A Study on Farm Waste Management in Ayodhya district of Uttar Pradesh

THESIS

SUBMITTED TO THE

ACHARYA NARENDRA DEVA UNIVERSITY OF AGRICULTURE & TECHNOLOGY, NARENDRA NAGAR (KUMARGANJ), AYODHYA-224 229, UTTAR PRADESH, INDIA

BY

Chethan R
Id. No. C-14877/23

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

Master of Science (Community Science)

IN

Resource Management and Consumer Science

JULY, 2025

Dedicated To My Parents Rajappa KM & BHAGYA N

Dr. Poonam Singh
Head
Department of Resource Management and Consumer Science

Department of Resource Management and Consumer Science
College of Community Science
Acharya Narendra Deva University of Agriculture & Technology,
Kumarganj, Ayodhya

CERTIFICATE-I

This is to certify that **Mr. Chethan R.**, Id. No. C-14877/23, a candidate for the degree of **Master of Science** in Community Science, with Major in Resource Management and Consumer Science, College of Community Science Post Graduate Studies, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, India has been working under my guidance and supervision during the session 2023-2025 and the present thesis entitled, "**A Study on Farm Waste Management in Ayodhya District of Uttar Pradesh''**, which He is submitting in partial fulfillment for the award of the said degree is him genuine work.

The assistance and help received during the course of this investigation have been acknowledged

P. Singh
23.8.2025

Place: Kumarganj, Ayodhya
Date: 21/07/2025

Dr. Poonam Singh
(Chairperson)

CERTIFICATE-II

This to certify that the thesis entitled "**A Study on Farm Waste Management in Ayodhya District of Uttar Pradesh**' 'Submitted by **Mr. Chethan R,** Id. No.**C- 14877/23** to the Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya in partial fulfilment of the requirement for the degree of **Master of Science (Community Science)** in Subject of **Resource Management and Consumer Science** has been evaluated satisfactory and approved by the **Student's Advisory Committee** after an oral examination on same in collaboration with an external examiner

ADVISORY COMMITTEE

External Examiner

Major Advisor & Chairman

23.8.2025

(Poonam Singh)
Associate Professor
Department of Resource Management and Consumer Science

Member

23.8.2025

(Babita Verma)
Assistant Professor
Department of Resource Management and Consumer Science

Member (Supporting)

(Manish Kumar)
Assistant Professor
Department of Agricultural Statistics

Dean's Nominee

(N.R. Meena)
Assistant Professor
Department of Extension Education

Dean
College of Community Science

23.8.2025

Head of Department (RMCS)

HEAD
DEPTT. OF RESOURCE MANAGEMENT & CONSUMER SCIENCE
COLLEGE OF COMMUNITY SCIENCE
A.N.D.U.A.T. KUMARGANJ-AYODHYA

CERTIFICATE-III

DECLARATION FOR ANTI-PLAGIARISM

I **Chethan R.,** Id No. **C-14877/23,** certify that the thesis entitled **"A Study on Farm Waste Management in Ayodhya District of Uttar Pradesh''** submitted in partial fulfilment of the requirements for the degree of **"Master of Science in Community Science''** in Resource Management and Consumer Science, College of Community Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) is original work and has similarities with published work not more than minor similarities as per the UGC (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2018, adopted by the university.

I declare that I have faithfully acknowledged, given credit to and referred to the research workers wherever their works have been cited in the text and body of the thesis. I further certify that I have not wilfully lifted up some others' work, para, text, data, results, etc. reported in the journals, books, magazines, reports, dissertations, thesis, etc., or available at web-sites and included them in this thesis and cited as my own work.

Chethan
(Signature candidate)

Place: Kumarganj, Ayodhya
Date: 21/07/2025

CERTIFICATE FROM THE MAJOR ADVISOR

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

P. Singh
23.8.2025
Dr. Poonam Singh
(Major Advisor)

P. Singh
23.8.2025

Dean PGS **Head of Department** **Dean**

HEAD
DEPTT. OF RESOURCE MANAGEMENT & CONSUMER SCIENCE
COLLEGE OF COMMUNITY SCIENCE
A.N.D.U.A.T. KUMARGANJ-AYODHYA

ACKNOWLEDGEMENT

All glory to the Almighty, whose blessings have been the guiding force behind the successful completion of this thesis. Praise, pride, and perfection belong to the Almighty; therefore, I humbly express my deepest sense of gratitude to the omniscient and omnipresent power of the universe-God-whose divine grace has supported me throughout this journey.

I express my heartfelt gratitude to my esteemed advisor, **Dr. Poonam Singh,** Head, Department of Resource Management and Consumer Science, College of Community Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya. Her valuable suggestions, constructive criticism, constant encouragement, and parental guidance have been instrumental in clarifying my doubts and misconceptions. Her unwavering support made this study possible, and it has been both a great opportunity and a proud privilege to work under her mentorship.

I gratefully extend my deep and heartfelt gratitude to the esteemed members of my advisory committee: **Dr. Babita Verma** (Assistant Professor, Department of Resource Management and Consumer Science), **Dr. N.R. Meena** (Assistant Professor, Department of Agricultural Extension Education), and **Dr. Manish Kumar** (Assistant Professor, Department of Agricultural Statistics), for their valuable suggestions, constant encouragement, and proper guidance throughout the course of this investigation.

I express my sincere gratitude to teaching staff **Dr. Preeti Singh** and **Dr. Poonam Singh** as well as non-teaching staff of department for their kind support.

There are no words to express the deep sense of gratitude to my beloved parents, **Mr. Rajappa K.M.** and **Mrs. Bhagya N**; my sister, **Mrs. Nandini R.;** and my brother in-law **Mr. Subramanya N.** whose continuous encouragement, love, guidance, care and support remain inspirations for my life.

Through this thesis, the patience and persistence effort could have been hardly possible for me without a few, who have ungrudgingly took pains and spared both time and energy for it. I am extremely thankful to my friends especially **Vanshika Tewari, Sandya Yadav, Shashi M. Sagar, Srinivas K.M., Niranjan H.S.**

At last, but not least, I am also thankful to all those who helped me directly or indirectly during the course of present study.

Chethan
(Chethan R.)

Place: Ayodhya
Date: 21/07/2025

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter-I

INTRODUCTION

Farm waste generation is a persistent issue that requires careful management. A significant portion of farm waste generated in India comes from crop fields, livestock waste, and agricultural residue from household purposes, respectively. Careless handling and ignorance, however, may be quite costly to a farmer as they can disrupt the multiple companies that make up a farm, spread disease, result in less wealthy yield, and more. **Obi *et al.*, (2016**) examined agricultural wastes are byproducts of the production and processing of agricultural products; they may contain useful materials, but their economic worth is less than the expenses associated with gathering, transporting, and preparing them for human use. Crop wastes can also be used for gasification, the production of biofuel, vermicomposting, bio methanation, and animal feed. Globally, abundant agricultural wastes are being generated each day to fulfil the increasing demands of the fast-growing population. The limited and improper management of the same has created an urgent need to devise strategies for their timely utilization and valorisation, for agricultural sustainability and human-food and health security. According to **Sharma & Iqbal (2022)** As agricultural byproducts are not the main goods, they are typically referred to as "farm waste." These wastes are mostly in the form of animal waste (manures) and crop residues (remaining stalks, straw, leaves, roots, husks, shells, etc.). **Sethi *et al*. (2023)** stated that Indian economy's expansion and growth are measured by its agricultural development. The state and the central governments have both developed numerous programmes for the welfare and livelihood of farmers to promote agriculture. However, some farmers are unable to take advantage of such government programmes due to a lack of information. The farmers must therefore be properly informed if they are to benefit from various government programmes. Generally, farm waste can be classified by

A. Crop waste (husk, straws, weeds, sugarcane bagasse, leaves roots, shells.)
B. Animal waste (residual milk, waste feed, dung, containing urine etc.)

Agricultural waste management involves various strategies to handle and repurpose the by-products generated from farming activities. Composting is a widely used method that transforms organic waste, such as crop residues and manure, into nutrient-rich compost, enhancing soil fertility. Similarly, anaerobic digestion breaks down organic waste in the

absence of oxygen, producing biogas as renewable energy and nutrient-dense digestate. Practices like mulching and crop residue management repurpose plant materials to retain soil moisture, reduce erosion, and improve soil health. Recycling and reuse, such as converting husks or stalks into biochar or animal bedding, further minimize waste. **Raza *et al*. (2022)** stated that the detrimental effects of open-field burning of agricultural wastes on the climate, air quality, and human health make it a serious problem. **Lalander *et al*. (2015**) examined the potential of vermicomposting as an efficient and dual-purpose organic waste management strategy for smallholder farmers, addressing environmental concerns and providing economic benefits. Livestock feed is another effective way to utilize by-products, such as fruit peels or spent grains, reducing feed costs and waste simultaneously. Advanced techniques like waste-to-energy conversion and biochar production transform non-recyclable waste into electricity or soil-enhancing products. Moreover, methods like land application, where untreated organic waste is used as fertilizer, and vermicomposting, which employs earthworms to create rich soil amendments, contribute to sustainable agriculture. These strategies, when combined, reduce environmental impact, conserve resources, and promote long-term agricultural sustainability.

One of the main unused resources in India and many other nations is animal waste. The term “animal wastes” mostly refers to bedding materials, urine, and excreta (dung). As an integral part of the traditional farming system, livestock was crucial in contributing to the sustainability of agricultural systems by: (i) utilizing crop residues and other feeds which were not used by humans and by converting them into milk and meat; (ii) providing a soil amendment (manure) which recycles about 70% of the feed minerals which are not digested and otherwise would be lost, and; (iii) for the poorest regions of the world, providing traction for cultivation, supply for energy production or home construction (dried cowpat). The world's biggest population of cows, bullocks, buffaloes, and piglets is found in India, where there are three percent cows for every 100 people. It’s interesting to note that the organized growth of the piggery and poultry industries over the past 20 years has made manure suitable for recycling nutrients. Cow population and dung yield per animal determine how much dung is produced. Gathering and utilizing all the manure that cattle create is a challenging task. Therefore, because there was no practical technology for their collection, transportation, and disposal of, these wastes could not be completely utilized. **Parihar *et al*. (2019)** Stated livestock waste means livestock excreta, bedding material, rain or other water, soil, hair, feathers or other debris normally included in animal waste handling operations.

Farmers are at the heart of farm waste management, as they are the primary generators and beneficiaries of effective waste utilization. Their role extends beyond simply managing waste; they are key drivers in transforming agricultural byproducts into valuable resources. By adopting sustainable practices, farmers can turn organic waste like manure, crop residues, and spoiled produce into compost, bioenergy, or animal feed, reducing dependence on synthetic fertilizers and lowering operational costs. **He *et al*. (2019)** explained that the reuse of agricultural waste plays a pivotal role in sustainable development and carbon emission abatement (CEA). They sought to confirm that social capital, a sociological concept, influenced farmers' willingness to reuse agricultural waste for CEA. Additionally, farmers ensure that farm waste is managed in ways that align with environmental regulations, preventing issues such as water contamination from runoff or methane emissions from decomposing organic matter.

Farm waste management is a crucial yet challenging aspect of sustainable agriculture, as it involves the collection, treatment, recycling, and disposal of waste generated from farming activities, including crop residues, animal manure, feedlot runoff, and agrochemical containers. One of the primary obstacles is the high cost of waste management, driven by the need for specialized infrastructure and technology, such as composting facilities, anaerobic digesters, and bioenergy conversion plants, which require significant initial capital investment. In rural and developing regions, the lack of accessible infrastructure further exacerbates the issue, limiting the widespread implementation of sustainable practices **(Rekleitis *et al*., 2020).** As a result, many farmers resort to simpler but environmentally detrimental methods such as open-field burning and landfilling, which contribute to air pollution, greenhouse gas emissions, and soil degradation. Although sustainable alternatives like composting and vermicomposting are widely recognized for their benefits, these methods are sensitive to environmental factors such as temperature, moisture, and humidity, which significantly influence their efficiency and the quality of the final product **(Katiyar *et al*., 2020).** Regions experiencing extreme weather conditions or seasonal fluctuations face significant challenges in maintaining the optimal conditions necessary for these processes. Furthermore, many farmers lack the knowledge, technical skills, and awareness required to adopt sustainable waste management practices. This knowledge gap is further compounded by weak enforcement of policies and inadequate regulatory frameworks, even in regions where governments have introduced measures to reduce agricultural waste and encourage sustainability.

The absence of incentives or financial support for farmers to adopt eco-friendly practices further hampers progress. Livestock waste management poses an additional challenge, particularly due to the risk of pathogen spread from untreated manure, which threatens environmental health and public safety**.** While farm waste has significant potential for repurposing into bioenergy, compost, or animal feed, the economic viability of such practices remains a concern. Factors such as market demand, financial incentives, and cost-benefit analyses heavily influence the adoption of these methods. Without clear and immediate financial returns, many farmers are hesitant to invest in the necessary technologies, despite their long-term environmental benefits **(Scarlat *et al.*, 2019)**. Addressing these challenges requires a multifaceted approach, including the development of affordable and accessible technologies, robust policy frameworks, and financial incentives to encourage sustainable practices. Additionally, education and awareness campaigns targeting farmers can play a vital role in bridging the knowledge gap and promoting the adoption of environmentally friendly waste management practices. Research and innovation should focus on region-specific solutions that take into account local climatic conditions, economic constraints, and farming practices. By integrating traditional methods with modern technologies, the agricultural sector can move toward a more sustainable model of waste management that benefits both the environment and the farming community

Farm waste management is essential for protecting the environment, enhancing economic efficiency, and promoting sustainability. Properly handling farm waste prevents soil and water pollution, reduces greenhouse gas emissions, and protects ecosystems. It also allows the recovery of valuable resources, such as compost or bioenergy, reducing reliance on chemical fertilizers and lowering disposal costs. Effective waste management minimizes health risks by controlling disease outbreaks and maintaining clean environments for livestock. Additionally, it ensures compliance with environmental regulations, avoiding legal penalties and fostering sustainable agricultural practices that benefit both the farm and the broader community.

Objectives

1. To study the socio-demographic profile of the respondents
2. To study the existing situation of farm wastes in Ayodhya district

3. To study the existing pattern of farm waste management
4. To provide some suggestions regarding waste management.

Chapter-II

REVIEW OF LITERATURE

2.1. Definition of farm waste management

According to Wikipedia, Farm waste management involves the systematic collection, treatment, and disposal or recycling of waste materials generated through agricultural activities. This includes both organic and inorganic waste such as crop residues, animal manure, feedlot runoff, agrochemical containers, and other by-products. Effective farm waste management practices are designed to minimize environmental pollution, enhance soil fertility, conserve water, and promote sustainable agricultural practices.

2.2. Types of farm waste management

2.2.1 Crop waste management

Akhter *et al*. (2016) stated agricultural waste management practices among farmers in Trishal Upazila, Mymensingh district, Bangladesh. Data was collected from 70 farmers and 5 farms using structured interviews. The study examined the relationship between

farming types and agricultural waste generation. It found that the amount of agricultural waste, particularly straw and husk, was closely linked to cropland size. For example, 36.62% of farmers produced ≤ 1000 kg of straw, and 54.92% produced ≤ 10000 kg, with similar trends observed for husk production. Dairy and poultry waste correlated with the number of cows and birds, with an average of 8.87 kg of dung per day and 46.36 kg of used litter per 800 birds. The study suggested biogas, composting, and fish culture as potential waste management solutions, though only a small percentage of respondents favoured these methods. The study concluded that effective agricultural waste management could be enhanced through awareness programs and farmer training on the economic benefits of waste utilization.

Oladipo *et al.* (2017) The study examined the use of agricultural waste by farmers in Kwara State, Nigeria's Irepodun Local Government Area. 120 farmers in the research region were surveyed using a structured interview schedule to gather data. The Results showed the majority of respondents (58.4%) were crop farmers who mostly cultivate cassava and maize for livelihood. The primary agricultural wastes produced in the region were cassava peels and stalks (60%) and maize cobs, husk, and stalk (62.5%).While over half of the respondents do not use the garbage they create from their farms, the majority of farmers burned their waste to get rid of it. According to the study's logistic regression modelling, farmers with greater education and agricultural experience are more likely to make effective use of their farm waste. Based on findings its support more effective and environmentally friendly farm waste utilization activities in the region, it is recommended that extension agencies launch education campaigns and provide farmers with training on a variety of creative farm waste utilization techniques.

Meena *et al*. (2018) evaluated the impact of FYM @ 10 t ha^{-1}, either by alone or in combination with NPK (100% RDF), on wheat (cv. Halana K-7903) at the agricultural research farm of the Department of Soil Science at Sam Higginbottom University of Agriculture, Technology & Sciences (U.P.) during the 2011–12 Rabi season. The study revealed significant enhancements in crop performance and soil health as compared to the control. When FYM was applied, either by alone or in conjunction with NPK, bulk density dropped but soil organic carbon and porosity rose. Higher nutrient absorption (N, P, K) was the result of increased $KMnO_4$-N, P, and K availability in treated plots. Furthermore, FYM

and NPK treatments resulted in noticeably greater grain and straw yields. The results emphasize the advantages of combining inorganic and organic fertilizers to increase nutrient availability, soil fertility, and long-term crop output.

Zhang *et al*. (2021) examined the effects of shifting from conventional tillage (CT) to no-till (NT) with crop residue management on weed dynamics and wheat production in the North China Plain. Their field experiment, conducted from 2008 at the Yucheng Comprehensive Experiment Station, revealed that continuous no-till resulted in higher aboveground weed density and species richness during the regrowth and stem elongation stages of wheat. However, during the flowering and filling stages, weed density decreased with crop residue mulching. The study also found that crop residue removal led to a significantly higher soil seed bank density compared to residue retention. Additionally, both crop residue mulching and incorporation into the soil significantly enhanced wheat yields compared to residue removal, regardless of the tillage method. The study concludes that crop residue retention reduces weed density and species richness, particularly broadleaf weeds, and improves wheat yield by inhibiting weed growth.

2.2.2 Livestock waste management

Mensah *et al*. (2015) investigated that the nutrient content and release patterns of cow dung from three manure management systems (free-range, semi-intensive, and intensive) in the Kumasi Metropolis of Ghana's semideciduous forest zone. Samples were analyzed for nitrogen (N), carbon (C), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and ash. The intensive system produced the highest nutrient levels, with nitrogen ranging from 1.44% to 2.10%, phosphorus from 0.48% to 0.80%, and potassium from 1.11% to 1.74%. A laboratory incubation study assessed nutrient-release patterns, revealing that manure from the intensive system mineralized ammonium nitrogen during the first six weeks, peaking in the fourth week. Immobilization of nitrate nitrogen occurred across all systems from the second to eighth week. Free-range and semi-intensive systems showed total nitrogen immobilization for most of the incubation period, limiting immediate crop nutrient availability. The study concluded that cow dung, particularly from less intensive systems, may not fully meet crop nitrogen requirements due to significant nutrient immobilization during decomposition.

Wang *et al*. (2020) conducted a study in Shandong Province, China, to investigate livestock and poultry waste disposal methods and the factors influencing farmers' disposal behaviours. Using the UTAUT theoretical framework and a disordered multi-class logit model, the study analyzed data from farmers across 30 counties in six cities. The results revealed that economic performance expectancy, subjective norms, farming population, and the number of livestock and poultry significantly impacted waste recycling methods, including direct return, compost fermentation, biogas fermentation, and fresh-packed sale. The study emphasized that the most crucial factors influencing waste disposal methods were subjective norms, farming scale, economic performance expectancy, and farming population. The authors recommended policies to promote resource utilization of livestock waste, such as raising awareness, providing subsidies, improving training content, and strengthening laws and regulations.

Farradinna *et al*. (2023) investigated efforts to improve waste management practices within the Wong Cilik Animal Husbandry Group, which had been relying on traditional methods that polluted air and soil. The initiative aimed to educate and empower the group to proactively manage and utilize cow manure waste. Experts from machinery, agriculture, and psychology facilitated the program, which included pre- and post-tests to assess the participants' knowledge. Results showed a significant increase in understanding of livestock waste management, with the community becoming aware of the potential to convert cow manure into valuable products, such as manure from biogas residual waste. This socialization strengthened the group’s capacity to transform waste into high-value resources, marking progress toward sustainable livestock waste management practices.

Lamontagne *et al*. (2024) addressed the environmental and economic challenges of managing hatchery residues, which are traditionally associated with greenhouse gas emissions, unpleasant odors, pathogen presence, and high disposal costs. The study explored on-farm alternatives such as composting, fermentation, and insect valorization, characterizing hatchery residues to define critical quality thresholds for effective management. Bi-monthly analyses over a year revealed residues to be energy-rich (2498 to 5911 cal/g), with high protein (21.3 to 49.4%) and lipid content (14.6 to 29.1%), but low carbohydrates (0 to 15.3%), alongside significant variability in ash content (8.6 to 49.1%) influenced by eggshell proportions. High microbiological loads, including total aerobic mesophilic bacteria, coliforms, and lactic acid bacteria, indicated the need for upstream

stabilization processes. Significant correlations between microbiological loads and factors such as pH, chroma, and fiber content highlighted key parameters for process optimization. The study underscored the potential for valorizing hatchery residues through tailored approaches like composting or insect upcycling, emphasizing the need for effective stabilization to enhance on-farm waste management.

2.3. Benefits & drawbacks of farm waste management practices

Bentsen *et al.* (2014) Conducted developed a method to calculate the potential energy and worldwide output of agricultural leftovers from the six main crops: wheat, barley, maize, rice, soybeans, and sugarcane. They used function-based factors to agricultural production statistics from 227 nations and territories, which were determined from residue-to-product ratios. In order to determine the dry matter content of residues while taking regional differences in crop management techniques and agricultural systems into consideration, the study combined global agricultural statistics with standardized conversion factors. The calorific value of the residues was used to compute the theoretical energy potential. A range of estimates for worldwide residue output and energy potential were provided via sensitivity analysis, which was conducted to resolve uncertainties resulting from residue-to-product ratios and geographical variations. This comprehensive method made it possible to conduct thorough evaluations of the contribution of agricultural leftovers to the production of materials and energy.

Hundal *et al.* (2016) conducted a study to assess the awareness, knowledge, and risks of zoonotic diseases among 250 livestock farmers in Punjab. The farmers were interviewed using a pretested questionnaire, and their knowledge was categorized into low, moderate, and high levels based on a scorecard. The study found that most farmers were under 40 years old, had a primary to secondary education, and owned fewer than 10 animals. While awareness of diseases like rabies and bird flu was high, knowledge gaps existed regarding zoonotic disease transmission, particularly for brucellosis and its preventive vaccine. Unsafe practices such as improper disposal of infected placenta and consuming unpasteurized animal products were common. The study concluded that there is a need to improve awareness and knowledge of zoonotic diseases among farmers in Punjab for better disease control and prevention.

Pandiaraj *et al.* (2016) investigated the impact of integrating pulses in crop sequences, crop residue management, and nitrogen fertilizer application on soil nitrogen,

organic carbon, nutrient uptake, and wheat yield in northern India's sub-humid and sub-tropical zone. Field experiments from 2009 to 2012 demonstrated that post-harvest incorporation of crop residues significantly enhanced wheat grain and straw yields, increasing by factors of 1.31 and 1.38, respectively. Including legumes (green gram) in rotations further improved yields, with grain and straw yields rising by factors of 1.89 and 2.05. Fertilizer N application to preceding maize crops showed a strong carryover effect, enhancing wheat yields, while direct application of N fertilizer to wheat increased grain and straw yields by factors of 1.69 and 1.79. The study concludes that improved crop residue management, combined with legume incorporation and nitrogen fertilization, enhances nitrogen efficiency and boosts productivity in low-nitrogen soils, promoting sustainable cereal cropping systems.

Rajkumar *et al.* (2016) A total of 250 livestock farmers were selected randomly from eight revenue villages. And each farmer was interviewed with a questionnaire containing both open- and close-ended questions on various aspects of zoonotic diseases, a total of 49 questionnaires were framed to assess the source and transmission of infection to the farmers and to test their knowledge and awareness about zoonotic diseases. The data collected were analysed by chi-square test using software Graph pad prism, and results were used to assess the relationship between education level and zoonotic disease awareness; risk of zoonotic diseases and its relation with independent variables.

Uddin *et al.* (2016) examine the status of rice crop residue management and its impact on farmers' livelihoods in two sub-districts of Mymensingh, Bangladesh, using data from 100 farmers divided into residue-practicing and traditional farming groups. The study reveals that crop residue retention was highest in distant plots and primarily associated with Boro rice, with no retention observed for Aus and Aman rice due to labour shortages and high wages. Farmers perceived crop residues as beneficial for adding organic matter, mulching, and livestock feeding, contributing to resource recycling between crops and livestock. These practices improved soil quality, moisture, and reduced inputs like fertilizers and irrigation for subsequent crops, leading to higher productivity, profitability, and income. Logit regression analysis identified factors such as age, farm size, and income sources as significant determinants of crop residue adoption. Using the asset pentagon approach, the study noted improvements in various livelihood capitals and recommended providing proper training to enhance crop residue management practices for better livelihood outcomes.

Palmieri *et al.* (2017) assessed the environmental impact of cereal straw management practices in the Apulia Region, Southern Italy, using field surveys and Life Cycle Assessment (LCA). Data were collected from local farms through a questionnaire on three straw management practices: soil incorporation, burning, and baling. Two scenarios were analysed: the "status quo," which reflects current practices, and the "demand-pulled" scenario, driven by increasing straw demand for energy production, where more straw was baled and less incorporated, while burning continued for soil preparation. The environmental impacts of these scenarios were evaluated across multiple categories using LCA, and sensitivity analysis was conducted to test different allocation methods (economic vs. mass allocation and cereal unit allocation). The results showed that straw incorporation was the most environmentally friendly practice. Although the two scenarios had similar impacts in most categories, the demand-pulled scenario resulted in lower impacts on global warming, human toxicity, and photochemical oxidation compared to the status quo. The study concluded that selling straw for energy production is a more sustainable alternative to current practices.

Shaha (2017) explored the public health and environmental risks posed by microbial constituents in cattle manure, emphasizing its potential as a source of pollution and infections. The study assessed zoonotic pathogens in manure and their contamination of water, food, and farm workers, highlighting the necessity of improved manure management practices and policies. Data were collected from 30 dairy farms across Begumgonj Upazila (Noakhali) and Anowara and Sitakunda Upazilas (Chittagong) to analyse management practices and associated socio-economic factors. Results revealed that over 70% of farmers were unaware of the disease transmission potential of livestock manure, with 56% of farm personnel experiencing skin issues, 4.9% respiratory problems, and 15% gastrointestinal ailments. The findings underscored a critical need for educating livestock keepers on best practices to mitigate health risks and promote sustainable manure management.

