leaves and tillers, very poor health, longest number of days from transplanting to maturity, and lightest panicle weight were observed on the plants with 1.92% extract but not significantly different with 3.35%. It was observed further that the treatments could slightly change the soil pH towards acidity. Furthermore, *Lantana* leaf extract was allelopathic to barnyard grass as it killed the test plants but was concentration-dependent. However, 100% mortality of the test plants was observed on the fourth-week application of 3.35% extract.

## Chapter 1

### THE PROBLEM AND ITS SCOPE

#### Rationale

*Echinochloa crus-galli* is considered the world's worst weed in rice paddies and has also been listed as a weed in at least 36 other crops throughout tropical and temperate regions of the world (FAO, 2014). It can reduce crop yields and cause forage crops to fail by removing up to 80% of the available soil nitrogen. This is also considered an environmental weed that has become invasive in natural grasslands, coastal forests, and disturbed sites in Asia, Africa, Australia, Europe, and America (FAO, 2014). Studies show that a single barnyard grass per square foot can reduce rice yields by about 25%, and 25 barnyard grasses per square meter can cause about 50% yield loss (PAN, 2015).

In the Philippines, this weed is managed using chemical herbicides and cultural methods. However, experience in other countries shows that, if not correctly managed, herbicide use can lead to resistance in weeds (Kalinova, 2009). A common practice by farmers is to follow up manual or rotary weeding after herbicide spraying to remove the susceptible and resistant biotypes and delay or prevent the evolution of resistance (Baltazar, 2017).

According to Kalinova (2009), proper use of allelopathic crops in agriculture could reduce the pesticide application and thereby reduce the environmental and food pollution, decrease costs in agriculture, improve food security and soil productivity, and increase biodiversity and sustainability in the agro-ecosystem.

Allelopathy is a biological phenomenon by which an organism produces one or more biochemicals that influence the germination, growth, survival, and reproduction of other organisms from the same community (Zimdahl, 2018). Allelopathy is a practical, economic, and environmentally friendly weed management approach. The release of allelopathic compounds from leaves, flowers, seeds, stems, and roots of living and decomposing plant materials can influence weed density and growth.

It is vital to harness the advantage of the inhibitory influence of allelopathic plants to regulate plant growth and development to ensure sustainability in agriculture. Hence, this study was conducted to evaluate the allelopathic effects of *Lantana* (*Lantana camara* L.) leaf extract on barnyard grass [*Echinochloa crus-galli* (L.) Beauv.].

### **Literature Background**

The related reading served as the legal basis of this study:

Many nations regulate organic agriculture methods internationally and legally enforce, based mainly on the standard set by the International Federation of Organic Agriculture Movement (IFOAM), an international umbrella organization for an organic farming organization established in 1972 (Luttikholt, 2007).

The Executive Order No.481, Promotion and Development of Organic Agriculture in the Philippines. Section 8. Research, Development, and Extension The Department of Agriculture (DA), Department of Science and Technology (DOST), State College and Universities (SUCs), and other appropriate agencies such as but not limited to scientific professional organizations and research

institutions shall develop, enhance, support and consolidated activities and related technologies to protect the environment and improve organic matter depleted agriculture soils, reduce the cost of production, improve productivity and increase value-added for the global competitiveness of organic produce.

### **Related Literature**

The following related literatures provided background information in this study:

#### **Lantana (*Lantana camara*)**

*Lantana camara* is a highly variable ornamental shrub native to the neotropics. It has been introduced to most of the tropics and subtropics as a hedge plant and has since been reported as highly weedy and invasive in many countries. It is generally deleterious to biodiversity and has been reported as an agricultural weed resulting in significant economic losses in several countries. This species has been the target of biological control programs for over a century, with successful control only being reported in a few instances.

The main spread of *Lantana camara* into new countries is via the horticultural trade, spreading numerous different varieties of this species. Once introduced into an area, the seeds of *Lantana camara* are readily dispersed into new areas by birds. *Lantana camara* has already spread widely, but there is potential for its range to expand further under future climate change. It is found in almost all climatically suitable habitats in Australia, but under future climate

change, it could expand into new areas in Victoria, South Australia, and Tasmania (Taylor et al., 2012; Taylor & Kumar, 2013).

According to Gindri D.M. et al. (2020), *Lantana camara* leaf extract reduces the viability of *Bidens pilosa* seeds during the germination phase III, reduces the germination speed index in the phases I and II, and causes solute extravasation, abnormalities in geotropism and root development. At 1.25-5.00 % concentrations, the extract inhibits the root and epicotyl growth independently of the sampled population.

Allelopathic effects of *Lantana camara* showed its potential interference with seed germination and growth of many plant species, including crops. The inhibitory effect of *Lantana camara* extracts is dependent very much on their concentration which was also reported by (Hossain & Alam, 2010).

### **Barnyard Grass (*Echinochloa crus-galli*)**

The origin of *Echinochloa crus-galli* remains obscure, but it is probably native to tropical Asia. *Echinochloa crus-galli* has a distribution extending from northern Europe to the subtropics and tropical regions from 50°N to 40°S. It is widespread in Europe, Asia, and Australia, although it is scarce in Africa. *Echinochloa crus-galli* thrives in wet soils and can continue to grow when partially submerged. It is found in many moist ecosystems such as cultivated areas, swamps, marshes, along shorelines, ditches, and disturbed areas (Learning Center 2012, OLA and MAFF 2002). It prefers climates with warm summer days and requires 160-200 days free from frost for survival (OLA and MAFF 2002). It is typically found only at low and medium altitudes between 50°N to 40°S

latitude. *Echinochloa crus-galli* can tolerate various soil types, but it grows best in rich, moist soils with high nitrogen content (OLA and MAFF 2002). It does not grow as tall in drier soils and has reduced numbers of panicles, tillers, and seeds.

Germination begins after the soil warms (late spring) and can occur in anaerobic environments (OLA and MAFF 2002). *Echinochloa crus-galli* continues to grow throughout the summer, produces seeds in September/October, and then dies shortly afterward. Seeds can be dispersed via waterways, insects, birds, the feet of larger animals, and anthropogenic causes (machinery, contaminated seed) (OLA and MAFF 2002). Increased time within the gut and digestive tract of birds reduces the probability of viability (Wongsriphuek et al., 2008). *Echinochloa crus-galli* populations can also expand when lower nodes of stems develop roots; however, these new segments often do not survive through the winter (OLA and MAFF 2002).

### **Allelopathy**

Allelopathy is a common biological phenomenon in which one organism produces biochemicals that influence other organisms' growth, survival, development, and reproduction. These biochemicals are known as allelochemicals and have beneficial or detrimental effects on target organisms. Plant allelopathy is one of the modes of interaction between receptor and donor plants. It may exert either positive effects (e.g., for agricultural management, such as weed control, crop protection, or crop re-establishment) or adverse effects (e.g., autotoxicity, soil sickness, or biological invasion). Allelochemicals can stimulate or inhibit plant germination and growth and permit the development of crops with low phytotoxic

residue amounts in water and soil, thus, facilitating wastewater treatment and recycling (Macias et al., 2003; Zeng et al., 2008).

They are a suitable substitute for synthetic herbicides because allelochemicals do not have residual or toxic effects, although the efficacy and specificity of many allelochemicals are limited (Bhadoria, 2011). The use of allelopathic crops in agriculture is currently being realized, e.g., as components of crop rotations, for intercropping, as cover crops, or as green manure (Cheema & Khaliq, 2000; Singh et al., 2003).

Allelopathy has been studied for quite some time, and many aspects of plant physiological and biochemical processes have been proved to be affected by allelochemicals (Zeng et al., 2001; Gniazdowska & Bogatek, 2005).

## THE PROBLEM

### Statement of the Problem

Generally, this study evaluated the allelopathic effects of *Lantana camara* on barnyard grass leaf extract on barnyard grass (*Echinochloa crus-galli*) under potted and greenhouse conditions.

Specifically, the study aimed to:

1. Assess the efficacy of different levels of *Lantana* leaf extract on the agronomic characteristics of barnyard grass, namely:
  - a. number of days from transplanting to maturity;
  - b. plant height;
  - c. number of leaves;
  - d. number of tillers;

- e. panicle weight;
  - f. panicle length;
  - g. fresh and dry matter weights; and
  - h. plant health.
2. Determine if there is a significant difference among the different levels of *Lantana* leaf extracts on the growth and yield parameters of barnyard grass.
  3. Assess the effect of the *Lantana* extract on soil pH.

### **Hypothesis**

There is no significant difference between allelopathic effects of *Lantana camara* on growth of barnyard grass under potted experiment in a protected environment.

### **Significance of the Study**

The study aimed to determine the effects of different levels of *Lantana* leaf extracts as biocontrol of *Echinochloa crus-galli* by which treatment concentration is effective in inhibiting the growth of barnyard grass.

Furthermore, the study is believed to be environmentally, economically, and socially valuable and acceptable in the following concern:

**Environmental Impact.** The harmful effect of using chemical inputs like pesticides and fertilizers affects our environment, which is blamed for the deterioration of the soil and water resources. The result of the study would be of great use, especially to the agriculture students who will undergo research study

using the *Lantana extracts* as an effective weed inhibitor. This technology offers data analysis to alternative agricultural practices that are environmentally safe, locally available, and seemingly easy to follow. Through this technology, chemical inputs can be minimally reduced.

**Economic Impact.** The output of this study would serve as a guide in innovating and formulating organic weed suppressants, which could cut the cost of the chemical inputs using readily available weed control. Aside from this, Coronitas or *Lantana* plants are always available in the community. The study encourages the students and the farmers to use organic and harness the allelopathic capability of others weeds to suppress its kind.

**Social Impact.** The result of the study would be helpful for instruction and research purposes. Results would be a reference for future researchers and community extension workers who will conduct a study related to this countryside development. This may serve as a basis for the farmers to use the *Lantana* plants to suppress other invasive weeds in the community or practice the technology in the province and its municipalities.

## RESEARCH METHODOLOGY

The study was conducted to evaluate the detrimental effects caused by different levels of concentration of *Lantana* leaf extracts on barnyard grass from February to March 2022 until the termination of the experiment.

**Barnyard Grass Seeds Collection.** The seed of *Echinochloa crus-galli* was collected at the researcher's neighboring barangay in West Canayaon,

Garcia-Hernandez, Bohol, not less than 3-4 months prior to the conduct of the study to allow the seed dormancy period to break. On the same day, the seeds were screened and cleaned from foreign debris, sundried for a day, sealed in a plastic container to preserve seed viability and stored in a refrigerator.

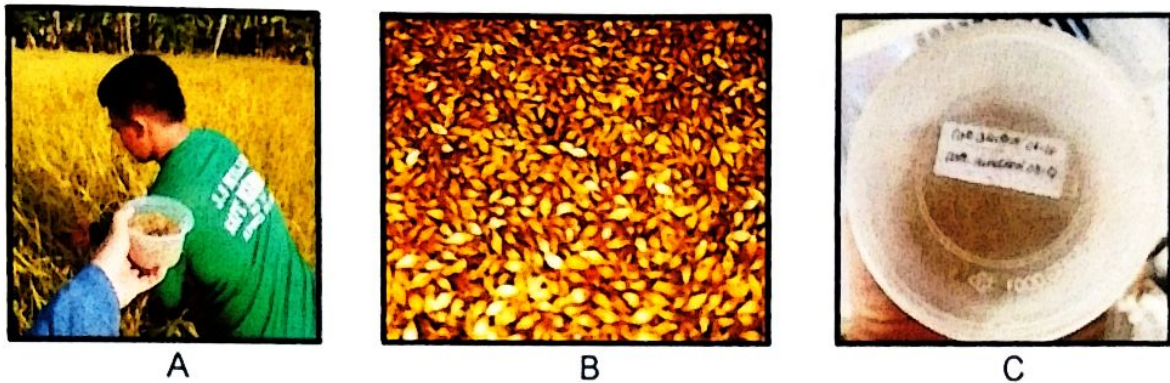


Figure 1. *Echinochloa crus-galli* (A) Seed Collection, (B) Sun-drying and (C) Labeling and Storing

***Lantana* Collection and Preparation.** Mature leaves of the *Lantana* plant were collected at West Ulbujan, Garcia-Hernandez, Bohol, where the said weed is abundant. They were air-dried for two days until brittle and pulverized using an electric blender.



