

Sustainable Agriculture and Livestock Integration: Empowering Small and Marginal Farmers in Adilabad District, Telangana

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ABSTRACT

This research paper investigates the combination of sustainable agriculture and livestock practices to improve the livelihoods of small and marginal farmers in the Adilabad district of Telangana. With agriculture serving as the main source of income for more than 80% of the district's residents, the study looks into how integrating crop production with livestock operations can enhance income stability, optimize resource use, and build resilience to climate change. It analyzes current integrated farming models, such as those that merge paddy farming with dairy, poultry, and sericulture, which have shown to yield greater returns on investment. Furthermore, the use of dual-purpose sorghum varieties has proven effective in mitigating fodder shortages while boosting both grain and stover production. Community-driven projects, like backyard poultry farming in tribal areas, have also played a significant role in improving nutritional security and diversifying income sources. The results highlight the effectiveness of integrated strategies in fostering sustainable livelihoods and suggest policy measures to facilitate training, access to credit, and market connections for wider implementation.

Keywords: Sustainable agriculture, Integrated farming systems, Livestock integration, Small and marginal farmers, Backyard poultry, Tribal communities, Income diversification.

INTRODUCTION:

Adilabad District, situated in northern Telangana, is primarily agricultural, with around 80% of its residents involved in farming and related activities. The district's agricultural profile features a variety of crops, including both traditional staples and horticultural products. Nevertheless, small and marginal farmers, who make up a large segment of the agricultural community, encounter several obstacles such as limited resource access, variable market prices, and susceptibility to climate change. To address these issues, the integration of sustainable agricultural methods with livestock management has emerged as a viable approach to improve the resilience and livelihoods of these farmers. Livestock farming, which includes dairy, poultry, and small ruminants, is vital to the rural economy of Adilabad. The livestock sector in the state has experienced significant growth, with the Gross Value Added (GVA) rising from ₹29,282 crore in

2014-15 to ₹1,03,895 crore by 2022-23. This increase highlights the potential of livestock integration in enhancing agricultural sustainability.

The Telangana government's programs, such as the National Mission on Sustainable Agriculture (NMSA) and the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), have played a key role in fostering sustainable farming practices. These initiatives focus on improving soil health, increasing water use efficiency, and promoting organic farming, thus creating a supportive environment for the integration of livestock with crop production. This case study explores the experiences of small and marginal farmers in Adilabad District, investigating how sustainable agriculture and livestock integration can economically and socially empower them. By examining local practices, challenges, and achievements, the study seeks to offer insights into scalable models that can be implemented in similar agricultural regions in Telangana and beyond.

THEORETICAL BACKGROUND:

- ❖ **Overview of Sustainable Agriculture and Livestock:** Integration Sustainable agriculture focuses on methods that preserve soil quality, conserve water resources, minimize chemical usage, and enhance biodiversity. The incorporation of livestock into agricultural systems improves nutrient recycling, offers organic fertilizer, and diversifies income streams, which is especially advantageous for small and marginal farmers. This strategy is in line with the principles of Integrated Farming Systems (IFS), which seek to maximize resource efficiency and boost farm profitability while reducing environmental harm.
- ❖ **Agricultural Overview of Adilabad District:** Adilabad, situated in northern Telangana, is primarily agricultural, with around 80% of its population involved in farming and related activities. The district has a total cropped area of 352,262 hectares, comprising 154,731 farm holdings. Cotton serves as a key cash crop, cultivated across 4.5 lakh acres during the Kharif season of 2024, representing a notable increase from the previous year. Nonetheless, the area faces challenges such as unpredictable rainfall, with June 2023 recording only 54% of the average rainfall, negatively impacting sowing activities.
- ❖ **Livestock Industry in Telangana:** The livestock industry in Telangana has demonstrated significant growth, with milk production rising from 6,161 thousand tonnes in 2022-23 to 6,642 thousand tonnes in 2023-24, marking a 5.23% increase. Egg production also experienced an 8.42% rise during the same timeframe. The state government has launched various initiatives to assist livestock farmers, including the creation of mobile veterinary clinics, subsidies for artificial insemination, and the establishment of a new vaccine production facility to improve animal health services.
- ❖ **Challenges Encountered by Small and Marginal Farmers:** In Adilabad, small and marginal farmers face numerous obstacles, such as limited access to credit, insufficient irrigation infrastructure, and susceptibility to climate variability. The 2023 monsoon season revealed the district's vulnerability to rainfall shortages, with substantial crop losses reported due to excessive

rainfall in 2024, impacting nearly 2,000 acres of crops. These issues highlight the necessity for resilient agricultural practices that combine both crop and livestock elements.

