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EXPERIENTIAL LEARNING IN AGRICULTURE WASTE MANAGEMENT: INSIGHTS FROM COIR PITH AND VERMICOMPOSTING ENDEAVOURS AT COLLEGE OF AGRICULTURE, AMBALAVAYAL, WAYANAD

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---ABSTRACT---
This paper delves into the Experiential Learning Programme on Agriculture Waste Management of the 2018 batch of B.Sc. (Hons) Agriculture students at the College of Agriculture, Ambalavayal, Wayanad. The programme sought to grant students an immersive experience in agricultural waste management, focusing on coir pith composting and vermicomposting. Highlighted in this paper are the day-to-day student activities in coir-pith and vermicomposting units, a deep dive into the composting processes, chemical and financial analysis. The study concludes by emphasizing the potential implications of the programme for sustainable agricultural practices and underscores the importance of further research in this domain.
INDEX TERMS - *Agricultural waste, Coir-pith, Composting technology, Soil health*---

1.INTRODUCTION

Agricultural education stands at the crossroads of traditional farming practices and innovative research, laying the foundation for sustainable agriculture's future. Central to this ethos is the experiential learning model, encapsulated in module ELCP 4204, which delves into the critical domain of Agricultural Waste Management. As environmental awareness grows, the sustainable management of agricultural detritus – ranging from field residues to agro-industrial remnants – emerges as both an environmental imperative and an economic opportunity.

Coir Pith Composting and Vermi composting technology have risen to the forefront as promising strategies in waste management. While the former leverages the coconut industry's coir husk by-product, refining its intrinsic challenges to render it an agricultural boon, the latter harnesses earthworms' natural recycling abilities to transform organic waste into a nutrient-rich vermicompost. These methods, in their essence, represent a merger of environmental stewardship and organic agricultural advancement.[1],[2]

However, the adoption of any agricultural practice, especially those rooted in sustainability, requires a dual assessment: environmental and economic. The need to measure the quality of the resultant compost is pivotal, ensuring it meets agronomic standards. Concurrently, understanding the financial dimensions, underscored by tools like the Benefit-Cost Ratio (BCR), becomes essential. Such an analysis not only reveals the economic viability of these methods but also aids stakeholders in navigating their choices in sustainable waste management.

This publication, a product of the experiential learning undertaken in the 8th semester of B.Sc. (Hons.) Agriculture, endeavours to dissect these innovative waste management techniques, examining their efficacy, challenges, and potential to reshape sustainable agriculture's landscape.

2.METHODOLOGY

2.1 Assessment of Experiential Learning Program and Student Experiences

2.1.1 Research Design

The research design employed for this study is a mixed-methods approach, combining both qualitative and quantitative research methods to comprehensively analyse the Experiential Learning Programme on Agriculture Waste Management. This approach allows for a holistic understanding of the program's impact, student experiences, and the scientific aspects of composting.

2.1.2 Sampling and Participants

The study focuses on the 2018 batch of B.Sc. (Hons) Agriculture students at the College of Agriculture, Ambalavayal, Wayanad, who participated in the Experiential Learning Programme on Agriculture Waste Management during their 8th semester. Approximately 20 students were involved in the program.

2.1.2 Data Collection Methods

a. **Observations:** Observed day-to-day activities of the students in coir-pith and vermicomposting units. Detailed notes were taken to document their activities, techniques, and challenges faced during the program.

b. **Surveys:** A structured questionnaire was administered to the participating students to gather their perceptions, experiences, and insights into the program. The survey included questions related to their learning experiences, perceived benefits, and suggestions for improvement.

c. Chemical Analysis: Samples of the coir pith compost and vermicompost produced during the program were collected and subjected to chemical analysis to determine key parameters such as pH, nutrient content, and microbial activity.

d. **Financial Analysis:** Financial data related to the costs incurred during the program, including materials, equipment, and labour, were collected and analysed to assess the economic feasibility of the composting methods.

2.1.3 Data Analysis

The collected data were analysed through qualitative analysis, which involved thematic analysis of observations and open-ended survey responses to identify recurring themes and insights about student experiences and challenges. In conjunction, quantitative analysis was employed to concisely summarize and present findings from chemical analysis, including soil testing data, and financial analysis.