Figure 2. *Lantana camara* Leaves (A) Collection and (B) Air-drying

**Sowing.** The soil medium used was sandy loam which is favorable to barnyard grass. It was moistened first thoroughly before sowing, the seeds in a seedbox to produce at least 200 seedlings of barnyard grass. They were covered with a thin layer of soil to protect the seeds from bird and ant damage and from being washed out during heavy rains afterward.



Figure 3. Soil Medium Preparation (A) Soil Sterilization (B) Moistening and (C) Sowing of Barnyard Grass Seeds

**Pot and Soil Medium Preparation.** The pot used was Polyethylene bags measuring 4.5in x 4.5in x 9in filled with sterilized sandy loam taken from the vicinity of BISU-Bilar campus. Every pot was filled with at least 2.25 kilograms of soil.

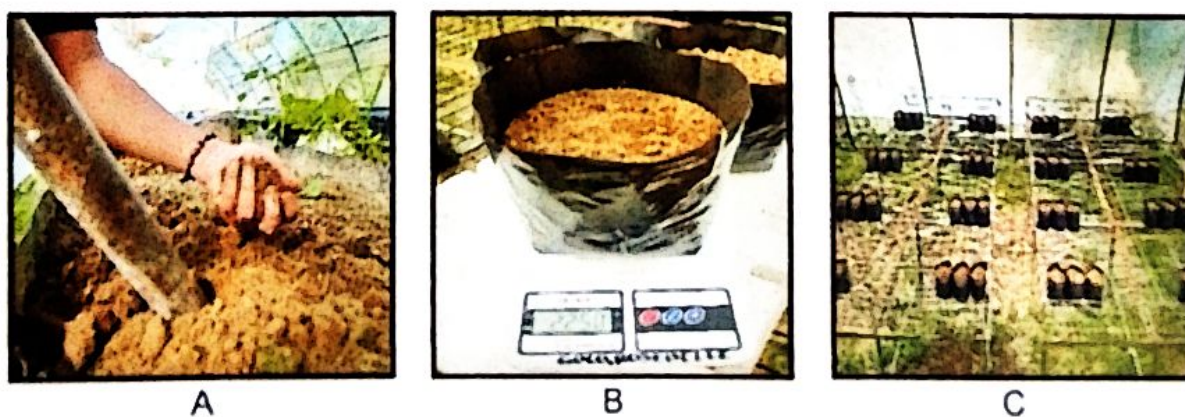


Figure 4. (A) Soil Gathering (B) Potting Bags Filled with Soil Weighed and (C) Area with Pots

**Soil pH Testing.** Before the experiment, the soil was tested for initial soil pH level. After the experiment, the soil was again tested to determine if there was a change in the soil's pH level as affected by the application of *Lantana* leaf extract.

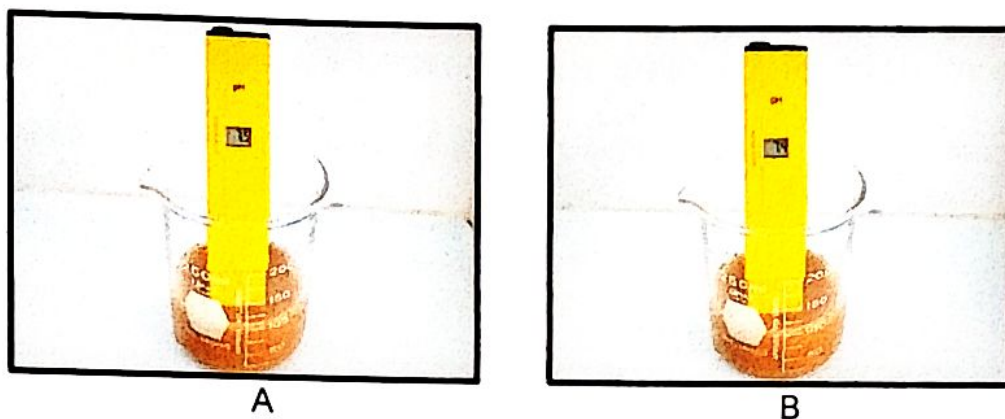


Figure 5. (A) Initial and (B) Final Soil pH Testing

**Transplanting.** Fourteen-day-old seedlings were transplanted at one (1) seedling per pot two weeks after sowing and hardened for one week. Proper handling and care were observed in transplanting the seedling to prevent damage to its roots. Transplanting was done late in the afternoon to avoid wilting of the seedling.



Figure 6. (A) Twenty-One Days Old Barnyard Grass Seedlings (B) Barnyard Grass Seedlings Transplanted in their Individual Pots

**Treatment Preparation and application.** *Lantana* leaf powder was added with 200 ml distilled water to its corresponding weight and soaked overnight. Then in the morning, the mixture was filtered using coffee filter paper and stored in a dark container. Each mixture was added with 2.4 liters of tap water. Each plant was applied with a 200mL solution of its corresponding concentration. Application of treatments started one week after transplanting with a one-week interval until termination of the study at eight weeks.

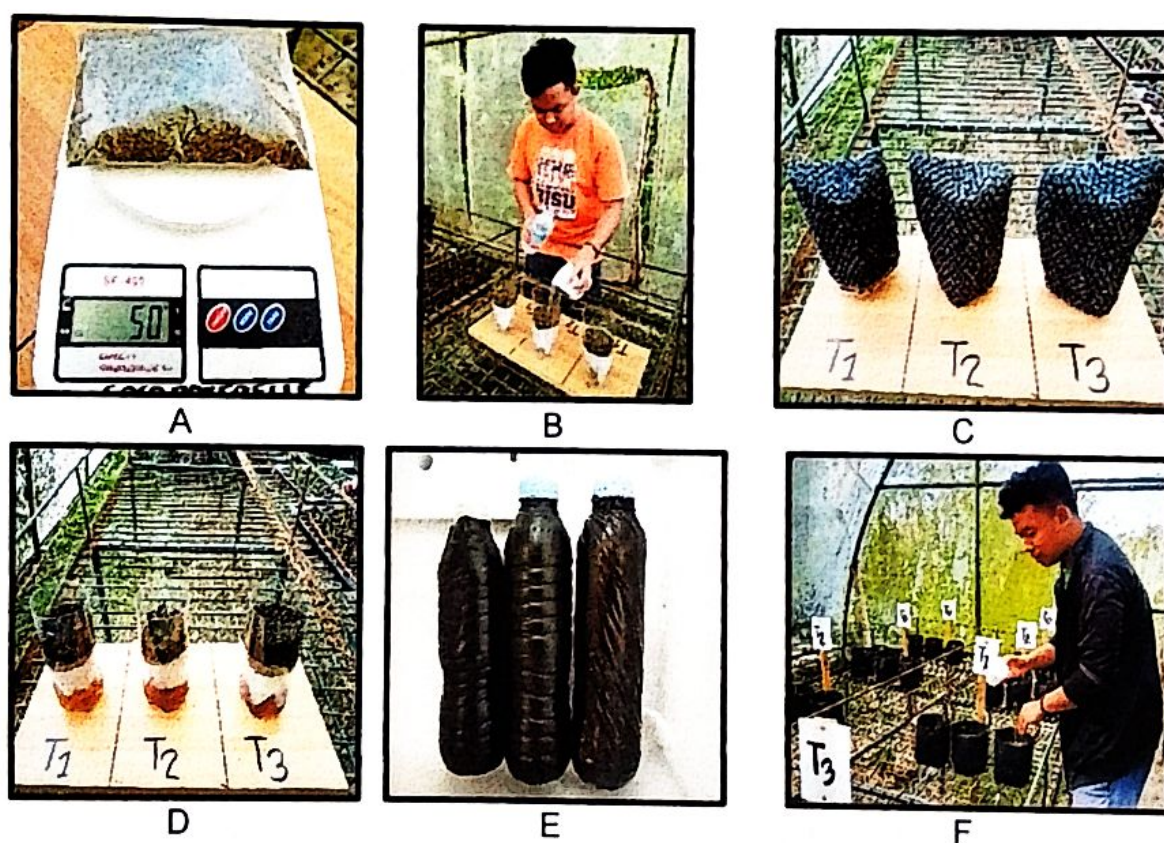


Figure 7. Treatment Preparation (A) Weighing of the Leaf Powder (B) Adding 200 ml of Water to the Leaf Powder (C) Preparation Covered with Black Cellophane (D) Allowing the Extract to Drain Using Coffee Filter (E) Extract Stored in Dark Container and (F) Application of the Treatment to the Plants

The treatments were as follows:

T1 – Control (water only)

T2 – 50g of leaf powder/200mL (1.92% concentration)

T3 – 75g of leaf powder/200mL (2.88% concentration)

T4 – 100g of leaf powder/200mL (3.85% concentration)

**Care and Management.** Proper water management was observed during the entire conduct of the study to promote the better growth of the experimental plants. The plants were watered daily on sunny days until the termination of the experiment. The watering of plants depends on the weather and soil moisture.

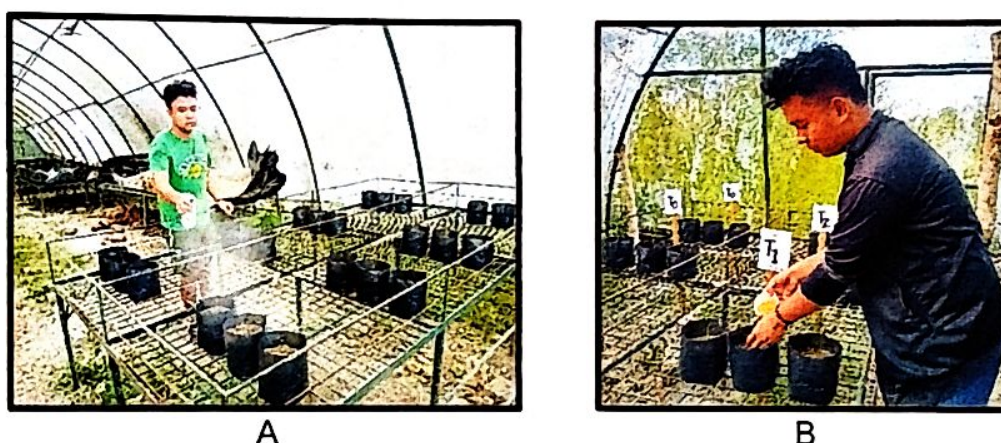


Figure 8. (A) Misting and (B) Watering of the Barnyard Grass Seedlings

**Experimental design.** The experimental pots were arranged in Completely Randomized Design (CRD) with four replications at three (3) pots per experimental unit with one (1) plant per pot. A total of 48 pots were used for the entire experiment.