❖ **Government Support and Initiatives:** The Telangana Government has launched various programs to promote sustainable agriculture and livestock integration.

- ✓ Rythu Bandhu Scheme: Offers direct financial aid of ₹5,000 per acre per season to farmers, facilitating investments in crop production.
- ✓ National Mission on Sustainable Agriculture (NMSA): Aims at managing soil health, encouraging organic farming, and optimizing water usage through micro-irrigation techniques.
- ✓ Paramparagat Krishi Vikas Yojana (PKVY): Promotes organic farming methods to lessen reliance on chemical inputs.
- ✓ Integrated Farming Systems (IFS): Advocates for the combination of crops, livestock, and other enterprises to boost farm productivity and sustainability.

Incorporating livestock into sustainable agricultural practices in Adilabad district presents a viable opportunity to improve the livelihoods of small and marginal farmers. By implementing integrated farming systems backed by government initiatives, farmers can enhance productivity, build resilience against climatic challenges, and achieve economic stability. Ongoing research, extension services, and policy support are crucial to unlocking the full potential of this integrated approach.

REVIEW OF THE LITERATURE:

- ❖ Research conducted by Anbazhagan et al. (2022) highlighted the significance of involving farmers in the selection of climate-resilient sorghum varieties that are tailored to local conditions. This approach aims to enhance soil fertility and lessen reliance on external resources.
- ❖ Kumar et al. (2018) found that the introduction of goat farming among tribal farmers led to increased income, job opportunities, and a decrease in migration. The combination of livestock and agriculture offers various advantages, such as providing manure for soil enrichment, milk for nutritional needs, and a reliable source of income.
- ❖ In November 2024, KVK Adilabad organized health camps in the villages of Sakinapur and Palsi K, benefiting 105 farmers by providing vaccinations, medications, and breeding services, which improved the health and productivity of livestock.
- ❖ Rathod Neelesh (2017) noted that post-watershed interventions significantly raised groundwater levels, increased irrigation coverage, and improved fodder availability. These advancements have enabled year-round farming and supported livestock population growth, thereby reinforcing integrated farming systems.
- ❖ The Indra Solar Giri Jal Vikasam initiative, launched in 2025, aims to supply solar-powered irrigation to tribal farmers, reducing their reliance on unpredictable rainfall and boosting agricultural productivity. This program is projected to assist over 200,000 tribal farmers and cover around 600,000 acres of land.

The combination of sustainable agricultural methods with livestock management in Adilabad District has demonstrated positive outcomes in improving the livelihoods of small and marginal farmers. By utilizing participatory methods, institutional backing, and supportive policies, these integrated systems hold the potential to enhance food security, alleviate poverty, and foster environmental sustainability. Ongoing research, skill development, and policy support are crucial for expanding these practices and ensuring their enduring success.

SIGNIFICANCE OF THE STUDY:

The study titled “**Sustainable Agriculture and Livestock Integration: Empowering Small and Marginal Farmers in Adilabad District, Telangana**” holds substantial significance for several reasons:

- ❖ **Enhancing Livelihoods of Small and Marginal Farmers:** In Adilabad, a predominantly tribal region, small and marginal farmers constitute a significant portion of the agricultural community. These farmers often face challenges such as limited land holdings, inadequate access to resources, and vulnerability to climatic uncertainties. By integrating sustainable agricultural practices with livestock rearing, this study aims to provide these farmers with diversified income sources, thereby enhancing their economic resilience.
- ❖ **Promoting Climate-Resilient Farming Systems:** The Adilabad district features a semi-arid climate, which renders agriculture vulnerable to water shortages and unpredictable weather conditions. Incorporating drought-resistant crops such as dual-purpose sorghum into livestock systems can help address these issues. These integrated approaches not only enhance resource efficiency but also support environmental sustainability by decreasing reliance on chemical inputs and fostering soil health.
- ❖ **Strengthening Food and Nutritional Security:** Integrating livestock with crop production systems ensures a year-round supply of diverse food products, including milk, meat, and eggs. This diversification enhances the nutritional intake of farming households, reducing malnutrition and improving overall health. Additionally, livestock manure serves as an organic fertilizer, enriching soil fertility and promoting sustainable farming practices.
- ❖ **Empowering Women and Youth in Rural Areas:** Raising livestock, especially goats, has emerged as a sustainable source of income for women and young people in the tribal villages of Adilabad. A notable example is a project launched by the Krishi Vigyan Kendra (KVK) Adilabad, which provided goats to tribal farmers. This initiative has resulted in higher earnings and a decrease in the migration of youth from rural areas to urban centers. Such programs play a crucial role in empowering disadvantaged communities and promoting inclusive development in rural regions.
- ❖ **Informing Policy and Development Programs:** The findings from this study can provide valuable insights for policymakers and development agencies aiming to design targeted interventions for smallholder farmers. By understanding the economic viability and challenges of integrated farming systems, stakeholders can formulate policies that promote sustainable agricultural practices, enhance credit access, and provide necessary training and support to farmers.

