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i

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EVALUATION OF WOOD FIBERS DERIVED FROM DIFFERENT TREE SPECIES AND PROCESSING METHODS ON CROP GROWTH AND MICROBIAL ACTIVITY IN SOILLESS SUBSTRATES

A Thesis

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Master of Science

in

The School of Plant, Environmental, and Soil Sciences

by Amanda Nicole Mizell B.S., Southeastern Louisiana University, 2021 December 2024 **Title Page** Bottom Portion Includes Previous Degrees Earned, the Institution, and the Year

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Figure and Table Titles Must Match EXACTLY



Figure 1.1. BPB symptoms on Bengal rice variety at maturity stage grown under greenhouse conditions. A and B) The rice plants exhibited panicle discoloration and grain rotting. C) The rice sheath and stems showing long vertical grayish lesions surrounded by a dark reddish-brown margin. The rice plants were inoculated using toothpick method developed in the laboratory. An overnight culture of *B. glumae* 336gr-1strain grown in LB plate, was inoculated during the booting stage by pricking the toothpick containing the inoculum in the stems of the rice plants.

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ABSTRACT

Soilless culture use is expanding as arable land and viable fumigants have decreased in availability. This has subsequently increased the demand for soilless substrates for container crop production. The primary component in most soilless substrates is Sphagnum peat moss, which is considered unsustainable due to the extensive time it takes to produce and the release of large amounts of carbon into the atmosphere during harvesting. Research into viable peat moss amendments to reduce reliance on this relatively non-renewable material has become a necessity. The most promising amendment that has been accepted in the horticulture industry as a viable amendment is wood fiber. However, there is still concern surrounding characteristics of wood fiber, such as nitrogen immobilization. Nitrogen immobilization is when microorganisms break down wood fiber by consuming carbon and utilizing nitrogen, which can cause plant nutrient deficiencies. This process can be influenced by many factors, including moisture, temperature, the processing method used for the wood material, and the tree species in which the wood fiber was derived from. To expand the research on wood fibers and how these different factors impact the biological stability of wood fiber substrates, the following thesis was conducted. Three projects were formulated to test wood fibers derived from six different tree species (Abies concolor, Calocedrus decurrens, Pinus lambertiana, Psuedotsuga menziesii, Pinus ponderosa, and Pinus taeda) and two different processing methods (disc-refining and hammermilling) under different moisture and temperature levels. The biological stability of the substrates was tested by assessing CO2 respiration rates and microbial community abundance, and growth trials were conducted to evaluate plant health and development. It was concluded that tree species, moisture level, temperature, and wood fiber processing influence biological stability of substrates and crop health. A commercial 85:15 peat:perlite substrate amended with 30% (vol.) hammermilled

Abstract

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Body

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Chapter 1. Introduction

1.1. Bacterial panicle blight and sheath blight of rice

There is a growing demand for food production across the globe. There are projections that put the global population at 9.1 billion by 2050. This projection would require raising overall food production by 70%, which implies significant increases in the production of several key commodities. For example, annual cereal production would have to grow by almost one billion tons. Rice (*Oryza sativa* L.) is the staple food of almost 3.5 billion people worldwide. An estimated amount of 715 million metric tons of paddy rice are produced annually in more than 100 countries including countries from Asia, North and South America, European Union, Middle East, and Africa (Muthayya et al., 2014).

Rice in the United States are mainly produced in six states, namely Arkansas, California, Louisiana, Missouri, Texas, and Mississippi (McBride et al., 2018). In 2018, the United States produced more than 224,000 metric tons (MT) of rice. In Louisiana, rice is grown on approximately 161,874 hectares each year and the annual crop is valued around \$360 million. Both the production and processing of rice play an important role in the state economy by generating \$200 million and accounting for thousands of jobs. Rice is also one of the state's top agricultural exports. However, such production is highly affected by abiotic and biotic factors. Globally, estimated yield losses due to pest and diseases accounting to 37% has been reported by the International Rice Research Institute, which can still increase depending on the production situation (Sparks et al., 2012). Bacterial panicle blight (BPB) and sheath blight are major rice diseases, which cause significant economic impacts worldwide chronically (Nandakumar et al., 2009) (Uppala et al., 2018).

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Chapter 3. Experiment 1 Results

3.1. Univariate Results

The univariate analyses served three primary purposes. The first was to ensure that eye movements during the study phase of the spatial reconstruction and object recognition tasks differed in the expected manner, such that fewer item-to-item transitions ("visits"), more intravisit fixations, and longer fixation durations occurred during the object task. The second purpose of the univariate analyses was to examine whether we were able to replicate the acrossparticipant correlations between study-phase eye movements and spatial reconstruction performance shown in Lucas et al (2019) and Lucas et al (2023). Finally, the third purpose was to examine whether similar correlations would be present in the object recognition task. **3.1.1. Task comparisons of study-phase eye movements**.