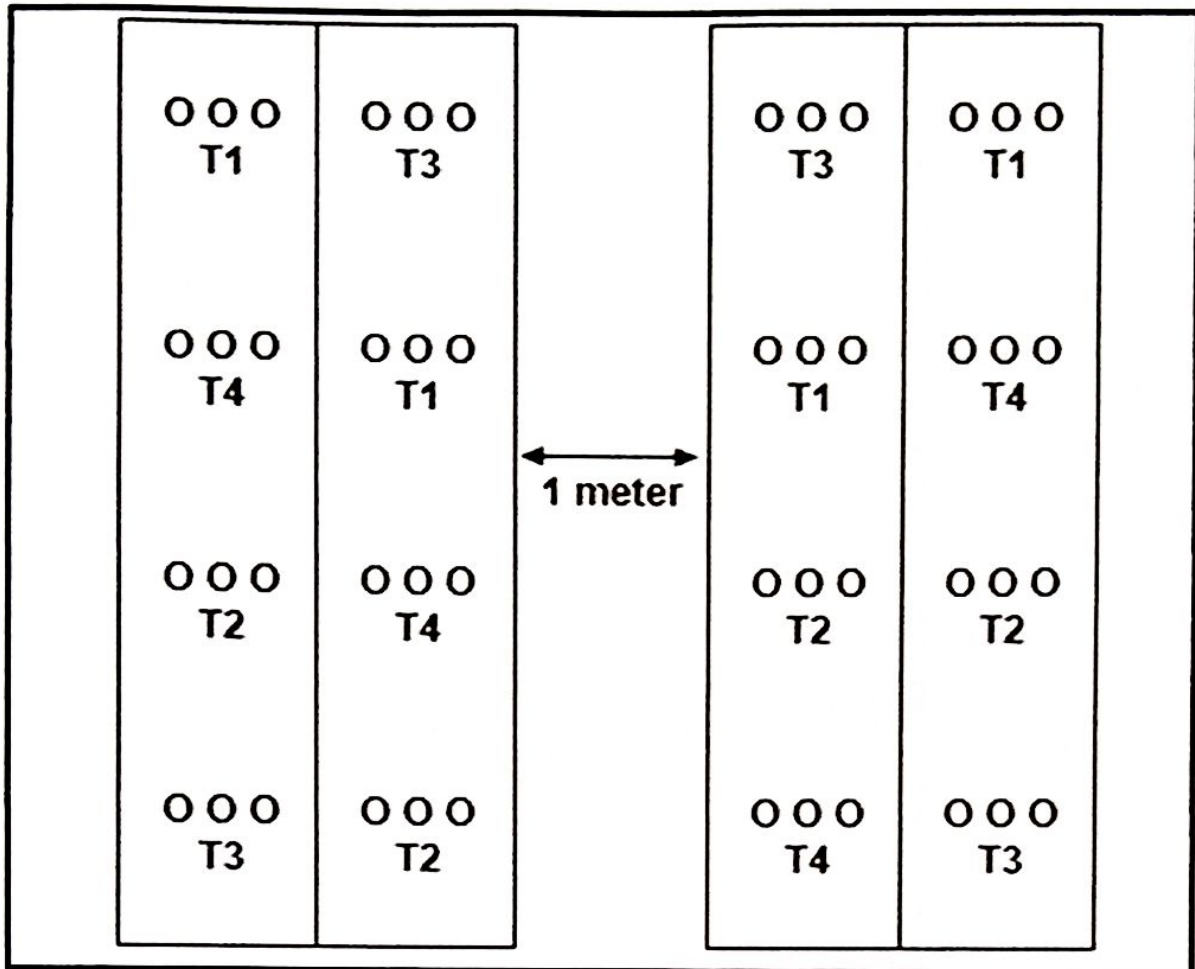


Figure 9. Lay-out of the Experiment Using Completely Randomize Design (CRD)

**Environment.** The study was conducted at a Screen House of Bohol Island State University – Bilar Campus in Zamora, Bilar, Bohol, from March to May 2022. The area was suitable for the experiment, had an adequate water supply, was exposed to sunlight, and protected from stray animals.



A



B

Figure 10. Experimental Area (A) Outside and (B) Inside the Screenhouse

**Statistical Treatment.** The data were tabulated and analyzed using Analysis of Variance (ANOVA) in Completely Randomized Design (CRD). The mean difference was determined using the Least Significant Difference (LSD) Test.

**Data Gathered.** The process in the collection of data were as follows:

1. **Number of days from transplanting to maturity.** This was determined by counting the days from transplanting to maturity when 90% of the grains were matured.
2. **Number of Leaves.** This was determined by counting the initial number of leaves one week after transplanting and at weekly intervals until termination at maturity and getting their difference.
3. **Plant Height (cm).** This was obtained by measuring the height of the three (3) sample plants starting from the soil level up to the tip of the highest leaves. Data were collected one week after transplanting and at weekly intervals until termination at maturity, and the difference was determined.
4. **Number of Tillers.** This was obtained by counting the initial number of tillers one week after transplanting and at weekly intervals until termination at maturity and getting their difference.
5. **Panicle Weight (g).** This was obtained by weighing the panicles of 3 sample plants during termination or 8 weeks after transplanting.
6. **Panicle Length (cm).** This was obtained by measuring the base until the tip of the panicle of the three (3) sample plants during the termination of the experiment.

7. **Fresh and Dry Matter Weight (g)**. This was obtained by weighing the fresh plants first and drying them after termination in the oven at 100°C until the weight becomes constant.

8. **Plant Health**. This was obtained using a rating system adopted from Arayantha et al. (2000) by rating the sample plants starting one week.

Table 1. Rating system for plant health

Rating	Plant Health	Symptoms
4	Healthy Plants	Deep green leaves and no chlorosis or wilting
3	Loss of Vigor	Reduce vigor, browning of the leaf tips
2	Poor Health	Wilting, chlorosis or necrosis of up to one third of the leaf area
1	Very Poor	Severe necrosis or wilting
0	Dead	All leaves dry, shriveled and necrotic

9. **Soil pH**. This was determined by getting composite samples of the soil medium before and after the experiment and subjecting them to analysis using a soil pH meter.

## DEFINITION OF TERMS

**Allelopathy** - the chemical inhibition of one plant (or other organisms) by another due to the release into the environment of substances acting as germination or growth inhibitors.

**Allelopathic Effects** - a common biological phenomenon by which one organism produces biochemicals that influence other organisms' growth, survival, development, and reproduction.

**Barnyard grass** - (*Echinochloa crus-galli*), also called barnyard millet or cockspur grass, is coarse tufted grass of the family Poaceae, a noxious agricultural weed.

**Biomass** - the total mass of organisms in a given area or volume.

**Extract** – is a substance made by extracting a part of raw material, often using a solvent such as ethanol, oil, or water.

**Lantana** - (*Lantana camara*) is a perennial, erect sprawling or scandent shrub that typically grows to around 2 m tall and forms dense thickets in various environments.

**Panicle** - a loose branching cluster of flowers, as in oats.

**Tillers** - a lateral shoot from the base of the stem, especially in grass or cereal.

**Treatment** – Any application or practices to be applied in the soil to help the plant grow and develop or even suppress the growth.

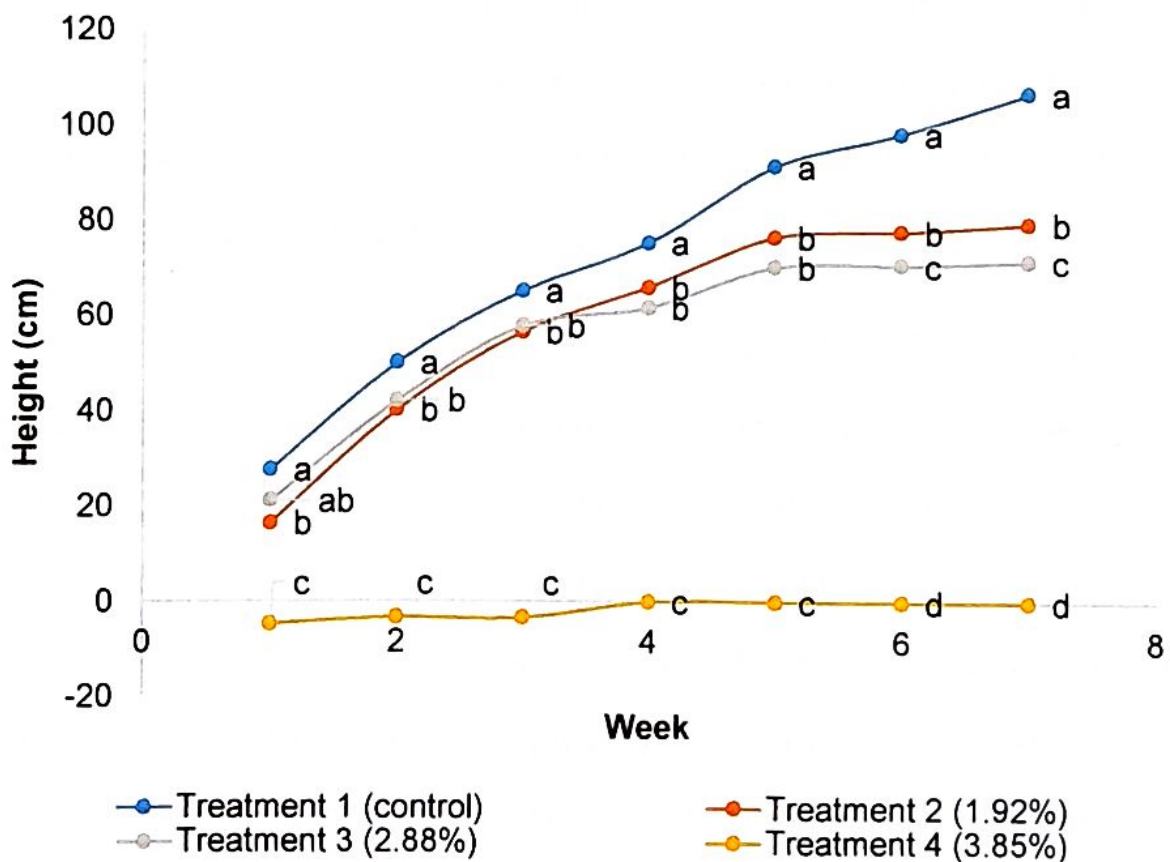
## Chapter 2

### PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter deals with the presentation, analysis, and interpretation of the data gathered on allelopathic effects of *Lantana* leaf extract on barnyard grass.

#### Agronomical Characteristics

**Plant Height.** Figure 11 presents the effects of different concentrations of *Lantana* leaf extract on the height increment of barnyard grass in screenhouse conditions.