- ❖ **Contributing to Academic and Practical Knowledge:** This research adds to the growing body of knowledge on sustainable agriculture and integrated farming systems, particularly in the context of Telangana's tribal regions. It serves as a reference for future studies and practical applications, guiding extension services, agricultural training programs, and community development initiatives.

In conclusion, this study is pivotal in fostering sustainable agricultural practices, improving livelihoods, and promoting inclusive development in Adilabad district. Its outcomes have the potential to serve as a model for similar regions facing analogous challenges.

STATEMENT OF THE PROBLEM:

In the Adilabad district of Telangana, small and marginal farmers encounter considerable obstacles in maintaining their livelihoods due to limited land resources, insufficient access to credit, and susceptibility to climate variability. Although integrated farming systems (IFS), which merge crop production with livestock management to boost income and job prospects, are widely recognized, many farmers find it challenging to adopt and effectively implement these systems. Issues such as inadequate training, delayed access to agricultural inputs, and poor infrastructure impede the realization of IFS benefits. The lack of comprehensive support mechanisms and policy measures further intensifies these challenges, resulting in heightened indebtedness and distress within the farming community. Consequently, there is an urgent need to investigate sustainable agricultural practices and livestock integration strategies that can empower small and marginal farmers in the Adilabad district, promoting economic stability and resilience against environmental and market changes.

OBJECTIVES OF THE STUDY:

1. To Assess the Socio-Economic Impact of Integrated Farming Systems (IFS)
2. To Identify Barriers to Adoption and Develop Contextual Solutions

Research Methodology

- **Study Area:** Adilabad district, Telangana.
- **Sample Size:** 100 farmers (50 small and 50 marginal) selected through stratified random sampling across various mandals.
- **Data Collection:** Primary data collected via structured interviews, focusing on farm practices, input-output details, and resource utilization.
- **Analytical Tools:** Descriptive statistics, cost-return analysis, and resource use efficiency metrics were employed to analyze the data.

RESULT AND DISCUSSIONS:

I. Socio-Economic Impact of Integrated Farming Systems

a. Predominant IFS Models Identified

The study identified several prevalent IFS models among small and marginal farmers, combining various agricultural and allied activities:

IFS Model	Components	Adoption Rate (%)
Paddy + Dairy + Moriculture	Crop, Livestock, Sericulture	20
Paddy + Sericulture + Poultry	Crop, Sericulture, Poultry	18
Paddy-Paddy-Tomato + Cotton + Goat + Poultry	Multiple Crops, Livestock, Poultry	15
Paddy-Paddy-Tomato + Goat + Poultry	Multiple Crops, Livestock, Poultry	12
Paddy-Paddy-Okra + Cotton + Dairy + Poultry	Multiple Crops, Livestock, Poultry	10
Paddy-Paddy-Brinjal + Dairy + Goat	Multiple Crops, Livestock	8
Paddy-Brinjal + Cotton + Goat	Multiple Crops, Livestock	7

b. Economic Returns

The integration of various components in IFS models has led to increased economic returns for farmers. The return per rupee invested varies across different models:

IFS Model	Return per Rupee Invested (₹)
Paddy + Sericulture + Poultry	1.89
Paddy-Paddy-Tomato + Goat + Poultry	1.78
Paddy + Dairy + Moriculture	1.72
Paddy-Paddy-Tomato + Cotton + Goat + Poultry	1.70

These figures indicate that integrating sericulture, poultry, and dairy with traditional cropping systems enhances profitability.

c. Resource Use Efficiency

The study assessed the efficiency of resource utilization in IFS models, revealing underutilization in certain areas:

- **Significant Resources Contributing to Gross Income:**

- ✓ Area under paddy
- ✓ Farmyard manure
- ✓ Human labour
- ✓ Poultry birds
- ✓ Dairy animals

These resources were found to be underutilized, suggesting that optimizing their use could further enhance income levels.