Dabas *et al.* (2018) conducted a longitudinal study from 2003 to 2012 across eight villages in Rajasthan, Haryana, and Uttar Pradesh to assess biogas adoption and its socio-economic and environmental impacts. Data were collected at the appraisal, concurrent, and terminal phases from 250 biogas users. Results revealed that farmers preferred smaller biogas units (3.0 m^3), which required 75 kg of cow dung daily and were affordable to construct (₹14,000-15,000 per unit). These units produced gas equivalent to three LPG

cylinders per household per month, sufficient for cooking, lighting (300 watts for 4 hours daily), and operating small engines (15 HP for 1 hour daily). Additionally, each unit generated 145-150 liters of slurry daily, equating to approximately 1000 liters weekly if properly stored. Economic analysis indicated significant savings, with families saving ₹33,000 annually and achieving a 120% net profit in the first year, increasing to 200% in subsequent years. Intangible benefits included reduced drudgery for women and lower household pollution levels. However, some constraints in biogas usage were identified by the respondents.

Radhakrishnan *et al*. (2018) highlighted significant gaps in waste management practices in pig farms in Kerala, emphasizing the environmental and public health risks posed by improper disposal of solid and liquid wastes. Despite pig farming being a low-input, demand-driven enterprise crucial for the rural economy, the study revealed limitations such as small landholdings, inadequate infrastructure, and diverse but inefficient waste disposal methods. Most farms relied on manure pits, septic tanks, or biogas plants, but the adoption of sustainable practices was inconsistent, with only 68% utilizing biogas systems and many depending on rudimentary solutions. Feeding practices involving kitchen and slaughterhouse waste further complicated waste management, raising potential health concerns. The findings underscored the urgent need for improved infrastructure and integrated waste management systems to enhance environmental sustainability and safeguard public health in Kerala's smallholder pig farming sector.

Rajkumar *et al*. (2018) examined the disposal practices of carcass and animal waste in Puducherry, India, focusing on its implications for zoonotic diseases. A survey of 250 respondents was conducted using a structured, pre-tested questionnaire that addressed awareness, knowledge, and practices related to waste disposal and hygiene. The study found that 60.8% of farmers tied aborted foetuses and retained placenta to trees based on a traditional belief to increase milk production. While 31.3% buried the waste, indicating some awareness of zoonosis, 10% disposed of it improperly. Regarding diarrheal animals, 40.9% used water to clean their sheds, and for dead animals, 67.6% buried them, reflecting concern about zoonotic risks. However, 28.4% sold dead animals for meat, an illegal practice, and 4% disposed of them improperly. The study concluded that farmers need education on proper

waste disposal to improve both human and animal health and called for stronger enforcement of policies to address zoonoses and environmental preservation.

Dukuziyaturemye *et al*. (2020) stated that due to socioeconomic and demographic considerations, the use of organic manure has always been crucial among farmers worldwide, particularly in India. The study focuses on examining the variables influencing farmers' opinions on the production and use of organic manure in Dakshina Kannada. Farmers' information was gathered via a questionnaire-based survey, which yielded quantitative data. The information reveals that 3.2% of farmers have been farming for more than 30 years, and their experience has impacted their understanding and opinions on using organic manure. 86% of both males and females expressed a good opinion of making organic manure, while 14% expressed a negative opinion.16.1% of all respondents cited good yield/crop production as their main incentive for farms to make organic manure from municipal solid wastes. The study shows that farmers in Dakshina Kannada, India, had a positive attitude and were willing to employ organic manure made from organic waste. In order to promote excellent practices, a strategy that involves farmers in the production of organic manure from organic waste might be implemented in place.

Shayaa *et al*. (2021) conducted a study in Al-Ghat, Saudi Arabia, to explore farmers' attitudes towards agriculture and the environment, particularly in relation to sustainable farming practices. The research aimed to assess the level of awareness among farmers regarding agricultural practices that could potentially harm the environment and identify areas for improvement in agricultural extension programs. A random sample of 110 farms was surveyed using a pre-tested questionnaire administered through face-to-face interviews. The data were analysed using percentages, arithmetic averages, standard deviations, and the Pearson correlation coefficient. The results showed that 87.3% of farmers expressed interest in continuing farming, though 77.3% did not consider it their primary occupation. About 55.5% of the farmers were aware of the environmental impacts of agricultural practices, and 57.3% understood the potential benefits of better utilizing agricultural organic waste. The study revealed a significant positive correlation between farmers' main profession and farm employment with their attitudes toward agriculture, while a negative correlation was found between education levels and their attitudes toward farming. Furthermore, education was positively correlated with the farmers' awareness of the environmental implications of agricultural practices and the potential for optimizing the use of organic residues. The

findings emphasize the importance of improving education and awareness to foster more environmentally sustainable farming practices.

Cishahayo *et al*. (2022) studied the impact of learning behavior and environmental awareness on the disposal of pesticide packaging waste among 632 banana farmers in China. Using an endogenous switching probit model, the study found that farmers engaged in self-learning and social learning exhibited higher environmental awareness compared to those who did not participate in such learning activities. A treatment effect model further revealed that farmers with greater environmental awareness were more likely to dispose of chemical packaging waste at designated trash sites. This highlights the crucial role of environmental awareness in promoting sustainable agricultural practices and mitigating the environmental and health risks associated with improper pesticide packaging waste disposal.

Shi *et al*. (2023) addressed the significant challenges of crop straw management in China, particularly its environmental impacts, through an integrated assessment framework incorporating greenhouse gas (GHG) emissions data. Using field surveys and literature reviews, the study tracked changes in straw utilization from predominantly open burning in the 1950s to increased retention in fields by the 2010s. Despite these shifts, straw utilization-induced GHG emissions rose from 100 Mt/yr in 1950 to 446 Mt/yr in 2021. The study demonstrated that converting inefficient uses of straw, such as open burning and traditional cooking or heating, into bioenergy could prevent 122 Mt of GHG emissions These findings underline the potential of bioenergy development as a sustainable strategy for mitigating GHG emissions and enhancing crop straw utilization in China's agriculture sector.

Huang *et al*. (2024) conducted a 10-year field experiment to examine the impact of crop straw return on dissolved organic matter (DOM) composition in rice paddy soils. The study involved four treatments: two crop straw addition treatments (NPK with 50% crop straw [NPK+1/2S] and NPK with 100% crop straw [NPK+S]), a conventional mineral fertilization control (NPK), and a non-fertilized control. Soil samples from topsoil (0–20 cm) and subsoil (20–40 cm) were collected to analyse DOM concentration, composition, soil nutrients, iron (Fe) fraction, microbial biomass carbon (MBC), and the optical properties of DOM using UV–Vis and fluorescence spectra. The results showed that straw addition reduced the humification of DOM in the subsoil, while microbial decomposition in the topsoil increased the formation of aromatic DOM. In the subsoil, DOM composition was influenced by selective adsorption by Fe (oxherd) oxides and microbial decomposition, with

protein-like compounds playing a significant role in DOM degradation. The study provides insights into how crop straw return affects DOM and its implications for carbon cycling in agricultural soils.

2.4. Methods of farm waste management

2.4.1 Composting method

Melinda *et al*. (2013) studied the management of agricultural and household waste in Laladon Lama Village, Bogor, West Java, to demonstrate how composting can mitigate environmental damage while improving agricultural quality. The project, initiated by students from Bogor Agricultural University, led to the establishment of "Saung Kompos," a composting facility designed to process rice straw, household, and animal waste. The system involved a four-partition setup to efficiently manage and decompose waste into compost. The initiative also incorporated the principles of Low External Input Sustainable Agriculture (LEISA), aiming to reduce the dependence on synthetic fertilizers by utilizing compost to balance soil nutrients. Farmers, recognizing the long-term harm of synthetic fertilizers, embraced the program enthusiastically. Over a three-month implementation period, the program aimed to increase rice production while lowering farmers' costs and promoting sustainable practices. This case illustrates the potential of integrating waste management with sustainable farming to address environmental challenges and enhance agricultural productivity.

Nigussie *et al*. (2015) investigated the limited application of agricultural waste as a soil supplement in underdeveloped nations, when its usage is frequently diverted by competition for feed and fuel. In order to identify four farmer groups-field crop cultivators, vegetable growers, decorative plant producers, and mixed farmers-the study used semi-structured questionnaires for surveying 220 randomly chosen farmers. Although field crop growers made up the majority of agricultural waste, they applied less than 10% to soils and more than 85% to feed and 80% to fuel. On the other hand, farmers of decorative and vegetable plants improved the nutritional balance in these systems by using more than 40% of their waste as soil supplements. Access to extension services, farm size, land tenure, and education were major obstacles to the use of waste. The study additionally revealed that the demand for compost was impacted by labour availability, land ownership, education, and

composting experience, underscoring the significance of focused interventions to support sustainable agricultural waste management.

Alfadlli *et al.* (2018) compared the effectiveness of bioethanol waste decomposer (DLB) with various commercial decomposers (A, B, and C) in composting cattle dung. Using a completely randomized design with four treatments and five replications, the study combined cattle dung with DLB or commercial decomposers at 0.5% concentrations, along with water and molasses. The mixtures were aerobically ripened for four weeks with weekly stirring. Analysis of the mature compost for C Organic, total N, total P, total K, total Ca, total Mg, C/N ratio, and pH revealed no significant differences in compost quality or pH between DLB and commercial decomposers. The study concluded that DLB is a viable alternative to commercial decomposers for processing cattle dung, providing a sustainable option for bioethanol industry waste management.

2.4.2. Burning method

Ahmed & Ahmed (2014) explored the variables affecting farmers' choices to burn rice crop leftover and investigated the possibility of producing power from this residue. Using data from 400 farmers in the rice-wheat cropping system, the study identified several significant factors affecting the burning decision, including farming experience, caste, farm size, livestock strength, residue handling costs, and availability of farm machinery. The analysis revealed The total amount of rice straw burned in these regions is 1704.91 thousand tons, and 162.51 MW of energy might be produced. This power generation has the potential to provide more revenue for farmers, generate jobs, and sustainably boost economic activity. The report also proposed that employing rice residue as an energy source might save foreign exchange expenditures on furnace oil, which would have both economic and environmental advantages, and that setting up decentralized power plants at the village level could lower transportation costs.

Grover *et al.* (2015) conducted a study to identify the reasons behind crop residue burning (CRB) and assess farmers' awareness of its environmental impacts. The research was carried out in Mirzapur village, Kurukshetra district, Haryana, using self-structured questionnaires and face-to-face interviews with 50 farmers. The results revealed that 96% of the farmers practiced CRB, mainly to quickly prepare land for the next crop and remove pests and weeds. Other reasons included the unavailability of labor for manual stubble

harvesting, high residue removal costs, and low market value of the residues. Although 90% of the farmers were aware that CRB contributes to air pollution, they were unaware of its specific health risks, greenhouse gas emissions, and negative effects on soil quality. The study concluded that there is a significant need for increased awareness among farmers about the full environmental impact of CRB. The authors recommended promoting the use of new technologies such as the Happy Seeder for direct seeding and composting to manage residues effectively. They also suggested that the government develop more effective policies, in consultation with farmers, to encourage better waste management practices.

Maurya *et al.* (2020) Adress the urgent issues facing India's agriculture sector, especially the necessity to maintain food grain output and soil fertility in the face of environmental degradation and rising food needs. They draw attention to farmers' false beliefs that burning agricultural leftovers improves soil fertility and manages pests, even though there is proof that doing so depletes soil nutrients and organic carbon while producing toxic gases and aerosols including CO_2, SO_2, and CO, which pose serious threats to human health and the environment. Due to labour constraints and the requirement for rapid field clearing, India produces over 500 Mt of crop residues annually, of which 93 Mt are burnt on farms. Crop leftovers are useful for making animal feed, mulch, compost, and mushrooms, but if they are not managed properly, they increase pest infestations and environmental problems. The authors support sustainable residue management techniques, such as incorporating soil, rotating crops as advised by ICAR, using it in small-scale companies to make goods like material and packaging, and establishing biomass power plants through public-private partnerships. In order to ensure sustainable agricultural growth and food security in India, these policies seek to reduce residue burning, enhance soil health, reward farmers financially, and reduce environmental degradation.

Venkatramanan *et al.* (2021) addressed a national inventory approach to estimate crop residue burning and associated emissions in India. The study followed the IPCC methodology for preparing emission inventories and included crop types such as cereals, pulses, oilseeds, sugarcane, cotton, jute, and Mesta. The total crop residue generated and burned in the year 2017-18 was calculated, and emission factors were applied to estimate the pollutants released, including CO2, CO, CH4, N2O, NH3, NMVOC, PM2.5, and PM10. Additionally, the study proposed a crop residue management-bioeconomy model, which integrates smart agricultural practices, waste valorization, capacity building, and supportive

government policies. This framework seeks to shift from conventional crop residue management methods to more sustainable practices, minimizing burning, boosting farmers' incomes, and fostering sustainable agricultural development.

Raza *et al*. (2022) emphasizes that the detrimental effects of open-field burning of agricultural wastes on the climate, air quality, and human health make it a serious problem. The study evaluated the economic and health effects of residue burning in comparison to the implementation of sustainable crop residue management practices (SCRMPs) using a main dataset of 420 farmers in Punjab, Pakistan. The results show that even though most farmers are aware of the negative consequences of burning, those that use SCRMPs have better health and well-being. During the hot season, both chronic and non-chronic illnesses get worse. increasing household healthcare costs by USD 8.79 and USD 13.37, respectively. SCRMPs dramatically lower these expenses, according to the propensity score matching research. This data emphasizes the necessity of policies encouraging the implementation of SCRMP in order to improve public health and environmental sustainability in Pakistan.

2.4.3. Vermicomposting

Lalander *et al*. (2015) examined the potential of vermicomposting as an efficient and dual-purpose organic waste management strategy for smallholder farmers, addressing environmental concerns and providing economic benefits. The study, conducted in Kampala, Uganda, used the earthworm species *Eudriluseugeniae* to treat cow manure and food waste over 172 days. The process achieved a 45.9% material reduction and a 3.5% waste-to-biomass conversion rate, with the potential for improvement through increased worm harvesting frequency. Vermicomposting proved economically viable, with a return on investment of 280% for managing manure from a 450 kg cow, while also generating valuable animal feed protein in the form of worm biomass. However, the resulting vermicompost required a post-stabilization step to improve hygiene quality. The study demonstrated that integrating vermicomposting into small-scale urban animal agriculture could incentivize better manure management while mitigating environmental and public health risks.

Aynehband *et al*. (2017) investigated vermicompost production using different crop residues under laboratory and field conditions at Shahid Chamran University, Ahvaz, Iran. The experiment employed a factorial design with four replications, examining four crop residues (rice, corn, wheat, and sugarcane) and three weight ratios (30%, 40%, and 50%). The results showed that vermicompost made from wheat residue at a 50% weight ratio

produced the highest total earthworm weight (352.3 grams) and the most effective conversion factor (83.2%). Rice residue at a 30% weight ratio yielded the highest earthworm numbers (7193). The highest vermicompost fertilizer production (3288.6 grams) also came from wheat residue at the 50% ratio. In terms of agricultural productivity, the highest mung bean grain yield (188.5 g/m²) was obtained from vermicompost produced with rice residue at a 40% weight ratio. The study concluded that vermicompost derived from crop residues offered better biological performance than manure or direct crop residue use, with different residues affecting the quality of the final vermicompost.

Sharma & Garg (2019) addressed the global challenges posed by rapid urbanization, industrialization, technological advancements, and population growth, which have led to a significant increase in solid waste production and its improper disposal. With over one billion tonnes of solid waste generated annually, the unscientific management of such waste imposes substantial social, economic, and environmental costs. The study emphasized the need for innovative and eco-friendly waste management technologies, highlighting vermicomposting as a highly effective biological method. Vermicomposting, a bio-oxidative decomposition process involving earthworms and microbes, transforms various waste types into fine, odor-free, nutrient-rich vermicompost. Earthworms enhance organic matter decomposition through fragmentation and improve the physicochemical characteristics of waste, aided by microorganisms in their gut. Vermicompost serves as an efficient plant growth promoter, enriched with nutrients, humic substances, enzymes, and growth hormones, improving crop yield and soil health. The process also contributes to a circular bioeconomy by converting waste into valuable resources, supporting sustainable development initiatives.

2.4.5 Biogas

Hiloidhari *et al*. (2014) highlight the India's vast agricultural industry plays a major part in the country's renewable sources of energy initiatives through biomass-based electricity generation. The study identifies a vital resource is agricultural residual biomass, of which India produces 686 MT yearly, 234 MT (34%) of which is excess and can be used to produce bioenergy. Based on data from 26 crops and 39 leftovers, the researchers calculate an annual bioenergy potential of 4.15 EJ, which would represent 17% of India's primary energy consumption. According to the study, there are significant variations across the states, with Punjab having the best potential for per capita bioenergy and Uttar Pradesh producing

the largest volume of agricultural waste. This research is anticipated to inform state-level planning and support the expansion of renewable energy in India. The results highlight the significance of localized biomass databases for efficient decentralized bioenergy planning

Ayamga *et al*. (2015) assessed the potential of crop residue biomass for second-generation biofuel production in the Lawra–Nandom district of Ghana using interviews, surveys, field, and laboratory experiments. The study found that the total annual crop residue production in the district was about 272,000 tons, with sorghum contributing the largest share (59%) by weight. If 40% of the crop residues produced between 2003 and 2012 were used for ethanol production, it could yield up to 40 million litters. The biofuel production process showed a net energy balance of 1718.7 MJ and an energy output-to-input ratio of 1.31. Despite the potential, the study highlighted that second-generation biofuels are more expensive than first-generation ones and called for intensified research on technology improvements and cost reduction to make it more viable for developing countries.

Piera *et al*. (2016) conducted a feasibility study on trigeneration (heat, power, and cold) in rural agricultural communities in Ghana, where crop residue could serve as a solid biomass fuel for power generation. The study focused on small farm typologies with sufficient clustered crop residue, surveying 11 districts in Ghana to assess agricultural waste levels and their potential for supplying a centralized trigeneration plant. The results showed promising prospects for deploying trigeneration in rural Sub-Saharan Africa, highlighting favourable plant capacity, biomass waste yields, energy output, and economic viability. The research suggests that trigeneration could be a viable solution for providing power, heat, and cold to remote agricultural villages with low electrification.

Case *et al.* (2017) studied how the bio-based, circular economy may benefit from the processing of organic waste since it can improve nutrient availability and increase its agricultural value when utilized as fertilizers. Their survey evaluated the usage of organic fertilizers, interest in converting to other types in the future, and perceived benefits and challenges among Danish farmers with landholdings larger than 10 hectares. The study received following the 452 respondents (28 percent), 72% reported using organic fertilizers now, and over 85% said they would like to use them within three years after the study. These results point to broad interest in and acceptance of organic fertilizers, which, when combined with an established manure redistribution system, promote sustainable nutrient management techniques.

Chibueze *et al.* (2017) addressed the national concern in Nigeria over petroleum scarcity, particularly kerosene, by exploring biogas production using cow dung and food wastes as feedstock. The study utilized food wastes (corn cobs and plantain peels in a 1:1 ratio) collected from the Abia State Polytechnic canteen and cow dung from the Aba North LGA slaughterhouse. These materials were combined for anaerobic digestion to enhance biogas generation. Proximate analysis revealed both feedstocks contained energy-yielding nutrients in varying concentrations. The pH of the slurries decreased over time due to acid production by bacteria, with the cow dung slurry turning acidic by the 4th day and the combined waste slurry by the 12th day. Biogas production was initially higher but declined as acid concentration increased, particularly in the combined waste slurry. The combined slurry produced more biogas (30.58 ml) than the cow dung slurry (19.20 ml), demonstrating that nutrient-rich food waste enhances biogas yield. The study concluded that combining cow dung with food waste improves the efficiency of biogas production, offering a sustainable solution for energy generation in Nigeria.

Acevedo *et al*. (2020) examined the overuse of non-renewable resources, which has led to a large increase in waste production, with extraction rates rising by 113% since 1990.The study highlighted the critical need for a sustainable growth model that increases the production of food and energy while decreasing reliance on fossil fuels, pollution emissions, and solid waste. Intense horticulture in Almería, Spain, where biomass from agricultural waste, especially tomato crops, showed great potential for utilization, was the goal of the study. Several technical papers, research, and interviews with important local and regional agents were used to collect data for the technique. Along with conducting interviews with department heads to verify and process the data, the study also included primary data collecting through direct phone and email correspondence with regional and local government entities. Furthermore, data was gathered from reliable sources such as Web of Science and Scopus for ensuring the precision and applicability of the results. The study showed that self-management of agricultural waste, including the creation of compost and green fertilizer, may be beneficial and support a more sustainable and circular agricultural system. It also emphasized how crucial government assistance is for raising awareness, funding research, and easing the shift to sustainable farming methods.

Reetsch *et al.* (2020) Examined how smallholder farmers in the Karagwe and Kyerwa districts of the Kagera area of northwest Tanzania use organic agricultural waste

and maintain damaged banana-coffee-based farming systems. According to an expert-based typology, a study of 150 farm families identified three different groups: high, moderate, and low, depending on their levels of biomass output. The result indicates those families in Groups A and B show a great deal of promise for increasing biomass production and attaining food security. On the other hand, unless specific measures increase their resources and resilience, households in Group C—which are distinguished by their small land size (less than one hectare) and poor socioeconomic standing—are probably going to continue to be at risk of food insecurity.

Shaibur *et al*. (2021) investigated cow dung management and biogas production in Ziala Village, Satkhira District, Bangladesh, to assess its socio-economic and environmental impacts. The study, based on interviews with dairy farmers and data from 12 biogas plants, highlighted that biogas systems successfully converted cow dung into energy and nutrient-rich organic fertilizer, reducing reliance on chemical fertilizers. The use of biogas as fuel improved cooking conditions and reduced the need for firewood collection, promoting forest preservation. These practices enhanced livestock management, elevated environmental quality, and improved socio-economic profiles through better occupational distribution and education. However, improper management of agricultural waste and cow dung by some households caused water and air pollution, indicating a need for better waste management practices.

Liu *et al*. (2023) studied how adding biochar from potato, rape, and wheat straw can improve biogas production in an anaerobic digestion (AD) system. AD is used to treat agricultural waste and reduce pollution, but it often has low yield and instability. In this study, straw was turned into biochar by heating it at 600°C, then added to a batch AD system. The results showed that biochar increased methane production by 35.45%–52.66%, with potato straw biochar producing the highest methane (1249.5 mL). The microbial community analysis showed that biochar boosted the number of *Methanobrevibacter* by up to 147 times. This study suggests that adding biochar can help increase biogas production in AD systems.

Hiranobe *et al*. (2024) explored the potential of sugarcane and its residual lignocellulosic biomass, such as bagasse, leaves, tops, and vinasse, as sustainable resources for biorefineries. The study reviewed recent advancements in recycling sugarcane for energy generation, biofuel production via pyrolysis, and biochar creation. Challenges include high

energy costs for high-temperature operations and large-scale biochar production, as well as the need for improved quality control in pellet production for long-term storage and transportation. In civil construction, sugarcane-derived materials must demonstrate long-term efficiency and reliability. Bagasse-based adsorbent materials are cost-effective and eco-friendly, but enhancing cellulose fiber properties remains challenging. Nanostructure synthesis struggles with low yields and scalability, while improving dispersion and reducing fiber agglomeration could enhance composite mechanical properties. The study highlights sugarcane's industrial and economic significance, emphasizing its potential to address global waste management and sustainability challenges.

2.5 Suggestions for farm waste management

2.5.1 government schemes

Sharafi *et al.* (2018) conducted a study in Kermanshah province, western Iran, to investigate the knowledge, attitudes, and behaviors of farmers regarding pesticide use and disposal, as well as the health effects associated with pesticide use. The study included 311 farmers who completed a structured questionnaire, which gathered information on their basic details, knowledge and attitudes towards pesticides, and their pesticide disposal practices. The study also recorded the types and amounts of pesticides used and any health symptoms experienced over the past year. The findings revealed that most farmers had not received formal training on pesticide use. Approximately 10% of the pesticides used contained highly hazardous compounds, 45% contained moderately hazardous compounds, and 17% contained slightly hazardous compounds. The majority of farmers had incorrect knowledge about the risks of pesticides and used improper methods for handling and applying pesticides and their wastes. Health symptoms were more prevalent among older farmers (≥65 years), those with no formal education, those with an income below 482 USD, untrained farmers, and those using highly hazardous pesticides. The study also found that age, education level, and pesticide training significantly influenced pesticide use. The authors concluded that comprehensive training programs and waste management systems could help reduce pesticide use and its harmful environmental impacts.

Yunita (2019) examined waste management efforts in Bukit Kijang Village, a young settlement in Namang Bangka Tengah District, to support its farm-based agriculture program on ex-mining land. The village farms, with nine adult cows and one calf, generated

substantial amounts of cow dung. To address livestock and household waste, a biogas system was implemented to convert cow dung into biogas, alongside producing solid and liquid fertilizers, and biofertilizers from organic household waste. Mentoring sessions involved women from the Family Welfare Empowerment group, villagers, and youth groups. However, the biogas and biofertilizers produced were inadequate due to equipment leakage and limited shelf life, preventing product testing. Despite these setbacks, the initiative demonstrated the potential for sustainable waste management to enhance agricultural development.

Seglah *et al*. (2020) examined crop straw utilization and the effects of straw burning in northern Ghana, focusing on rural households in Yendi municipality, Saboba and Tatale-Sanguli districts. Data collected from 384 farmer households were analyzed using SPSS. The study found that of the total crop yield of 1.29 kton, 3.05 kton of crop straw was produced, with cereals contributing 56.4% and legumes 43.6%. About 40.3% of the straw (1.23 kton) was used for purposes such as soil enrichment, livestock fodder, cooking fuel, and sale, while 59.7% (1.82 kton) was burned in the fields. The burning rate varied by crop, with maize (77.6%), sorghum (58.6%), and groundnut (56.5%) having the highest levels of field burning. The study identified farming practices and farm size as key factors influencing straw burning, and it was found that field burning resulted in a decline in crop yields for 65.7% of respondents. The authors concluded that crop straw utilization in the region is underutilized and recommended government policies to promote its effective use and prohibit field burning.

Wang *et al*. (2020) investigated the production and utilization of crop straw and livestock-poultry manure (CSLM) in five multi-ethnic regions of China (Yunnan, Tibet, Liangshan, Garze, and Aba), primarily inhabited by Tibetan, Qiang, and Yi communities, from 2007 to 2016. Their study evaluated CSLM production across multiple dimensions, including geographic distribution, species source, and nutrient composition. Findings showed that crop straw production increased from 18.44 Mt in 2007 to 21.90 Mt in 2016, while manure production rose from 223.56 Mt to 309.02 Mt during the same period. The nutrient content of CSLM, quantified as N, P2O5, and K2O, was compared to chemical fertilizer use, demonstrating CSLM's potential to reduce chemical fertilizer dependency and promote sustainable agriculture. The authors emphasized the role of agricultural waste recycling in addressing poverty and environmental challenges in underdeveloped ethnic

minority areas, advocating for policies that incentivize farmers, enhance CSLM utilization, and mitigate pollution. These findings underscore the need for integrated strategies to foster sustainable agricultural practices in remote regions.