2.1.4 Limitations

It is important to acknowledge the limitations of this study, including the small sample size of 20 participants and the potential for participant bias in survey responses. Additionally, the study focuses on a single batch of students and may not fully capture the long-term impacts of the program.

2.2 Coir Pith Composting Technology [2], [3],[4]

1. Collection of Raw Material
    - Coir pith collected from coir industry, ensuring the absence of fibers. Any present fibers are sieved out at the source.
2. Site Selection for Composting
    - An elevated, shady spot, preferably under trees, is chosen. An earthen or compacted floor, potentially with a roof, is advantageous for moisture retention and protection from elements. Here a well shaded shed near the Bio-control lab of Regional Agriculture Research Station ,Ambalavayal was chosen.

- 3. Heap Preparation
    - Coir pith spread in dimensions of 4 feet (length) by 3 feet (breadth). Initial 3-inch layer is moistened and supplemented with a nitrogenous source (either urea or poultry litter). Microbial inoculum, Pleurotus is then added in layers.
- 4. Turning and Aeration
    - Every 10 days, the heap is turned to release trapped air and to promote aeration.
- 5. Moisture Maintenance
    - Moisture level kept consistent at approximately 60%. Wetness of material is ensured without dripping excess water.
- 6 .Monitoring Compost Maturity
    - Physical parameters such as volume reduction, color change to black, particle size reduction, and earthy odor are observed. A laboratory analysis is conducted.
- 7. Harvesting
    - Composted material is sieved and stored in a cool, open area, occasionally sprinkled with water to maintain moisture

2.3 Vermicomposting of Farm Wastes [1]:

1. Pit Preparation
   - Pits of 2.5 m x 1 m x 0.3 m are dug under thatched sheds. The pit's bottom and sides are compacted and lined with coconut husk for drainage and aeration. Here shed near the Block-2 of RARS, Ambalavayal was selected as site for compost preparation.
2. Bio-waste Layering:
   - A blend of biowaste and cow dung (8:1 ratio) is layered up to 30 cm above ground level. Water is sprinkled daily.
3. Worm Introduction:
   - After 7-10 days of partial biowaste decomposition, 1000 worms are introduced per pit. The pit is then covered with coconut fronts and moisture maintained at 40-50%.
4. Harvesting:
   - Post 60-75 days, mature compost is separated from worms and kept in shade. After a day or two, top compost is removed, while undecomposed residues and worms are reused for subsequent composting.
5. Nutrient Analysis:
   - Analysis is done after harvest of the compost.

2.4. Quality Analysis of Compost

1. Soil pH
   - Method: Soil Water Suspension Method
   - Equation: pH = -log(H+ concentration)
2. Organic Carbon
   - Method: Walkley-Black Wet Oxidation Method
   - Equation: Organic Carbon (OC) =(Volume of blank
   - \- Volume of sample) x Normality of $FeSO_4$ / Weight of soil sample x 0.003
3. Available Nitrogen
   - Method: Alkaline Permanganate Method
   - Equation: Available Nitrogen (N) = (Volume of standard acid x Normality of acid x 1.4015) / Weight of soil sample.
4. Available Phosphorous
   - Method: Olsen's Bicarbonate Method
   - Equation: Available Phosphorous (P) = (Amount of P in extract (mg) x Volume of extract (ml)) / Weight of soil sample (g)
5. Available Potassium
   - Method: Flame Photometric Method
   - Equation: Available Potassium (K) = (Reading from Flame Photometer x Volume of extract (ml)) / Weight of soil sample (g)
6. Available Calcium and Magnesium
   - Method: Versenate Method (EDTA titration method)
   - Equation:
   - Exchangeable Calcium (Ca) = (Volume of EDTA used x EDTA concentration) / Weight of soil sample x 200
   - Exchangeable Magnesium (Mg) = (Total volume of EDTA - Volume of EDTA for Ca) x EDTA concentration / (Weight of soil sample x 121.4)
7. Available Sulphur
   - Method: Turbidimetric Method
   - Equation: Available Sulphur (S) = (Turbidity reading x Factor)/ Weight of soil sample

8.Estimation of Heavy Metals

- Digest 5.0g dried sample with triacid mixture.
- Use Atomic Absorption Spectrophotometer for detection.