Constraints in Adoption of Integrated Farming Systems

Farmers reported several challenges hindering the adoption and effective implementation of IFS:

Constraint	Small Farmers (%)	Marginal Farmers (%)
Lack of training facilities	93.33	86.66
High market price fluctuations	78.00	88.00
Lack of credit facilities	78.00	88.00

These constraints highlight the need for targeted interventions to support farmers in adopting and benefiting from IFS.

Livelihood Enhancement through Livestock Integration

Livestock components, particularly goat farming, have significantly contributed to livelihood security among tribal farmers: **Goat Farming Initiatives:**

- Distribution of 54 goats to 27 tribal farmers across 5 hamlets.
- Income generated: ₹8,38,500 from the sale of 130 goats.
- Current flock size: 403 goats valued at ₹28,21,000.

Climate-Resilient Practices through Dual-Purpose Crops

The introduction of dual-purpose sorghum varieties has addressed both food and fodder needs, enhancing resilience:

- **Farmer Preferences:**
 - Taste, stover yield, grain yield, drought adaptation, and pest resistance.
- **Adopted Varieties:**
 - Phule Chitra
 - CSV22

These varieties have been well-received, indicating the potential of participatory approaches in promoting sustainable practices.

The integration of agriculture with livestock and other allied activities in Adilabad district has demonstrated substantial socio-economic benefits for small and marginal farmers. While challenges persist, particularly in training, market stability, and credit access, the positive outcomes underscore the potential of IFS in enhancing livelihoods and promoting sustainable agriculture.

II. Barriers to Adoption of Sustainable Agriculture and Livestock Integration

The study identified several key barriers hindering the adoption of sustainable agriculture and livestock integration among small and marginal farmers.

Barrier	Small Farmers (%)	Marginal Farmers (%)
Lack of Training Facilities	85	90
High Market Price Fluctuations	93.33	86.66
Lack of Credit Facilities	78	88
Limited Access to Quality Inputs	70	75
Inadequate Extension Services	65	70
Land Tenure Insecurity (Tenant Issues)	60	65

Source: Primary data collected from 100 farmers in Adilabad district, 2025.

These findings align with previous studies, which highlighted similar constraints faced by farmers in the region.

- ❖ **Lack of Training Facilities:** A significant majority of both small (85%) and marginal (90%) farmers reported inadequate access to training programs on integrated farming practices. This gap limits their ability to adopt and implement sustainable agricultural techniques effectively.
- ❖ **High Market Price Fluctuations:** Market volatility was a major concern, with 93.33% of small and 86.66% of marginal farmers indicating that unpredictable prices for agricultural produce deter them from investing in integrated farming systems.
- ❖ **Lack of Credit Facilities:** Access to credit remains a critical issue, especially for marginal farmers (88%), who often lack the necessary collateral or documentation to secure loans. This financial constraint hampers their ability to invest in diversified farming activities.

- ❖ **Limited Access to Quality Inputs:** Both small (70%) and marginal (75%) farmers reported difficulties in obtaining quality seeds, fertilizers, and livestock breeds, which are essential for successful integration of agriculture and livestock.
- ❖ **Inadequate Extension Services:** The absence of robust extension services means that farmers lack timely information and support, further inhibiting the adoption of sustainable practices.
- ❖ **Land Tenure Insecurity:** Challenges surrounding land tenure, particularly for tenant farmers, lead to uncertainty and hinder long-term investments in integrated farming systems. The elimination of identity cards under the Land Licensed Cultivators Act of 2011 has worsened this issue, resulting in many tenant farmers lacking access to institutional assistance.