Sreedaya *et al.* (2022) conducted a study to assess farmers' perceptions of crop insurance schemes in Kerala, focusing on three districts: Kottayam, Malappuram, and Idukki, during 2020-2021. The study found that the majority of farmers (69.17%) had a medium perception of the crop insurance schemes, while 18.33% had a low perception and 12.50% had a high perception. The research highlighted significant associations between farmers' profile characteristics, such as education, operational landholding, credit orientation, and decision-making ability, with their perceptions of crop insurance schemes. When comparing the perceptions of farmers benefiting from three major crop insurance schemes—Restructured State Crop Insurance Scheme of Kerala (RSCIS), Pradhan Mantri Fasal Bima Yojana (PMFBY), and Restructured Weather Based Crop Insurance Scheme (RWBCIS)—the study revealed significant differences between state and central insurance schemes, while no significant difference was found between the two centrally sponsored schemes. This indicates varied levels of awareness and satisfaction among farmers, depending on the type of insurance scheme.

Sethi *et al.* (2023) examine the awareness of farmers regarding agricultural schemes implemented by the central and state governments in India. Agricultural development is crucial for the country's economic growth, and various government schemes aim to improve the welfare and livelihoods of farmers. However, the study identifies a gap in awareness, with some farmers unable to benefit from these schemes. To understand the level of awareness, the study was conducted using a random sampling technique, and primary data was collected through structured questionnaires and personal visits to farmers between October and December 2022. The results revealed that 55.6% of the farmers in the study area were aware of the government schemes, with television being the primary source of awareness, followed by newspapers and radio. The study highlights the need for better education and training to ensure that farmers can fully avail themselves of the benefits of these welfare schemes, which are essential for their development and overall agricultural progress.

Indrarosa *et al.* (2024) investigated the effectiveness of a special training program for smallholder livestock farmers in Indonesia, focusing on waste management and its

impact on farmers' knowledge acquisition. The study was conducted at the Animal Husbandry Training Centre at Songgoriti, which regularly holds training sessions for smallholder farmers. The research aimed to assess the training outcomes and identify factors influencing knowledge attainment. Data from the training centre's reports and documentation for the years 2021 and 2022 were analyzed using a multiple regression model. The results showed that the training led to noticeable improvements in knowledge acquisition, although some participants showed better results than others. The starting point of participants' existing knowledge was found to be a significant factor influencing the outcomes. The study recommends that participants be grouped based on their baseline knowledge to optimize training effectiveness, with more advanced participants being separated from beginners for better results.

2.5.2 Utilization of waste management

Shehrawat *et al*. (2015) conducted a study in Hisar and Sonipat districts of Haryana, interviewing 120 farmers. The study found that while awareness of agricultural waste utilization, such as biogas plant waste and mushroom, wheat, and mustard waste, was high (over 70%), the actual utilization of these wastes by farmers was low. Farmers reported modest benefits from waste utilization, such as higher milk yields, extra income from selling waste, reduced fertilizer costs, and a cleaner environment. The study also suggested that employment opportunities could increase if industries for value-added products, handicrafts, handmade paper, and waste collection centers were developed in rural areas.

Wang *et al*. (2018) highlighted the economic and environmental significance of crop straw utilization as part of an energy development strategy in southwest China. Using agricultural statistics and regional data, the study assessed the distribution, resource utilization, and demonstration projects for crop straw in the Socio-economic Development Region (SEDR). In 2015, the theoretical straw yield was estimated at 8.2×10^7 t, with corn straw contributing 54.28% of the total, followed by rice and beans. Crop straw was primarily utilized for soil amendment, fertilizer, fodder, industrial materials, biogas production, and power generation, with an emphasis on promoting fermentation technologies for ecological agriculture. The innovative practices in the Liupanshui Agricultural District (LAD) were particularly noted, where 82% of the straw was utilized for biogas production, feedstuff, and returning to fields. The study identified critical challenges in straw utilization and stressed the importance of coordinated SEDR system planning at a strategic level to ensure efficient

and sustainable agricultural waste management. Recommendations included developing a modern agricultural waste management system through comprehensive planning and demonstration practices.

Singh *et al.* (2021) stated that farmers in India rely on major farm produce and do not utilize the by-products or wastes emerging from their farms for monetary benefits. The study emphasizes the utilization of wastes through vermicomposting clubbed with biogas production for augmenting farmers' income. The researcher conducted the study in Ludhiana District of Punjab on three dairy farmers, each pursuing vermicomposting, biogas production and traditional composting. After the analysis, it was found that the highest net returns per metric tonne of dung were obtained from vermicomposting (INR 2224.72), followed by biogas production (INR 536.66, USD 7.10) and composting (INR 45.59, USD 0.60). Net returns from the dung obtained from one cattle equivalent were highest from vermicomposting (INR 11012.34, USD 145.64), followed by biogas production (INR 2656.74, USD 35.14) and composting (INR 225.68, USD 2.98). The study concludes that high profitability was accorded to vermicomposting because it is sold at remunerative prices.

Wang *et al*. (2020) investigated the production and utilization of crop straw and livestock-poultry manure (CSLM) in five multi-ethnic regions of China (Yunnan, Tibet, Liangshan, Garze, and Aba), primarily inhabited by Tibetan, Qiang, and Yi communities, from 2007 to 2016. Their study evaluated CSLM production across multiple dimensions, including geographic distribution, species source, and nutrient composition. Findings showed that crop straw production increased from 18.44 Mt in 2007 to 21.90 Mt in 2016, while manure production rose from 223.56 Mt to 309.02 Mt during the same period. The nutrient content of CSLM, quantified as N, P2O5, and K2O, was compared to chemical fertilizer use, demonstrating CSLM's potential to reduce chemical fertilizer dependency and promote sustainable agriculture. The authors emphasized the role of agricultural waste recycling in addressing poverty and environmental challenges in underdeveloped ethnic minority areas, advocating for policies that incentivize farmers, enhance CSLM utilization, and mitigate pollution. These findings underscore the need for integrated strategies to foster sustainable agricultural practices in remote regions.

Atinkut *et al*. (2021) explored the status of agricultural waste management (AWM) and farmers' willingness to pay (WTP) for eco-friendly waste management practices in the Mirab Gojjam region of Ethiopia. The study focused on the environmental issues caused by

open biomass burning after harvest and in household cooking. Data were collected through a contingent valuation survey of 353 randomly selected farmers during early spring 2018. The study found that the mean annual WTP was 6.84 labour days (equivalent to 273.50 Birr) and 8.20 Birr in monetary value. Key factors influencing WTP included age, education, family size, income source, land ownership, livestock, and environmental perception. The Tobit model showed that factors such as bid value in labour days, environmental awareness, government subsidies, and farm shortages significantly affected farmers' willingness to pay. The findings highlight the need for both private and public interventions to encourage sustainable agricultural waste management and turn waste into a valuable resource.

Miah *et al*. (2022) examined the availability and use of organic fertilizers and soil amendments on smallholder farms in Bangladesh. A case study of 300 households in northern and southern Bangladesh revealed that agricultural waste production averaged 822 kg per month, with cow dung making up 65% of the total. Most farmers used cow dung as organic fertilizer, while smaller amounts were used as cooking fuel. The study found that factors such as the number of cattle, land area, and family size influenced waste production. Households could reduce chemical fertilizer costs by using compost made from waste. The research highlighted the potential for composting and vermicomposting, suggesting that both public and private sectors should promote waste management practices to maximize benefits.

Ravi *et al*. (2022) conducted a study on agricultural waste management practices and farmers' awareness in Medak district, Telangana, using an Ex-post facto research design. A total of 120 farmers were selected through simple random sampling. The results revealed that 55% of farmers had high awareness, 27.5% had medium awareness, and 17.5% had low awareness of agri-waste management practices. The study found significant positive relationships between awareness and factors such as infrastructure facilities, achievement motivation, age, education, farm size, farming experience, cropping pattern, innovativeness, information-seeking behavior, and training received. However, cropping intensity and level of aspiration had a non-significant relationship with awareness. The study recommended government subsidies for machinery, special programs to improve awareness, and the establishment of agri-waste communities to promote sustainable waste management practices.

Xu *et al.* (2023) emphasized the critical role of agricultural waste treatment in ensuring the sustainability of agricultural production and enhancing the well-being of rural communities. The study analyzed sources of agricultural waste, disposal methods, and farmers' attitudes in 21 rural communities in Shaanxi, involving 359 farmer respondents. The findings identified key agricultural waste types and highlighted that farmers' experience, reputation, and active engagement in recycling domestic waste significantly influence their attitudes toward waste management. Farmers predominantly focused on treating biowaste, using it for biogas generation or as crop fertilizer. The study underlined the need for better waste management facilities, improved accessibility, and economic incentives to enhance recycling rates. Training programs and practical guidance on waste handling and recycling were also deemed essential. This research provides a foundational basis for designing effective agricultural waste management strategies and identifying future directions for sustainability

2.6. Challenges are faced in farm waste management

Manegar (2015) examined the agrarian crisis in Karnataka, highlighting the challenges faced by farmers due to improper technology, inadequate water management, and agricultural debts. The state's agriculture sector has been severely affected by recurring droughts, particularly in the northern regions, which lack proper irrigation infrastructure. Despite government policies and a budg*et al*location of ₹3823 crore in 2017-18, two-thirds of Karnataka's agricultural production remains dependent on rainfall, leaving farmers vulnerable to delays or deficits in precipitation. Between 2013 and 2017, over 3500 farmer suicides were reported, with approximately 2500 linked to droughts or crop failures. This crisis has stagnated the growth of the agricultural sector, even as Karnataka's economy increasingly relies on its IT industry. The opposition parties have used these issues to pressurize the government for more effective interventions to address the persistent problems in the agricultural sector. The study underscores the urgent need for robust water management systems and policy implementation to alleviate the plight of Karnataka's farmers and revitalize the agricultural economy.

Mohan *et al.* (2021) investigated the challenges associated with traditional manual methods of managing animal manure, which, despite being a valuable nutrient source for crops, involved significant physical effort. To address these issues, the study developed a

manure pulverizer cum applicator for simultaneous pulverization and field application. The device, which included a KAU manure pulverizer, blower, and 3-way bevel-gearbox, achieved a maximum field capacity of 0.395 ha/h at a forward speed of 3.0 km/h, although application rates decreased with increasing speed. The highest application rates recorded were 1387.1 kg/ha for cow dung, 1624.4 kg/ha for goat droppings, and 1618.6 kg/ha for neem cake at 2 km/h. This innovation provided a more efficient and less labor-intensive solution to traditional manure management practices.

Mohan *et al*. (2021) investigated the challenges associated with traditional manual methods of managing animal manure, which, despite being a valuable nutrient source for crops, involved significant physical effort. To address these issues, the study developed a manure pulverizer cum applicator for simultaneous pulverization and field application. The device, which included a KAU manure pulverizer, blower, and 3-way bevel-gearbox, achieved a maximum field capacity of 0.395 ha/h at a forward speed of 3.0 km/h, although application rates decreased with increasing speed. The highest application rates recorded were 1387.1 kg/ha for cow dung, 1624.4 kg/ha for goat droppings, and 1618.6 kg/ha for neem cake at 2 km/h. This innovation provided a more efficient and less labor-intensive solution to traditional manure management practices.

2.7. Income

Abdullah *et al*. (2024) explored the potential of converting livestock waste into compost as a sustainable practice that benefits both livestock and crop farmers. This practice can increase farmers' income and contribute to achieving sustainable development goals (SDGs). However, issues such as limited knowledge, lack of extension services, uncertain demand for compost, and reluctance to use organic compost hinder its widespread adoption. The study, conducted among 100 livestock farmers in southern Malaysia (Negeri Sembilan, Melaka, and Johor), found moderate adoption scores for livestock waste management, farmers' behaviour, external factors, and perception. The results suggest collaboration with the private sector and strengthening extension services to encourage wider adoption of composting, improving farmers' well-being and livelihoods.

Cariappa *et al*. (2022) analysed the effects of COVID-19-induced lockdowns in India on food loss, waste, and agricultural value chains by questioning 729 consumers and 225 farmers and conducting disrupted time series analysis. The study found notable price

rises for essential commodities, including tomatoes (78.2%), mung beans (5.2%), and chickpeas (4.8%), with tomatoes suffering major losses as a result of market disruptions and perishability. In addition to causing food losses in supply chains and consumer waste, lockdowns limited market access, which resulted in price increases for 75% of customers. The impact on livelihoods was moderate to severe (59.53% and 3.3%, respectively), and 92% of customers said their buying habits had changed. The study demonstrates how strong Indian agriculture is because food waste has decreased over time, but it also suggests that institutions, laws, and changes be put in place to support small-scale agricultural systems. Promoting contract farming, farmer producer organizations, social safety nets, digital market access, and food waste management capacity building are some of the suggested strategies to lower supply chain losses and protect populations at risk.

Devi *et al*. (2017) analysed the significant volumes of agricultural residues generated by crops and their potential uses for sustainability and economic gains. The study highlighted that these residues, often wasted, represent a missed opportunity to enhance farmers' income, particularly with the rising demand for bio-energy, animal feedstock, and organic agriculture. Using government data and SWOT analysis, the study estimated that India produced 516 million tons of agricultural residues in 2014–15, with cereals and sugarcane as the primary contributors. The energy potential of these residues was substantial, with paddy rice straw contributing 486,955 megawatts and coarse cereals 226,200 megawatts. The research also examined successful case studies in India and globally, emphasizing the need to optimize residue utilization for sustainability and environmental care.

Lim *et al*. (2015) aimed to develop a cost-effective and simple method for producing biofertilizer using agro-wastes. The study utilized five types of agro-wastes: watermelon, papaya, pineapple, citrus orange, and banana. Solid-state fermentation was employed to produce the biofertilizer, which was then applied to vegetable plantations. After 5 weeks, physical property tests on plant samples revealed promising results, particularly for those treated with biofertilizer derived from watermelon, papaya, and banana wastes. Additionally, pH and potassium content analyses showed that watermelon biofertilizer had the highest pH value (5.15), while banana biofertilizer had the highest potassium content (3.932 g K/L). This research demonstrates the potential of using agro-wastes to produce effective biofertilizers that can improve plant growth and provide sustainable agricultural solutions.

Devi *et al*. (2024) evaluated the supply and demand for feed and fodder in many areas of Karnataka, India, with an emphasis on the connection between the expansion of livestock production and the availability of fodder. While primary data was gathered to comprehend situations at the village level, secondary data on land usage, crop output (2015–2019), and animal census were used to estimate dry matter (DM) availability and demand. The findings showed that the state's average dry matter availability was just 68.61±54.41%. Twelve districts showed substantial deficiencies with less than 40% DM availability, whereas six of the 30 districts had surplus DM (>100%). The largest percentage of the total DM (69.01%) came from crop leftovers. According to the study, areas with significant deficiencies relied more on plants overall. Bengaluru Urban had the least amount of DM available, while Bagalkot district had the most. In order to alleviate regional differences in fodder supply and boost livestock output, Karnataka must design a strategic fodder strategy based on these findings.

Meganathan *et al*. (2024) stated how important agriculture and animal husbandry are to India, since 60% of the population depends on these sectors for a living. Cattle dung, urine, and byproducts from animal agricultural operations like apiculture and agriculture are among the significant wastes produced by livestock, poultry, and associated businesses that are highlighted in the study. Managing and using this animal waste has grown crucial as the demand for animal products rises as a result of urbanization, population expansion, and shifting lifestyles. The authors emphasize that making efficient use of this unused waste might greatly increase farmers' profits and support the national economy. Manure can be used as fertilizer, biogas can be produced, bio-oil can be produced, panchagavya (a traditional mixture) can be made, algae can be cultivated, and value-added products like bedding made from dried manure solids, cosmetics made from bee waste, and derivatives from snails and land animals can be made. These methods assist sustainable livestock and agricultural activities while also aiding in waste management and providing financial and environmental advantages.

Chapter-III

MATERIALS AND METHODS

This chapter explains the research procedure and materials used for the study. The chapter materials and method has been divided into following categories:

3.1 Study Area

Purposively, a specific district in Uttar Pradesh (U.P.) was selected to fulfill the objectives of the present investigation. Uttar Pradesh, with Lucknow as its capital and Prayagraj as the judicial capital, comprises 75 districts and 18 divisions. The net sown area constitutes 68.5% of the cultivable land, which itself makes up 82% of the total geographical area. U.P., the fourth-largest Indian state by area, covers 240,928 km² (93,023 sq mi), accounting for 7.3% of the country's total area. Although historically known for its sugar production, the services sector now dominates the state's economy. As of 2020, small and marginal farmers represented about 93% of agricultural households in Uttar Pradesh. According to data from the National Sample Survey Office (NSSO), 57.8% of rural households are engaged in agriculture. Considering the large rural population in Uttar

Pradesh, it is reasonable to assume that a significant proportion of these households are involved in farming. Ayodhya district was selected for the study due to its convenience, accessibility, and availability of resources, all of which facilitated smooth data collection.

Ayodhya is a city situated on the banks of the Saryu River in the Indian state of Uttar Pradesh. Historically known as Saketa, Ayodhya had a population of 55,890 as per the 2011 Census of India, with males constituting 56.7% and females 43.3%. The city had an average literacy rate of 78.1%. I have collected my data from four blocks of the Ayodhya district:

- **Milkipur Block**, which includes the villages of Bawan, Surwara, Kuchera, and Chiruli.
- **Amaniganj Block**, which includes the villages of Pithla, Kandasha, Kumarganj, and Akma.
- **Rudauli Block**, which includes the villages of Akhtiyar Pur, Amanta, Baboo Pur, and Dilwal.
- **Masodha Block**, which includes the villages of Dasauli, Daulat Pur, Barwa, and Kurawam.

3.2 Study Duration

Study was carried out from September to June in the year 2024-2025. Questionnaire was prepared in the month of November 2024. After the preparation process, the questionnaire got disseminated in the month of December 2024. The total study duration in which the responses have been taken from the respondents is from December to January 2023-2024 via offline method.

3.3 Selection of Respondents

Respondents were selected randomly from purposively chosen districts of Uttar Pradesh for the study. A total of 120 respondents were selected to participate in the research.

3.3.1 Inclusion Criteria:

1. Farmers residing in the selected districts of Uttar Pradesh.
2. Individuals actively engaged in farming and farm waste management practices.
3. Households or farms generating significant amounts of agricultural waste.

4. Respondents with knowledge of traditional or modern waste management methods.
5. Farmers willing to share information through interviews or surveys.
6. Individuals utilizing innovative or sustainable waste management techniques.

3.3.2 Exclusion Criteria:

1. Individuals not engaged in agricultural activities.
2. Respondents residing outside the selected districts of Uttar Pradesh.
3. Farms that do not generate any significant farm waste.
4. Individuals unwilling to participate or provide accurate information.
5. Households or enterprises that do not engage in farm waste management.
6. Seasonal labourers or temporary workers without direct involvement in waste disposal.

3.4 Tool of Data Collection

A self-structured questionnaire was designed to collect relevant information in alignment with the objectives of the study. The questionnaire was developed to ensure a comprehensive understanding of the socio-demographic profile of respondents, the existing situation of farm waste in Ayodhya district, and current farm waste management practices. The questionnaire consisted of three sections.

1. **Socio-Demographic Profile:** Questions related to age, gender, education level, landholding size, and farming experience of the respondents.
2. **Farm Waste Generation and Current Situation:** Questions addressing the types and quantities of farm waste produced and awareness of farm waste issues.
3. **Farm Waste Management Practices:** Questions focusing on existing disposal methods, utilization techniques, challenges faced, and policies.

3.4.1 Survey Dissemination

The self-structured questionnaire was disseminated through multiple methods to ensure comprehensive data collection from the selected respondents. The dissemination process was designed to maximize participation and accuracy in responses. The following approaches were used:

I. **Personal Interviews:** Face-to-face interactions were conducted with farmers to explain the purpose of the survey and assist in answering questions. This method ensured clarity and minimized response errors.

II. **Field Visits:** Direct visits to farms allowed researchers to observe farm waste management practices firsthand. This helped validate the responses provided by the participants.

III. **Group Discussions:** Small focus group discussions were organized to gather collective insights and community-based practices related to farm waste management.

3.4.2 Sample Size

The sample size for the study was determined based on the objectives and scope of the research. A total of 120 respondents were selected from the Ayodhya district using a random sampling technique from purposively chosen areas. The selected respondents included farmers, agricultural workers, and individuals directly involved in farm waste management.

3.4.3 Eco-Friendly Pot Making from Agricultural Byproducts and Public Awareness

To prepare the sustainable eco-pot, farm waste materials including wheat husk, cow dung, and shredded coconut husk were collected and partially dried. These were mixed in a 2:2:1 ratio. Additionally, a moderate quantity of black soil was added to enhance binding and nutrient content, and natural glue (such as tapioca-based or organic adhesive) was incorporated to improve cohesion and molding capability. A medium proportion of cement (approximately 25–30% by dry weight) was also added to enhance structural strength and durability. Water was gradually added to achieve a workable consistency, and the mixture was molded into pots by hand-pressing in pot molds. The pots were air-dried in shade for 1–2 days, followed by sun-drying for 3–4 days to ensure proper hardening. Once fully dried, the pots were painted with acrylic paints to improve appearance and weather resistance.

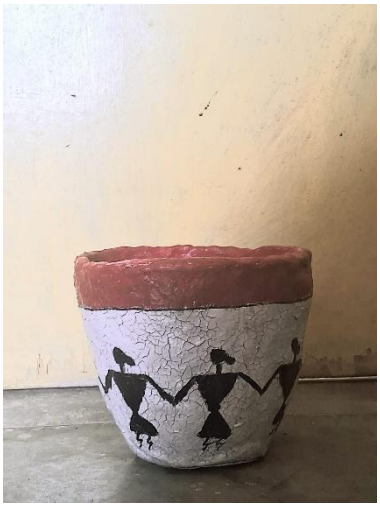


Fig 3.1: Demonstration eco- pot

3.5 Protocol for Assessment

The assessment protocol was designed to systematically collect, analyse, and interpret data related to farm waste management in Ayodhya district. The study followed a structured approach to ensure accuracy and reliability in findings.

3.5.1 Data Collection Procedure

- **Preliminary Survey:** Conducted to understand the local context and refine the questionnaire.
- **Respondent Selection:** Participants were randomly chosen from purposively selected areas.
- **Survey Administration:** Questionnaires were distributed through personal interviews, field visits.

3.5.2 Data Analysis Methodology

- **Quantitative Analysis:**
  - Data were compiled, categorized, and statistically analysed using appropriate tools.
  - Socio-demographic data and farm waste generation trends were assessed numerically.
- **Qualitative Analysis:**
  - Open-ended responses from group discussions were thematically analysed.

- Farmers' opinions on waste management challenges and suggestions were categorized.

3.6 Statistical Tool

The following statistical techniques have been applied in the analysis of data.

1. Percentage

Single comparisons were made based on percentages. To calculate the percentage, the frequency of a particular category was multiplied by 100 and then divided by the total number of respondents in that category.

$$\text{Percentage} = \frac{\text{The sum of all the respondents}}{\text{Total number of all the respondents}} \text{ x } 100$$

1. Arithmetic Mean ($\overline{X}$)

The arithmetic mean ($\overline{X}$) represents the average value of a dataset and is calculated by summing all observations and dividing by the total number of observations. The formula used is:

$$\overline{X} = \frac{\sum x}{N}$$

Where,

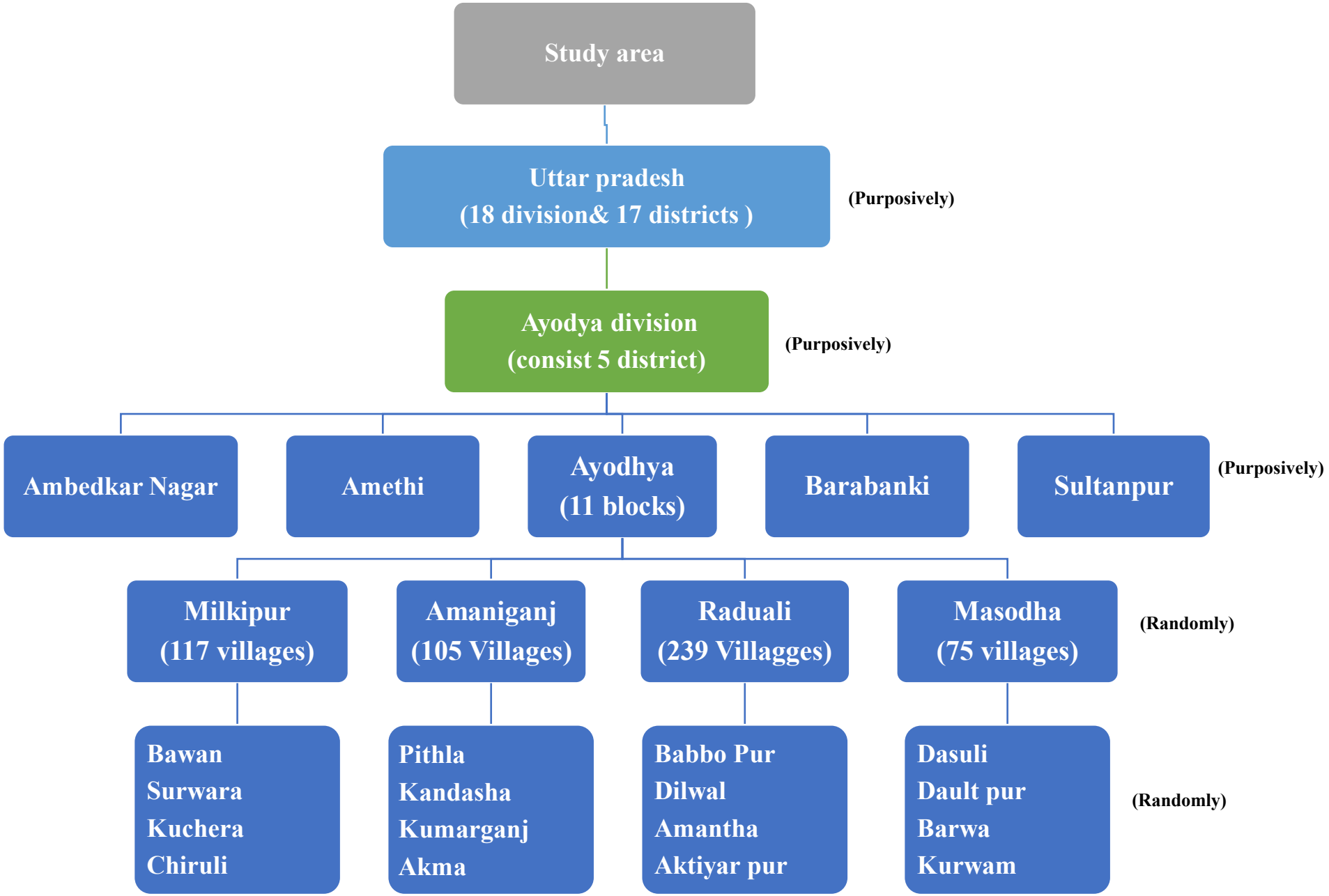
$\overline{X}$ = Average of mean

$\sum x$ = total number of scores obtained by respondents

N = Total number of respondents

3. Rank

Ranks were assigned based on the values obtained from the weighted mean scores. The ranking was done in descending order, where the highest weighted mean score was given the top rank, followed by the next highest, and so on, down to the lowest frequency or mean score. This method helped in prioritizing factors based on their relative importance.