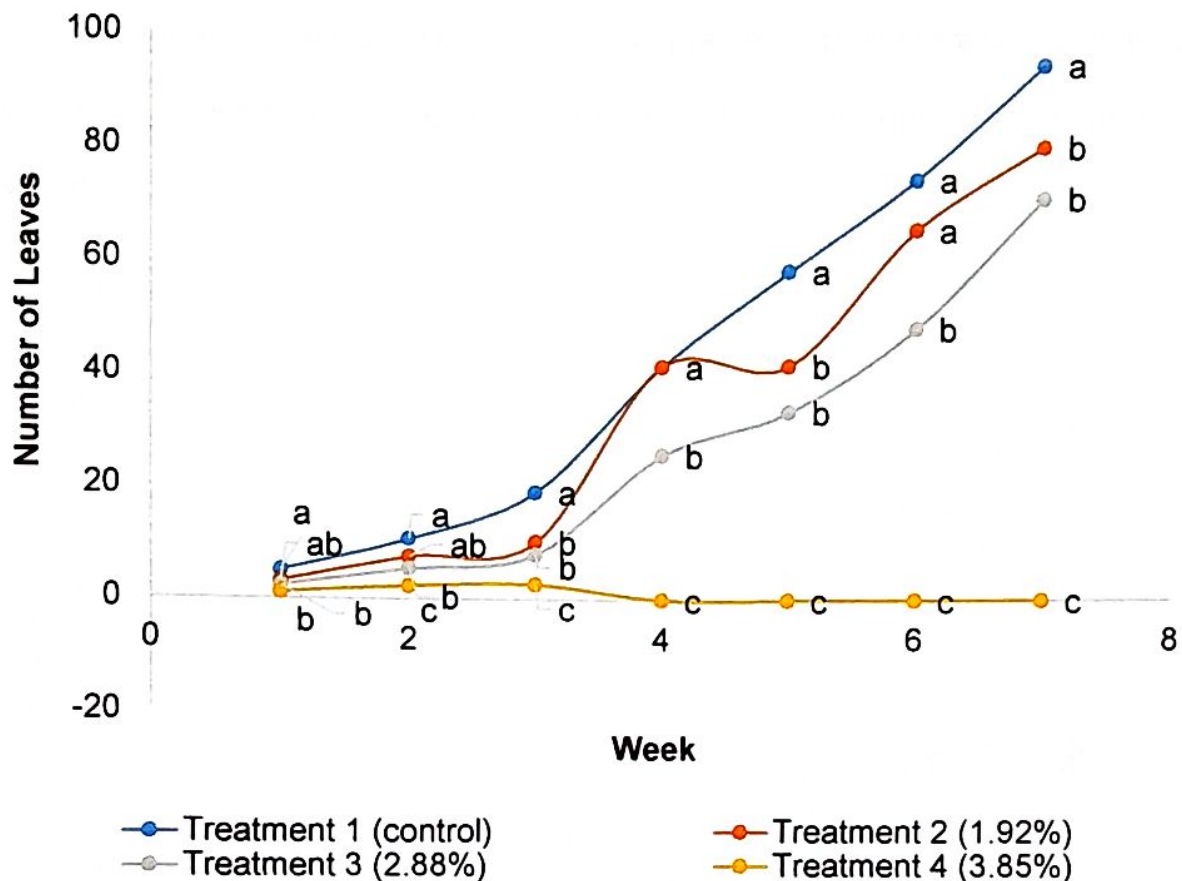
\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Figure 11. Effects of Different Concentrations of *Lantana* Leaf Extract on the Height Increment of Barnyard Grass in Screenhouse Condition

Data showed that in the first three weeks of treatment application, the shortest height was consistently exhibited by barnyard grass treated with 3.85% extract concentration (-4.67 cm), while the control group gave the tallest barnyard grass (27.71 cm). Significant differences were observed between the control and treated plants starting from one week after application until the termination of the experiment on the seventh week. Significantly different heights were also recorded among plants with different concentrations except between 1.92% and 2.88% concentrations on the first to the fifth week of application.

However, on the fourth week, all plants applied with 3.85% extract were already dead. This result implies that *Lantana* leaf extract was inhibitory to the growth of barnyard grass, and it depends on the extract's concentration. This is in line with the findings of Hossain and Alam (2010) also reported previous studies on allelopathic effects of *Lantana*, which showed potential interference with seed germination and growth of many plant species, including crops.

**Number of Leaves.** Figure 12 shows the effect of different concentrations of *Lantana* leaf extract on the numbers of leaves of barnyard grass under greenhouse conditions. Data showed the least number of leaves of barnyard grass treated with the highest extract concentration of *Lantana* leaf, while the highest number of leaves were on plants treated with none of the control plants. The significant difference between plants with 3.85% concentration and control plants was consistently observed one week after treatment application until the seventh week.



\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Figure 12. Effects of Different Concentrations of *Lantana* Leaf Extract on the Number of Leaves of Barnyard Grass in Screenhouse Condition

Moreover, it can also be observed that starting from the third week to the seventh week, barnyard grasses applied with 3.85% *Lantana* extract were significantly different from plants applied with 1.92% to 2.88% only. However, the control plants and plants applied with 1.92 to 2.88% extract were comparable. However, on the fourth week, all plants applied with 3.85% extract were already dead. This means that *Lantana* leaf extract as high as 3.85% is detrimental to barnyard grass after four applications due to its allelopathic effect. Reduction in the shoot, root length, and the number of leaves of seedlings of certain plants as affected by aqueous extract of *Lantana* had been reported by El-Kenany and El-Darier (2013), Kar et al. (2014), and Hussain et al. (2011).

**Number of Tillers.** Figure 13 reflects the effect of different concentrations of *Lantana* leaf extract on the number of tillers of barnyard grass in screenhouse conditions.

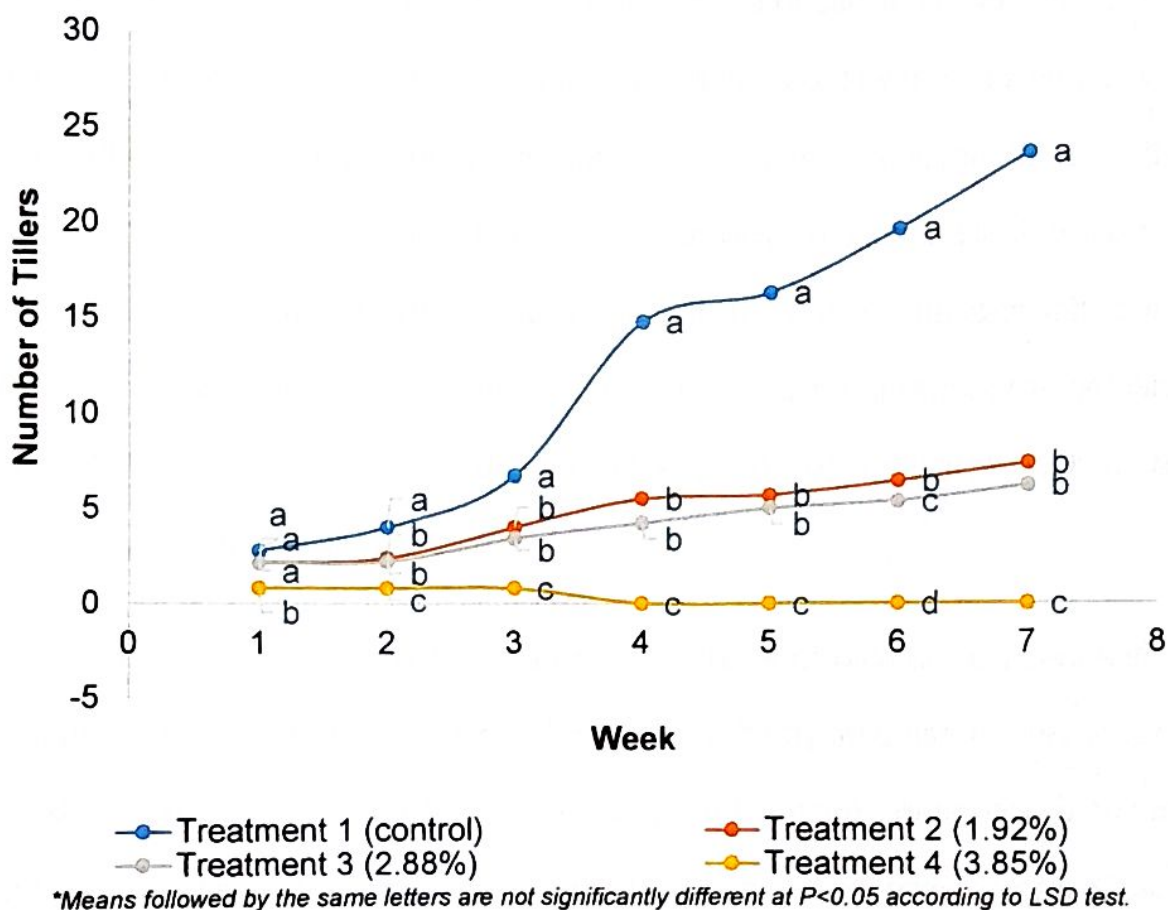


Figure 13. Effects of Different Concentrations of *Lantana* Leaf Extract on the Number of Tillers of Barnyard Grass in Screenhouse Condition

Results of the study revealed the lowest number of tillers on barnyard grass treated with the highest concentration of *Lantana* extract of 3.85%. In contrast, the highest number of tillers was observed in control plants in the first week. Statistical analysis shows a significant difference between plants applied with 3.85% of *Lantana* extract with plants treated with 2.88% and 1.92% extract, and those plants in the control group. However, non-significant differences were observed on

barnyard grass applied with 2.88% and 1.92% extract and control plants. This shows growth inhibition in the test plants with increasing extract concentration. In the fourth week, 100% mortality of the plants treated with 3.85% of *Lantana* extract was observed. This shows that *Lantana* extracts induced a higher allelopathic effect on barnyard grass at this concentration, as indicated by the total mortality of the plants and lower production of tillers at the lower concentrations of the treatment. This further shows that the phytotoxicity of *Lantana* leaf extract is concentration-dependent. The study of Qasem JR. (2006) supports this claim *Lantana camara* inhibited or suppressed crop germination, growth, development, or metabolism of other plants due to the secretion of allelochemicals to the rhizosphere of neighboring crop plants.

**Plant Health.** Figure 14 presents the effects of different concentrations of *Lantana* leaf extract on the overall plant health of barnyard grass in greenhouse conditions. Results revealed that test plants applied with the highest concentration of *Lantana* extract were the fastest to show chlorosis, wilting, and necrosis of one-third of the leaf area 48 hours after application, and 2 sample plants from higher concentration treatment eventually died after 78 hours. Severe necrosis or wilting was observed two to four weeks after application, and they eventually died in the fifth week. On the other hand, barnyard grasses treated with lower concentrations were losing vigor to having poor health.

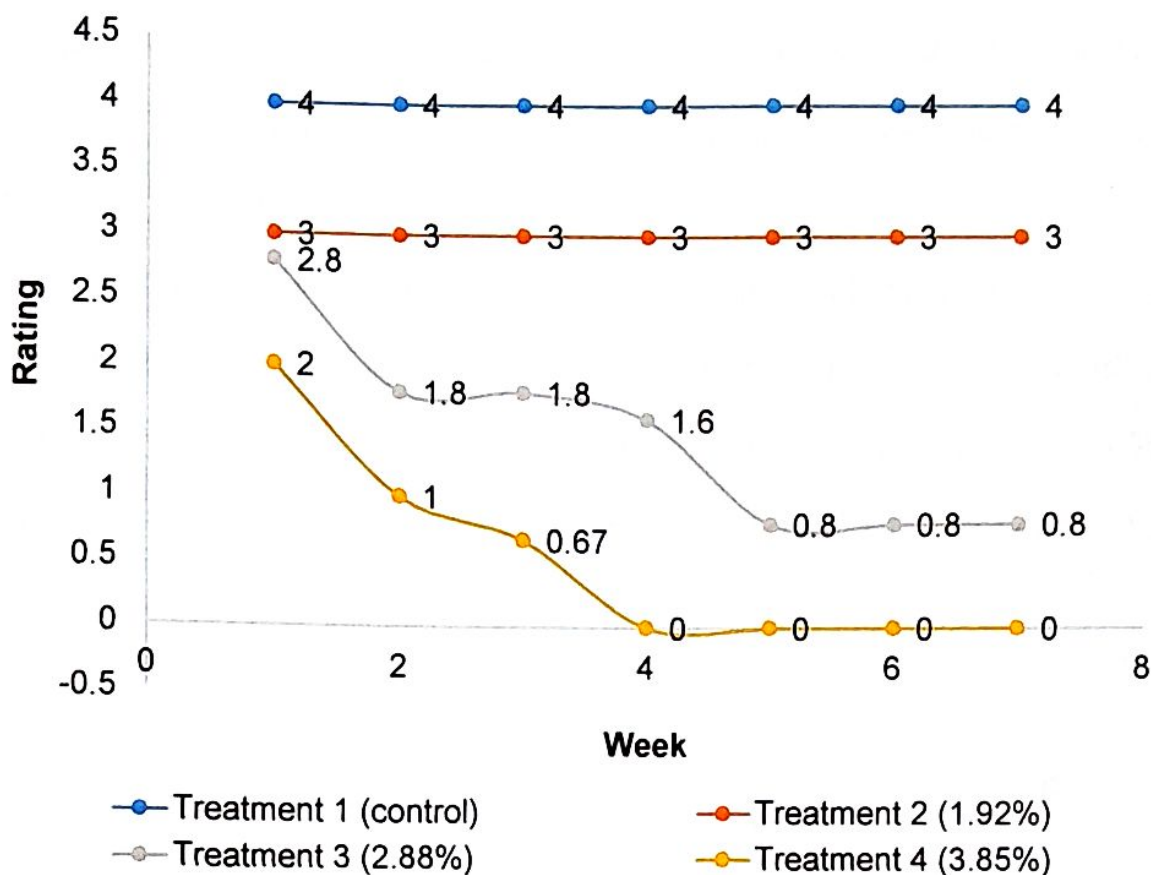


Figure 14. Effects of Different Concentrations of *Lantana* Leaf Extract on Overall Weekly Plant Health of Barnyard Grass in Screenhouse Condition