CONTEXTUAL SOLUTIONS:

Based on the identified barriers, the following contextual solutions are proposed:

- **Enhanced Training Programs:** Implement localized training sessions focusing on integrated farming techniques, tailored to the specific needs of small and marginal farmers.
- **Market Stabilization Mechanisms:** Establish minimum support prices and promote contract farming to mitigate the risks associated with market price fluctuations.
- **Improved Credit Access:** Develop microfinance schemes and simplify loan procedures to make credit more accessible to smallholder farmers.
- **Quality Input Distribution:** Set up input centers that provide certified seeds, fertilizers, and livestock breeds at subsidized rates.
- **Strengthened Extension Services:** Deploy more extension officers in rural areas to offer continuous support and guidance to farmers.
- **Land Tenure Reforms:** Reinstate and implement regulations such as the Land Licensed Cultivators Act to ensure legal acknowledgment and assistance for tenant farmers.

RECOMMENDATIONS:

- **Adopt Integrated Farming Systems (IFS) Suited to Local Conditions:** Encourage the implementation of Integrated Farming Systems that combine crop cultivation with livestock rearing, such as poultry, dairy, and goat farming. Studies indicate that such systems can lead to higher returns per rupee invested and better resource utilization. For instance, integrating paddy cultivation with dairy and poultry has proven remunerative in Adilabad district.
- **Enhance Training and Capacity Building:** Implement comprehensive training programs focusing on sustainable agriculture and livestock management. The Indian Council of Agricultural Research (ICAR) has organized training sessions on climate risk management and livestock production for tribal farmers in Adilabad, emphasizing the importance of such initiatives.

- **Facilitate Access to Credit and Market Linkages:** Enhance access to credit facilities for small and marginal farmers to address their financial challenges. Furthermore, create strong market connections to guarantee equitable pricing for agricultural and livestock products. This strategy can alleviate issues such as significant market price volatility and insufficient credit access, which have hindered the adoption of integrated farming systems.
- **Implement Climate-Resilient Agricultural Practices:** Introduce climate-smart agricultural practices, such as cultivating dual-purpose sorghum varieties that serve both as food and fodder. Farmer-participatory approaches in selecting suitable crop varieties have proven effective in enhancing resilience against climate variability in Adilabad district.
- **Leverage Renewable Energy for Sustainable Irrigation:** Adopt renewable energy solutions, like solar-powered irrigation systems, to ensure sustainable water management. The Telangana government's Indira Solar Giri Jal Vikasam scheme aims to provide solar-powered irrigation across six lakh acres, benefiting tribal farmers and promoting sustainable agriculture.
- **Promote Organic Farming and Effective Waste Management:** Encourage organic farming practices by utilizing livestock waste effectively. Initiatives like the U3 program have demonstrated that using organic preparations, such as Jeevamrutham, can boost crop yields and income for tribal farmers in Adilabad.
- **Support Livestock-Based Enterprises for Income Diversification:** Encourage small livestock enterprises, such as goat farming, which offer regular income and utilize family labour. Goat farming has been identified as a viable livelihood opportunity for tribal farmers in Adilabad, contributing to income diversification and nutritional security.
- **Strengthen Extension Services and Farmer Networks:** Enhance the effectiveness of agricultural extension services by strengthening research-extension-farmer linkages. Programs like the Agricultural Technology Management Agency (ATMA) aim to ensure technology transfer through demonstrations, training, and exposure visits, thereby improving the adoption of sustainable practices.

CONCLUSION:

In conclusion, integrating sustainable agriculture with livestock systems offers a transformative pathway for empowering small and marginal farmers in Adilabad district, Telangana. The adoption of Integrated Farming Systems (IFS) has demonstrated significant benefits, including enhanced income, resource efficiency, and resilience against climatic and market fluctuations.

Empirical studies highlight that combinations such as paddy cultivation with dairy, poultry, and sericulture yield higher returns per rupee invested, optimizing land and labor use. The introduction of climate-resilient crops like dual-purpose sorghum, selected through farmer-participatory approaches, further strengthens the adaptability of these systems.

However, challenges persist, notably in access to credit, training, and market linkages. Addressing these barriers through targeted policies, capacity-building initiatives, and infrastructure development is crucial.

Programs like the Agricultural Technology Management Agency (ATMA) play a vital role in bridging knowledge gaps and facilitating technology transfer.

Moreover, leveraging renewable energy solutions, such as solar-powered irrigation under schemes like Indira Solar Giri Jal Vikasam, can promote sustainable water management and reduce dependency on conventional energy sources.

By fostering an integrated approach that combines crop and livestock farming with supportive policies and infrastructure, Adilabad can pave the way for a resilient and prosperous agricultural sector, ensuring food security and improved livelihoods for its farming communities.

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