Study area
Uttar pradesh
(18 division& 17 districts)
(Purposively)
Ayodya division
(consist 5 district)
(Purposively)
Ambedkar Nagar
Amethi
Ayodhya
(11 blocks)
Barabanki
Sultanpur
(Purposively)
Milkipur
(117 villages)
Amaniganj
(105 Villages)
Raduali
(239 Villagges)
Masodha
(75 villages)
(Randomly)
Bawan
Surwara
Kuchera
Chiruli
Pithla
Kandasha
Kumarganj
Akma
Babbo Pur
Dilwal
Amantha
Aktiyar pur
Dasuli
Dault pur
Barwa
Kurwam
(Randomly)

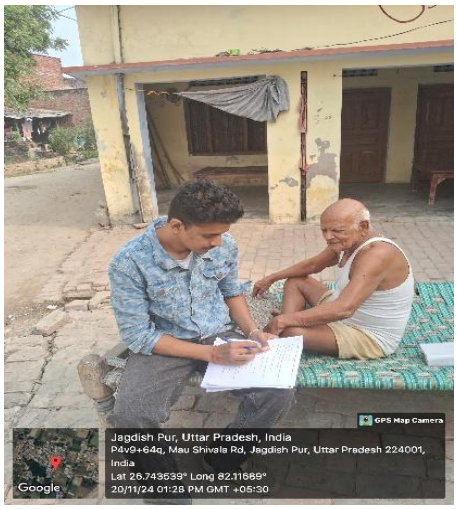


Fig 3.2: Data Collection

Fig 3.3: Livestock Fodder

Fig 3.4: Cow dung cake

Fig 3.5: Incineration

Fig 3.6: painting on eco - pot

Fig 3.7: sustainable eco- pot

Fig 3.8: demonstrating eco- pot to Ayodhya peoples

RESULTS AND DISCUSSION

After statistical analysis of the data collected the findings of the present study, **"A Study on Farm Waste Management in Ayodhya district of Uttar Pradesh"** have been presented and discussed in this chapter. Results have been divided under the following objectives:

4.1 To study the socio-demographic status of the respondents

4.2 To study the existing situation of farm waste in Ayodhya district

4.3 To study the existing method of farm waste management

4.4 To provide some suggestion regarding waste management

4.1.1 Distribution of respondents according to their age group

N=120

Age of respondents	Frequency (f)	Per cent (%)
25-30	16	13.33
30-35	19	15.83
35-40	26	21.67
Above 40 years	59	49.17

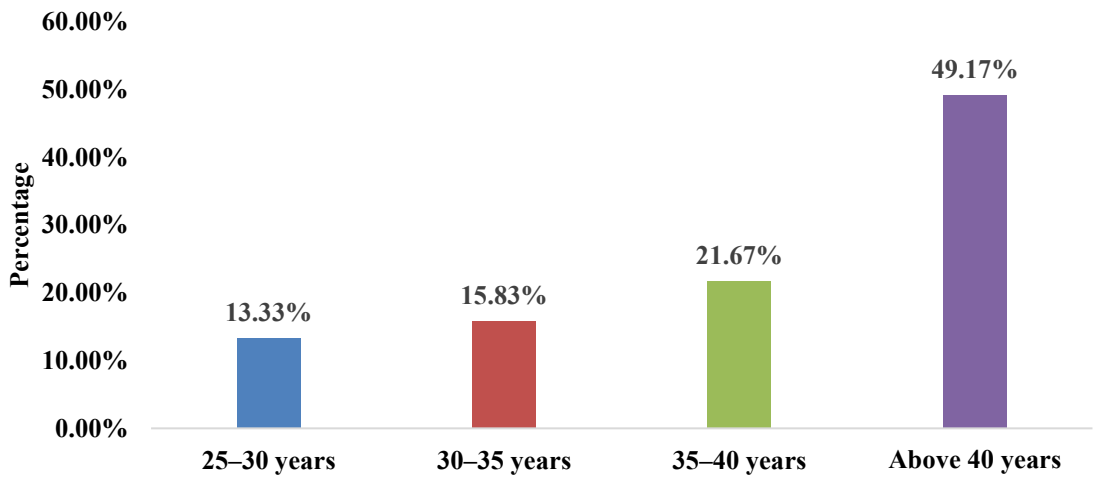


Fig.4.1.1 : Distrubution of respondents according to their age group

Table 4.1.1 presented the age distribution of the respondents, 49.17 per cent of respondents were above 40 years old, followed by 21.67 per cent of respondents aged between 35-40 years old, 15.83per cent of respondents aged 30-35 years old, and only 13.33 per cent respondents belong to the age group of 25-30 years.

4.1.2 Distribution of respondents according to their gender

N=120

Gender	Frequency(f)	Per cent(%)
Male	80	66.67
Female	40	33.33

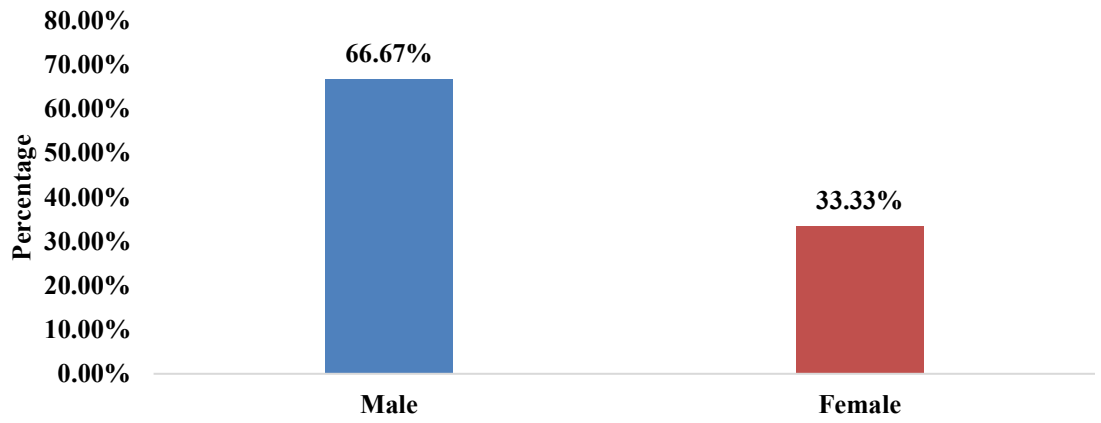


Fig.4.1.2 : Distrubution of respondents according to thair gender

Table 4.1.2 revealed that 66.67 per cent of the respondents were male and 33.33per cent of the respondents were female, highlighting a higher male representation

4.1.3 Distribution of respondents according to their education

N=120

Education	Frequency(f)	Per cent (%)
Illiterate	24	20
Primary	35	29.17
Secondary	39	32.5
Higher secondary	13	10.83
Graduate	09	7.5
Postgraduate	00	00

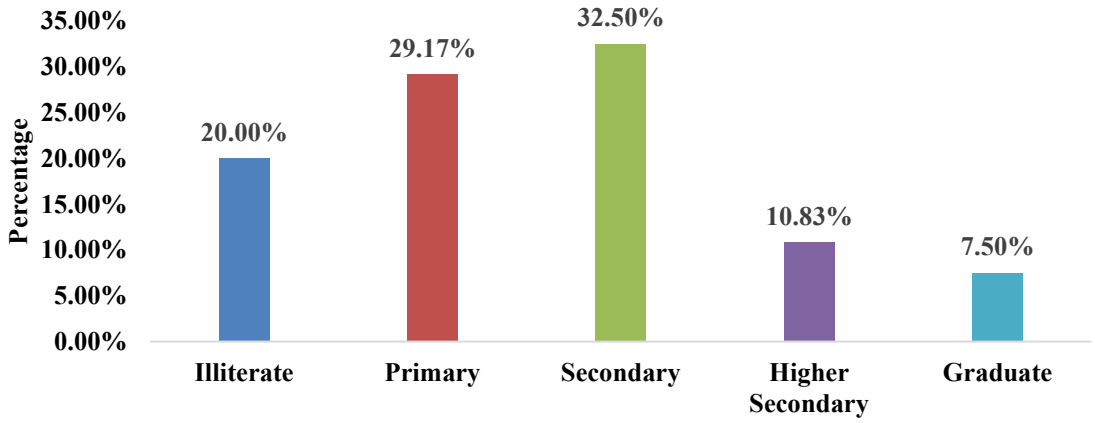


Fig.4.1.3: Distrubution of respondents according to education

Table 4.1.3 showed the educational qualifications of the respondents. The highest proportion, 32.5per cent of respondents, had attained secondary education, followed by 29.17per cent of respondents had completed primary education. Additionally, 20per cent of respondents were illiterate, highlighting a significant portion without formal education. A further 10.83per cent of respondents had achieved higher secondary education, while only 7.5per cent of respondents held a graduate degree. This distribution indicates that most of the respondents had only basic or intermediate levels of education, which may have implications for their access to opportunities and the depth of insight they could offer in the study.

4.1.4 Distribution of respondents according to their religion

N=120

Religion	Frequency(f)	Per cent (%)
Hinduism	107	89.17
Islam	13	10.83
Buddhism	00	00
Christianity	00	00

Fig.4.1.4 : Distribution of respondents according to their religion

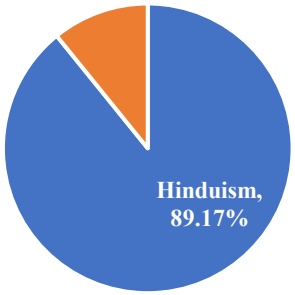


Table 4.1.4 showed the religious composition of the respondents. A large majority, 89.17 per cent of respondents identifying as Hindu, while only 10.83 per cent of respondents followed Islam.

4.1.5 Distribution of respondents according to their caste

N=120

Caste	Frequency(f)	Per cent (%)
General	41	34.17
OBC	52	43.33
SC	19	15.83
ST	08	6.67

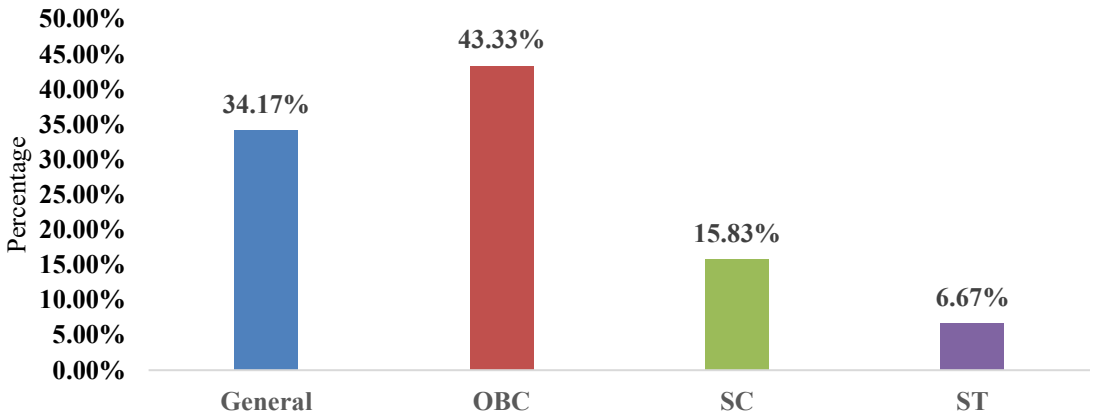


Fig.4.1.5 : Distrubution of respondentes according to thair caste

Table 4.1.5 reported the caste distribution of the respondents. The largest segment 43.33 per cent of respondents reported belonging to the Other Backward Classes (OBC), indicating their dominant presence within the sample. This was followed by 34.17 per cent of respondents from the General category. Additionally, 15.83 per cent of respondents were from the Scheduled Castes (SC), while only 6.67 per cent of respondents reported belonging to the Scheduled Tribes (ST).

4.1.6 Distribution of respondents according to their occupation

N=120

Occupation	Frequency(f)	Per cent (%)
Farmer	103	85.83
Laborer	10	8.33
Business	04	3.33
Government	03	2.5
Other	00	00

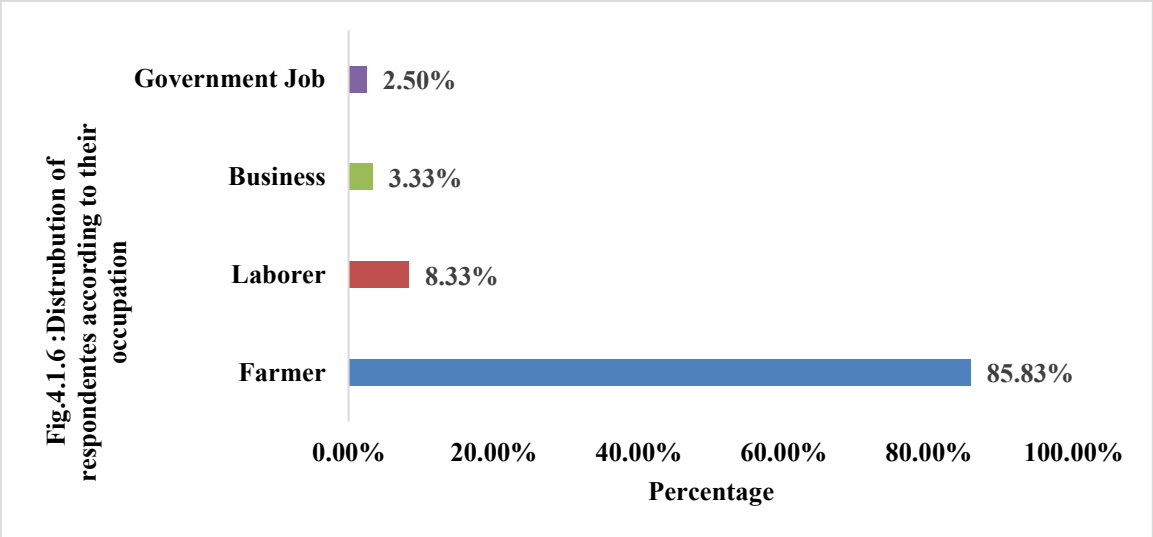


Fig.4.1.6 :Distrubution of respondentes according to their occupation

Table 4.1.6 showed the occupation of the respondents. The largest group, 85.83 per cent of respondents, reported working as farmers, indicating a strong agricultural presence within the sample. This was followed by 8.33 per cent of respondents who worked as labourers. A smaller percentage, 3.33% of respondents, were engaged in business, while only 2.5% of respondents held government jobs. Interestingly, no respondents reported working in other occupations.

4.1.7 Distribution of respondents according to their monthly income

N=120

Monthly income	Frequency(f)	Per cent (%)
<20,000 Rs	84	70.00
20,000-50,000 Rs	30	25.00
50.000-100,000 Rs	06	5.00
>100,000 Rs	00	00

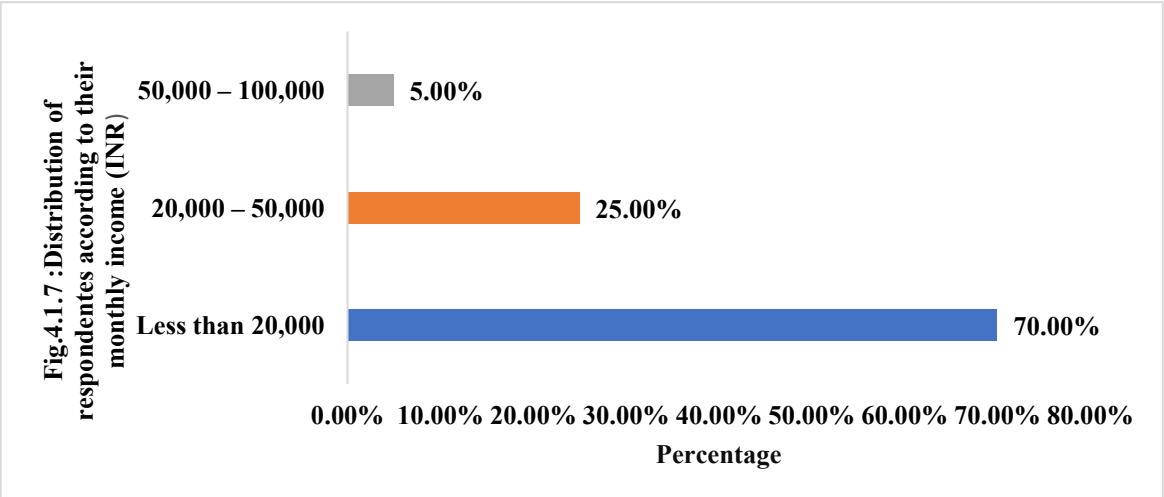


Fig.4.1.7 :Distribution of respondentes according to their monthly income (INR)

Table 4.1.7 examined the monthly income levels of the respondents, revealing that the majority, 70 per cent of respondents, earned less than 20,000 Rs per month. About 25 per cent of respondents had an income between 20,000 Rs and 50,000 Rs, while only 5 per cent of respondents earned between 50,000 and 100,000 Rs.

4.1.8 Distribution of respondents according to their family type

N=120

Family Type	Frequency(f)	Per cent (%)
Nuclear Family	50	41.67
Joint Family	49	40.83
Extended Family	21	17.5

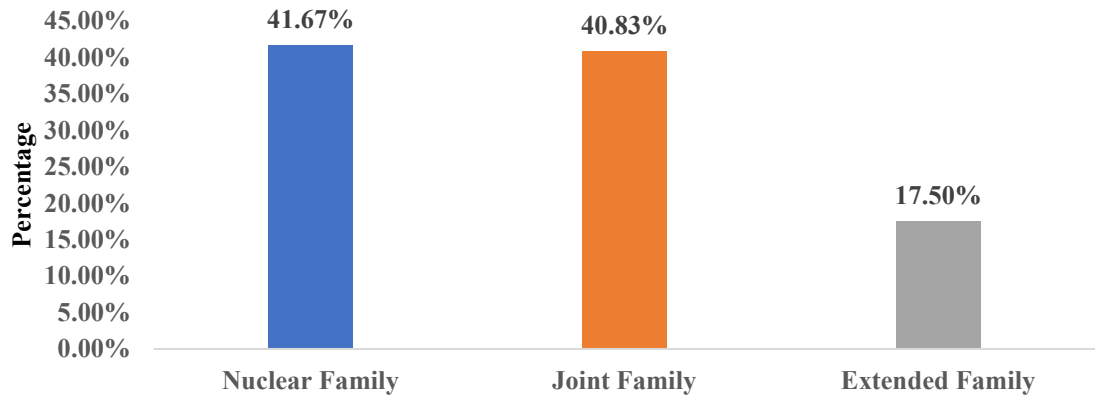


Fig.4.1.8: Distribution of respondents according to family type

Table 4.1.8 showed the family type of the respondents. A slight majority, 41.67 per cent of respondents, belonged to nuclear families, followed closely by 40.83 per cent who reported living in joint families. Additionally, only 17.5 per cent of respondents were part of extended families. The data indicates a fairly balanced distribution between nuclear and joint family structures, with a smaller proportion of respondents living in extended family settings.

4.1.9 Distribution of respondents according to their location

N=120

Location	Frequency(f)	Per cent (%)
Urban	39	32.5
Rural	81	67.5

Fig.4.1.9: Distribution of respondents according to their location

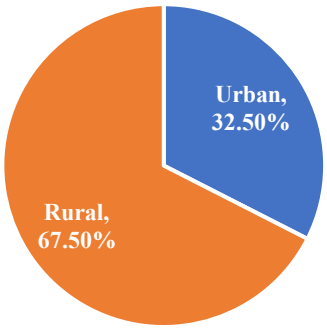


Table 4.1.9 depicted the geographical location of the respondents. A significant majority, 67.5 per cent of respondents, were from rural areas, while only 32.5 per cent of respondents resided in urban areas.

4.2 To study the existing situation of farm waste in Ayodhya district

Table 4.2.1: Distribution of respondents according to their farm type they have

N=120

Farm Type	Frequency(f)	Per cent (%)
Small(<2acres)	31	25.83
Medium(2-5acres)	62	55.83
Large(>5acres)	27	18.34

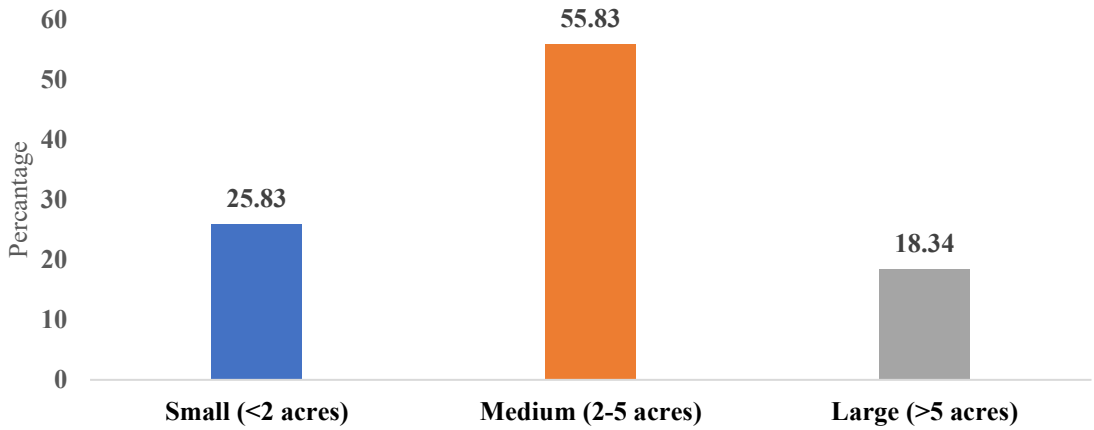


Fig 4.2.1 : Distribution of respondents according to their farm type they have

Table 4.2.1 showed the 55.83 per cent of the respondents owned medium-sized farms ranging from 2 to 5 acres. This was followed by 25.83 per cent of respondents who had small farms of less than 2 acres, while only 18.34 per cent of the respondents managed large farms exceeding 5 acres. The findings indicated that medium-sized farms were the most common among the respondents, suggesting a relatively balanced pattern of land distribution. Similarly, **Singh *et al.* (2020)** reported that 60 per cent of farmers in their study owned small farms <2 acres, suggesting a higher prevalence of small landholdings in their research area compared to the present study.

Table 4.2.2: Distribution of respondents according to their primary crops they grow

N=120

Primary crops	Frequency(f)	Per cent (%)
Wheat	60	50.00
Rice	31	25.83
Maize	18	15.00
Millets	08	6.67
Sugarcane	03	2.5

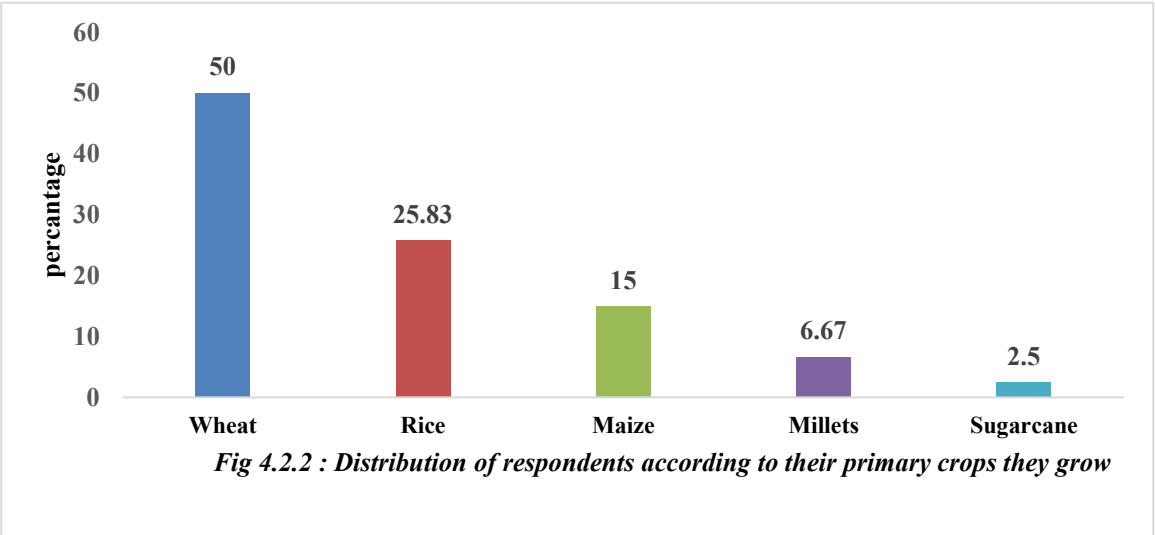


Fig 4.2.2 : Distribution of respondents according to their primary crops they grow

Table 4.2.2 showed the distribution of respondents based on the primary crops they grow. 50.00 per cent of respondents reported growing wheat, making it the most commonly cultivated crop in the study area. This was followed by 25.83 per cent of respondents who grew rice, and 15.00 per cent who cultivated maize. A smaller proportion, 6.67 per cent,

grew millets, while only 2.50 per cent of respondents reported growing sugarcane. The findings indicate that wheat is the dominant crop among respondents, with rice and maize being the next most common crops. **Sharma *et al.* (2019)** found that 45per cent of farmers in their study primarily cultivated wheat, which is slightly lower than the 50% recorded in this study, indicating variations in wheat production across different regions.

Table 4.2.3: Distribution of respondents according to livestock they have

N=120

Primary livestock	Frequency(f)	Per cent (%)
Cattle	89	74.16
Oxen	12	10.00
Goats	16	13.34
Hen	03	2.50

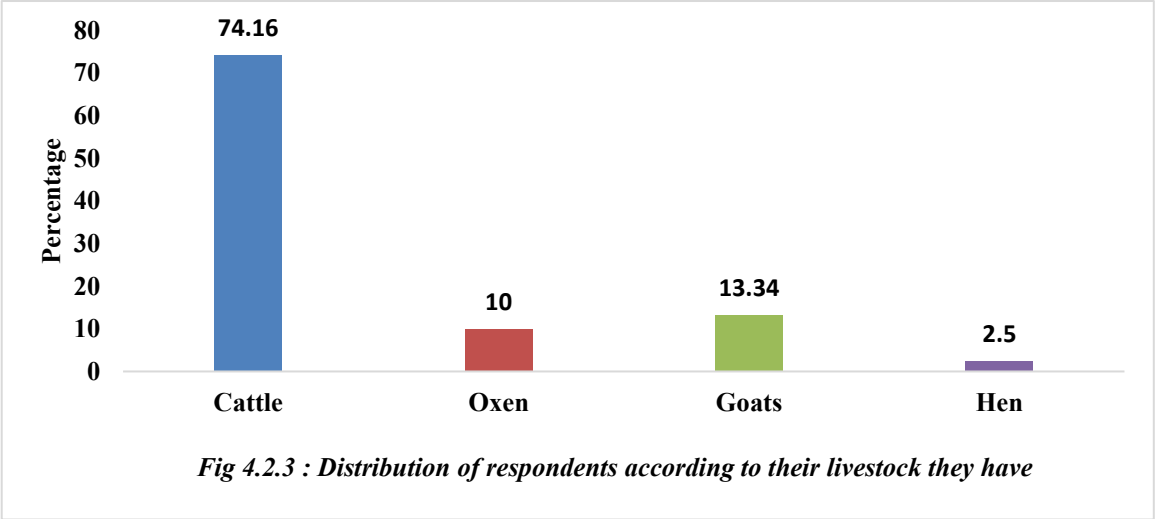


Fig 4.2.3 : Distribution of respondents according to their livestock they have

Table 4.2.3 revealed the distribution of respondents according to the livestock they own. The majority of respondents, 74.16 per cent, owned cattle, making it the most common livestock among the respondents. This was followed by 13.34 per cent of respondents who raised goats, and 10.00 per cent who kept oxen. Hens were the least commonly owned livestock, with only 2.50 per cent of respondents managing them. The findings indicate that cattle are the most prevalent form of livestock ownership in the study area. **Yadav *et al.* (2021)** found that 65% of farmers in their study primarily owned goats, which contrasts with the current study, where cattle ownership is dominant.

