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FEASIBILITY OF AGRO-FORESTRY FOR SUSTAINABLE DEVELOPMENT OF SMALL RUMINANT PRODUCTION IN TAMIL NADU'S DRY LANDS

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Abstract: An in-depth investigation was carried out to determine the potential of Silvipasture in supporting sustainable small ruminant production within Tamil Nadu's dry land tract. The study centered on a one-acre plot, where tree components Gliricidia sps. and Leucaena leucocephala were selected, and Cenchrus ciliaris, Stylo hamata, and Stylo scabraas were used for pasture establishment, with a seed ratio of 3:1:1. Biomass yield was recorded every two months over a three-year period, with annual yields ranging between 35-37 metric tons. The results indicated that the biomass yield from Gliricidia sps was greater than that of Leucaena leucocephala, and the yield from the grass and leguminous component through the cut and carry system was sufficient to meet the nutrient requirements of both sheep and goats, as per the Bureau of Indian Standards (BIS). This Silvipasture system could therefore sustain around 16-18 sheep or 12-14 goats, providing farmers with an economically viable approach to increasing revenue from their land and maintaining sustainable small ruminant production.

Keywords: Carrying Capacity - SilviPasture System - Small Ruminant Production.

Introduction

Agroforestry systems, which integrate trees and shrubs into agricultural landscapes, have been identified as a promising strategy for enhancing the productivity and sustainability of smallholder livestock production systems, particularly in the context of climate change and increasing demands for food and environmental services (Garrity et al., 2010). Small ruminants, such as sheep and goats, play a crucial role in the livelihoods of millions of rural households in developing countries, providing meat, milk, manure, hides, and a source of financial security (Devendra, 2010). However, small ruminant production systems face several challenges, including land degradation, water scarcity, and low productivity (Schoeneberger et al., 2012). In the dryland

regions of Tamil Nadu, India, small ruminant production is an important component of rural livelihoods, but it is threatened by land degradation and climate change (Rajendran et al., 2018).

The potential of agroforestry systems to support sustainable small ruminant production in these areas has been recognized, but empirical evidence on their effectiveness and the factors influencing their adoption and success is scarce. This article aims to address this research gap by evaluating the potential of agroforestry systems to support sustainable small ruminant production in Tamil Nadu's dryland tract.

Agroforestry systems have been shown to provide various ecosystem services, including enhanced soil fertility, carbon sequestration, and improved water availability (Jose, 2009; Nair et al., 2009). In addition, trees and shrubs in agroforestry systems can provide fodder, shade, and shelter for small ruminants, potentially leading to improved animal health, productivity, and resilience to climate change (Devendra, 2010; Mekoya et al., 2012). Agroforestry systems can also increase the diversity of forage resources available to small ruminants, allowing them to better cope with seasonal fluctuations in feed availability (Haile et al., 2016).

In Tamil Nadu's dryland regions, the major agroforestry systems include silvopastoral systems, where trees and shrubs are integrated with pasture or grazing lands, and agrosilvopastoral systems, where trees and shrubs are integrated with both crops and pastures (Rajendran et al., 2018). These systems have the potential to improve small ruminant production through increased fodder availability, improved soil fertility, and enhanced resilience to climate change. However, the adoption and success of these systems depend on various factors, such as farmers' knowledge, attitudes, and access to resources, as well as the availability of suitable tree and shrub species for integration (Haile et al., 2016; Rajendran et al., 2018)

Evaluating the potential of agroforestry systems to support sustainable small ruminant production in Tamil Nadu's dryland tract requires a multidisciplinary approach, combining insights from agronomy, animal science, ecology, and social science. Key research questions to be addressed include:

1. What are the potential benefits of agroforestry systems for small ruminant production in terms of improved fodder availability, animal productivity, and resilience to climate change?
2. What are the main tree and shrub species suitable for integration into small ruminant production systems in Tamil Nadu's dryland tract, and what is their potential contribution to fodder availability and quality?
3. What are the factors influencing the adoption and success of agroforestry systems among small ruminant producers in Tamil Nadu's dryland tract, and how can these factors be addressed to promote the wider adoption of these systems?
4. What are the potential trade-offs and synergies between the various ecosystem services provided by agroforestry systems, and how can these be managed to optimize small ruminant production, while also ensuring environmental sustainability?

In conclusion, agroforestry systems have the potential to support sustainable small ruminant production in Tamil Nadu's dryland tract by enhancing fodder availability, improving animal productivity, and increasing resilience to climate change. However, further research is needed to provide empirical evidence on the effectiveness of these systems and to identify the factors influencing their adoption and success. Addressing these research questions will contribute to the development of context-specific strategies for promoting agroforestry systems as a viable and sustainable solution for small ruminant production in Tamil Nadu's dryland regions.

