



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating: 5.20
www.agronomyjournals.com
2025; 8(3): 463-468
Received: 07-01-2025
Accepted: 11-02-2025

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Analysis of the Korangadu agro-pasture system of Tamil Nadu

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DOI: <https://www.doi.org/10.33545/2618060X.2025.v8.i3f.2673>

Abstract

The present study was conducted in Coimbatore, Erode, Karur and Tirupur districts of Tamil Nadu with the objective to analyze the Korangadu agro-pasture system of Tamil Nadu. Snowball sampling technique was pursued to identify 50 *Kangayam* cattle farmers in each district, thus a total of 200 respondents were selected for the study. 100 *Kangayam* farmers out of the selected 200, who have Korangadu farm lands in operating condition at the time of study, were selected adopting proportionate random sampling technique. The data regarding management of Korangadu farming land were gathered from the respondents through the interview schedule during personal interviews and the data was analyzed by using appropriate statistical methods. Results revealed that majority (64.00 per cent) of the respondents had Korangadu farm land within three kilometre distance from their residence, all the respondents (100.00 per cent) ploughed their korangadu farm land soon after summer showers and for this activity above one-half of the respondents (52.00 per cent) prepared their land by using *Kangayam* cattle and all the respondents (100.00 per cent) sowed *Cenchrus* grass during September – October months and they developed live fencing by using *Kiluvai* / *Mullukiluvai* (*Commiphora berryii*). Most of the respondents (76.00 per cent) installed cement tanks / plastic troughs. etc., inside the Korangadu farm land, 82.00 per cent of the respondents had up to 20 *Velvel* (*Acacia leucophloea*) trees per acre of land and 72.00 per cent of the respondents allowed four adult *Kangayam* cattle plus four calves or 40 sheep or six buffaloes per four hectares of their Korangadu farm land.

Keywords: Korangadu, Agro-pasture system and live fencing

Introduction

Korangadu is a traditional heritage rich grazing land lying under the western agro climatic zone of Tamil Nadu in the rain shadow of the Western Ghats. It exists in 500 villages in a compact or contiguous area (4,000 sq km) and the total grassland area is about 50,000 ha. “*Korangadu*”, a lesser known but significant farming practice associated with *Kangayam* breed is a Globally Important Agricultural Heritage System (Ganesan *et al.*, 2012) ^[3] a form of land use in which tracts of rainfed lands are enclosed by live fences and maintained exclusively for grazing purpose. *Korangadu* is maintained naturally without any artificial fertilizer except dung of the animal left in the field while grazing. This semi - arid tract is also natural rain water harvesting place and therefore it conserves ground water in the entire tract of *Korangadu* pasture land. Due to the changes in the economic pattern towards increased industrialisation, the area under *Korangadu* pasture lands also seen a drastic reduction (Kumar *et al.*, 2011) ^[4]. Under the circumstances stated above, it is important to document the farming system of the Korangadu will be a permanent record for the future generations and could be used to propagate the farming system into other areas.

Materials and Methods

Four districts (Coimbatore, Erode, Karur and Tirupur) of Tamil Nadu were purposively selected since they were identified as the breeding tract with considerable cattle population. Descriptive research design was employed to obtain pertinent and precise information concerning the phenomenon under quest and to draw possible valid general conclusions. Since the cattle farmers were scattered in the selected four districts, Key informants including local Veterinarians, cattle breeders, officials of Primary Milk Producers Cooperative Societies,

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representatives of NGOs and progressive farmers were involved to identify the initial respondents for the study in each district. Through these initially identified respondents, other respondents were identified and selected through snowball sampling technique leading to a total of 50 respondents in each district. Thus, a total of 200 respondents were selected for the study. Owing to the fact that Korangadu- silvi pasture lands were being maintained not by all, but limited number of Kangayam farmers at present days, a list consisting of 100 respondent farmers out of the selected 200, who have Korangadu farm lands in operating condition at the time of study was prepared. A sample of 50 farmers from the list consisting of 17 respondents from Erode district, 13 respondents from Tiruppur district, 12 respondents from Karur district and eight from Coimbatore district were selected adopting proportionate random sampling technique. The data regarding management of Korangadu farming land viz., land area, no of years in operation, nature of inheritance, management procedures like method of land preparation, type of vegetation, nature of fencing method, grazing system, provisions for housing and watering the animals, stocking capacity and economics of development of Korangadu silvi pasture lands, etc., were gathered from the respondents through the interview schedule during personal interviews and the data was analyzed by using appropriate statistical methods.