3.RESULTS AND DISCUSSION

3.1 Coir pith compost financial analysis

Sl No.	Particulars	Quantity	Rate(Rs.)	Total(Rs.)
1	Land (Rent)	-	500	500
2	Coir pith	1670Kg	7.2/Kg	12,525
3	Urea	8.5 Kg	6.67/Kg	56.70
4	Pleurotus sp.	2.5Kg	45/300grams	360
5	Labour	7 persons	200/3 hour	1,400
Total				14,841.7

Benefits

- Total coir pith compost obtained: 1000Kg
- Price for 1 Kg: Rs. 15
- Total: Rs. 15,000

Benefit - Cost Ratio

- BC Ratio: 15,000 / 14,841.7 = 1.01

3.2 Vermi compost Financial Analysis

Sl No	Particulars	Quantity	Rate(Rs.)	Total(Rs.)
1	Vermi Unit	500/month		1500
2	Farm waste	1000 Kg		-
3	Cow dung	125 Kg	4	500
4	Earth worm	2000 worms		1400
5	Miscellaneous	-		200
6	Labour	20 persons	200/person	4000

Benefits

Total Vermicompost Obtained: 650 Kg
Price of 1 Kg Vermicompost: Rs. 20
Total Returns: 13,000/-
BC Ratio: 1.71

3.3 Coir- Pith Compost Quality Analysis

Parameter	Value
Moisture	56.3%
Bulk density	0.46 g/cc
pH	6.75
Electrical conductivity of the compost	0.35dS/m
Total C%	44.2%
N %	0.5%
P%	0.06%
K%	1.12%

3.4 Insights from Experiential Learning

3.4.1 Students' Experiences and Reflections

- The experiential learning process proved steep yet immensely rewarding for the students. Many students shared that they were able to connect theoretical knowledge with practical application seamlessly.
- Coir Pith Composting presented a unique set of challenges, mainly regarding maintaining the moisture level and ensuring the right microbial environment. This hands-on process taught the students patience, observation, and timely intervention skills.
- Vermicomposting, on the other hand, became a lesson in biology and ecology. Students were fascinated to witness the transformation of waste by worms into rich compost.

- Some challenges included monitoring worm activity, ensuring optimal pH levels, and maintaining the right composting environment.

3.4.2 Faculty and Mentors' Observations

- Faculty noticed an enhanced engagement level when students were involved in the hands-on process.
- A notable improvement in problem-solving skills was observed as students encountered real-world challenges during composting processes.
- Mentors appreciated the initiative and foresaw a more holistic understanding of waste management in students due to these hands-on experiences.

3.4.3 Benefits of Experiential Learning

- Experiential learning in Coir Pith composting and Vermicomposting fortified students' conceptual clarity and gave them an appreciation for sustainable agricultural practices.
- The hands-on approach fostered a deeper understanding of the complex processes, moving beyond theoretical knowledge.

3.4.4 Challenges Enriching Learning

- The challenges faced during the composting processes—like maintaining moisture, ensuring the right microbial balance, or managing worm populations—made students more adaptable and solution-oriented.
- These hurdles, rather than deterring students, enriched their learning experience by pushing them to innovate and think critically.

3.4.5 Integration of Hands-on Experiences

- Integrating experiential learning into the curriculum made complex topics more accessible and tangible for students. They were better able to grasp the scientific, economic, and environmental aspects of agricultural waste management.

3.4.6 Broader Implications for Education

- This experiential learning module can serve as a blueprint for other agricultural institutions aiming to provide holistic and comprehensive education.

4. CONCLUSION

- Experiential learning in agriculture, as showcased by the Coir Pith composting and Vermicomposting endeavours, has a transformative nature. By bridging the gap between theory and practice, students emerge better prepared for real-world challenges.
- For a discipline as dynamic as agriculture, integrating more hands-on experiences into curricula is not just beneficial; it's imperative.

5. RECOMMENDATIONS

5.1 Strategies for Other Institutions

- Institutions looking to incorporate experiential learning in waste management can start with smaller pilot programs, gather feedback, and gradually expand.
- Emphasize creating a balance between theoretical knowledge and hands-on experiences to ensure holistic learning.

5.2 Potential Collaborations

- Partnering with local farmers, agro-industries, and even waste management organizations can provide students with diverse learning opportunities.
- Collaborations with experts in the field can also help institutions stay updated with the latest techniques and advancements in agricultural waste management.

By fostering such an integrated approach, educational institutions can play a pivotal role in shaping the future of sustainable agriculture.

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