Table 4.2.4: Distribution of respondents according to their number of family members working at their farm

N=120

Family members working their farm	Frequency(f)	Per cent (%)
1-3	11	9.24
3-5	72	60.50
5-8	29	24.36
Above 8	07	5.89

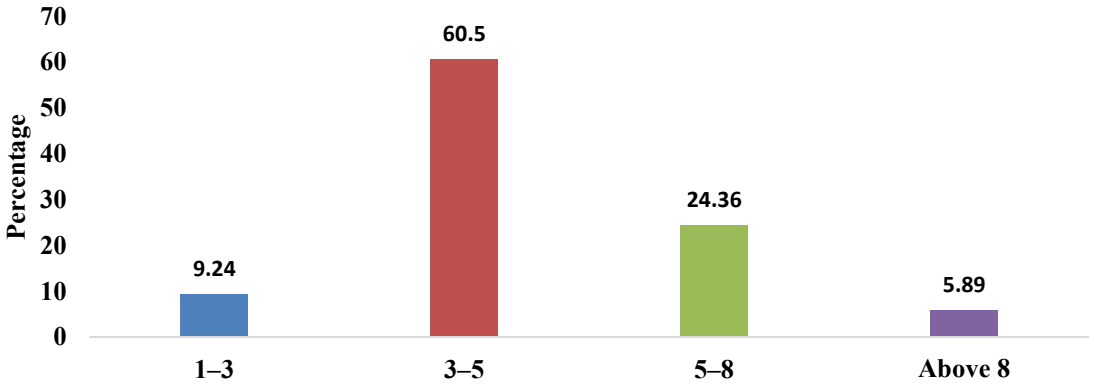


Fig 4.2.4 : Distribution of respondents according to their family members working at their farm ...

Table 4.2.4 presented the distribution of respondents based on the number of family members working at their farms. With the majority of respondents, 60.50 per cent, families having 3 to 5 members involved in farm activities. This was followed by 24.36 per cent of families were 5 to 8 members working on the farm. A smaller proportion, 9.24 per cent, had 1 to 3 family members engaged in farming, while only 5.89 per cent of respondents reported having more than 8 family members contributing to farm activities. These findings suggest that most farms in the study area rely on a moderate level of family labor.

Table 4.2.5: Distribution of respondents according to type of farm waste generated on their farm

N=120

Type of waste generated from farm	Frequency(f)	Per cent (%)
Crop residues	105	87.5
Animal waste	15	12.5
Pesticide waste	00	00
Plastic waste	00	00

Fig 4.2.5 : Distribution of respondents according to type of farm waste generated from farm

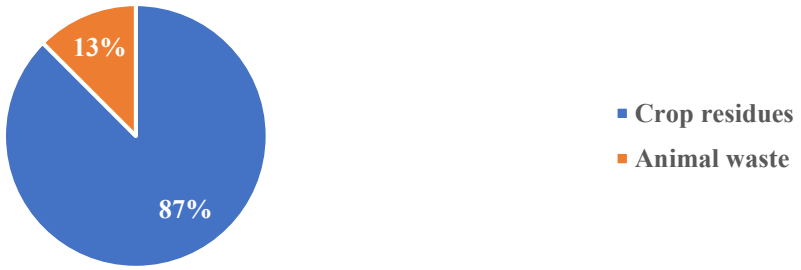


Table 4.2.5 depicted the distribution of respondents according to the type of farm waste generated on their farms. The majority of respondents, 87.5 per cent, reported the major farm waste generated as the form of crop residues after harvesting the crops. followed by 12.5 per cent of respondents reported that waste generated by livestock. While **Obi *et al.* (2016)** additionally, studies indicate that 80per cent of maize processing results in waste, reinforcing the idea that crop residues remain a major component of agricultural waste.

Table 4.2.6: Distribution of respondents according to their farm waste generation monthly

N=120

Monthly Farm Waste Generation	Frequency(f)	Per cent (%)
<100kg	30	25.00
100-200kg	76	63.40
>200kg	14	11.66

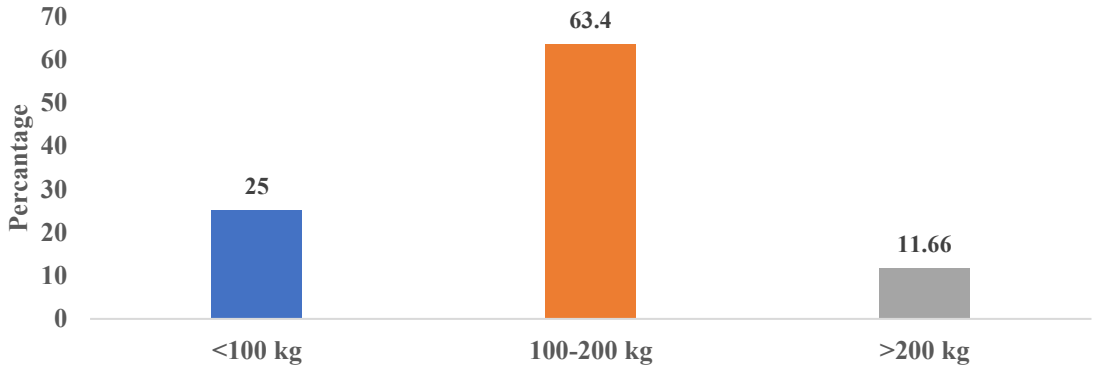


Fig 4.2.6 : Distribution of respondents according to their monthly farm waste generation

Table 4.2.6 presented data on farm waste generation per month among respondents. 63.33 per cent of respondents produce between 100 and 200 kg of waste, indicating that this is the most common range of waste generation. This is followed by 25.00 per cent of respondents who generate less than 100 kg of waste per month, while only 11.66 per cent of respondents produce more than 200 kg of waste monthly. The findings suggest that most farms fall within a moderate waste generation range, with only a small proportion contributing to higher waste output. This trend aligns with findings by **Singh *et al.* (2018)**, who reported that small to medium-scale farms typically generate 100–250 kg of waste monthly, with larger farms exceeding 200 kg due to increased agricultural activities.

Table 4.2.7: Distribution of respondents according to harvesting method adopted for crop harvesting

N=120

Crop harvesting method	Frequency(f)	Per cent (%)
Manual harvesting	89	74.10
Mechanized harvesting	31	25.90

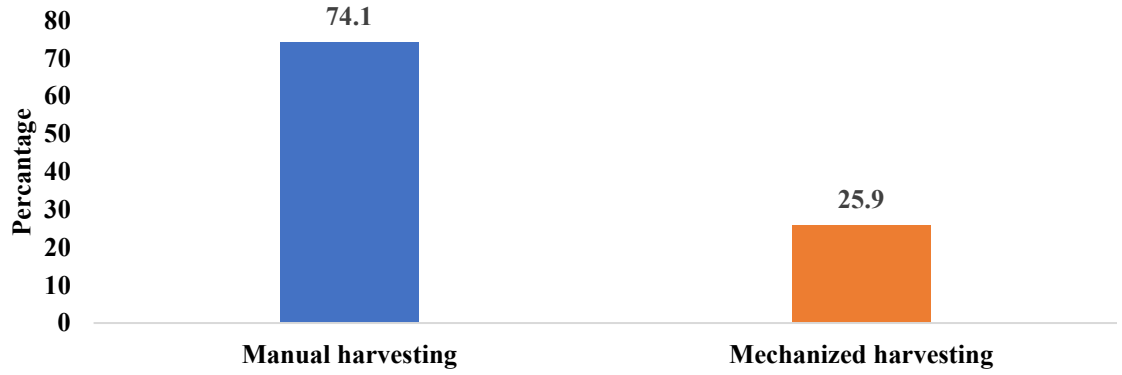


Fig 4.2.7: Distribution of respondents according to their method adopted for crop harvesting

Table 4.2.7 depicted the data on crop harvesting methods reveals that a significant portion of farmers, 74.10per cent of respondents depend on manual harvesting, whereas only 25.90per cent of respondents utilize mechanized harvesting. This indicates that traditional harvesting methods remain prevalent, potentially due to factors such as cost, farm size, or the type of crops grown. The lower adoption of mechanized harvesting suggests limited access to advanced machinery or a preference for manual techniques to ensure better handling of crops, in comparison, studies such as **Benaseer *et al.* (2018)** highlighted that manual harvesting, while common, can lead to significant crop losses due to delays and

inefficiencies. They report that harvest losses can range from 5per cent to 16per cent for rice and 8per cent to 18per cent for various cereal crops, often attributed to factors like shatter loss during delayed harvesting. Similarly, research by **Kumar *et al.* (2019)** focuses on optimizing operational parameters for mechanized harvesting of pigeon-pea using combine harvesters. Their findings indicated that proper adjustment of machinery settings can achieve threshing efficiencies exceeding 98 per cent, with grain damage kept below 1per cent under optimal conditions.

Table 4.2.8: Distribution of respondents according to satisfaction level with their current farm waste management practices

N=120

Level of Satisfaction	Frequency(f)	Per cent (%)
Very dissatisfied	00	00
dissatisfied	24	20.0
Neutral	32	26.6
Satisfied	39	32.5
Very satisfied	25	20.90

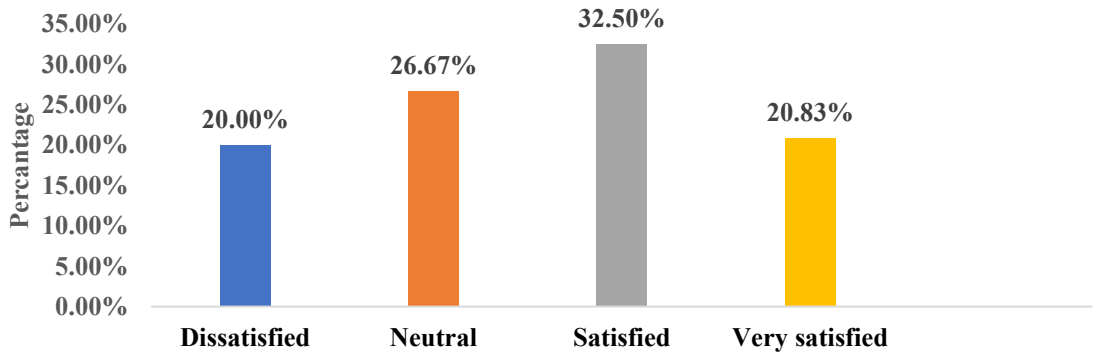


Fig 4.2.8 : Distribution of respondents according to satisfaction level with their current farm waste management practices

Table 4.2.8 presented data on the satisfaction level of respondents with their current farm waste management. A majority, 32.5 percent of respondents, expressed satisfaction with their current farm waste management practices, making it the most common level of satisfaction. This is followed by 26.6 percent of respondents who reported a neutral stance on the issue. 20.0 percent of respondents expressed dissatisfaction, while 20.90 percent were very satisfied. Only a negligible proportion, 0.0 percent of respondents, were very dissatisfied.

4.3 To study the existing method of farm waste management

Table 4.3.1: Distribution of respondents according to their adopted farm management practice for farm waste

N=120

Adopted farm management method	Frequency(f)	Per cent (%)
Composting	37	30.80
Vermicomposting	00	00
Fodder	79	65.80
Other's	04	3.4

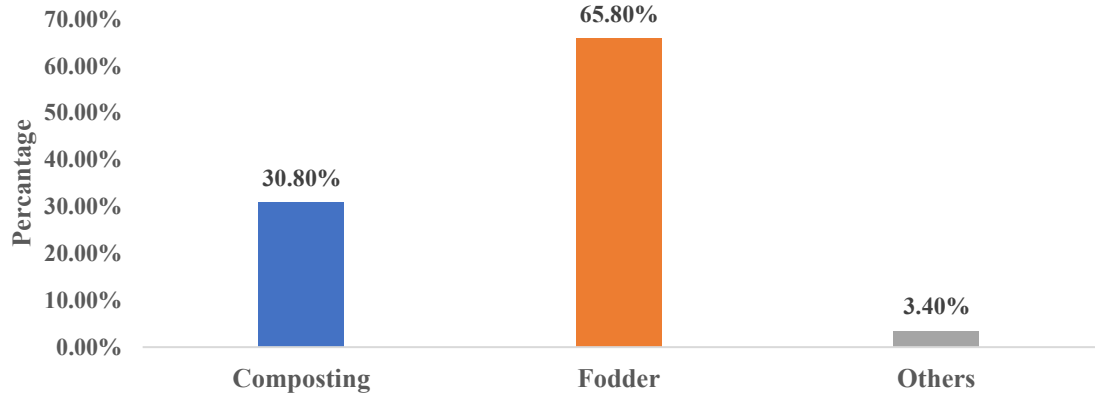


Fig 4.3.1 : Distribution of respondents according to their adopted farm management practice for farm waste

Table 4.3.1 the data on respondents' current farm waste management practices highlighted the majority, 65.80per cent of respondents utilize farm waste as fodder, making it the most common management method. Composting is the second most preferred approach, adopted by 30.80 per cent of respondents indicating a focus on organic waste recycling. Interestingly, vermicomposting is entirely absent 0per cent, suggesting a lack of awareness, resources, or infrastructure for this method. Only 3.4per cent of respondents reported using other waste management practices, which could include burning, landfill disposal, or alternative recycling methods. This distribution indicates a strong reliance on repurposing waste for animal feed while composting remains a secondary yet notable practice. In comparison, **Singh *et al.* (2024)** highlighted the effectiveness of vermicomposting in recycling organic solid waste, emphasizing its role in sustainable waste

management. The absence of vermicomposting in the current study suggests a lack of awareness or infrastructure, contrasting with findings where vermicomposting has been successfully adopted as an eco-friendly waste disposal method.

Table 4.3.2: Distribution of respondents according to their awareness level regarding sustainable farm waste management practices

N=120

Awareness of sustainable farm waste management	Frequency(f)	Per cent (%)
Yes	71	59.17
No	49	40.83

Fig 4.3.2 : Distribution of respondents according to their awareness level regarding sustainable farm waste management practices

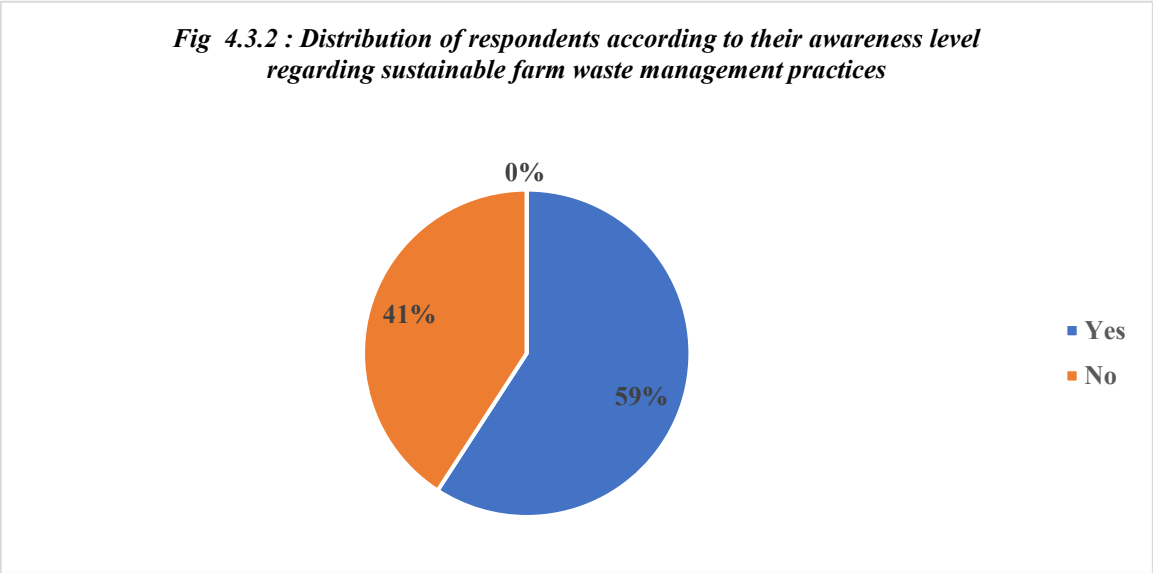


Table 4.3.2 the data revealed that 59.17 per cent of individuals are aware of such practices, while only 40.83 per cent are not. This indicates that although a majority of respondents recognize sustainable waste management methods, a significant portion still lacks awareness. Similarly, **Singh *et al.* (2024)** emphasized the role of educational programs in increasing awareness of sustainable practices, highlighting that areas with well-structured training initiatives tend to have higher adoption rates. The relatively lower awareness observed in this study suggests the need for targeted educational campaigns and policy interventions to bridge the knowledge gap and promote sustainable waste management among farmers.

4.3.3: Distribution of respondents according to their preference on adopting sustainable management practices

N=120

Preference for adoption	Frequency(f)	Per cent (%)
Yes	115	95.84
No	49	4.16

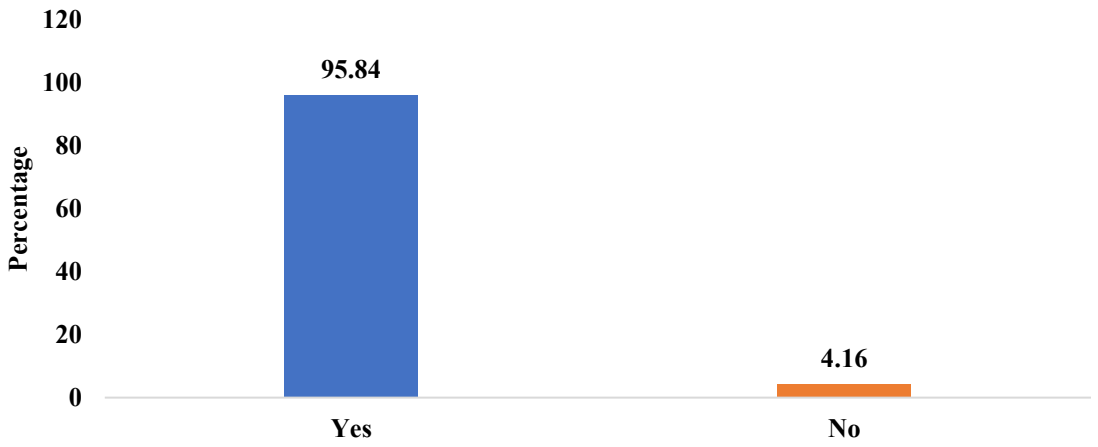


Fig 4.3.3: Distribution of respondents according to their Preference on adopting sustainable management practices

Table 4.3.3 reveled that a significant majority of respondents 95.83 per cent reported adopting sustainable management practices, while only 4.17 per cent stated that they did not engage in such practices. This high adoption rate suggests a growing awareness and commitment to sustainability, possibly driven by regulatory requirements, corporate social responsibility initiatives, and the recognition of long-term benefits. While **Han *et al.* (2023)** highlights different adopter typologies, with a substantial portion of respondents embracing sustainable practices. Approximately 70% of farmers were classified as active adopters, motivated by perceived benefits such as increased yields and cost savings.

4.3.4: Distribution of respondents according to their motivational factor adopt sustainable practice

N=120

Factor adopt sustainable practice	Frequency(f)	Per cent (%)
Economic benefits	112	93.33
Environmental concerns	05	4.16
Social benefits	01	0.85
Other	02	1.66

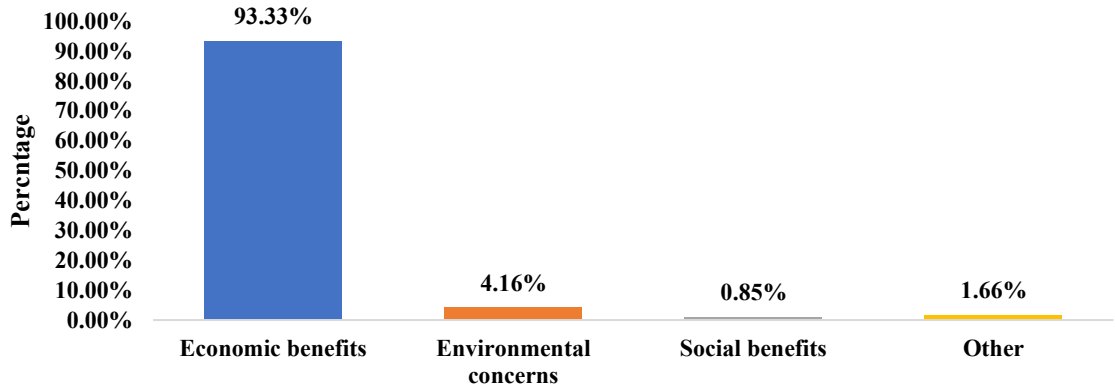


Fig 4.3.4 :Distribution of respondents according to their motivational factor adopting sustainable practice

Table 4.3.4 showed the distribution of respondents based on their motivational factors for adopting sustainable practices. The majority 93.33 per cent of respondents were primarily driven by economic benefits. A smaller proportion4.16 per cent of respondents-adopted sustainable practices due to environmental concerns, while only 0.85 per cent of respondents cited social benefits as their motivation. Additionally, 1.66 per cent of respondents indicated other reasons for adopting sustainable practices. This data highlights that financial incentives play a crucial role in encouraging sustainable behavior among respondents.

4.3.5 Distribution of respondents according to preference generate energy from farm waste

N=120

Preferred energy source	Frequency(f)	Per cent (%)
Bio gas	00	00
Bio mass	00	00
Cow dung	115	95.83
Others	05	4.16

Fig 4.3.5: Distrubution of respomndentes according to prefarance genaerating energy from farm waste

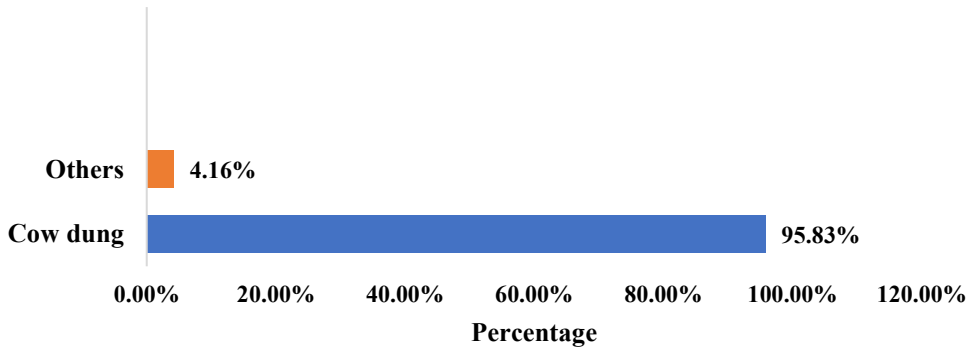


Table 4.3.5 distribution of respondents based on their preference for generating energy from farm waste indicated that 95.83 per cent of respondents prefer using cow dung as an energy source. A smaller proportion of 4.16 per cent of respondents opted for other sources. Notably, none of the respondents preferred bio-gas or biomass for energy generation, as both categories recorded 0 per cent. This data suggests that cow dung is the most fevered option for energy generation among respondents, likely due to its availability and ease of use in farming communities. In contrast, **Dabas *et al.* (2018)** found that 100per cent of the surveyed farmers used cow dung for biogas production, with approximately 90 per cent preferring small-scale biogas plants (3.0 m^3 capacity). Their study demonstrated that biogas systems from cow dung provided significant economic benefits, with a 120 per cent higher net profit in the first year and 200per cent in subsequent years.

Table 4.3.6 Distribution of respondents according to their preference to composting the farm waste

N=120

Preference for Composting	Frequency(f)	Per cent (%)
Yes	120	100
No	00	00

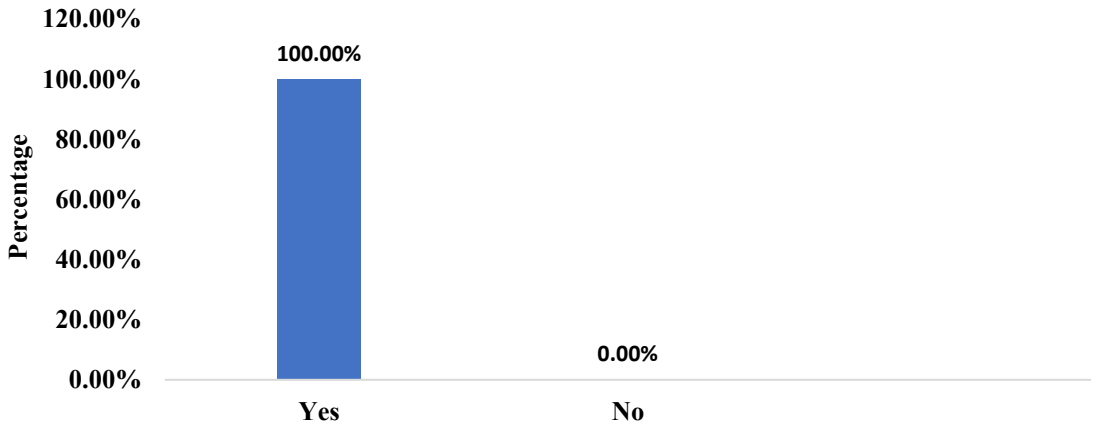


Fig 4.3.6 : Distrubution of respondent according to thair preference to composting the farm waste

Table 4.3.6 the results revealed that 100 per cent of respondents prefer composting farm waste. In contrast, **Dabas *et al.* (2018)** reported an 85 per cent composting adoption rate among farmers in Rajasthan, Haryana, and Uttar Pradesh, with the remaining 15 per cent opting for less sustainable methods like burning or landfill disposal. The complete adoption

in this study suggests stronger awareness, better accessibility to composting resources, or policy support encouraging sustainable waste management practices.

