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Sheep penning for agro-pastoral economy and restoration of soil fertility

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Abstract

Goat and manure, known for its higher nutrient content, particularly nitrogen, plays a crucial role in enhancing soil fertility, especially through the traditional practice of penning. Penning involves confining livestock to graze on fallow lands, allowing them to deposit manure directly onto the soil. This practice, deeply rooted in the agro-pastoral traditions of Southern India, contributes to sustainable farming by improving soil health and reducing reliance on chemical fertilizers. Historical evidence from the Southern Indian Neolithic era and contemporary studies highlights the effectiveness of penning in enriching soil with essential nutrients, controlling soil-borne pathogens, and fostering beneficial microbial activity. While much research has focused on the agronomic benefits, the socio-cultural, economic, and ecological aspects of penning remain underexplored. This study underscores the need to institutionalize penning as a key component of natural farming practices, advocating for its inclusion in agricultural policies to promote sustainable soil management and support rural livelihoods. Traditional plant growth promoting formulation namely Goat 'aavottam' or 'aattottam' needs to be popularized widely for sustainable crop productivity.

Keywords: Penning, soil fertility, sheep and goat manure, natural farming, agro-pastoral traditions

Introduction

Sheep and goat manure typically has a higher nitrogen content than cattle manure, as observed by Zhu *et al.* (2020) [1], due to small ruminants selectively consuming plants with greater nutritional value. A goat weighing between 20 and 40 kg can produce around 0.3 to 0.6 kg of dung each day, which equates to about 0.3 tonnes annually. Farmers with more than 45 goats can produce approximately 21.3 kg of manure daily, amounting to about 7,760.8 kg per year (Washaya *et al.* 2023) [2]. Earlier research studies by Parasite (2012) [3] clearly highlighted those higher concentrations of the goat dung extract completely inhibited the growth of soil borne pathogens especially *Sclerotium rolfsii* and also enriched the soil with all major nutrients required for plants growth.

Penning is camping the bovine such as cattle and sheep voluntarily in the fallow land for grazing after the harvest of the last crop, throughout day or night for a period of week or a month along with suitable food and shelter. Sheep penning is usually done between March to July, especially during the summer, when the irrigated lands are left without cultivation. Penning can be implemented in both irrigated and dryland conditions across various types of soils, representing a promising collaborative effort between the farming community and pastoralists. This practice typically occurs after crop harvesting, with flock sizes ranging from 1000 to 4000 sheep or goats. Larger flocks, owned by 10-15 farmers, may contain up to 4000 sheep. The cost of penning ranges from Rs 1,000 to Rs 1,200 per acre. In addition to enhancing soil health, sheep serve as a quick source of cash and can be sold as needed. Notably, 40 sheep can provide benefits equivalent to 10 acres of land. Sheep will be brought to a designated area before nightfall so the young can stay with their mothers, and any crops can be grown afterward. The soil fertility provided by penning is rapid and equivalent to the fertility provided by DAP, resulting in highly fertile penned fields. Penning begins at 6 P.M. Sheep and goat manure are relatively lower in moisture content and higher in nutrient value

than cattle manure. Average nutrient composition (%) of sheep and goat manure 1.93 N, 0.6 P and 1.90 K. Due to the manure of sheep, activity of different type of organism increases in the soil which makes it more porous. The root grub dies due to the power of sheep urine.

Traditional system of Sheep penning

This traditional practice in Southern India, vital for a thriving agro-pastoral economy and ecological sustainability, has origins dating back to the Neolithic era. The penning of livestock in particular is rooted in the Neolithic period of the Southern Indian Peninsula. The widespread presence of 'Ashmounds' throughout much of the southern peninsula suggests that a complex agro-pastoral economy thrived during the Southern Indian Neolithic era. Even today, sheep rearing remains largely nomadic and has traditionally been the main livelihood for certain pastoralist communities in India. The Dhangars of Maharashtra, Kuruma of Andhra Pradesh and Telangana, Kuruba of Karnataka of the Deccan Plateau region, the Konar of Tamil Nadu, basically the penning material used is called as 'patti' made by bamboo sticks and locally some people called as 'Kidai adaithal or kidai kattudhal' in Tamil by Sekar (2015) [4], the Bakarwals of Jammu and Kashmir, the Gaddis, Kanets, Kaulis and Kinnauras of Himachal Pradesh, the Bhotias of Uttar Pradesh, the Raikas of Gujarat and Rajasthan, of India are particularly associated with sheep and goat rearing and are known for sharing an intricate socio-cultural, religious, spiritual, and economic relationship with them. Recent studies on sheep penning in India have primarily concentrated on its impact on soil fertility, organic farming, and economic aspects, while other dimensions, such as social, cultural, ecological, environmental, and geoethno-archeological factors, have been largely overlooked. Against this backdrop, a study was undertaken to explore the socio-cultural aspects and economic significance of the sheep penning tradition in the Deccan plateau region of India. In Telangana, it is customary to compensate shepherds during penning, either with cash, in kind, or a combination of both. The farmer in whose field penning is being done, would supply food materials, two times a day. Shepherds who looked after the sheep cook their own food. In the morning, they are given 20 kg of foxtail-milleand tamarind chutney. More quantities are given in the evening as they have to feed the dogs as well. During penning, dogs guard the sheep during night. These dogs watch over a radius of 1 km when the sheep graze in the fields. The dogs live with the sheep from the beginning and are trained to hunt foxes, wolves, and rabbits. When a person has a large number of sheep, they need to provide food for the caretaker for only one month. For the other 11 months, the responsibility for feeding the caretakers falls to the farmers who host the sheep for penning.