Results and Discussion

The data regarding Korangadu farming system were gathered from the selected respondents as well as from secondary sources and the results were documented and presented.

1. History of the Korangadu Silvo-Pastoral Management System

“Korangadu” pasture land is a privately owned silvi pasture system in which paddocks has typical combination of grasses, legumes and trees and is fenced with live thorny shrubs. (FAO, 2008) [2].

The meaning of the term *Korangadu* [pronounced *ko-run-gaa-doo*] in the Tamil language is “left out uncultivated land that allows natural vegetation”. It is a traditional pasture land farming system spread over in semi-arid tract of Erode, Coimbatore, Tiruppur, Karur and Dindigul districts of Tamil Nadu state in South India, covering an area of approximately 3,841 sq. km. The Korangadu farm land are located between 77° 17” E and 77° 55” E longitude and 10° 44” N and 11° 03” N latitude. The east-west spread of the Korangadu land is 70 km and the north-south spread is 45 km. (Kumar *et al.*, 2011) [4]. The region lies east of the Western Ghats in the rain-shadow area and has been sustainably managed for over one hundred and fifty years.

In a region with scanty rainfall per annum, growing grass for their livestock is the farmer’s main vocation. During the British period, between 1855 and 1881, majority of government wastelands in this region were given on lease to farmers who systematized the lands into grazing paddocks. (Littlewood, 1936) [5].

Upon discussion with the respondent, they emphasized that the paddock system of Korangadu management has been in trend ‘since time immemorial’, but in fact it had emerged within a short span of time between 1855 and 1881. The grassland is conveniently divided into paddocks of two to ten hectare depending upon the wealth status of the farmers. The technology of live fencing around Korangadu lands using *Commiphora berryii* was known to people even in 1800 (Buchanan, 1807) [1].

2. Plant Species in Korangadu

Korangadu is characteristically a combination of grass, legumes and tree species including annual and perennials. An attempt was made to identify the flora present in the korangadu lands through participatory mode.

It was found that the Korangadu had predominantly three major species of flora, which were being cultivated in three different tiers. The lower tier was grown with *kolukattai* grass (*Cenchrus* sp.), upper tier with the tree species that included *Velvel* (*Acacia leucophloea*) and the land was fenced with thorny shrub locally called as *Mullu Kiluvai* (*Commiphora berryii*) as live fence that make up the middle tier. The flora of Korangadu was classified and presented in the following Table 1.1.

Table 1.1: Flora in Korangadu

Type of Vegetation	Vernacular name	Botanical name	Spatial distribution
Grass	Kolukattaipul	<i>Cenchrus ciliaris</i> , <i>Cenchrus setigerus</i>	Lower tier
	Kurutupul	<i>Chloris barbatta</i>	
	Cholapul	<i>Chrysopogon montanus</i>	
	Ottanpul	<i>Setaria verticillata</i>	
	Nathaichuri	<i>Borreria hispida</i>	
	Arugampul	<i>Cynodon dactylon</i>	
Legumes	Naripayathankodi / Naripayaru	<i>Phaseolus trilobus</i>	Lower tier
	Seppunerinji	<i>Indigofera enneaphylla</i>	
	Savurikodi	<i>Merremia tridentata</i>	
	Poonapudukukodi	<i>Crotalaria globosa</i>	
	Dadara	<i>Borreria hispida</i>	
	Kollu	<i>Macrotyloma uniflorum</i>	
	Kattukollu/ Malaikollu	<i>Rhynchosia rufescens</i>	
Shrubs in live fence	Avuri / Aviri	<i>Indigofera eneophylla</i>	Middle tier
	Kiluvai	<i>Commiphora berryii</i>	
	Mullukiluvai	<i>Balasamoen dronberryi</i>	
Trees	Rayil Kattalai / Century plant	<i>Agave americana</i>	Upper tier
	Velvel	<i>Acacia leucophloea</i>	
	Arappu / Usialai	<i>Albizia Amara</i>	
	Murungai	<i>Moringa oleifera</i>	