4.3.7 Distribution of respondents according to materials they use for composting processes

N=120

Materials for composting processes	Frequency(f)	Per cent (%)
Crop residue	84	70.00
Livestock manure	20	16.66
Organic waste	16	13.34
Food waste	00	00
Other's	00	00

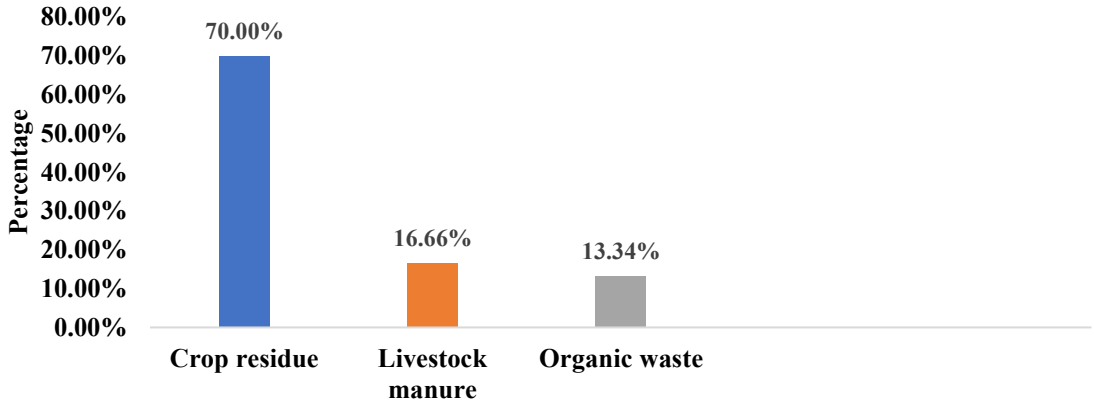


Fig 4.3.7 :Distribution of respondents according to materials they use for composting processes

Table 4.3.7 showed that 70 per cent of respondents utilized crop residue, followed by 16.66 per cent of respondents who used livestock manure. A smaller proportion, 13.34 per cent of respondents, used organic waste, while food waste and other materials were not used at all, with 0.00 per cent of respondents indicating their use. In comparison, **Ghava *et al.* (2018)** reported that agricultural residues accounted for 68per cent of composting materials, while organic waste contributed 20 per cent. Additionally, livestock manure was used by 10per cent of farmers, and food waste made up 2per cent of composting inputs. This suggests that while both studies highlight the dominance of crop residues, there are differences in the utilization of organic waste and food waste, which may be influenced by regional practices, waste availability, or farmer awareness of composting methods.

4.3.8 Distribution of respondents according to composting method they use for farm waste management

N=120

Composting method for farm waste management	Frequency(f)	Per cent (%)
Pit composting	87	72.5
Vermicomposting	00	00
Incineration	33	27.5

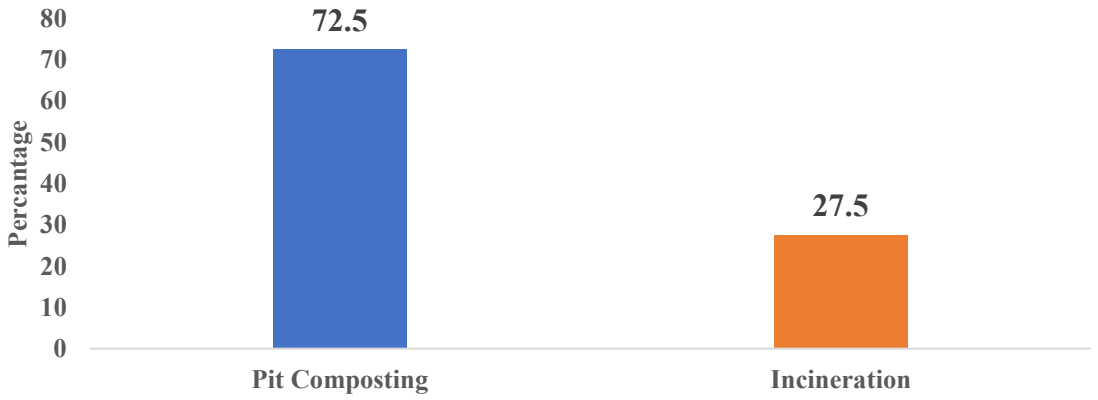


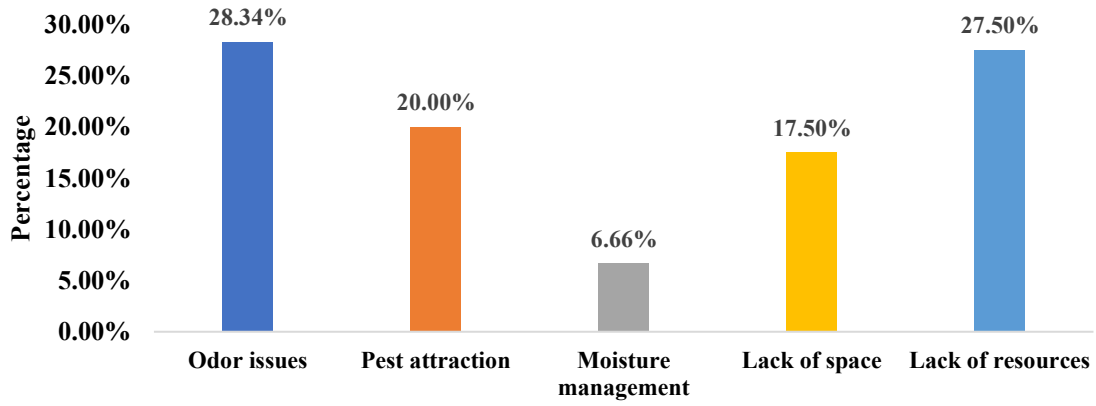
Fig 4.3.8 ; Distribution of respondents according to composting method they use for farm waste management

Table 4.3.8 The findings indicated that pit composting is the most widely used method for farm waste management, with 72.5 per cent of respondents adopting this technique. Meanwhile, 27.5 per cent of respondents reported incineration farm waste, while vermicomposting was not used at all 0 per cent. This suggests that while composting is a common practice, alternative sustainable methods like vermicomposting have not been adopted by the respondents. This aligns with **Bhuvaneshwari *et al.* (2019)** reported that 25-35per cent of agricultural waste is burned in India due to limited composting technology and awareness. Their study highlighted the environmental risks of burning and emphasized the need for policy interventions, subsidies, and farmer education. The absence of vermicomposting supports their argument that limited access to resources hinders sustainable practices, underscoring the need for government support and technology adoption.

4.3.9 Distribution of respondents according to challenges faced by them in composting process

N=120

Challenges faced in composting process	Frequency(f)	Per cent (%)
Odor issues	34	28.34
Pest attraction	24	20.00
Moisture management	08	6.66
Lack of space	21	17.5
Lack of resources	33	27.5



4.3.9 :Distribution of respondents according to challenges faced by them in composting process

Table 4.3.9 presented the challenges faced by respondents in the composting process. The most commonly reported issue was odor problems, affecting 28.34 per cent of respondents, followed closely by a lack of resources at 27.5 per cent. Pest attraction was another significant challenge, experienced by 20 per cent of respondents, highlighting concerns related to hygiene and pest control. Additionally, 17.5 per cent of respondents reported a lack of space, indicating spatial constraints as a limiting factor for composting. Only 6.66 per cent faced moisture management issues, suggesting that while this is a challenge, it is less prevalent compared to the others. Similarly, **Ayilara *et al.* (2020)** reported that odor issues 35 per cent and pest attraction 25 per cent were among the most common complaints from farmers engaged in composting, aligning with the findings of this study.

4.3.10 Distribution of respondents according to their preference for incineration of farm waste

N=120

Preference for Incineration	Frequency(f)	Per cent (%)
Yes	43	35.83
No	77	64.17

Table 4.3.10 indicated that 64.17 percent of respondents do not prefer the incineration waste disposal method, while 35.83 percent of respondents opt for this method**.** Compared to **Obame *et al.* (2024)** reported that 58 per cent of farmers in their study also preferred burning waste due to limited alternatives, while 42 per cent opted for more sustainable methods such as composting or recycling. Similarly, **Ayilara *et al.* (2020)** found that 50 per cent of farmers burned waste, but regions with better waste management

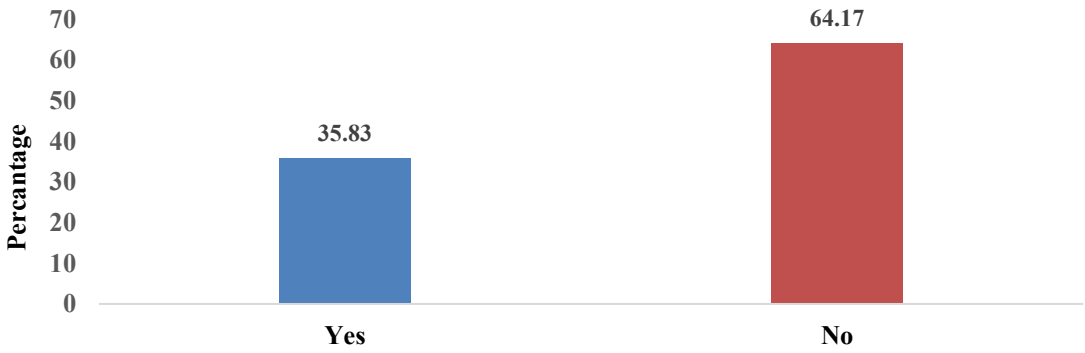


Fig 4.3.10 : Distribution of respondents according to their preference for incinartion of farm waste

awareness had a lower percentage. The continued preference for burning in this study highlights the need for increased awareness and adoption of sustainable waste management practices to reduce environmental impact.

4.3.11 Distribution of respondents according to the type of farm waste incinerated

N=120

Material Burned	Frequency(f)	Per cent (%)
Crop Residues	38	100
Livestock waste	00	00
Hazardous waste	05	00
Organic waste	00	00

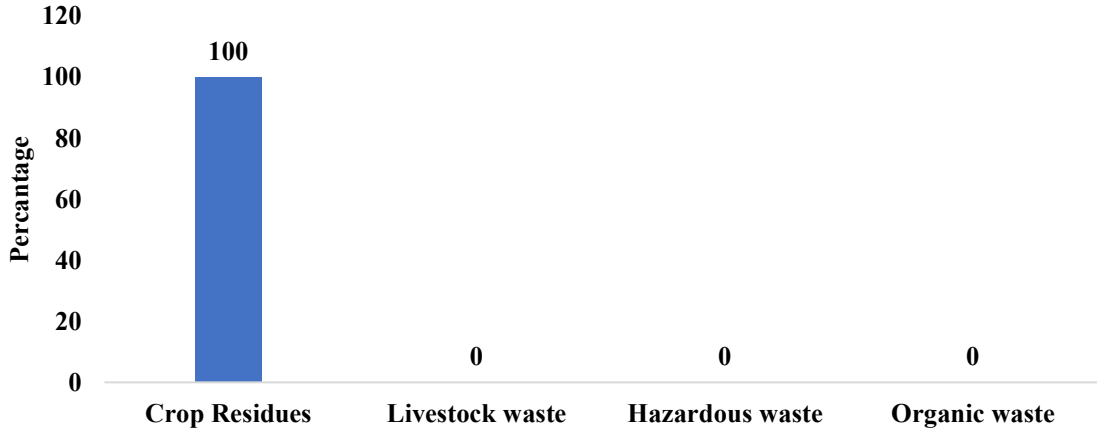


Fig 4.3.11 : Distribution of respondents according to the type of farm waste Incinerated

Table 4.3.11 presented the materials incinerated by respondents who reported engaging in farm waste burning. Out of the 120 respondents surveyed, 43 respondents acknowledged burning farm waste. 100 per cent of respondents primarily incinerate crop residues These findings highlight the urgent need to promote sustainable farm waste management practices through awareness campaigns, training programmes, and government interventions to mitigate the harmful impacts of farm waste incineration. **Grover *et al.* (2015)** reported that 96 per cent of farmers practiced crop residue burning (CRB), primarily to quickly prepare land for the next crop and eliminate pests and weeds.

4.3.12 Distribution of respondents according to their preferred area for farm waste incineration

N=120

Preferred area for farm waste incineration	Frequency(f)	Per cent (%)
Yes	34	79.06
No	09	20.94

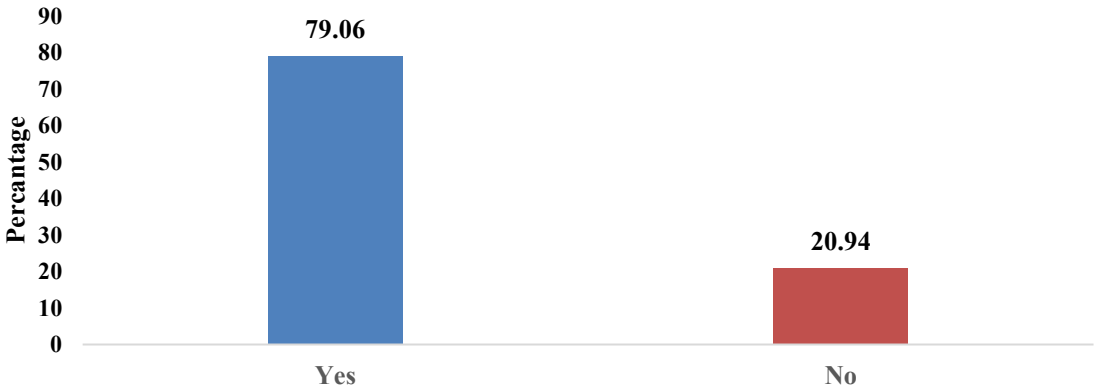


Fig 4.3.12 : Distribution of respondents according to their preferred Area farm waste incineration

Table 4.3.12 presented the distribution of respondents according to their preferred area for incinerating farm waste. Out of the 43 respondents who reported incinerating farm waste, 79.06 per cent indicated that they have a designated area for the activity. In contrast, 20.94 per cent reported not having a specific location for incineration. The presence of a designated area may reflect an effort to carry out the incineration process in a more controlled and organized manner, potentially helping to reduce environmental and health-related risks.

4.3.13 Distribution of respondents according to their biogas utilization

N=120

Biogas usage	Frequency(f)	Per cent (%)
Yes	00	00
No	120	100

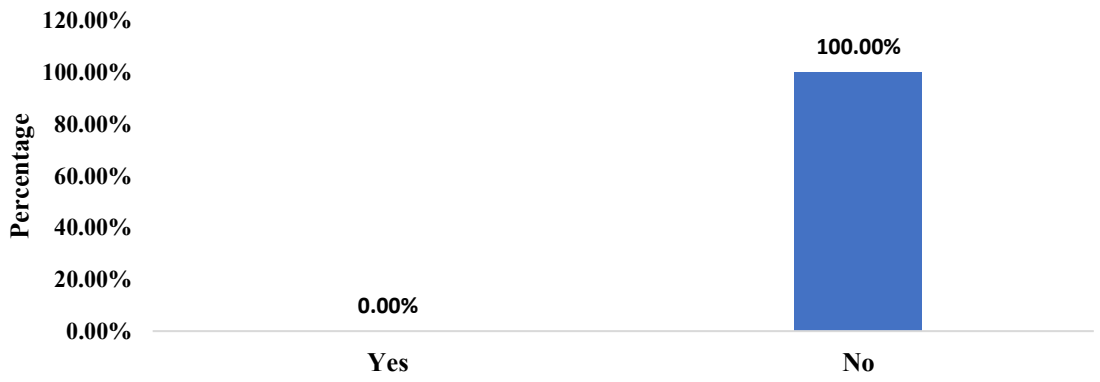


Fig 4.3.13 : Distribution of respondents according to their biogas utilization

Table 4.3.13 showed that none of the respondents had utilizing a biogas plant, with 100per cent indicating its absence. This highlights the complete lack of biogas plant usage among the surveyed respondents. In comparison, **Obame *et al.* (2024)** found that 10per cent of farmers in their study had access to a biogas plant, demonstrating limited adoption but some presence.

4.3.14 Distribution of respondents according to their preference for landfilling farm waste

N=120

Landfilling farm waste	Frequency(f)	Per cent (%)
Yes	69	57.50
No	51	42.50

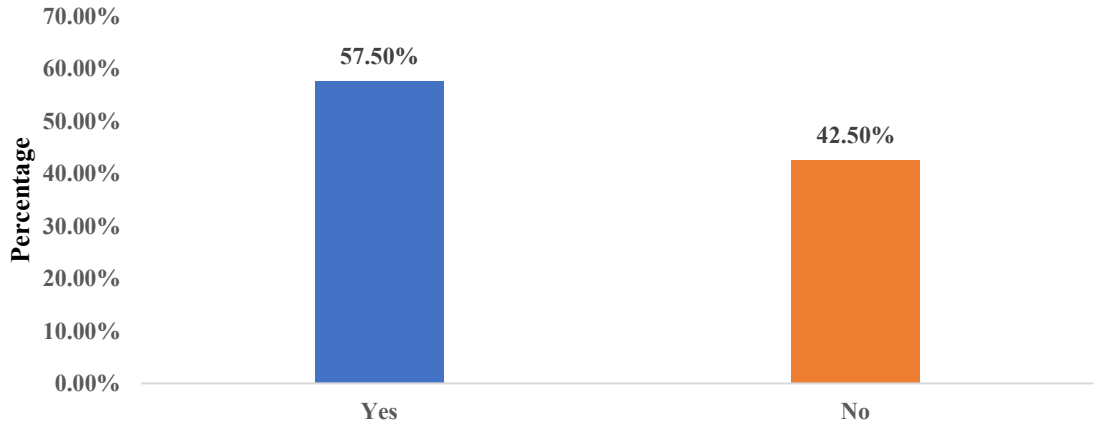


Fig 4.3.14 : Distribution of respondents according to their preference for landfilling farm waste

Table 4.3.14 indicated that the majority of respondents 57.5 per cent prefer landfilling as a method for disposing of farm waste, while 42.5 per cent of respondents do not use the landfilling method. This preference may be influenced by factors such as ease of disposal, the lack of alternative methods, or limited awareness of more sustainable waste management practices. In comparison, **Oshima (2024)** highlighted the challenges in agricultural waste management, emphasizing that the absence of policy frameworks and farmer education often leads to a reliance on landfilling as a convenient disposal method. Similarly, **Rao *et al.* (2024)** conducted a comprehensive review on agricultural waste production and onsite management, noting that in areas lacking access to advanced waste treatment technologies, landfilling remained the most prevalent disposal method among farmers.

4.3.15 Distribution of respondents according to material they use for landfilling process

N=120

Material used for landfilling	Frequency(f)	Per cent (%)
Crop Residues	45	65.23
Livestock manure	08	11.59
Pesticide container	10	14.49
Other's	06	8.69

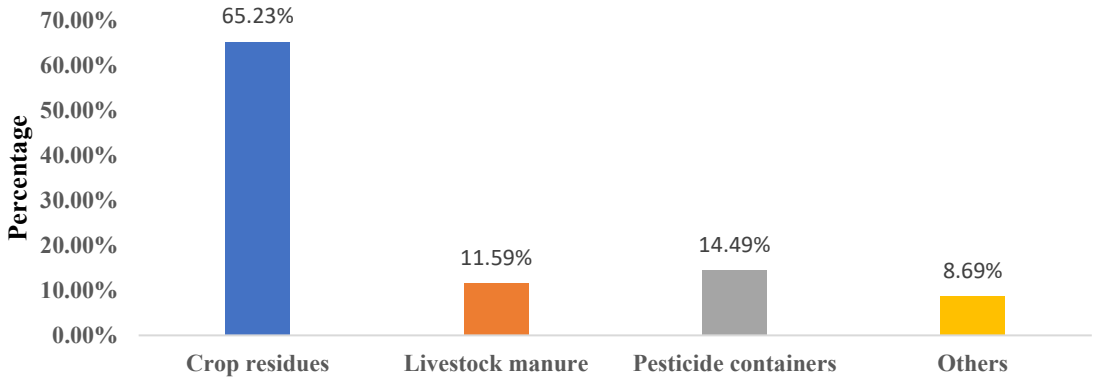


Fig 4.3.15 : Distribution of respondents according to their material they use for landfilling process

Table 4.3.15 Presented the distribution of respondents based on the materials they use for landfilling. Among the 120 respondents surveyed, 69 reported engaging in landfilling as a waste disposal method. The most commonly landfilled material was crop residues 65.23per cent, followed by pesticide containers 14.49 per cent, livestock manure 11.59 per cent, and other materials 8.69 per cent. These findings indicate that a significant portion of farm waste disposed of through landfilling consists of organic matter, while a notable percentage includes hazardous waste such as pesticide containers. In comparison, **Oshima (2024)** found that crop residues were the dominant material in landfilling 60 per cent in their study, which aligns with the findings of this research. However, they also reported a higher percentage 20 per cent of pesticide containers being landfilled, suggesting greater exposure to hazardous waste.

4.4 To provide some suggestion regarding farm waste management

- It has been suggested to the farmers of Ayodhya district adopt eco-friendly and sustainable methods of farm waste management by taking benefits to government schemes and locally available techniques. Awareness should be created about

schemes such as the National Mission on Sustainable Agriculture (NMSA), the Gobardhan Scheme, and the Rural Compost Scheme, which support the conversion of farm waste into useful products like compost and biogas.

- During my field visits, farmers were getting aware about the usage of eco-pot with having benefits of processing and reusage of Agri waste and by products. especially recommend that farmers adopt the vermicomposting method, as it is not currently practiced in the area. Vermicomposting, which involves using earthworms to convert organic waste into rich compost, is an efficient and natural way to improve soil fertility and reduce the need for chemical fertilizers. Instead of burning crop residues-which causes pollution and soil degradation—farmers can explore better options like mulching or in-situ decomposition. Non-compostable waste should be disposed of safely through landfilling in designated areas to maintain hygiene.
- Farmers should also be guided to segregate biodegradable and non-biodegradable waste at the source. To build awareness and technical knowledge, regular training programs and workshops should be conducted through Krishi Vigyan Kendras (KVKs) and local agricultural departments. In addition, village-level community composting or biogas units should be promoted for collective waste management.
- farmers are unsure about how to properly utilize or dispose of farm waste, they should contact their nearest KVK or attend local agricultural programs to gain practical knowledge and guidance. These steps will help improve farm productivity, protect the environment, and promote sustainable agricultural practices in the Ayodhya region.

4.4.1 Distribution of respondents according to their attendance at workshop/training session on farm waste management

N=120

Attendance at Workshop/Training	Frequency(f)	Per cent (%)
Yes	17	85.83
No	103	14.17

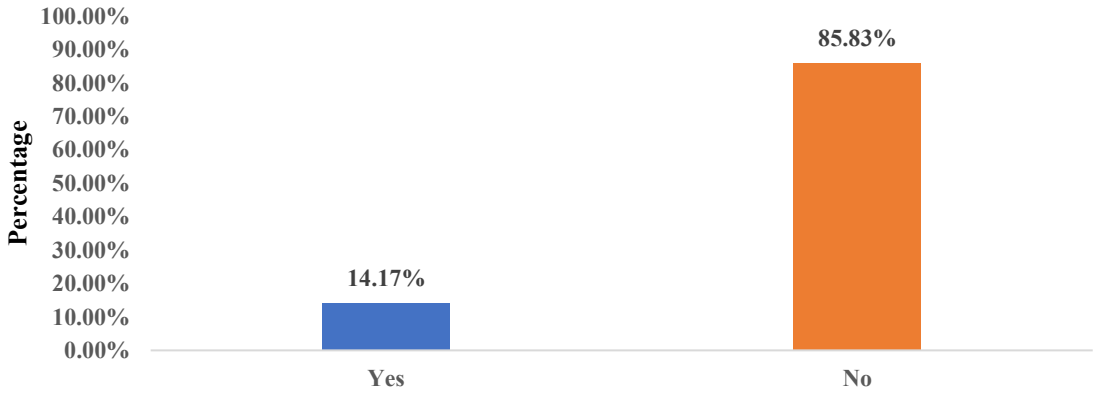


Fig 4.4.1 : Distribution of respondents according to their attendance at workshop/training session on farm waste management

Table 4.4.1 showed the distribution of respondents based on their participation in workshops or training sessions on farm waste management. A significant majority 85.83 per cent of respondents reported not attending any training programme on farm waste management, while only 14.16 per cent of respondents indicated having participated in such sessions. This lack of participation in training programmes highlights a significant gap in awareness and capacity-building efforts aimed at promoting sustainable waste management practices among farmers. Similarly, a study by **Bhanwaria &Agarwal (2024)** in the Chomu block of Jaipur district, Rajasthan, assessed farmers' knowledge of agricultural waste management techniques. Initially, only 0.6per cent of respondents demonstrated high knowledge in this area. However, after participating in a structured training program focusing on technologies like vermicomposting, 90.7per cent of the farmers achieved a high level of knowledge. This significant improvement highlights the effectiveness of targeted training programs in enhancing farmers' understanding of waste management practices.

4.4.2 Distribution of respondents according to their interested in participating in farm waste management program

N=120

Interest in participation	Frequency(f)	Per cent (%)
Yes	108	90.00
No	12	10.00

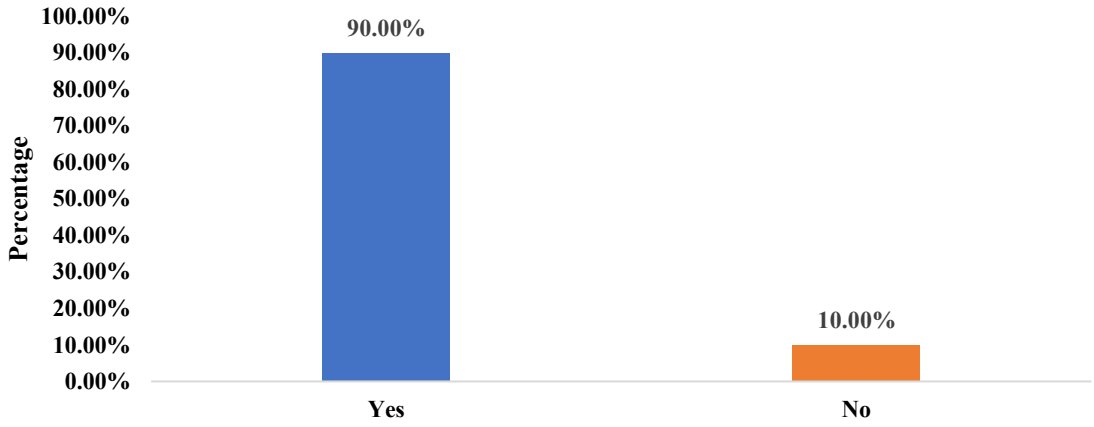


Fig 4.4.2 : Distribution of respondents according to their Interest in participation in farm waste management

Table 4.4.2 revealed the 90.00 per cent of the respondents are interested in participating in a farm waste management program, while only 10.00 per cent of respondents are not interested. This indicates a significant level of interest among respondents in engaging with farm waste management initiatives.