Case studies in sheep penning

Jiang *et al.* (1996) [5] conducted a series of experiments at Guizhou Province of China and demonstrated that night penning was proved to be a successful technique for the improvement of native pastures through enhancement of soil fertility and change in the botanical composition of the sward. They have indicated that penning intensity of 7 to 8 sheep nights per m² is a successful pasture establishment strategy from May to September and four species of grasses such as ryegrass, cocksfoot, Yorkshire fog and white clover that were pre-sown was found to be most suitable for establishment in pastures.

Zhang *et al.* (2001) [6] studied the effect of sheep treading and application of sheep urine and dung separately in different fields of Guizhou Weining, China at the rate of 8 sheep during nights m⁻². The trampling of sheep helped to remove all the herbage, all the vegetation on the ground. Manual addition of dung and urine added more ammonium nitrogen to the soil. Treading further improved the air permeability in the soil.

Loh *et al.* (2005) [7] experimented the effect of cattle and goat manure based vermicasts in decreasing the C:N ratio. The concentrations of total C, P and K in goat manure vermicasts were higher than those in cattle manure vermicasts. However the nitrogen content, reproductive performance of earthworms and biomass, was comparatively higher in cattle manure than compared to goat manure.

In Alps Mountain, a model was developed by Ravetto Enri *et al.* (2019) [8] for the effective utilization of land use intensity in topography for sheep flocks during night penning. They suggested that using the distance from TNPA, preferably weighted on the number of penning nights, are an effective proxy to estimate the spatial variability of sheep stocking rate during grazing in the Alps and also protected from wolf attacks, improved accessibility to water sources.

Ilaiyadeepan *et al.* (2015) [9] conducted a field experiment to study the effect of vermicompost, goat manure and garden soil on green gram yield and yield attributes. It was observed that application of FYM based vermicompost highly contributed to the improvement of yield parameters such as leaf area, plant height and grain filling capacity, played an important role in improving the soil fertility and sustainability compared to the goat manure and garden soil. Nandhini and Suganthi (2018) [10] conducted a case study on sheep penning using migratory flock owners from Ramnad and Sivagangai districts in Cauvery delta region of Tamil Nadu, India where the land is put under fallow for a period of three months from April to June in harvested fields during July, August and September seasons. The penning was allowed even in coconut fields by making nylon netted fencing of about four to five feet height supported with iron rod pillars around the field. In soft textured soils after penning, Horse gram was grown as a good fodder for animals.

Jaramillo *et al.* (2021) [11] Cattle, sheep, and goats all have different grazing behavior and diet selection patterns, which can affect sward structure. For example, sheep choose a higher-quality diet than cattle, so swards grazed by sheep have higher proportions of white clover than swards grazed by cattle. This is thought to be because cattle use their tongues to sweep larger amounts of lower-quality forages into their mouths, whereas sheep use their prehensile lips to select individual tillers. The overall evidence suggests that well-managed multispecies swards can enhance the productivity as well as environmental sustainability of grazing systems. In Red Chillies, application of goat manure and goat urine based organic fertilizers increased the productivity in Indonesia, where largest Goat population is recorded (Batubara *et al.* 2021) [12].

Sheep and Goat in natural and organic farming

In traditional preparations, a special type of indigenous formulations rich in Potassium 92 mg/kg reported from Erode district is 'Goat aavottam'. It is applied as plant growth promoter as 2% foliar spray to improve branching, leafing, flowering and fruiting in most of the crops (Nandhini and Somasundaram, 2023) [13].

Suganthi *et al.* (2023) [14] have elaborated an in-depth study in various bio-inputs for natural farming at Nammazhvar

Organic Farming Research Centre at Tamil Nadu Agricultural University, Coimbatore, Tamilnadu. Based on the experience gained during indigenous technology knowledge (ITK) gathering and following the concepts of Thiru. G. Nammazhvar, the natural farming agriculturist, founder of Nammazhvar Ecological Foundation For Farm Research and Global Food Security Trust (NEFFFRGFST) or simply Vanagam to located in Karur, Tamilnadu, a goat dung based natural farming input namely Goat *aavottam* or *aattottam* with the goat based ingredients.