As predicted, the results of the paired t-tests comparing viewing behaviors between the two tasks revealed that significantly more visits between objects occurred during the spatial reconstruction task (M = 18.76, sd = 4.17), as compared to the object recognition task (M = 15.47, sd = 4.30), t(59) = 7.17, p < .001, Cohen's d = .78. Participants also made significantly fewer fixations within the same visit to an object during the spatial reconstruction task (M = 1.56, sd = .82) in comparison to the object recognition task (M = 2.10, sd = 1.13), t(59) = 7.77, p < .001, Cohen's d = .45. Finally, participants made significantly shorter fixations during the spatial task (M = 295.36, sd = 54.02) than during the object task (M = 309.92, sd = 63.84), t(59) = 4.51, p < 0.001, Cohen's d = .23). Violin plots depict the distribution of univariate eye movement behaviors in Figure 3. Overall, these results confirm that participants tailored their study-phase eye movements to the demands of the upcoming memory test, and that these changes included



Figures and Tables

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Figures and Tables



Figure 1.6. Seed priming overview.

One example is the biopriming of rice seeds using strains of Bacillus, Serratia and

Pseudomonas in reducing the disease severity of Magnaporthe oryzae L. (Amruta et. al., 2019).



Figure 1. Example of a 10-Variable Partial Correlation Network Structure Note Latters AP represent answares used in a hypotherical control analysis and are referred to as the "modes" of the network. The lines that connect the nodes, also called "edges," represent partial correlation coefficients between any two nodes that are connected. Blue edges represent partial correlation coefficients presents the structure of the structure of the structure of the nodes, whereas even of edges represent an agaptive correlation between two nodes, distinguily (e.g. hickness) represents the structure of partial correlations (e.g. the theoret in each, the structure the correlation).

Recently, network analyses have been utilized for research of suicidal thoughts and

Table 2. TOE and CEF used for the study

Item	Ton of Oil Equivalent(TOE)	Carbon Emission Factor
	value	(CEF) value
Diesel	0.000845	0.837
Gasoline	0.000740	0.783
Electricity	0.000249	0.233

Source: Intergovernmental Panel on Climate Change (IPCC) 2006

Table 3. Corresponding respiratory rates and levels of activity for Laborers

Activity Level	Respiratory Rate (Breaths	Net Respiratory Rate
Activity Level	per minute)	(Breaths per minute)
Idle	12	0
Low	18	6
Medium	28	16
High	34	22
Intensive	40	28

Source: Int Panis et al., (2010) and Lauralee Sherwood, (2006)

4.1. Carbon Emissions

Carbon emissions generated during the project's construction phase are calculated and visualized



Notes: The graph values are for CANES measures of self-reported voter turnout (turnout = 1) and Mark Frank's (2 2009) compiled state Gini coefficient measures (1974 – 2020). follows: 1 = terrible, 2 = unhappy, 3 = mostly dissatisfied, 4 = mixed (about equally satisfied and

dissatisfied), 5 = mostly satisfied, 6 = pleased, and 7 = delighted. Scores on the BMSLSS are

Table 3. Descriptive Risk Cutoffs on the BESS-SF

Index			Descriptiv	e Category		
	Norm	al Risk	Elevat	ed Risk		y Elevated isk
	Age	Score	Age	Score	Age	Score
		Range		Range		Range
Internalizing Risk Index						
	8-11	0-11	8-11	12-16	8-11	17-30
	12-14	0-12	12-14	13-19	12-14	20-30
	15-18	0-13	15-18	14-22	15-18	23-30
Self-Regulation Index						
-	8-18	0-8	8-11	9-13	8-11	14-18
			12-18	9-12	12-18	13-18
Personal Adjustment Risk Index						
	8-11	13-24	8-11	8-12	8-14	0-7
	12-18	13-18	12-14	8-11	15-18	0-6
			15-18	7-11		

Source: Reynolds and Kamphaus (2015)

Table 8.1. Modes of political participation ranking of CANES alternative dependent variable measures

Participation mode	Initiative required	Skills/Resource demand	Group cooperation
Influence vote	Little	Little	Little
Wear button	Little	Some	Some
Attend meeting/rally	Some/much	Great	Some/much
Political donation	Great	Substantial	Much/great
Work for campaign	Substantial	Substantial	Substantial

Independent variable: State income inequality. My primary independent variable is

income inequality measured at the state level. I utilize the Gini coefficient as my main state income



Landscaped Figures and Tables



Figure 3.3. Schematic of the experimental configuration utilized in this study. The overflow reservoir is just used in the setup running stage for collecting overflows from the RS washing, setup priming, and cell seeding procedures and is removed from the setup later. The media arbitrary of the setup is during experiment initiation and media change steps as a reservoir for fresh media and for collecting old media from the bioreactor during the media change procedure.