4.4.3 Distribution of respondents according to support for establishment of community composting facilities

N=120

Support for Community Composting	Frequency(f)	Per cent (%)
Yes	112	93.33
No	08	6.66

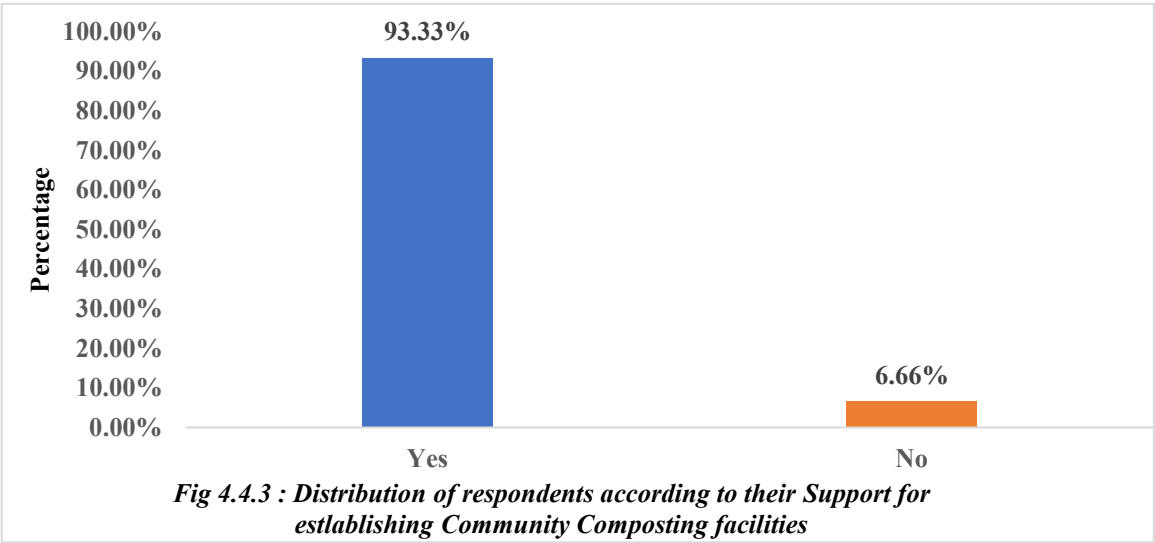


Fig 4.4.3 : Distribution of respondents according to their Support for estlablishing Community Composting facilities

Table 4.4.3 reveals that 93.33 per cent of the respondents support the establishment of community composting facilities, while only 6.66 per cent of respondents do not support it. This indicates strong support among respondents for community-based composting initiatives.

4.4.4 Distribution of respondents according to views on whether the government should invest in farm waste management infrastructure

N=120

Government investment in farm waste management	Frequency(f)	Per cent (%)
Yes	11	9.17%
No	109	90.83%

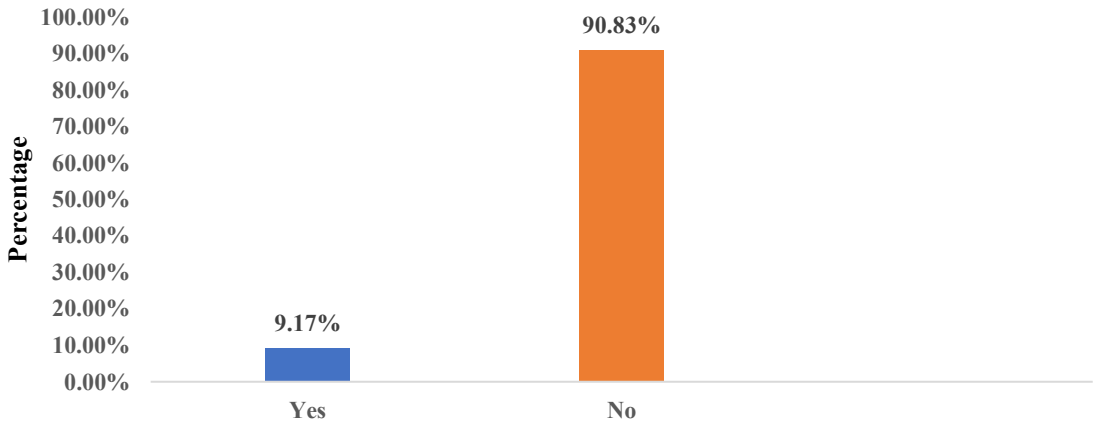


Fig 4.4.4 : Distribution of respondents according to their Government Investment in Farm Waste Management

Table 4.4.4 revealed the significant majority 90.83 per cent of respondents do not believe the government should invest in farm waste management infrastructure, while only 9.17 per cent of respondents support such investment. This highlights a notably low level of approval for government involvement in developing infrastructure for farm waste management. In contrast, **Singh *et al.* (2024)** highlighted that a significant majority 85 per cent acknowledged the economic advantages of crop residue burning despite its environmental and health consequences. Additionally, 83.75 per cent of respondents believed that government financial aid, such as subsidies, could prevent crop residue

burning, suggesting that targeted government interventions might receive substantial support from the farming community. Similarly, **Siwach and Gupta (2024)** emphasized the challenges in policy implementation and underscored the need for new policies to effectively address agricultural waste issues, noting that the success of these policies largely depends on proper execution and public support.

4.4.5 Distribution of respondents according to their prioritization of waste collection and transportation services

N=120

Prioritization of waste collection and transportation services	Frequency(f)	Per cent (%)
Yes	77	64.16%
No	43	35.84%

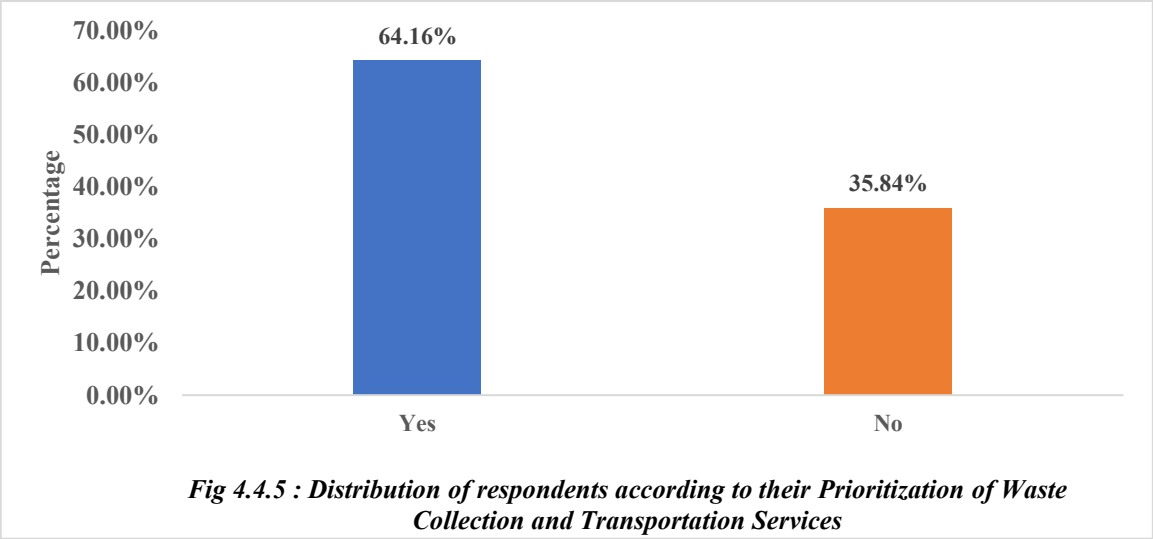


Fig 4.4.5 : Distribution of respondents according to their Prioritization of Waste Collection and Transportation Services

Table 4.4.5 showed that 64.16 per cent of the respondents prioritize waste collection and transportation services, while 35.84 per cent of respondents do not consider it a priority. The majority's emphasis on waste collection and transportation indicates a recognized need for effective waste management infrastructure.

4.4.6 Distribution of respondents according to their belief that economic incentives would encourage the adoption of sustainable waste management practices

N=120

Adoption of sustainable waste management practices	Frequency(f)	Per cent (%)

Yes	97	80.83
No	23	19.17

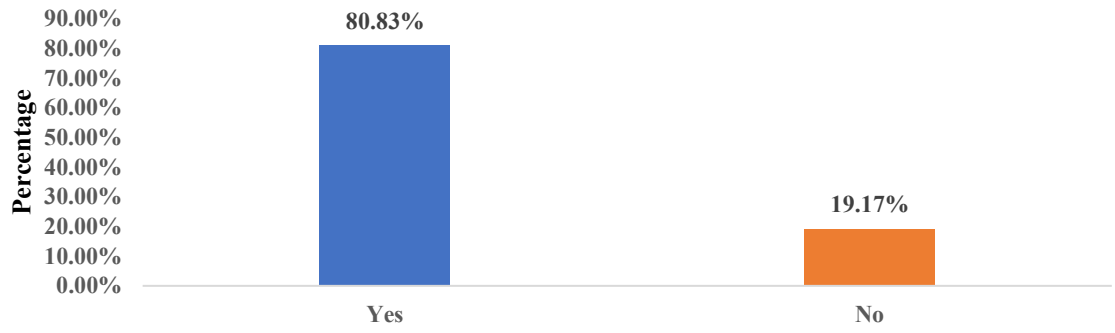


Fig 4.4.6 : Distribution of respondents according to their Belief in Economic Incentives

Table 4.4.6 showed that 80.83 per cent of respondents believe that economic incentives would encourage the adoption of sustainable waste management practices, while only 19.17 per cent of respondents do not share this belief. The significant majority who support economic incentives suggests a strong belief in the effectiveness of financial support in promoting sustainable practices. This indicates that subsidies, tax breaks, or other forms of financial assistance could be pivotal in encouraging farmers and other stakeholders to transition to environmentally friendly waste management methods.

4.4.7 Distribution of respondents according to their opinion on the type of incentives that would be most effective for prompting waste management practices

N=120

Effective incentives for waste management	Frequency(f)	Per cent (%)
Subsidies	38	31.93
Market support	58	48.73
Tax breaks	20	16.80
Other's	03	2.54

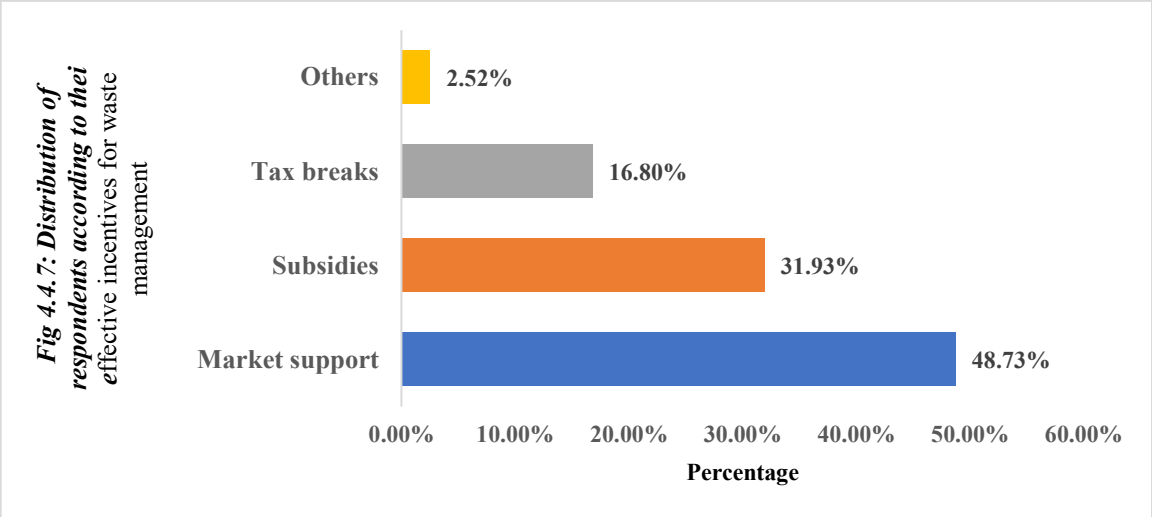


Fig 4.4.7: Distribution of respondents according to their effective incentives for waste management

Table 4.4.7 shows that 48.73 per cent of respondents view market support as the most effective incentive for encouraging waste management practices. This suggests that enhanced market access for products made from sustainably managed waste could drive wider adoption. A further 31.93 per cent of respondents favored subsidies, emphasizing the significance of direct financial aid. Additionally, 16.80 per cent of respondents preferred tax incentives, indicating that indirect financial benefits could also motivate the adoption of sustainable waste disposal methods. Only 2.54 per cent identified other forms of incentives, reflecting some alternative preferences among the respondents. The strong preference for market-based support suggests that policies facilitating fair pricing, value addition, and commercial opportunities for recycled farm waste could be key drivers of sustainable waste management adoption.

4.4.8 Distribution of respondents according to their support for a pay per use model for waste management practices

N=120

Pay per use model	Frequency(f)	Per cent (%)
Yes	65	54.16
No	55	45.84

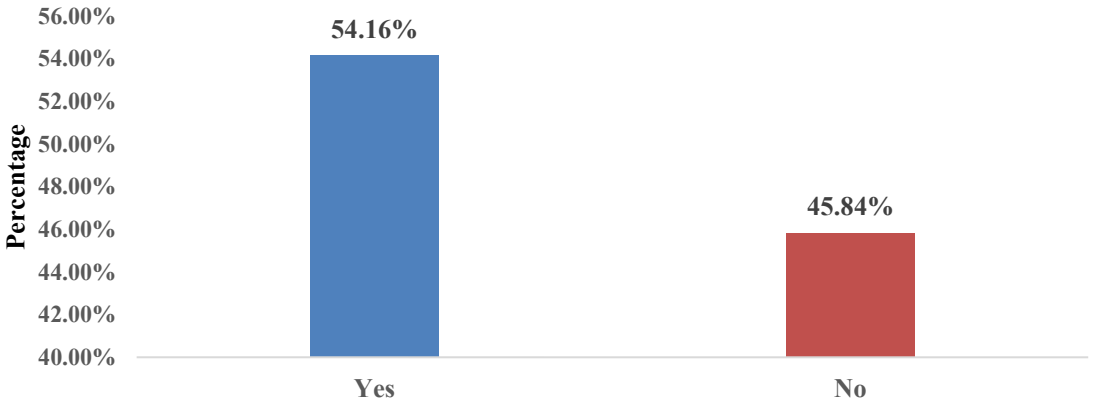


Fig 4.4.8 : Distribution of respondents according to their suppourt for Pay-Per-Use Model

Table 4.4.8 indicated that a majority of respondents 54.16 per cent support the pay-per-use waste management model, while 45.84 per cent of respondents oppose it. For instance, **Bashir *et al.* (2024)** reported that 90.6 per cent of respondents in Srinagar were willing to pay for improved waste management, with socio-economic factors influencing their willingness. This stands in stark contrast to the findings of this study, where opposition was much higher.

4.4.9 Distribution of respondents according to their views on whether awareness campaigns on farm waste management would impact their practices

N=120

Awareness campaigns for farm waste management	Frequency(f)	Per cent (%)
Yes	44	36.66
No	76	63.64

Fig 4.4.9 : Distribution of respondents according to their views on whether awareness campaigns on farm waste management would impact their practices

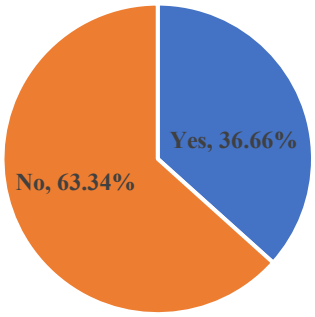


Table 4.4.9 indicated that a majority of respondents 63.64 per cent believe that awareness campaigns on farm waste management would not impact their practices, while only 36.66 per cent of respondents think such campaigns would make a difference. This finding aligns with **Murase *et al.* (2017)**, who observed that awareness-raising activities led to a modest 6.0 per cent increase in properly separated organic solid waste in Balikpapan City, Indonesia, suggesting limited influence on behavior. Similarly, a study by **Ailyn (2025)** found that while awareness campaigns increased knowledge about recycling, only 35per cent of participants adopted top-tier waste management practices, indicating a gap between awareness and action. These studies suggest that awareness campaigns alone may not be sufficient to drive significant changes in waste management behaviors.

Chapter-V

SUMMARY AND CONCLUSIONS

After the analysis and interpretation of the data, this chapter summarizes and concludes the attained objectives of the present study **"A Study on Farm Waste Management in Ayodhya district of Uttar Pradesh" under following heads:**

1. To study the socio-demographic profile of the respondents
2. To study the existing situation of farm wastes in Ayodhya district
3. To study the existing method of farm waste management
4. To provide some suggestions regarding waste management

1. To study the socio-demographic status of the respondents

- 66.67 per cent of the respondents were male, while 33.33 per cent were female, highlighting higher male representation.
- 49.17 per cent of the respondents were above 40 years of age, followed by 21.67 per cent aged between 35–40 years, 15.83 per cent aged between 30–35 years, and only 13.33 per cent aged 25–30 years.
- 32.5 per cent of the respondents had completed their secondary education, followed by 29.17 per cent with primary education. 20 per cent had no formal education, 10.83 per cent studied up to higher secondary, and only 7.5 per cent were graduates. No respondents had a postgraduate degree.
- 89.17 per cent of the respondents belonged to the Hindu religion, while 10.83 per cent were Muslim. No respondents identified as Buddhist or Christian.
- 43.33 per cent of the respondents were belongs to Other Backward Class (OBC), followed by 34.17 per cent belong to General category, 15.83 per cent belong to Scheduled Caste (SC), and only 6.67 per cent belong to Scheduled Tribe (ST).
- 85.83 per cent of the respondents were farmers, 8.33 per cent were laborers, 3.33 per cent were business owners, and only 2.5 per cent were government employees. No respondents were involved in other professions.
- 70 per cent of the respondents earned less than ₹20,000 per month, 25 per cent earned between ₹20,000–50,000, and only 5 per cent earned between ₹50,000–100,000. No respondents reported an income above ₹100,000.

- 41.67 per cent of the respondents lived in nuclear families, 40.83 per cent lived in joint families, and only 17.5 per cent lived in extended families.
- 67.5 per cent of the respondents resided in rural areas, while 32.5 per cent lived in urban locations.

2. To study the existing situation of farm wastes in Ayodhya district

- 55.83 per cent of the respondents owned medium-sized farms (2–5 acres), followed by 25.83 per cent with small farms (<2 acres), and 18.34 per cent managing large farms (>5 acres), indicating that medium-sized farms were the most common and reflecting a relatively balanced land distribution pattern.
- 50 per cent of the respondents cultivated wheat, making it the most commonly grown crop, followed by rice 25.83 per cent, maize 15 per cent, millets 6.67 per cent, and sugarcane 2.5 per cent, indicating wheat's dominance in agricultural production and reflecting regional crop preferences.
- 74.16 per cent of the respondents owned cattle, followed by 13.34 per cent who raised goats, 10.00 per cent who kept oxen, and only 2.50 per cent who managed hens, indicating that cattle were the most commonly owned livestock among respondents.
- 60.50 per cent of the respondents had 3 to 5 family members working on farms, making it the most common group, followed by 24.36 per cent with 5 to 8 members, 9.24 per cent with 1 to 3 members, and only 5.89 per cent with more than 8 members, indicating that mid-sized family workforces are typical and large family-operated farms are less frequent, highlighting the vital role of family in agricultural activities.
- 87.5 per cent of the farm waste generated consisted of crop residues, making it the most significant contributor, followed by 12.5 per cent from animal sources, while pesticide and plastic waste were completely absent.
- 63.33 per cent of the respondents generated 100–200 kg of farm waste per month, making it the most common range, followed by 25.00 per cent who produced less than 100 kg, and 11.66 per cent who generated more than 200 kg monthly, indicating that most farms fall within a moderate waste generation range with only a small proportion contributing to higher waste output.

- 74.10 per cent of the respondents relied on manual harvesting methods, while only 25.90 per cent used mechanized harvesting, indicating a strong dependence on traditional labour-intensive practices for crop harvesting.
- 32.5 per cent of the respondents were satisfied with their current farm waste management, 20.83 per cent were very satisfied, 26.6 per cent remained neutral, and 20.0 per cent were dissatisfied, while none reported being very dissatisfied, indicating a generally positive outlook with some uncertainty and minimal extreme dissatisfaction.

3. To study the existing method of farm waste management used by the respondents

- 65.80 per cent of the respondents used farm waste as fodder, making it the most common management practice, followed by 30.80 per cent who practiced composting, 3.4 per cent who used other methods such as burning or landfill disposal, and 0 per cent who used vermicomposting, indicating a strong reliance on repurposing waste for animal feed and a lack of adoption of vermicomposting due to possible gaps in awareness or infrastructure.
- 59.17 per cent of the respondents were aware of sustainable farm waste management practices, while 40.83 per cent were not, indicating that although a majority recognize such methods, a considerable portion still lacks awareness.
- 95.83 per cent of the respondents reported adopting sustainable management practices, while only 4.17 per cent did not, indicating a high adoption rate likely influenced by growing awareness, regulatory demands, and recognition of long-term benefits.
- 93.33 per cent of the respondents were primarily motivated by economic benefits to adopt sustainable practices, followed by 4.16 per cent driven by environmental concerns, 0.85 per cent citing social benefits, and 1.66 per cent mentioning other reasons, indicating that economic factors dominate the motivation for sustainability adoption.
- 95.83 per cent of the respondents preferred using cow dung as an energy source, while 4.16 per cent opted for other sources, and none preferred bio-gas or biomass for energy generation, indicating that cow dung is the most favored energy source due to its availability and ease of use in farming communities.

- 100 per cent of the respondents preferred composting farm waste, with 0 per cent reporting that they did not use composting methods, indicating a universal adoption of composting practices among the respondents.
- 70.00 per cent of the respondents used crop residue for composting, making it the most commonly used material, followed by 16.66 per cent using livestock manure and 13.34 per cent using organic waste, while food waste and other materials were not used at all, recording 0 per cent.
- 72.5 per cent of the respondents used pit composting for farm waste management, while 27.5 per cent reported incineration.
- 28.34 per cent of respondents reported Odor problems as the most common challenge in the composting process, followed by 27.5 per cent facing a lack of resources, 20 per cent experiencing pest attraction, 17.5 per cent struggling with a lack of space, and 6.66 per cent encountering moisture management issues, highlighting a range of concerns with varying prevalence.
- 64.17 per cent of respondents do not preferred incineration of farm waste as a disposal method, while 35.83 per cent of respondents opt for this method.
- Out of 120 respondents, 43 reported engaging in farm waste incineration**.** Among them, 100 per cent of respondents primarily incinerated crop residues.
- Out of the 43 respondents who reported incinerating farm waste, 79.06 per cent indicated having a designated area for incineration**,** while 20.94 per cent did not have a specific location, suggesting that most respondents manage the incineration process in a designated space, though a notable portion lacks a structured approach.
- 100 per cent of the respondents reported not having access to a biogas highlighting the complete absence of biogas utilization among the surveyed respondents.
- 57.5 per cent of respondents preferred landfilling as a method for disposing of farm waste, while 42.5 per cent did not, suggesting that the preference for landfilling may be influenced by factors such as ease of disposal, lack of alternatives, or limited awareness of more sustainable practices.
- Among the 120 respondents, 69 reported engaging in landfilling as a waste disposal method. The most commonly landfilled material was crop residues (65.23 per cent), followed by pesticide containers (14.49 per cent), livestock manure (11.59 per cent),

and other materials (8.69 per cent), indicating that a significant portion of farm waste disposed of through landfilling consists of organic matter, while hazardous waste like pesticide containers is also included.

- Among the 120 respondents, 69 reported engaging in landfilling as a waste disposal method. The most commonly landfilled material was crop residues 65.23 per cent, followed by pesticide containers 14.49 per cent, livestock manure 11.59 per cent, and other materials 8.69 per cent, indicating that a significant portion of farm waste disposed of through landfilling consists of organic matter, while hazardous waste like pesticide containers is also included.

4. To provide some suggestions regarding waste management

- 85.83 per cent of the respondents reported not having attended any workshops or training sessions on farm waste management, while only 14.16 per cent had participated in such sessions, highlighting a significant gap in formal education and awareness on proper waste disposal practices among the surveyed respondents.
- 90.00 per cent of the respondents expressed interest in participating in a farm waste management program, while only 10.00 per cent were not interested, indicating a strong willingness among the majority to engage in farm waste management initiatives.
- 93.33 per cent of the respondents supported the establishment of community composting facilities, while only 6.66 per cent did not, indicating strong overall support for community-based composting initiatives among the surveyed respondents.
- 90.83 per cent of the respondents did not support government investment in farm waste management infrastructure, while only 9.17 per cent believed the government should invest in this area, indicating a low level of approval for government involvement in farm waste management among the surveyed respondents.
- 64.16 per cent of the respondents prioritized waste collection and transportation services, while 35.84 per cent did not consider it a priority, indicating a recognized need among the majority for effective waste management infrastructure.
- 80.83 per cent of the respondents believed that economic incentives would encourage the adoption of sustainable waste management practices, while 19.17 per cent did not

share this belief, indicating that financial support such as subsidies, tax breaks, or other incentives could play a pivotal role in promoting environmentally friendly waste management methods among farmers and stakeholders.

- 48.73 per cent of the respondents believed that market support is the most effective incentive for promoting waste management practices, indicating that improved market access for sustainably managed waste products could drive adoption. Subsidies were preferred by 31.93 per cent, emphasizing the importance of direct financial assistance, while 16.80 per cent favored tax breaks, suggesting that indirect financial incentives could also encourage sustainable waste disposal. A small percentage, 2.52 per cent, identified other incentives, reflecting alternative preferences among a few respondents.
- 54.16 per cent of the respondents supported the pay-per-use waste management model, while 45.84 per cent opposed it, indicating a slight majority in favor of this approach to waste management.
- 63.64 per cent of the respondents believed that awareness campaigns on farm waste management would not impact their practices, while only 36.66 per cent thought such campaigns would make a difference, indicating a significant portion of respondents who feel awareness efforts may not lead to changes in their behavior.

Conclusions

The study reveals key insights into the farm waste management practices and socio-economic characteristics of the respondents in Ayodhya district. It was found that a majority of the respondents are farmers, with most belonging to the Hindu religion and coming from the Other Backward Class (OBC) and General categories. The respondents were predominantly male, and a significant portion was engaged in farming with medium-sized landholdings. The respondents also showed a marked interest in agricultural activities, with a large proportion involved in crop cultivation, particularly wheat. Regarding farm waste management, crop residues emerged as the dominant form of farm waste, followed by livestock manure. The study showed that many respondents rely on traditional methods such as using farm waste as fodder, composting, and landfilling, but vermicomposting was not practiced. While the majority of respondents were aware of sustainable waste management practices, challenges such as odor, lack of resources, and pest attraction were common in the

composting process. The study also indicated a high reliance on manual labor, with respondents preferring methods such as pit composting over more innovative techniques like vermicomposting. Additionally, while some respondents prefer incinerating farm waste, others showed support for alternatives like community composting facilities. However, there was limited government involvement in waste management infrastructure, and respondents were hesitant about the government's role in this area. Despite this, the majority expressed an interest in participating in farm waste management programs, indicating a strong willingness to adopt more sustainable practices if supported. Economic incentives, such as subsidies and market support, were identified as the most effective motivators for adopting sustainable waste management practices. The study concluded that financial incentives and the promotion of community-based waste management initiatives could encourage more widespread adoption of sustainable practices.

The study highlighted the challenges faced in farm waste management and the factors that influence respondents' attitudes toward sustainable practices. It is clear that while there is interest and willingness to adopt more sustainable methods, factors such as resource availability, training, and economic incentives play a critical role in shaping waste management practices in the region. Additionally, the availability and use of biogas plants were found to be absent, further indicating the need for increased awareness, infrastructural development, and government support in this area.

LITERATURE CITED

Abdullah, F.A., Sabaruddin, S.A., Noor, W.N.W.M. and Zaman, N.B.K. 2024. Livestock waste management adoption among livestock farmers: A study in the southern region of Peninsular Malaysia. In: *IOP Conference on Earth and Environmental Science*, 1397(1): 012033.