**Rating Scale:**

- 0. Dead: All leaves dry, shriveled and necrotic;
- 1. Very Poor: Severe necrosis or wilting;
- 2. Poor Health: Wilting, chlorosis or necrosis of up to one third of the leaf area;
- 3. Loss of Vigor: Reduce vigor, browning of the leaf tips;
- 4. Healthy Plants: Deep green leaves and no chlorosis or wilting

On the contrary, control plants remained healthy with deep green leaves and no chlorosis or wilting, as shown in Figures 15 a, b, and c. Furthermore, control plants produced panicles more than the rest of the test plants. The most detrimental effect caused by the extract was highly noticeable in plants with the highest concentration. The health started to degrade in the second week to the third week after another week; 100% mortality was already observed. According to Mishra (2012), depletion of chlorophyll is due to phytotoxic effects of

allelochemicals. Chlorophyll contents of *Parthenium hysterophorus* were also inhibited with the treatment of different concentrations of leaf, stem, and root aqueous extract of *Lantana camara*.

Furthermore, phytotoxicity was directly proportional to the concentration of the extracts, and a higher concentration had a more potent inhibitory effect. Results imply a maximum reduction in chlorophyll contents was observed in 100% aqueous leaf extract. Minimum reduction in chlorophyll contents was observed in 25% aqueous leaf extract.



A



B

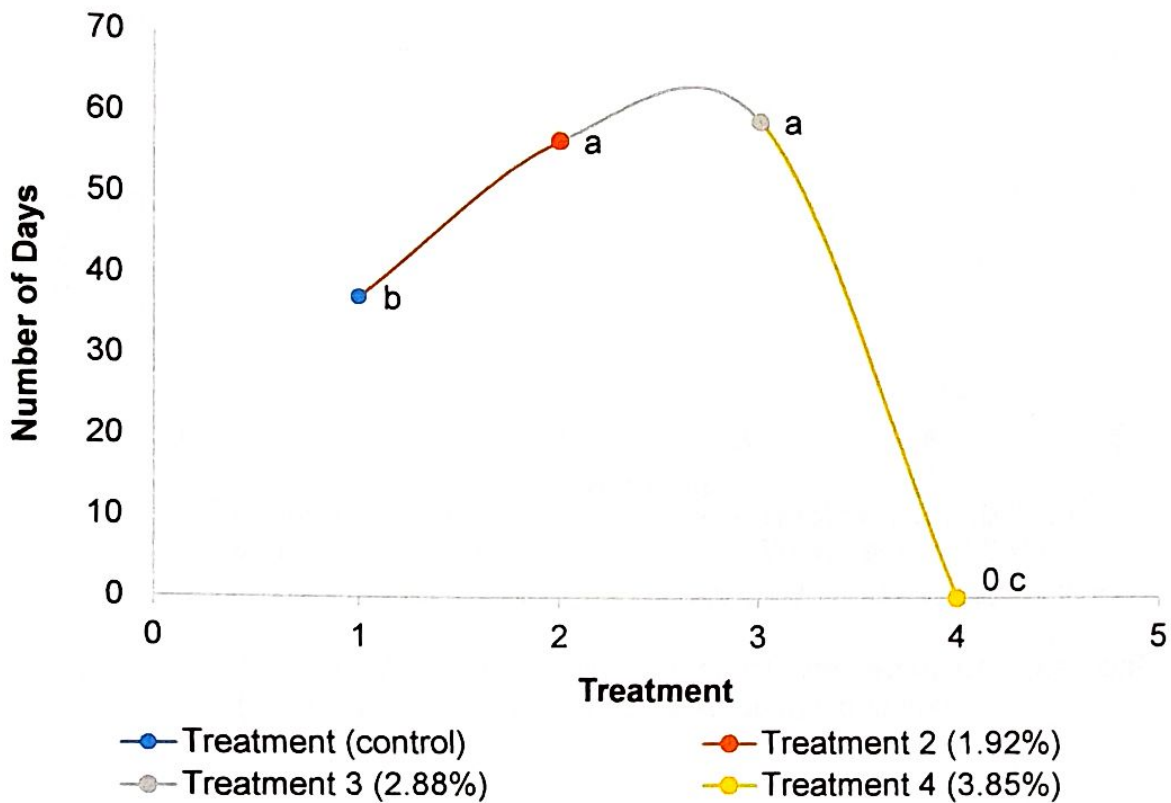


C

Figure 15. (A) Forty-Eight Hours Observation of Barnyard Grass (B) Showing Wilting, Browning and Yellowing of Leaves (C) 63 Days Old Barnyard Grass Affected by Different Concentration of Leaf Extract

**Number of Days from Transplanting to Maturity.** Figure 16 shows the effects of different concentrations of *Lantana leaf* extract on the number of days from transplanting to maturity of barnyard grass in screenhouse conditions. Statistical analysis revealed that the barnyard grass treated with a 3.85% concentration of *Lantana leaf* extract was significantly different from the rest of the treatments since the test plants were still dead at the vegetative stage. Weed plants treated with 2.88% extract with an average of 59.75 days show the longest

days to mature their panicle, followed by 1.92% with an average of 57.25 days. On the contrary, the shortest number of days was recorded on control plants.

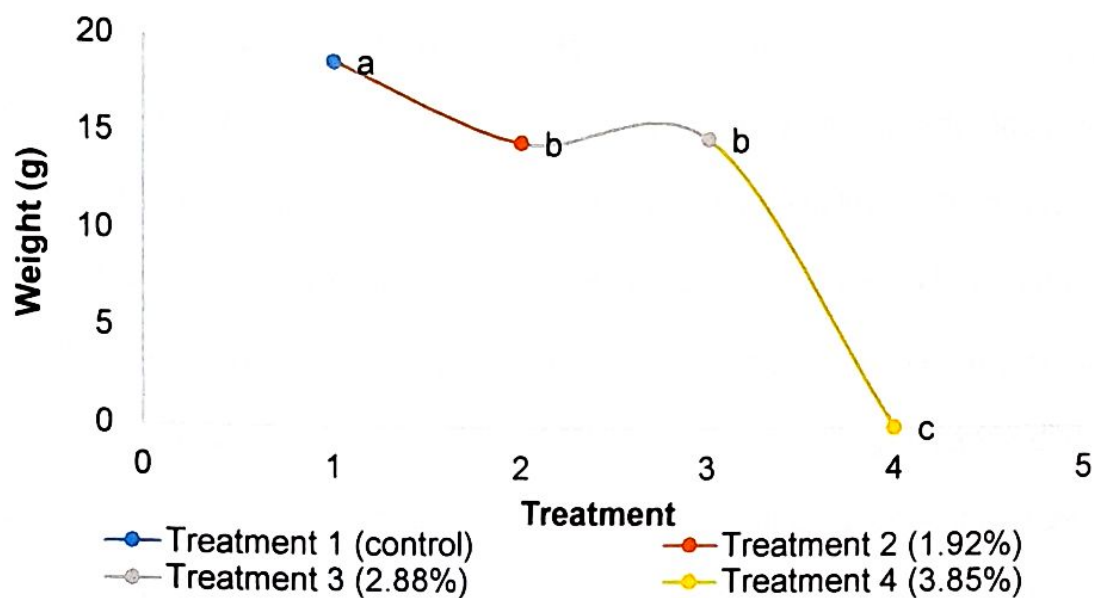


\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Figure 16. Effects of Different Concentrations of *Lantana* Leaf Extract on the Number of Days from Transplanting to Maturity of Barnyard Grass in Screenhouse Condition

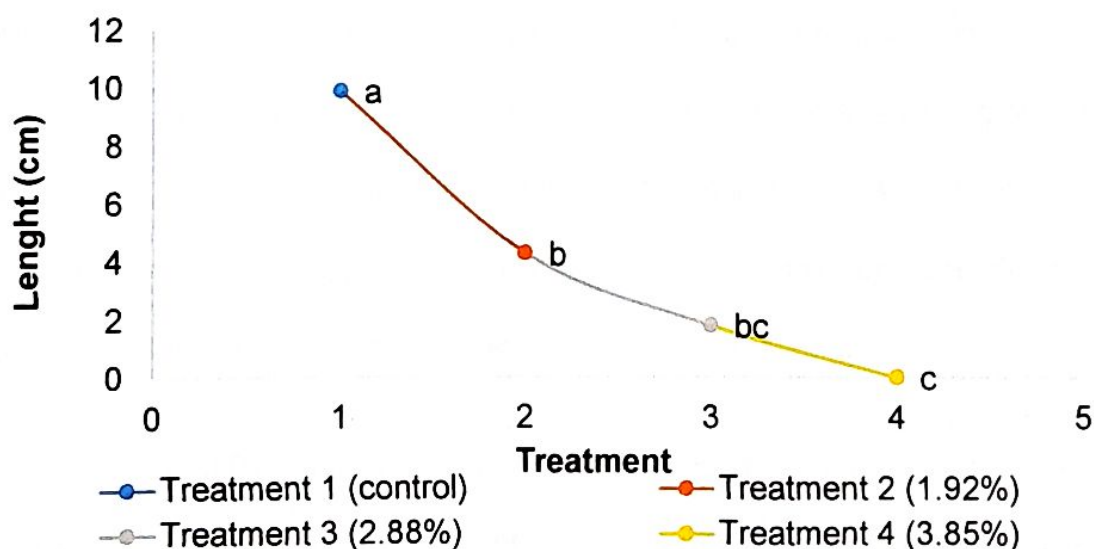
This result implies that *Lantana* leaf extract delays panicle maturity if applied at 2.88% or lower concentrations. However, applying at a 3.85% concentration will kill barnyard grass five weeks after weekly applications. This observation was supported by Zhung et al. (2005), where the extract of *Lantana* leaves suppressed the emergence of leaf buds of the water hyacinth plant and caused the decay of its leaves by foliar spraying.

**Panicle Length and Weight.** Figure 17 presents the panicle length and panicle weight of barnyard grass as affected by leaf extract in protected conditions.