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Table 4.2. Gamification Referenced in Literature

Author (Year)	Education Method	Teaching Style	Names Teaching Style/Learning Theory
Adams & Makra-	Attacker-centric	Performative,	Yes ("gamification" - performative teaching style,
malla (2015)	gamification	Technological	technological teaching style)
Alqahtani & Kavakli-	CybAR	Investigative,	Yes (situated learning theory, "constructivist" - co
Thorne (2020)		Performative,	nitive learning theory, "game-based" - performativ
		Technological	teaching style, technological teaching style, "inqui
			learning" - investigative teaching style)
Arachchilage &	Self-efficacy gamifica-	Performative,	Yes ("gamification" - performative teaching style,
Hameed (2017)	tion	Technological	technological teaching style)
Bahrini et al. (2019)	Make my phone	Investigative,	Yes ("gamification" - performative teaching style,
	secure!	Performative,	technological teaching style)
		Technological	
Balon & Baggili	Cybercompetitions	Deliberative,	Yes ("gamification" - deliberative teaching style,
(2023)		Performative,	performative teaching style, technological teaching
		Technological	style)
Bhardwaj (2019)	Cyber Air-Strike	Expositive, Perfor-	Yes ("gamification" - performative teaching style,
		mative, Technolog-	technological teaching style)
		ical	
Chothia et al. (2017)	Story based cyber-	Individualistic,	Yes ("gamification" - performative teaching style,
	security education	Investigative,	technological teaching style)
	VM	Performative,	
		Technological	
Deeb & Hickey (2019)	Escape the Room	Expositive, Perfor-	Yes ("gamification" - performative teaching style,
	game	mative, Technolog-	technological teaching style)
		ical	
Filippidis et al.	Cyber Hygiene	Associative, Delib-	Yes ("gamification" - deliberative teaching style,
(2022)		erative, Performa-	performative teaching style)
	1	tive	

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References

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[Sample vita]

Susan Mary Alford, born in Topeka, Kansas, worked as a newspaper reporter for several years in Oklahoma after receiving her bachelor's degree from the University of Kansas. She began to work as a volunteer for local and national political campaigns. As her interest in politics grew, she decided to enter the Department of Political Science at Louisiana State University. Upon completion of her master's degree, she will begin work on her doctorate.

VITA

Vita **One or Two Biographical** Paragraphs, Written in 3rd Person Alternatively, May Include a Curriculum Vitae



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Spring Calendar 2025

Note: The Office of the Bursar must receive your payments by December 16, 2024, or you will lose your scheduled courses. Fee bills are not mailed to you. Pay fees through your MyLSU account or at the Office of the Bursar. Candidates for degree should access the Application for Degree form before the January 24 deadline at: https://www.lsu.edu/graduateschool/students/grad_student_forms.php

Month	Date	Event
January	10	International Student Orientation (Please check ISO website for dates)
	13	Classes begin, 7:30 a.m.
	20	Martin Luther King Day Holiday
	27	Final date for dropping courses without receiving a grade of "W," 4:30 p.m. deadline
	28	Final date for adding courses for credit (including 8000 & 9000) and making section changes, Degree Only 4:30 p.m. deadline. Final date for submitting change to pass/fail grading audit
	28	Final date for *Degree Only: it is suggested that documents be uploaded at least two (2 weeks prior to this date to ensure editors' final approval by the January 23 4:30p.ms deadline. All degree requirements must be met in the previous semester: final defense reports, document approval forms, Survey of Earned Doctorates completion certificates and Declaration of Co-Authors (if applicable). Also, departments must submit fina defense reports for non-thesis students by 4:30 p.m.
	31	Final date for submitting to the Graduate School the Application for Degree for spring commencement, 4:30 p.m. deadline
	31	Final date for submitting to the Graduate School Request for Final Defense (comprehensive exam, thesis/dissertation defense) for degrees to be awarded at spring commencement, 4:30 p.m. deadline. Note : All final defense requests must be submitted 3 weeks prior to the date of the defense, but no later than January 24.
March 3	3	Mardi Gras holiday begins, 7:30 a.m.
	5	Classes resume, 12:30 p.m.
	28	Final date for dropping courses/resigning from the university, 4:30 p.m. deadline.
	31	Spring Break begins, 7:30 a.m.
April	3	Thesis and Dissertation <u>Uploading</u> deadline. All thesis and dissertations of the current semester's graduates must be <u>committee approved and uploaded</u> to the Graduate School's Digital Commons site by 4:30 p.m. In addition, all degree requirements must be met. Dissertation Title Deadline : Any changes to dissertation titles turned in after this date will not be reflected in the commencement guide at
		graduation.
	7	Classes resume, 7:30 a.m.
	TBD	Course scheduling for fall semester and winter session begins 5:00 p.m.
	24	Final Resolution of Editors' Requested Corrections to Theses and Dissertations. All final revisions requested by the editor must be uploaded to Digital Commons by 4:30 p.m. Also, departments must submit final defense reports for non-thesis students by 4:30 p.m.
	18	Good Friday Holiday
May	3	Classes end, 10:00 p.m.
	5	Final examinations begin
	10	Final examinations end
	13	Final grades due (degree candidates), 9:00 a.m. deadline
	14	Final grades due (non-degree candidates), 9:00 a.m. deadline
	16-17	Commencement activities

**Final exams must have been taken in a previous semester. See "degree-only" registration in the Graduate Section of the General Catalog. Revised 7/2024

Graduate School Calendar

April 3 = Uploading Deadline

April 24 = Date for Final Resolution



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Linda K. Levy Thesis Editor <u>llevy@lsu.edu</u>