Acevedo, M., Belmonte-Ureña, L.J., Plaza-Úbeda, J.A. and Camacho-Ferre, F. 2020. The management of agricultural waste biomass in the framework of circular economy and bioeconomy: An opportunity for greenhouse agriculture in Southeast Spain. *Agronomy*, 10(4): 489.

Ahmed, T. and Ahmad, B. 2014. Burning of crop residue and its potential for electricity generation. *Pakistan Development Review*, 275–292.

Akhter, T., Ashraf, M. A., Hassan, M. M., Akhter, F. and Riza, A. N. 2016. Agricultural waste management practices in Trishal upazila, Mymensingh. *Research in Agriculture, Livestock and Fisheries*, 3(3): 395–402.

Alfadlli, N.S., Noor, S., Hertanto, B.S. and Cahyadi, M. 2018. The effect of various decomposers on quality of cattle dung compost. *Buletin Peternakan*, 42(3): 250–255.

Al-Shayaa, M., Al-Wabel, M. S., Herab, A. H., Sallam, A., Baig, M. B. and Usman, A. R. A. 2021. Environmental issues in relation to agricultural practices and attitudes of farmers: A case study from Saudi Arabia. *Saudi Journal of Biological Sciences*, 28(1): 1080–1087.

Arranz-Piera, P., Bellot, O., Gavaldà, O., Kemausuor, F. and Velo, E. 2016. Trigeneration based on biomass-specific field case: Agricultural residues from smallholder farms in Ghana. *Energy Procedia*, 93: 146–153.

Atinkut, H. B., Yan, T., Arega, Y. and Raza, M. H. 2020. Farmers' willingness-to-pay for eco-friendly agricultural waste management in Ethiopia: A contingent valuation. *Journal of Cleaner Production*, 261: 121211.

Ayamga, E. A., Kemausuor, F., and Addo, A. 2015. Technical analysis of crop residue biomass energy in an agricultural region of Ghana. *Resources, Conservation and Recycling*, 96: 51–60.

Ayilara, M.S., Olanrewaju, O.S., Babalola, O.O. and Odeyemi, O. 2020. Waste management through composting: Challenges and potentials. *Sustainability*, 12(11): 4456.

Aynehband, A., Gorooei, A. and Moezzi, A.A. 2017. Vermicompost: An eco-friendly technology for crop residue management in organic agriculture. *Energy Procedia*, 141: 667–671.

Benaseer, S., Masilamani, P., Albert, V. A., Govindaraj, M., Selvaraju, P., and Bhaskaran, M. 2018. Impact of harvesting and threshing methods on seed quality—A review. *Agricultural Reviews*, 39(3): 183–192.

Bentsen, N. S., Felby, C., and Thorsen, B. J. 2014. Agricultural residue production and potentials for energy and materials services. *Progress in Energy and Combustion Science*, 40: 59–73.

Bikkannavar, A. A. K., Salunke, R. S., Chitagubbi, G., and Potdar, M. 2024. Knowledge level of farmers of Dharwad district towards farm waste management. *Journal of Farm Sciences*, 37(1): 100–102.

Bhuvaneshwari, S., Hettiarachchi, H., and Meegoda, J. N. 2019. Crop residue burning in India: Policy challenges and potential solutions. *International Journal of Environmental Research and Public Health*, 16(5): 832.

Cariappa, A. A., Acharya, K. K., Adhav, C. A., Sendhil, R., and Ramasundaram, P. 2022. COVID-19 induced lockdown effects on agricultural commodity prices and consumer behaviour in India – Implications for food loss and waste management. *Socio-Economic Planning Sciences*, 82: 101160.

Case, S. D. C., Oelofse, M., Hou, Y., Oenema, O., and Jensen, L. S. 2017. Farmer perceptions and use of organic waste products as fertilisers – A survey study of potential benefits and barriers. *Agricultural Systems*, 151: 84–95.

Chibueze, U., Okorie, N., Oriaku, O., Isu, J., and Peters, E. 2017. The production of biogas using cow dung and food waste. *International Journal of Materials and Chemistry*, 7(2): 21–24.

Cishahayo, L., Yang, Q., Zhu, Y., and Wang, F. 2022. Learning behavior, environmental awareness, and agricultural waste management of banana farmers in China. *Social Behavior and Personality: An International Journal*, 50(5): 1–11.

Dabas, J. P. S., Sharma, N., Dubey, S. K., Sharma, A., Singh, L., and Dubey, A. V. 2018. Utilizing cow dung and slurry for energy sufficiency of farms and households: Experiences of field studies across three Indian states. *Indian Journal of Agricultural Sciences*, 88(8): 1208–1213.

Dallaire-Lamontagne, M., Lebeuf, Y., Prus, J. M. A., Vandenberg, G. W., Saucier, L., and Deschamps, M. H. 2024. Characterization of hatchery residues for on-farm implementation of circular waste management practices. *Waste Management*, 175: 305–314.

Devi, C. L., Biradar, N., GK, A. K., Guledagudda, S., and Bheemappa, A. n.d. Availability and requirement of feed and fodder in different districts of Karnataka. *Indian Journal of Animal Sciences*, 94(10): 892–895.

Devi, S., Gupta, C., Jat, S. L., and Parmar, M. S. 2017. Crop residue recycling for economic and environmental sustainability: The case of India. *Open Agriculture*, 2(1): 486–494.

Duque-Acevedo, M., Belmonte-Ureña, L.J., Plaza-Úbeda, J.A. and Camacho-Ferre, F. 2020. The management of agricultural waste biomass in the framework of circular economy and bioeconomy: An opportunity for greenhouse agriculture in Southeast Spain. *Agronomy*, 10(4): 489.

Dukuziyaturemye, P., Banamwana, C., and Naik, P. 2020. Farmers' perspective about organic manure production and utilization in Dakshina Kannada, India. *Rwanda Journal of Engineering, Science, Technology and Environment*, 3(1).

Ewusi-Mensah, N., Logah, V., and Akrasi, E. J. 2015. Impact of different systems of manure management on the quality of cow dung. *Communications in Soil Science and Plant Analysis*, 46(2): 137–147.

Farradinna, S., Elfis, E., Arizona, R., Rahman, J., and Titisari, P. W. 2023. Livestock waste management to improve community knowledge in the cow farming groups. *Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang*, 8(1): 52–62.

Grover, D., Kaur, P., and Sharma, H. R. 2015. Possible reasons and farmers awareness towards crop residue burning: An overview and a case study from Mirzapur village of Kurukshetra district, India. *Environment & We: International Journal of Science & Technology*, 10:75–85.

Han, G., and Niles, M. T. 2023. An adoption spectrum for sustainable agriculture practices: A new framework applied to cover crop adoption. *Agricultural Systems*, 212: 103771.

Hiloidhari, M., Das, D., and Baruah, D. C. 2014. Bioenergy potential from crop residue biomass in India. *Renewable and Sustainable Energy Reviews*, 32: 504–512.

Hiranobe, C. T., Gomes, A. S., Paiva, F. F., Tolosa, G. R., Paim, L. L., Dognani, G., and Cabrera, F. C. 2024. Sugarcane bagasse: Challenges and opportunities for waste recycling. *Clean Technologies*, 6(2): 662–699.

Huang, R., Li, Z., Xiao, Y., Liu, J., Jiang, T., Deng, O., and Li, B. 2024. Composition of DOM along the depth gradients in the paddy field treated with crop straw for 10 years. *Journal of Environmental Management*, 353:120084.

Hundal, J. S., Sodhi, S. S., Gupta, A., Singh, J., and Chahal, U. S. 2016. Awareness, knowledge, and risks of zoonotic diseases among livestock farmers in Punjab. *Veterinary World*, 9(2): 186.

Indrarosa, D., Mariyono, J., and Santoso, S. I. 2024. Factors determining knowledge acquisition in livestock waste management training held by Animal Husbandry Training Centre at Songgoriti, Batu-Indonesia. In: *IOP Conference Series: Earth and Environmental Science*, 1364(1): 012026.

Kumar, D., Dogra, B., Dogra, R., Singh, I., and Manes, G. S. 2019. Optimization of operational parameters for mechanised harvesting of pigeonpea (Cajanus cajan) with combine harvester. *Legume Research: An International Journal*, 42(2): 198–204.

Lalander, C. H., Komakech, A. J., and Vinnerås, B. 2015. Vermicomposting as manure management strategy for urban small-holder animal farms – Kampala case study. *Waste Management*, 39: 96–103.

Lim, S. F., and Matu, S. U. 2015. Utilization of agro-wastes to produce biofertilizer. *International Journal of Energy and Environmental Engineering*, 6:31–35.

Liu, M., Li, Z., Qi, X. E., Chen, Z., Ni, H., Gao, Y., and Liu, X. 2023. Improvement of cow manure anaerobic digestion performance by three different crop straw biochars. *Environmental Technology & Innovation*, 31: 103233.

Manegar, V. K. H. 2015. Problems faced by farmers in Karnataka. *International Journal of Research and Analytical Reviews*, 2(4): 46–56.

Maurya, R., Bharti, C., Singh, T. D., and Pratap, V. 2020. Crop residue management for sustainable agriculture. *International Journal of Current Microbiology and Applied Sciences*, 9(5): 3168–3174.

Meganathan, A., Shekar, K., Minhas, A. P., Jaganathan, M. K., Thiruvengadam, R., and Ramya Devi, K. T. 2024. Utilization of animal waste to produce fertilizer, biogas, bio-oils, and other value-added products. In: *From Waste to Wealth*. Singapore: Springer Nature Singapore, 1063–1087.

Meena, K. B., Alam, M. S., Singh, H., Bhat, M. A., Singh, A. K., Mishra, A. K., and Thomas, T. 2018. Influence of farmyard manure and fertilizers on soil properties and yield and nutrient uptake of wheat. *International Journal of Chemical Studies*, 6(3): 386–390.

Melinda, L., Aryawati, P. A., Supraba, A. P., and Arman, A. 2013. Utilization of agriculture waste for farmers' empowerment based on LEISA system. In: *Annual International Scholars Conference*, Taiwan.

Miah, M. M., Haque, M. E., Bell, R. W., Rahman, M. W., Akhter, S., and Hossain, M. B. 2022. Availability and utilisation pattern of agricultural waste at household level in selected areas of Bangladesh. *Waste Management & Research*, 40(8): 1277–1284.

Mohan, S. S., and Jayan, P. R. 2021. Livestock waste utilization through manure pulverizer cum applicator. *International Journal of Livestock Research*, 11(4): 19–27.

Nigussie, A., Kuyper, T. W., and de Neergaard, A. 2015. Agricultural waste utilisation strategies and demand for urban waste compost: Evidence from smallholder farmers in Ethiopia. *Waste Management*, 44: 82–93.

Obame, R. M., Musadji, N. Y., Menken, E. F., Ntoma, R. O., Koutika, L. S., Mouaromba, W., and Mounguengui, M. M. 2024. Farm waste management and recycling for negative carbon sink in agriculture: A review. *Journal of Agricultural Science*, 17(1): 128.

Obi, F. O., Ugwuishiwu, B. O., and Nwakaire, J. N. 2016. Agricultural waste concept, generation, utilization and management. *Nigerian Journal of Technology*, 35(4): 957–964.

Oladipo, F. O., Olorunfemi, O. D., Adetoro, O. O., and Oladele, O. I. 2017. Farm waste utilization among farmers in Irepodun Local Government Area, Kwara State, Nigeria: Implication for extension education service delivery. *Ruhuna Journal of Science*, 8(1).

Oshima, T. 2024. Overcoming challenges in agricultural waste management for a cleaner future. *Journal of Agricultural Science and Food Research*, 15:194.

Pandiaraj, T., Selvaraj, S., and Ramu, N. 2018. Effects of crop residue management and nitrogen fertilizer on soil nitrogen and carbon content and productivity of wheat (Triticum aestivum L.) in two cropping systems.

Radhakrishnan, M., Saseendran, P. C., Anil, K. S., George, S., Usha, A. P., Kannan, A., and Muhammad Aslam, M. K. 2018. Analysis of waste management system followed in pig farms in Kerala. *Animal Science Reporter*, 11(4).

Rajkumar, K., Bhattacharya, A., David, S., Balaji, S. H., Hariharan, R., Jayakumar, M., and Balaji, N. 2016. Socio-demographic study on extent of knowledge, awareness, attitude, and risks of zoonotic diseases among livestock owners in Puducherry region. *Veterinary World*, 9(9): 1018.

Rao, M. M., Botsa, S. M., Rao, T. P., Goddu, S. R., and Vijayasanthi, C. 2024. A comprehensive review on agricultural waste production and onsite management with circular economy opportunities. *Discover Sustainability*, 5(1): 288.

Raza, M. H., Abid, M., Faisal, M., Yan, T., Akhtar, S., and Adnan, K. M. 2022. Environmental and health impacts of crop residue burning: Scope of sustainable crop residue management practices. *International Journal of Environmental Research and Public Health*, 19(8): 4753.

Reetsch, A., Feger, K. H., Schwärzel, K., Dornack, C., and Kapp, G. 2020. Organic farm waste management in degraded banana-coffee-based farming systems in NW Tanzania. *Agricultural Systems*, 185: 102915.

Ravi, G., Savitha, B., Sreenivasulu, M., and Vidyasagar, G. E. 2022. A study on constraints and suggestions in agriwaste management by farmers of Medak District in Telangana. *International Journal of Environment and Climate Change*, 12(1): 82–90.

Seglah, P. A., Wang, Y., Wang, H., Bi, Y., Zhou, K., Wang, Y., and Feng, X. 2020. Crop straw utilization and field burning in Northern region of Ghana. *Journal of Cleaner Production*, 261: 121191.

Sethi, M. K., and Biswal, S. K. 2023. Awareness of farmers towards the agricultural schemes of Govt.: A study on Dhenkanal District, Odisha. *International Journal of Research and Development*. *(Note: Volume and issue information missing – please provide if available.)*

Shaibur, M. R., Husain, H., and Arpon, S. H. 2021. Utilization of cow dung residues of biogas plant for sustainable development of a rural community. *Current Research in Environmental Sustainability*, 3: 100026.

Shaha, M. 2017. Cattle waste and the impacts of waste management practices on public health. *Chattogram Veterinary and Animal Sciences University, Chattogram-4225, Bangladesh. (This appears to be a thesis or report – not a journal article.)*

Sharma, K., and Garg, V. K. 2019. Vermicomposting of waste: A zero-waste approach for waste management. In: *Sustainable Resource Recovery and Zero Waste Approaches*, pp. 133–164.

Sharma, S., Padbhushan, R., and Kumar, U. 2019. Integrated nutrient management in rice–wheat cropping system: An evidence on sustainability in the Indian subcontinent through meta-analysis. *Agronomy*, 9(2): 71.

Shehrawat, P. S., and Sindhu, N. 2015. Agricultural waste utilization for healthy environment and sustainable lifestyle. *Annals of Agricultural and Biological Research*, 20: 110–114.

Shi, W., Fang, Y. R., Chang, Y., and Xie, G. H. 2023. Toward sustainable utilization of crop straw: Greenhouse gas emissions and their reduction potential from 1950 to 2021 in China. *Resources, Conservation and Recycling*, 190: 106824.

Singh, A., Tiwari, R., Chandrahas, and Dutt, T. 2021. Augmentation of farmers' income in India through sustainable waste management techniques. *Waste Management & Research*, 39(6): 849–859.

Singh, P., Swetanshu, Yadav, R., Erfani, H., Jabin, S., and Jadoun, S. 2024. Revisiting the modern approach to manage agricultural solid waste: an innovative solution. *Environment, Development and Sustainability*, 26(7): 16337–16361.

Singh, S., Singh, J., Kandoria, A., Quadar, J., Bhat, S. A., Chowdhary, A. B., and Vig, A. P. 2020. Bioconversion of different organic waste into fortified vermicompost with the help of earthworm: A comprehensive review. *International Journal of Recycling of Organic Waste in Agriculture*, 9(4): 423–439.

Sreedaya, G. S., and Suresh, N. 2022. Perception of farmers towards crop insurance schemes in Kerala, India. *Asian Journal of Agricultural Extension, Economics & Sociology*, 40(1): 437–447.

Tadesse, B., and Terefe, H. 2021. Determinants of agricultural waste management practices among rural households in Ethiopia. *Cogent Environmental Science*, 7(1): 1921629.

Uddin, M. T., and Fatema, K. 2016. Rice crop residue management and its impact on farmers livelihood – an empirical study. *Progressive Agriculture*, 27(2): 189–199.

Venkatramanan, V., Shah, S., Rai, A. K., and Prasad, R. 2021. Nexus between crop residue burning, bioeconomy and sustainable development goals over North-Western India. *Frontiers in Energy Research*, 8: 614212.

Wang, B., Li, M., Wen, X., Yang, Y., Zhu, J., Belzile, N., and Chen, S. 2020. Distribution characteristics, potential contribution, and management strategy of crop straw and

livestock-poultry manure in multi-ethnic regions of China: A critical evaluation. *Journal of Cleaner Production*, 274: 123174.

Wang, B., Shen, X., Chen, S., Bai, Y., Yang, G., Zhu, J., and Xue, Z. 2018. Distribution characteristics, resource utilization and popularizing demonstration of crop straw in southwest China: A comprehensive evaluation. *Ecological Indicators*, 93: 998–1004.

Wang, Y., de Boer, I. J., Hou, Y., and van Middelaar, C. E. 2022. Manure as waste and food as feed: Environmental challenges on Chinese dairy farms. *Resources, Conservation & Recycling*, 181: 106233.

Xu, X., Mola-Yudego, B., Selkimäki, M., Zhang, X., and Qu, M. 2023. Determinants of farmers' waste generation and disposal in rural areas of central China. *Environmental Science and Pollution Research*, 30(4): 9011–9021.

Yadav, D. K., Singh, S. V., Ramakant, J. P., Singh, R. K. G., Maurya, S. K., and Niyogi, D. 2021. Ethno-veterinary practices of goat farmers in different districts of Vindhyan Zone of Uttar Pradesh. *Journal of Pharmacognosy and Phytochemistry*, 10(1): 2858–2862.

Yunita, A. 2019. Utilization of cow and organic waste as organic waste empowerment solution. In: *Journal of Physics: Conference Series*, 1424(1): 012003. IOP Publishing.

Zhang, J., and Wu, L. F. 2021. Impact of tillage and crop residue management on the weed community and wheat yield in a wheat–maize double cropping system. *Agriculture*, 11(3): 265.

ANNEXURE-I

Questionnaire based on farm waste management in Ayodhya district of Uttar Pradesh

Objective 1: To study the socio-demographic profile of the respondents

1. **Name:**
2. **Age:**

   a) 25-30 years b) 30-35 years c) 35-40 years d) Above 40 years

3. **Gender:**
   a) Male b) Female c) Others

4. **Education**
   a) Illiterate b) Primary c) secondary d) Higher secondary

   e) Graduate f) postgraduate

5. **Religion**
   a) Hinduism b) Islam c) Buddhism d) Christianity

6. **Caste**
   a) General b) OBC c) SC d) ST

7. **Occupation:**
   a) Farmer b) laborer c) Business d) Government e) other

8. **Monthly Income:**
   a) < ₹20,000 b) ₹20,000-₹50,000 c) ₹50,000-₹100,000 d) > ₹100,000

9. **Family Type**
   a) Nuclear family b) joint family c) Extended family d)

10. **Location:**
    a) Urban b) Rural

ANNEXURE-II

Objective 2: To study the existing situation of farm wastes in Ayodhya district

11. Farm type

a) Small (< 2 acres) b) Medium (2-5 acres) c) Large (> 5 acres)

12. Primary Crops:

a) Wheat b) Rice c) Maize d) millets e) sugarcane f) other's

13. Primary Livestock:

a) Cattle b) oxen c) goats d) hen e) others

14. No of family members working on form

a) 1-3 b) 3-5 c) 5-8 d) Above 8

15. What type of farm waste is generated on your farm?

a) Crop residues b) Animal waste c) Pesticide waste d) Plastic waste

16. Waste Generation (Monthly):

a) <100kg b) 100 – 200 kg c) >200kg

17. What harvesting method do you use?

a) Manual harvesting b) mechanized harvesting

18. How satisfied are you with your current farm waste management practices?

a) very dissatisfied b) dissatisfied c) neutral d) satisfied e) very satisfied

ANNEXURE-III

Objective 3: To study the existing method of farm waste management

19. How do you currently manage your farm waste?

a) Composting b) vermicomposting c) fodder d) others

20. Are you aware of sustainable farm waste management practices? (Yes/No)

21. Would you like to adopt sustainable farm waste management practices? (Yes/No)

22. What motivates you to adopt sustainable practices?

a) Economic benefits b) Environmental concerns c) Social benefits d) other

23. Do you generate energy from farm waste? (Yes/No)

I. If yes, specify:

a) Biogas b) biomass c) cow dung d) others

24. Do you compost farm waste? (Yes/No)

I. If yes, what materials do you compost?

a) Crop residues b) Livestock manure c) organic waste d) food waste e) other

II. What composting method do you use?

a) Pit composting b) Vermicomposting c) burning d) other

III. What are the challenges faced in composting?

a) Odor issues b) Pest attraction c) Moisture management d) lack of space e) lack of resources

25. Do you incarnation farm waste? (Yes/No)

I. If yes, what materials do you incarnated?

a) Crop residues b) Livestock m c) hazardous waste d) organic waste e) other's

II. Do you have a designated area for incarnation? (Yes/No)

III. What are the concerns related to incarnation waste?

a) Air pollution b) Fire risk c) Soil degradation d) Other (specify)

26. Do you have a biogas plant? (Yes/No)

I. What feedstocks do you use for biogas production?

a) Livestock manure b) Crop residues c) Food waste d) Other (specify)

27. Do you landfill farm waste? (Yes/No)

I. What materials do you landfill?

a) Crop residues b) Livestock manure c) pesticide container d) other's

ANNEXURE-IV

Objective 4: To provide some suggestions regarding waste management

28. . Have you ever attended a workshop/training on farm waste management? (Yes/No)

29. Would you be interested in participating in a farm waste management program? (Yes/No)

30. Would you support the establishment of community composting facilities? (Yes/No)

31. Should the government invest in farm waste management infrastructure? (Yes/No)

32. Would you prioritize waste collection and transportation services? (Yes/No)

33. Would economic incentives encourage you to adopt sustainable waste management practices? (Yes/No)

34. What type of incentives would be most effective?

a) Subsidies b) Market support c) Tax breaks d) Other (specify)

35. Would you support a pay-per-use model for waste management services? (Yes/No)

36. Would awareness campaigns on farm waste management impact your practices? (Yes/No)

37. If you want give suggestions for farm waste management?

Name of student: Chethan R

I.D. No: C-14877/23

Degree: M.Sc. (Community Science)

Department: Resource Management and Consumer Science

Major (subject): RMCS

Minor: EECM

Topic: "A study on Farm Waste Management in Ayodhya district of Uttar Pradesh"

Advisor: Dr. Poonam Singh (Associate Professor & HOD)

Abstract

This study aimed to explore the socio-economic profile of farmers, examine the existing patterns of farm waste generation and management, and suggest appropriate strategies for promoting sustainable farm waste management in Ayodhya district, Uttar Pradesh. To achieve this, a total of 120 farmers were randomly selected, and data were collected through self-structured questionnaires and structured interviews. The study revealed that most farmers were engaged in medium-sized farming operations, with limited incomes and a strong dependence on traditional, manual harvesting methods. Crop residues emerged as the primary source of farm waste, commonly managed through fodder use and pit composting, while environmentally harmful practices like landfilling were still widely practiced. Although many farmers had adopted sustainable waste management techniques, their motivation was largely driven by economic benefits rather than environmental awareness. The absence of biogas usage and minimal participation in formal training programs highlighted significant gaps in waste management practices. Despite these challenges, the majority of respondents showed a strong interest in community composting, structured waste management programs, and financial incentives to improve current practices. The findings emphasize the urgent need for awareness generation, improved infrastructure, accessible waste management technologies, and supportive policies to encourage the adoption of sustainable farm waste management in the region.

P. Singh 23.8.2025

(Poonam Singh)

Chethan

(Chethan R)

नाम: चेतन आर

सेमेस्टर: चतुर्थ

प्रवेश वर्ष : 2023

आई.डी. नंबर: C-14877/23

डिग्री: एम.एस.सी. (समुदाय विज्ञान)

विभाग :विभाग संसाधन प्रबंधन और उपभोक्ता विज्ञान

शीर्षक: "उत्तर प्रदेश के अयोध्या जिले में कृषि अपशिष्ट प्रबंधन"

मुख्य सलाहकार और विभागाध्यक्ष:

डॉ. पूनम सिंह (सहायक प्रोफेसर)

सारांश

इस अध्ययन का उद्देश्य किसानों की सामाजिक-आर्थिक प्रोफ़ाइल का पता लगाना, कृषि अपशिष्ट उत्पादन और प्रबंधन के मौजूदा पैटर्न की जांच करना, और अयोध्या जिले में सतत कृषि अपशिष्ट प्रबंधन को बढ़ावा देने के लिए उपयुक्त रणनीतियों का सुझाव देना था। इस उद्देश्य को प्राप्त करने के लिए कुल 120 किसानों का यादृच्छिक चयन किया गया, और डेटा स्वयं-निर्मित प्रश्नावली और संरचित साक्षात्कार के माध्यम से एकत्र किया गया। अध्ययन से पता चला कि अधिकांश किसान मध्यम आकार की कृषि संचालन में लगे हुए थे, जिनकी आय सीमित थी और पारंपरिक, मैनुअल कटाई विधियों पर उनकी मजबूत निर्भरता थी। फसल अवशेष कृषि अपशिष्ट का प्राथमिक स्रोत के रूप में उभरे, जिन्हें आमतौर पर चारा उपयोग और गड्ढा खाद बनाने के माध्यम से प्रबंधित किया गया, जबकि पर्यावरण के लिए हानिकारक प्रथाएँ जैसे जलाना और लैंडफिलिंग अभी भी व्यापक रूप से प्रचलित थीं। हालांकि कई किसानों ने सतत अपशिष्ट प्रबंधन तकनीकों को अपनाया था, उनकी प्रेरणा मुख्य रूप से आर्थिक लाभों द्वारा संचालित थी, न कि पर्यावरणीय जागरूकता द्वारा। बायोगैस के उपयोग की अनुपस्थिति और औपचारिक प्रशिक्षण कार्यक्रमों में न्यूनतम भागीदारी ने अपशिष्ट प्रबंधन प्रथाओं में महत्वपूर्ण अंतराल को उजागर किया। इन चुनौतियों के बावजूद, अधिकांश उत्तरदाताओं ने सामुदायिक खाद बनाने, संरचित अपशिष्ट प्रबंधन कार्यक्रमों, और वर्तमान प्रथाओं में सुधार के लिए वित्तीय प्रोत्साहनों में मजबूत रुचि दिखाई। निष्कर्षों ने क्षेत्र में सतत कृषि अपशिष्ट प्रबंधन को अपनाने के लिए जागरूकता उत्पन्न करने, बेहतर बुनियादी ढाँचे, सुलभ अपशिष्ट प्रबंधन प्रौद्योगिकियों, और सहायक नीतियों की तत्काल आवश्यकता पर जोर दिया।

chethan

((चेतन आर)

23.8.2025

(पूनम सिंह)