\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Figure 17.1. Panicle Weight of Barnyard Grass as Affected by *Lantana* Leaf Extract Concentrations in Screenhouse Condition

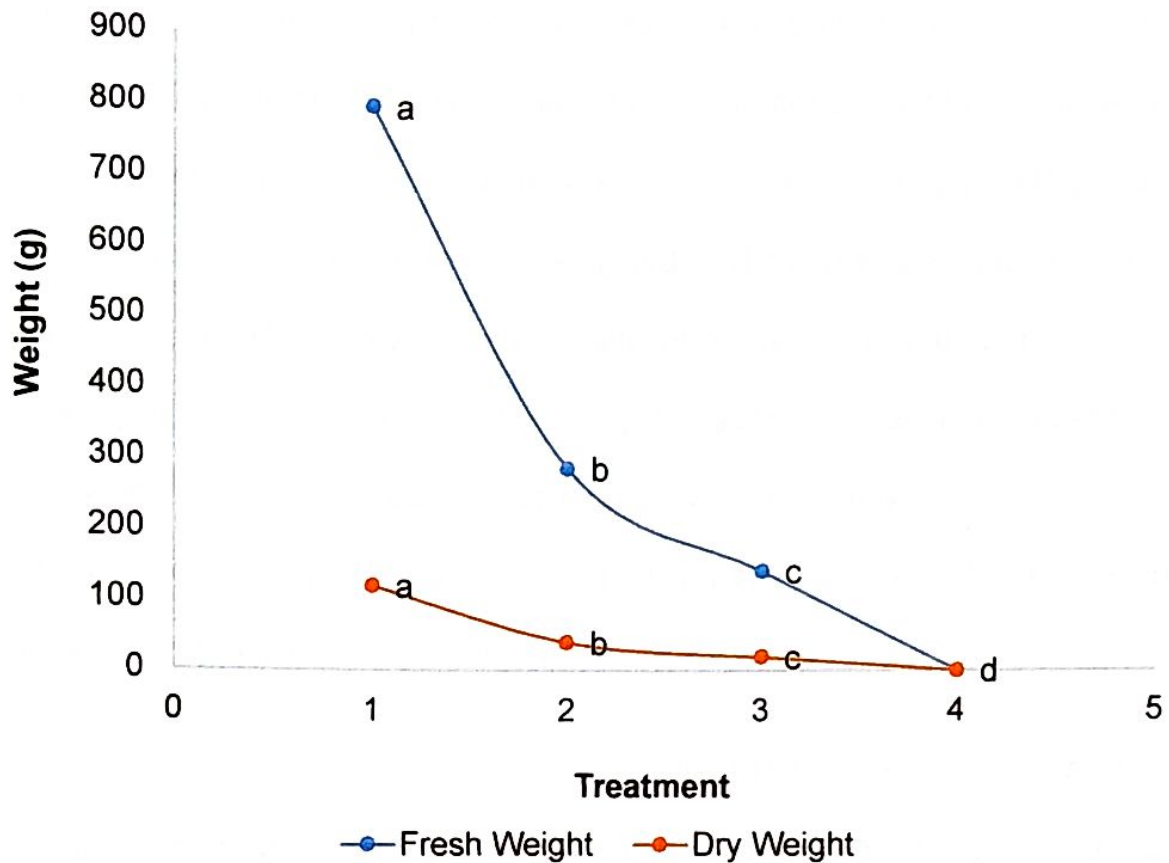


\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Figure 17.2. Panicle Length of Barnyard Grass as Affected by *Lantana* Leaf Extract Concentrations in Screenhouse Condition

Results showed the shortest panicle length on plants treated with 1.92% extract, while the longest was with plants in the control group. However, 1.92% extract showed no significant difference with 2.88% extract. Moreover, plants with 1.92% and 2.88% concentrations were statistically different from the control plants. Barnyard grasses applied with 3.85% *Lantana* extract were already dead before reaching the reproductive stage. This means that *Lantana* leaf extract effectively reduces the reproductive ability of barnyard grass or may kill them before they can reproduce. T2 gave the lightest panicle of 1.77g, while the heaviest was observed in the plants treated with none. T3 and T4 plants were not significantly different, implying that they have similar effects in terms of panicle production. However, they are significantly more effective in suppressing panicle growth than T2 and T1. This indicates that the application of *Lantana* leaf extract effectively controls the barnyard grass population, especially at higher concentrations. The results are in line with Gantayet et al. (2011). This may be due to phenolic compounds leaching from the dust that might have interfered in oxidoreduction reactions, nucleotide biosynthesis, and other vital functions, controlling and preventing gibberellin's biosynthesis and accumulation of growth regulators in the cells. This has caused an inhibitory effect, vegetative growth, and grain development during the reproductive phase, which might have reflected in seed weight.

**Fresh and Dry Matter Weight.** Figure 18 shows barnyard grass's fresh and dry weights as affected by different concentrations of *Lantana* leaf extract in greenhouse conditions.



\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Figure 18. Fresh and Dry Weight of Barnyard Grass as Affected by Different Concentrations of *Lantana* Leaf Extract in Screenhouse Condition

Among treatments, a drastic decrease in fresh and dry weights in all the plants treated with *Lantana* leaf extract was observed. There were no recorded fresh and dry weights of weed plants applied with a 3.85% concentration because they were all dead before the termination of the experiment at the seventh week after the first application. However, the lightest weights were observed on plants treated with 2.88% extract, while the heaviest was the control plants. A highly significant difference among concentrations of *Lantana* leaf extract was recorded in barnyard grass's fresh and dry matter weights. This significant difference implies that *Lantana* leaf extract is good in inhibiting barnyard grass's fresh and dry matter

production, especially at higher concentrations. This result is supported by Das et al. (2012) also observed a reduction in the dry weight of shoot and root at various concentration levels of leachate. In addition, Gentle and Duggin (1997) also reported that *Lantana camara* significantly reduced biomass and was associated with stunted growth of the seedlings (Tripathi et al., 1999 and 2000). The biomass variation in increased concentration may be associated with the release of phytochemicals from the *Lantana camara* powder that may hinder the plant's growth. During the decomposition process, plant secondary metabolites may be altered or/and inhibit the available nutrient for plant growth.

**Soil pH.** Before the study, the soil media used was tested for its initial pH to have a comparative result if the soil was affected by the treatments applied. The initial soil pH was 6.9, a slightly acidic but nearly neutral level of 7.0. The result showed that applying the treatments changes the soil pH towards acidity, as shown in Figure 19.

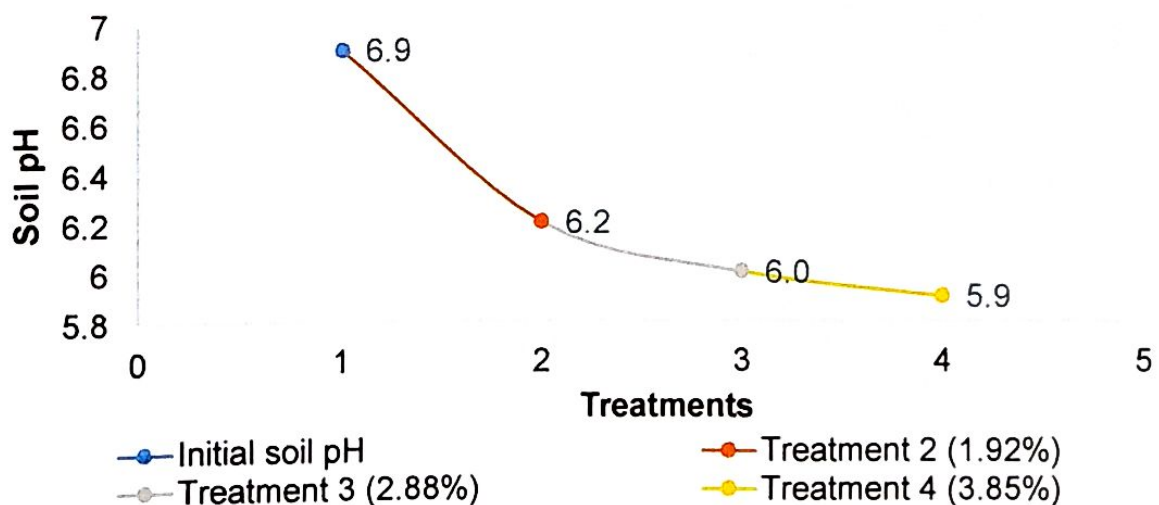


Figure 19. Effects of *Lantana* Leaf Extract on Soil pH

However, this alteration in the soil pH is not subjected to statistical analysis, and it is not conclusive to say the treatments significantly affect the soil pH. However, Sahid and Sugau (1993) reported that *Lantana* could not influence soil fertility, which is closely related to soil pH, wherein nutrients are either available in sufficient or toxic amounts with the increase or decrease of the pH.

## Chapter 3

### SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusions, and recommendations drawn from the findings.

#### Summary of Findings

Results showed that applying *Lantana* leaf extracts was significantly detrimental to barnyard grass in terms of its agronomic characteristics, namely plant height, number of leaves, number of tillers, number of days from transplanting to maturity, panicle length, panicle weight, and dry matter weight. The control exhibited the tallest plants, highest number of leaves and tillers, healthiest plants, longest and heaviest panicles, and heaviest fresh and dry matter weights until the experiment's eighth week. One hundred percent mortality of the test plants was observed on the fourth-week application of the highest extract concentration of 3.85%. However, significant differences in the parameters mentioned were also recorded among treatments one week after application of the extract. Shortest panicle length, least number of leaves and tillers, very poor plant health, longest number of days from transplanting to maturity, and lightest panicle weight were observed on plants with 1.92% extract concentration but not significantly different with 2.88%. It was observed that the treatments could slightly change soil pH towards acidity. These results imply that applying *Lantana* leaf extract can suppress barnyard grass's growth and reproductive ability in the potted experiment and screenhouse condition.

## Conclusions

Based on the results, the following conclusions were drawn:

*Lantana* leaf extracts application in barnyard grass influenced its agronomic characteristics, namely the number of days from transplanting to maturity, plant height, number of leaves, number of tillers, panicle weight, panicle length, fresh and dry matter weight, plant health, and soil pH. Lower concentration for as low as 1.92% of *Lantana* leaf extract inhibited the growth parameters of barnyard grass. However, a higher concentration at 3.85% was more effective in controlling the test plant as it killed the weed before the reproductive stage. Thus, the leaf extract is allelopathic to barnyard grass. There were also significant differences among the concentrations used. It can also change soil pH towards acidity. Therefore, the assumption was rejected.

## Recommendations

Based on the conclusions, the following recommendations were formulated:

1. Other researchers may conduct the same study on field conditions with rice to evaluate the effects of *Lantana camara* from the real farm scenario.
2. It is also recommended to conduct the same study, but statistical analysis of the soil pH may be performed.
3. It is also suggested that the institution may encourage other researchers to study the allelopathy of weeds against other invasive weed species of rice.