Constituents in 'Goat *aavottam*'

1. Goat dung (soaked in water overnight)
2. Goat urine (fresh)
3. Green gram after grinding (soaked in water overnight)
4. Goat Milk
5. Curd from goat milk
6. Banana (ripened)
7. Tender coconut water
8. Fermented coconut water
9. Sugarcane juice

Preparation of 'Goat *aavottam*'

Goat or sheep dung was soaked overnight in water, added with fresh goat urine in the next day and mixed well, to this Green gram paste, Goat Milk, Curd from goat milk, ripened Banana, Tender coconut water, fermented coconut water and sugarcane juice were added and allowed for 21 days of fermentation as that of *Panchakavya* preparation from desi cow dung.

Foliar application and benefits of 'Goat *aavottam*'

- Apply 2% in water as spray during dawn or dusk on any crop.
- The solution should be filtered properly before pouring into the hand sprayer. For best results, spray at the time of branching, before flowering and fruit setting.
- It provides excellent nutrients to the soil
- It assists in plant growth and increases chlorophyll
- Improves branching, leafing, flowering and fruiting
- It is easy to prepare
- Excellent plant growth promoter

A study was conducted to study the efficiency of goat, cow and poultry litter-based vermicomposting against the model indicator plant namely mustard in improving the plant nutrient status, and growth promotion proved that chicken manure vermicompost registered more available phosphorous, potassium content was higher in goat manure vermicompost, whereas nitrogen content was maximum in cattle based vermicompost (Anandyawati *et al.* 2023) [15].

Siripurapu (2023) [16] made an exploratory study on sheep pastoralists of Kuruma community in semi-arid region of Deccan plateau of Telangana state. It was stated that, animal dung due to penning accounted for major income contributing to the manure economy, and more predominantly the farmers relied less on chemical fertilizers contributing to minimized transportation cost of manures and thereby soil fertility restoration was assured.

Scope of Sheep penning in Tamil Nadu

In the Southern Peninsular India, Sheep reared exclusively for both mutton and carpet wool are Bellary, Coimbatore (MCW), and Nilgiri for Apparel wool, Daccani, Hassan, Kanguri, Kilakarsal, Madras Red, Mandya, Mecheri, Nellore, Ramnad White, Tiruchy Black, Vembur are specially reared

for mutton. In north-western agro climatic zone, the district such as Salem, Dharmapuri, Erode, Krishnagiri and Namakkal of Tamil Nadu, the true-to-type Salem Black goats, locally called as '*Karuppuadu*' in Tamil language and Mecheri breed are widely distributed and are reared especially for meat. Breeds such as Ramanathapuram white and *Keezhakaraisal* or *Karuvai* or *Adikaruvai* is a meat purpose breed distributed in Ramanathapuram, Sivagangai and Thirunelveli districts of Tamilnadu. Goats such as *Chevaadu*, *Kanni aadu*, *Pallai aadu*, *Chippiparai* are also famous in Tirunelveli district (Thangaraj Ravimurugan *et al.* 2012; Ravimurugan, 2017) [17, 18]. Pure breed of large-sized breed Pattanam are distributed in Paramakudi, Mudukulathur and Kamuthi taluks of Ramanathapuram district and Aruppukottai and Virudunagar district of southern agroclimatic zone of Tamil Nadu, India (Ravimurugan *et al.* 2012) [19]. In Tuticorin and Virudhunagar districts of Tamilnadu, Vembur sheep breed is used for meat purpose. Trichy black is most popular in Trichy and Perambalur district of Tamil Nadu. An indigenous breed of sheep native to the northeastern parts of Tamil Nadu such as Chennai, Kancheepuram, Tiruvellore, Villupuram and adjoining areas of Vellore, Cuddalore and Thiruvannamalai districts are the Madras Red sheep. Owing to these availability of wide range of traditional sheep and goat community that are highly suitable for varied agro-climatic condition, nomadic lifestyle showing adaptability to the different type of vegetation across Tamilnadu, shepherds from Southern parts of Tamilnadu are in lateral agreement with landlords at the rate Rs.150/- per day for sheep penning. During the festival occasion like Diwali, Christmas or Bakrid, the sale of goat at Veppur Shandy of Cuddalore district goes even to 4-5 Crores per day.



Fig 1: Goat penning at Kammapuram village, Cuddalore district

Conclusion

Penning and the sale of manure should be established as a key component of a "manure economy" and integrated into the responsibilities of state agriculture and animal husbandry departments. Policymakers need to focus on preserving these practices and advancing traditional methods for improving soil fertility. As India is marching towards natural farming concepts in all its human resource developmental activities, majority of the focus is not cornered towards penning and major importance is given to desi cow dung only. Preparation of traditional goat/sheep dung-based formulation called as '*Aattotam*' need to be stressed along with all other natural farming inputs.

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