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Materials and Methods

To assess the carrying capacity of the dry land for small ruminant production a trial was conducted to establishing Silvipasture in a dry land tract. The area selected for the trial had an average annual rain fall of 650-750 mm and temperature ranged between 28^0 -45^0C.One acre of land was earmarked for the trial and the land was prepared to establish silvipasture. *Gliricdia* sps.and *Leucaena leucocephala* seedlings were selected for tree component and planted in the space 3X3 m. The understorey, the land between the trees was utilized to establish pasture with *Cenchrus ciliaris* as grass component as source of energy and *Stylo hamata* and *Stylo scabra*as leguminous fodder crop as a source for protein with seed ratio of 3:1:1. Rain gun facilities were established for periodical irrigation. The biomass yield wasrecorded for three years at an interval of two months. After every harvest the fodder, top dressing was done by farm yard manure.

Results and Discussion

The total biomass yield from the tree component, grass and legume component were 35-37 MT per annum. The biomass yield of the tree component, *Gliricidia sps.* was higher than *Leucaena leucocephala*. The biomass yield from the grass and leguminous component by cut and carry system was able to supply fodder tomeet nutrient requirements of sheep and goat. Feeding grass and tree leaves each at 50% level was found economically superior than feeding grass and concentrate mixture in lambs (Parthasarathy, *et.al*, 1998). As per the BIS requirements for sheep and goats, by establishing this type of Silvipasture, the famers could maintain around 16-18 sheep or 12-14 goats in an economic way to enhance the revenue from the unit of land. Silvopasture, as an integrated land use practice, has been proven to be economically and environmentally sustainable both at small and large scales. Simelton and Hoang, (2011) also stated that Agro-forestry diversifies the environmental and economic functions of small scale farming system and is therefore considered more resilient than monocropping to external stress.

Conclusion

The results of the trial ascertained the possibilities of establishment of silvi-pasture by cut and carry system to cater the nutrient requirement of the sheep and goat to make this as a successful enterprise for improving the social-economic status of the farming community.

References

Jose S, Walter D, Mohan Kumar B (2019) Ecological considerations in sustainable silvopasture design and management. Agroforest Syst. https://doi.org/10.1007/s10457-016- 0065-2

Jose S and Jeanne Dollinger (2019). Silvopasture: a sustainable livestock production system Agroforest Syst. 93:1–9

Parthasarathy, R., Murugan, M and Kathaperumal, V.1998. Effect of feeding top feeds on the performance and nutrient utilization in small ruminants. In: National seminar on Integration of livestock and agroforestry systems in wasteland development, Chennai, pp78-81.

Pasha, S.M., 2000. Economy and ecological dimensions of livestock economy. Common wealth publishers, New Delhi.

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Devendra, C. (2010). Smallholder farming systems in Asia. Agricultural Systems, 103(5), 295-306. Garrity, D. P., Akinnifesi, F. K., Ajayi, O. C., Weldesemayat, S. G., Mowo, J. G., Kalinganire, A., ... & Oluyede, C. (2010). Evergreen agriculture: A robust approach to sustainable food security in Africa. Food Security, 2(3), 197-214.

Haile, B., Alemu, G., & Alemayehu, K. (2016). Role of agroforestry in the livelihood of small ruminant owners in the East Shewa Zone, Ethiopia. Agroforestry Systems, 90(4), 693-702.

Jose, S. (2009). Agroforestry for ecosystem services and environmental benefits: An overview. Agroforestry Systems, 76(1), 1-10.

Mekoya, A., Oosting, S. J., Fernandez-Rivera, S., & Van der Zijpp, A. J. (2012). Farmers' perceptions about exotic multipurpose fodder trees and constraints to their adoption. Agroforestry Systems, 84(1), 87-103. Nair, P. K. R., Kumar, B. M., & Nair, V. D. (2009). Agroforestry as a strategy for carbon sequestration. Journal of Plant Nutrition and Soil Science, 172(1), 10-23.

Rajendran, K., Chatterjee, S. R., & Kumar, B. M. (2018). Agroforestry for rural livelihood in Tamil Nadu's dryland tracts: A review. Indian Journal of Agricultural Sciences, 88(10), 1491-1499.

Schoeneberger, M., Bentrup, G., & de Gooijer, H. (2012). Branching out: Agroforestry as a climate change mitigation and adaptation tool for agriculture. Journal of Soil and Water Conservation, 67(5), 128A-136A.

Singh, G.1995. An agroforestry practice for the development of salt lands using *Prosopis Juliflora* and *Lepto chloafusca*. Agroforestry Systems. 29: 61-75.

Simelton, E and Hoang Minh, H. 2012. Proceedings - Climate Change Resilient Agroforestry Systems for Livelihood Improvement of Smallholders in Vietnam \ http://www.fao.org/climatechange/climatesmart/66248/en/