## REFERENCES

- Aryantha, I. Cross, R., and Guess, D. (2000). Suppression of *Phytophthora cinnamomic* in potting mixes amended with uncomposted and composted animal manures. *Phytopathology* 90, 775-782
- Baltazar, A. M. (2017). Herbicide-resistant weeds in the Philippines: Status and resistance mechanisms. *Weed Biology and Management*, 17(2), 57–67. Retrieved on March 10, 2022
- Bhadoria P. (2011). Allelopathy: a natural way towards weed management. *Am. J. Exp. Agric.* 1, 7–20.
- Cheema Z. A., and Khaliq A. (2000). Use of sorghum allelopathic properties to control weeds in irrigated wheat in a semi-arid region of Punjab. *Agric. Ecosyst. Environ.* 79, 105–112. 10.1016/S0167-8809(99)00140-1.
- Das, C.R., N.K. Mondal, P. Aditya, J.K. Datta, A. Banerjee and K. Das, (2012). Allelopathic potentialities of Leachates of leaf litter of some selected tree species on gram seeds under laboratory conditions. *Asian J. Exp. Biol. Sci.*, 3(1): 59-65.
- El-Kenany. ET, and El-Darier, SM. (2013). Suppression effect of *Lantana camara* L. aqueous extracts on germination efficiency of *Phalaris minor* Retz. and *Sorghum bicolor* L. (Moench). *J Taibah Univ Sci* 7 (2) : 64 – 71.
- Excerpt from the Office of the President of the Philippines. (2005). [Executive Order No. 401-500]. Manila. Retrieved from [www.officialgazette.gov.ph/2005/12/27/executive-order-no.481-s-2005](http://www.officialgazette.gov.ph/2005/12/27/executive-order-no.481-s-2005).
- FAO. (2014). Grassland species profiles. Retrieved from <http://www.fao.org/ag/AGP/AGPC/doc/Gbase/Default.htm> on March 10, 2022
- Gantayet, PK., Lenka, KC. and Padhy B (2011). Vegetative growth and yield response of Niger (*Guizotia abyssinica*) to leaf- litter dust of *Lantana camara*. *The Bioscan.* 6(2): 207-210.
- Gentle, C.B. and Duggin, J.A. (1997). Allelopathy as a competitive strategy in persistent thicket of *Lantana camara* L. in three Australian forest communities. *Plant Ecol.*, 132: 85-95..
- Gindri, D.M., Coelho, C.M.C., Uarrota, V.G. and Rebelo A.M. (2020). Herbicidal bioactivity of natural compounds from *Lantana camara* on the germination and seedling growth of *Bidens Pilosa*. e-ISSN 1983-4063 - [www.agro.ufg.br/pat](http://www.agro.ufg.br/pat) - *Pesq. Agropec. Trop.*, Goiânia, v. 50, e57746, 2020

- Gniazdowska A. and Bogatek R. (2005). Allelopathic interactions between plants. Multi-site action of allelochemicals. *Acta Physiol. Plant* 27, 395–407. 10.1007/s11738-005-0017-3
- Hossain, M.K., and Alam, N.M.D. (2010). Allelopathic effects of *Lantana camara* leaf extract on germination and growth behavior of some agricultural and forest crops in Bangladesh. *Pakistan J. of Weed Sci. Res.* 16(2):217-226.
- Hussain, F., Ghulam, S., Sher, Z., and Ahmad, B. (2011). Allelopathy by *Lantana camara*. *Pak J Bot* 43 (5) :2373 – 2738.
- Kalinova, J. (2009). Allelopathy and organic farming in sociology, organic farming, climate change and soil science pp.379-418. Retrieved from [https://www.researchgate.net/publication/226151781\\_Allelopathy\\_and\\_Organic\\_Farming](https://www.researchgate.net/publication/226151781_Allelopathy_and_Organic_Farming) on February 16, 2022.
- Kar, I., Ram, V. and Panda, P. (2014). Allelopathic effect of *Lantana camara* on seedling growth behavior of Garden pea (*Pisum sativum* L.). *World J Agric Sci* 10 (5) : 243 – 246.
- Luttikholt, A. (2007). *NJAS- wageningen Journal of Life Science*, [www.sciencedirect.com/science/article/pii/S157352140780008](http://www.sciencedirect.com/science/article/pii/S157352140780008).
- Macias FA, Marin, D., Oliveros-Bastidas, A., Varela, R.M., Simonet, A.M., Carrera C. and Molinillo, J.M. (2003) *Biol Sci Space*. Jun; 17(1):18-23.
- Mishra, A. and Singh, R. (2012): Allelopathic effect of *Lantana camara* extract of different parts on seed germination of *Parthenium hysterophorus* L. – *International Journal of Plant Science* 5: 74-75.
- Open Learning Agency (OLA) and British Columbia Ministry of Agriculture, Food, and Fisheries (MAFF). (2002). *Guide to weeds in British Columbia*. Open Learning Agency. Burnaby, British Columbia, Canada. 195 pp.
- Pesticide Action Network. (2015). Barnyard grass: *Echinochloa spp.* Retrieved from [www.oisat.org/pests/weeds/grasses/barnyard\\_grass.html](http://www.oisat.org/pests/weeds/grasses/barnyard_grass.html) on March 10, 2022
- Qasem JR (2006). Response of onion (*Allium cepa* L.) plants to fertilizers, weed competition duration and planting times in the central Jordan Valley. *Weed Biology and Management* 6 : 212-220.
- Sahid, I.B & Sugau, J.B. (1993). Allelopathic effects of lantana (*Lantana camara*) and siam weed (*Chromolaena odorata*) on selected crops. *Weed Science*, 41(2): 303-308.

- Samreen, U., F. Hussain and Z. Sher. (2009). Allelopathic potential of *Lantana camara*, Pak. J. Pl. Sci., 15(1):7-14.
- Saxena, K.M. (2000). Aqueous leachate of *Lantana camara* kills water hyacinth. Journal of Chemical Ecology 26 (10): 2435-2447.
- Singh H. P., Batish D. R., and Kohli R. K. (2003). Allelopathic interactions and allelochemicals: new possibilities for sustainable weed management. Crit. Rev. Plant Sci. 22, 239–311.
- Taylor, S. and Kumar, L. (2013). Potential distribution of an invasive species under climate change scenarios using CLIMEX and soil drainage: a case study of *Lantana camara* L. in Queensland, Australia. Journal of Environmental Management, 114:414-422.  
<http://www.sciencedirect.com/science/journal/03014797>
- Taylor, S. Kumar L. and Reid N, (2012). Impacts of climate change and land-use on the potential distribution of an invasive weed: a case study of *Lantana camara* in Australia. Weed Research (Oxford), 52(5):391-401.
- Tripathi, S., A. Tripathi and D.C. Kori, (1999). Allelopathic evaluation of *Tectona grandis* leaf, root and soil aqueous extracts on soybean. Indian J. Forestry, 22: 366-374.
- Tripathi, S., A. Tripathi, D.C. Kori and S. Paroha, (2000). The effect of *Dalbergia sisso* extracts, rhizobium and nitrogen on germination growth and yield of *Vigna radiata*. Allelopathy J., 7: 255-263.
- Wongsriphuek, C., B.D. Dugger, and A.M. Bartuszevige. (2008). Dispersal of wetland plant seeds by mallards: influence of gut passage on recovery, retention, and germination. Wetlands 28(2): 290—299.
- Zeng R. (2008). "Allelopathy in Chinese ancient and modern agriculture," in Allelopathy in Sustainable Agriculture and Forestry, eds Zeng R., Mallik A., Luo S. (New York: Springer New York Press;), 39–59.
- Zeng R. S., Luo S. M., Shi Y. H., Shi M. B. and Tu C. Y. (2001). Physiological and biochemical mechanism of allelopathy of secalonic acid F on higher plants. Agron. J. 93, 72–79. 10.2134/agronj2001.93172x
- Zhung, M., Ling, B., Kong, C., Liang, G. and Dong Y (2005). Allelopathic effect of lantana (*Lantana camera* L) on Water hyacinth (*Eichomea crasspes solum*). Allelopathy J. 15: 125-130.
- Zimdahl R. L., (2018). Fundamental of weed science. Academic Press.

## **APPENDICES**

## LIST OF APPENDIX TABLE

Appendix A. ANOVA Table of Weekly Height Increment of Barnyard Grass

Treatment	Weekly Height Increment (cm)						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
1 (control)	27.71a	50.33a	65.53a	75.70a	92.03a	98.78a	107.37a
2 (20%)	16.50b	40.34b	56.83b	66.25b	76.92b	78.08b	79.83b
3 (30%)	21.22ab	42.30b	58.13b	61.88b	70.63b	70.97c	71.88c
4 (40%)	-4.67 c	-3.25c	-3.42c	0.00c	0.00c	0.00d	0.00d
CV = %	29.07	12.11	7.05	5.93	6.91	5.8	5.63

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix B-1. ANOVA Result on Weekly Height Increment of Barnyard Grass Week 1

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	2356.9711	786.657	40.28	0.0000**
Error	12	234.0509	19.5045		
Total	15	2591.022			

*\*\*= highly significant*

Appendix B-2. Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 1

Treatment	means	N	Group
1	27.71	4	A
2	16.50	4	B
3	21.22	4	Ab
4	-4.67	4	C

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix C-1. ANOVA Result on Weekly Height Increment of Barnyard Grass Week 2

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	2356.9711	786.657	40.28	0.0000**
Error	12	234.0509	19.5045		
Total	15	2591.022			

*\*\*= highly significant*

Appendix C-2. Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 2

Treatment	means	N	group
1	50.33	4	a
2	40.34	4	b
3	42.30	4	b
4	-3.25	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix D-1. ANOVA Result on Weekly Height Increment of Barnyard Grass Week 3

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	12306.0865	4102.0288	420.72	0.0000**
Error	12	116.9996	9.7500		
Total	15	12423.0862			

*\*\*= highly significant*

Appendix D-2. Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 3

Treatment	Means	N	group
1	65.53	4	a
2	56.83	4	b
3	58.13	4	b
4	-3.44	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix E1. ANOVA Result on Weekly Height Increment of Barnyard Grass Week 4

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	14249.0979	4979.6993	519.90	0.0000**
Error	12	109.3600	9.1358		
Total	15	14358.7279			

*\*\*= highly significant*

Appendix E-2. Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 4

Treatment	Means	N	group
1	75.70	4	a
2	66.25	4	b
3	61.88	4	b
4	0.00	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix F-1. ANOVA Result on Weekly Height Increment of Barnyard Grass Week 5

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	19310.4914	6436.8305	370.38	0.0000**
Error	12	208.5491	17.3791		
Total	15	19519.0405			

*\*\*= highly significant*

Appendix F-2. Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 5

Treatment	Means	N	group
1	92.03	4	a
2	76.92	4	b
3	70.63	4	b
4	0.00	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix G-1. ANOVA Result on Weekly Height Increment of Barnyard Grass Week 6

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	22144.0326	7381.3442	571.77	0.0000**
Error	12	154.9154	12.9096		
Total	15	22298.9480			

*\*\*= highly significant*

Appendix G-2. Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 6

Treatment	Means	N	group
1	98.78	4	a
2	78.08	4	b
3	70.97	4	c
4	0.00	4	d

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix H-1. ANOVA Result on Weekly Height Increment of Barnyard Grass Week 7

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	25.184.6659	8382.8886	629.74	0.0000**
Error	12	159.7406	13.3117		
Total	15	25308.4065			

*\*\*= highly significant*

Appendix H-2. Least Significant Difference (LSD) Test Result on Weekly Height Increment of Barnyard Grass Week 7

Treatment	Means	N	group
1	107.37	4	a
2	79.83	4	b
3	71.88	4	c
4	0.00	4	d

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix I. ANOVA Table Weekly Number of Leaves of Barnyard Grass

Treatment	Weekly Number of Leaves						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
1 (control)	5.17a	10.83a	19.25a	41.75a	58.58a	74.75a	94.96a
2 (20%)	3.23ab	7.67ab	10.34b	41.75a	41.84c	65.85b	80.49b
3 (30%)	2.42b	5.50bc	8.09b	25.92a	33.67c	48.33	71.33c
4 (40%)	1.25b	2.43c	2.75c	0.00b	0.00d	0.00cd	0.00d
CV = %	46.6	44.92	32.76	46.36	18.15	21.46	13.06

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix J-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 1

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	32.6231	10.8744	3.73	0.0419*
Error	12	34.9728	2.9144		
Total	15	67.5960			

\*= significant

Appendix J-2. Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 1

Treatment	means	N	group
1	5.17	4	a
2	3.23	4	ab
3	2.42	4	b
4	1.25	4	c

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix K-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 2

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	150.5478	50.1826	5.70	0.0116**
Error	12	105.7199	8.8100		
Total	15	256.2677			

\*\*= highly significant

Appendix K-2. Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 2

Treatment	means	N	group
1	10.83	4	a
2	7.67	4	ab
3	5.50	4	bc
4	2.43	4	c

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix L-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 3

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	567.2943	189.0981	17.25	0.0001**
Error	12	131.5158	10.9599		
Total	15	698.8128			

\*\*= highly significant

Appendix L-2. Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 3

Treatment	means	N	group
1	19.25	4	a
2	10.34	4	b
3	8.09	4	b
4	2.75	4	c

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix M-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 4

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	4659.4371	1553.1457	6.53	0.0072**
Error	12	2852.6775	237.7231		
Total	15	7512.1146			

\*\*= highly significant

Appendix M-2. Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 4

Treatment	means	N	group
1	41.75	4	a
2	41.75	4	a
3	25.92	4	b
4	0.00	4	c

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix N-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 5

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	7283.5211	2427.8404	65.60	0.0000**
Error	12	444.1119	37.0093		
Total	15	7727.6330			

\*\*= highly significant

Appendix N-2. Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 5

Treatment	means	N	group
1	58.58	4	a
2	41.84	4	b
3	33.67	4	b
4	0.00	4	c

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix O-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 6

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	13344.6954	4448.2318	43.27	0.0000**
Error	12	1233.4796	102.7900		
Total	15	14578.1750			

\*\*= highly significant

Appendix O-2. Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 6

Treatment	means	N	group
1	74.75	4	a
2	65.58	4	b
3	48.33	4	c
4	0.00	4	d

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix P-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 7

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	21436.04999	7145.3500	110.10	0.0000**
Error	12	778.7958	64.8996		
Total	15	22214.8456			

\*\*= highly significant

Appendix P-2. Least Significant Difference (LSD) Test Result on Weekly Number of Leaves of Barnyard Grass Week 7

Treatment	means	N	group
1	94.96	4	a
2	80.49	4	b
3	71.33	4	c
4	0.00	4	d

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix Q. ANOVA Table Weekly Number of Tillers of Barnyard Grass

Treatment	Weekly Number of Tillers						
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
1 (control)	2.83a	4.08a	6.83a	15.00a	16.50a	19.84a	23.83a
2 (20%)	2.17a	2.42b	4.08b	5.58a	5.75b	6.50b	7.42b
3 (30%)	2.17a	2.25b	3.50b	4.92a	5.08b	5.42c	6.25b
4 (40%)	0.83b	0.83c	0.83c	0.00c	0.00c	0.00d	0.00c
CV = %	25.42	21.74	26.46	13.95	13.96	15.08	10.49

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix R-1. ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 1

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	32.6231	10.8744	3.73	0.0419*
Error	12	34.9728	2.9144		
Total	15	67.5960			

\*= significant

Appendix R-2. Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 1

Treatment	means	N	group
1	2.83	4	a
2	2.17	4	a
3	2.17	4	a
4	0.83	4	b

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix S-1. ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 2

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	150.5478	50.1826	5.70	0.0116**
Error	12	105.7199	8.8100		
Total	15	256.2677			

*\*\*= highly significant*

Appendix S-2. Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 2

Treatment	means	N	group
1	4.08	4	a
2	2.42	4	b
3	2.25	4	b
4	0.83	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix T-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 3

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	567.2943	189.0981	17.25	0.0001**
Error	12	131.5158	10.9599		
Total	15	698.8128			

*\*\*= highly significant*

Appendix T-2. Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 3

Treatment	Means	N	group
1	6.83	4	a
2	4.08	4	b
3	3.50	4	b
4	0.83	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix U-1. ANOVA Result on Weekly Number of Leaves of Barnyard Grass Week 4

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	4659.4371	1553.1457	6.53	0.0072**
Error	12	2852.6775	237.7231		
Total	15	7512.1146			

*\*\*= highly significant*

Appendix U-2. Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 4

Treatment	means	N	group
1	15.00	4	a
2	5.58	4	b
3	4.92	4	b
4	0.00	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix V-1. ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 5

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	7283.5211	2427.8404	65.60	0.0000**
Error	12	444.1119	37.0093		
Total	15	7727.6330			

*\*\*= highly significant*

Appendix V-2. Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 5

Treatment	means	N	Group
1	16.50	4	a
2	5.75	4	b
3	5.08	4	b
4	0.00	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix W-1. ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 6

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	13344.6954	4448.2318	43.27	0.0000**
Error	12	1233.4796	102.7900		
Total	15	14578.1750			

*\*\*= highly significant*

Appendix W-2. Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 6

Treatment	means	N	group
1	19.84	4	a
2	6.50	4	b
3	5.42	4	c
4	0.00	4	d

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix X-1. ANOVA Result on Weekly Number of Tillers of Barnyard Grass Week 7

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	21436.04999	7145.3500	110.10	0.0000**
Error	12	778.7958	64.8996		
Total	15	22214.8456			

*\*\*= highly significant*

Appendix X-2. Least Significant Difference (LSD) Test Result on Weekly Number of Tillers of Barnyard Grass Week 7

Treatment	means	N	group
1	23.83	4	a
2	7.42	4	b
3	6.52	4	c
4	0.00	4	d

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix Y. Average Number of Days from Transplanting to Maturity

Treatment	Number of days to maturity
1 (control)	37.5b
2 (20%)	57.25a
3 (30%)	59.75a
4 (40%)	0c
CV = %	4.29

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix Z-1. ANOVA Result on Number of Days from Transplanting to Maturity of Barnyard Grass

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	9145.2500	30.4167	1108.52	0.0000**
Error	12	33.0000	2.7500		
Total	15	9178.2500			

**\*\*= highly significant**

Appendix Z-2. Least Significant Difference (LSD) Test Result on Number of Days from Transplanting to Maturity of Barnyard Grass

Treatment	means	N	group
1	37.50	4	b
2	57.25	4	a
3	59.75	4	a
4	0.00	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix A.A. ANOVA Table of Panicle Weight and Length

Treatment	Panicle Weight (g) and Length (cm)	
	Weight (g)	Length
1 (control)	18.87a	9.89a
2 (20%)	14.79b	4.25b
3 (30%)	15.00b	1.77bc
4 (40%)	0.00c	0.00c
CV = %	14.44	44.97

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix A.B-1. ANOVA Result on Panicle Weight (g) of Barnyard Grass

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	223.0395	74.3456	23.22	0.0000**
Error	12	38.4191	3.2016		
Total	15	261.4586			

\*\*= highly significant

Appendix A.B-2. Least Significant Difference (LSD) Test Result on Panicle Weight (g) of Barnyard Grass

Treatment	Means	N	group
1	18.87	4	a
2	14.79	4	b
3	15.00	4	b
4	0.00	4	c

\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.

Appendix A.C-1. ANOVA Result on Panicle Length (cm) of Barnyard Grass

Source	DF	Sum of Square	Mean Square	F Value	Pr (>F)
Treatment	3	831.4317	277.1439	89.87	0.0000**
Error	12	37.0073	3.0839		
Total	15	868.4390			

\*\*= highly significant

Appendix A.C-2. Least Significant Difference (LSD) Test Result on Panicle Length (cm) of Barnyard Grass

Treatment	Means	N	group
1	9.89	4	a
2	4.25	4	b
3	1.77	4	bc
4	0.00	4	c

*\*Means followed by the same letters are not significantly different at  $P < 0.05$  according to LSD test.*

Appendix A.D. Soil pH

Treatment	Soil pH
Initial	6.9
Treatment 2 (20%)	6.2
Treatment 3 (30%)	6.0
Treatment 4 (40%)	5.9

## LIST OF APPENDIX FIGURES



Republic of the Philippines  
**BOHOL ISLAND STATE UNIVERSITY-BILAR**  
 Zamora, Bilar Bohol  
**COLLEGE OF AGRICULTURE AND NATURAL RESOURCES**



February 11, 2022

**MARIETTA C. MACALOLOT, PH. D**  
 Campus Director  
 Bohol Island State University  
 Zamora, Bilar, Bohol

Dear Ma'am,

Greetings of Peace!

I am Junry M. Naypa, a fourth year Bachelor of Science in Agriculture student of the College of Agriculture and Natural Resources.

At the highest stage of student life, there is a chapter to look forward to which is research making. Long before I decided to take Agriculture, I have been very eager to do research in this field so I could further my knowledge and expertise.

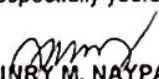
In view hereof, I sincerely request permission from your good office to conduct my thesis in the campus for the following reasons:

1. There is no suitable site to conduct our study in our locality;
2. Renting a paddy field outside the campus will need additional budget; and
3. The research needs a Laboratory for seed germination testing, which is found in the campus.


Rest assured that school rules and regulations, as well as, IATF standard health protocols will be strictly followed while research is conducted.


I am looking forward for your favorable response in this request.

Respectfully yours,

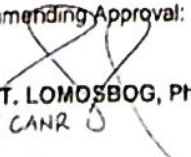
  
**JUNRY M. NAYPA**  
 Student Researcher

Noted:

  
**NIDA B. RATILLA, MSc**  
 Adviser

  
**WILSON U. LLEGUNAS, PhD**  
 Chairperson, Agriculture Department

Recommending Approval:

  
**NOEL T. LOMOSBOG, PhD**  
 Dean, CANR

Approved:

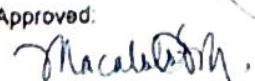
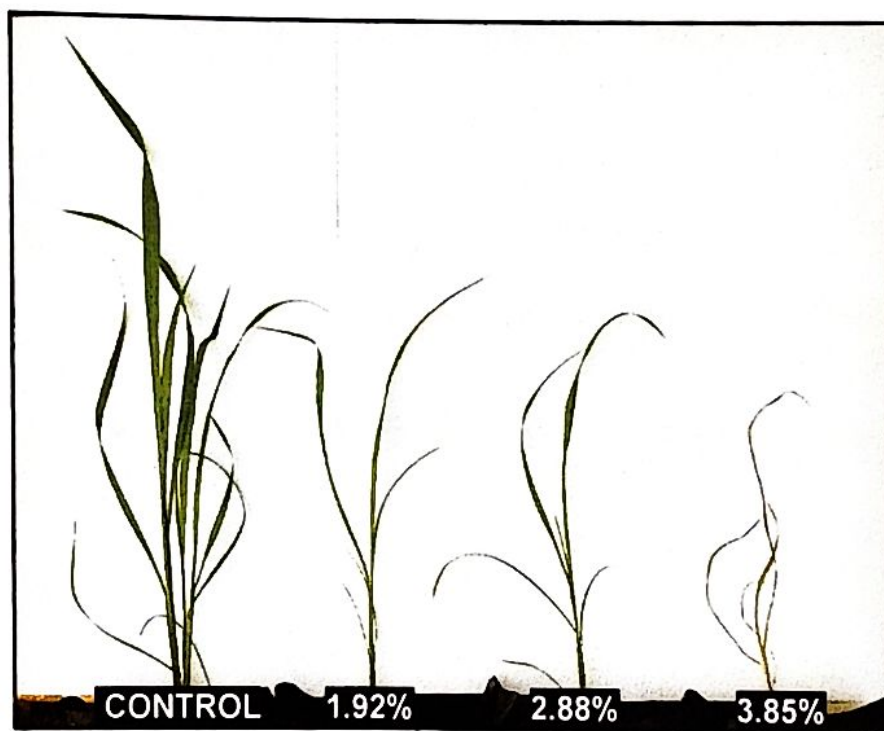
  
**MARIETTA C. MACALOLOT, PhD**  
 Campus Director

FIGURE A.E. Letter of Approval to Conduct Research Inside Campus Premises



Appendix A.F. Fourteen Days Old after Transplanting Barnyard Grass Height Affected with Different Concentration of Leaf Extract



Appendix A.G. Barnyard Grass Applied with 3.85% Concentration at 48 Hours Observation Showing Wilting after First Application



Appendix A.H. Barnyard Grass Applied with the Extract Showing Leaf Chlorosis after First Application



Appendix A.I. Barnyard Grass Applied with the Extract Showing Leaf Tip Browning after Second Application



Appendix A.J. Barnyard Grass Applied with the Extract Showing Weak Stem



Appendix A.K. Barnyard Grass Applied with the Extract Showing Shriveled or Necrotic Leaf