3. Establishment of Korangadu pastureland

a. Establishment of lower tier of vegetation

The soil in this region has low retentive power of moisture and is hard with a calcareous sub-soil with abundance of calcium and phosphorous in the form of “Canker Gravel” (Pattabiraman, 1958) [7]. Soon after the summer showers (May - June), the land to be converted for Korangadu has to be ploughed for two to three times to break the upper layer of the soil. During September – October, sowing of *Cenchrus* (Kolukattai grass) has to be carried out. On an average, 15 kg of Kolukattai grass seeds will be sufficient to cover one acre of Korangadu. If required, reseeding with seeds of *Cenchrus* is done to boost the forage yield in subsequent years. Harvesting of *Cenchrus* seeds will be carried out in the month of January – February. Some farmers followed the practice of mixing the *Naripayathan kodi* / *Naripayaru* (*Phaseolus trilobus*) and Horse gram seeds at the rate of about 10 kg each for one acre of land in order to produce very nutritious feed. When the monsoon is in order, these grasslands receives two blooms of flash growth per year, the major one in September and the minor one in May to June.

For the first year after sowing the *Cenchrus* seeds, no grazing is permitted but allowed in the second year onwards. This will facilitate the grass and legumes to attain required growth stage.

Re-seeding with seeds of *Cenchrus* is done by broadcasting to boost the forage yield in subsequent years. The grassland will be ploughed once in two to three years in order to break the clod and to enhance aeration and moisture conservation. Re-seeding

is done once in four to six years for better growth of grasses and to obtain higher biomass for livestock feeding. The nutritive value of the fodder grasses present in the Korangadu land is given below

Table 1.2: Nutritive value of the fodder grasses present in the Korangadu land

S. No	Name of fodder	Moisture	Ash	Insolubles	Calcium CaO	Phosphorus P ₂ O ₅	Crude protein
1	Kolukkattai grass	6.95	12.20	8.54	0.36	0.19	5.02
2	Vennampul	5.15	13.00	2.49	1.71	0.48	6.89
3	Ottanpul	4.60	13.82	1.13	0.66	0.35	8.56
4	Kuruttupul	9.19	12.12	5.74	0.48	0.46	5.04
5	Cholapul	7.55	5.37	3.16	0.34	0.10	3.05
6	Naripayathan kodi	6.51	6.67	0.83	1.59	0.55	9.19
7	Cheppuneringi	7.07	16.36	3.75	5.17	0.36	11.88
8	Savanikodi	5.78	8.70	0.83	2.82	0.40	11.80
9	Poonaipuddu kodi	6.97	10.41	1.31	1.91	0.50	10.14

Source: Pattabiraman (1958)^[7]

The Kolukkattai grass has the habit of forming comparatively bigger tufted growth, with the result that the volume of Kolukkattai grass turned out in a particular area will be more than other grasses. This evidently shows a comparatively deep and extensive rooting habit of this grass. This rooting habit of Kolukkattai grass breaks up the soil though in a slow manner and the inter-space that is available between the plants due to this process encourages the settling down of other grasses and legumes. Thus the Kolukkattai not only settles itself but also encourages the settling down of other forages and legumes. (Pattabiraman, 1958)^[7]

b. Establishment of middle tier of vegetation / live fencing

The middle tier of Korangadu was made up of thorny shrub locally called as Kiluvai / Mullukiluvai (*Commiphora berryii*) which also served as live fencing and protect the pasture land. This is undertaken by planting cuttings of Kiluvai / Mullukiluvai (*Commiphora berryii*). About four feet length stumps of Kiluvai / Mullukiluvai found in wastelands / jungles is cut with a thickness of three cm. These stumps are being planted along the border and intersection of the farm land at one feet depth. Usually, two rows of planting with cuttings of Kiluvai / Mullukiluvai are completed during the month of July – August. The survival and establishment of live fencing will be ensured with the onset of monsoon during September – October. About 30 labourers are required to plant Kiluvai stumps in one acre of land to establish live fencing in two days time. Every year the established fence has to be maintained by proper gap filling with fresh cuttings of *Commiphora* and any such new plantings are performed usually only in the month of June – July. A small gate (*Padal* in Tamil) made up of bamboo or *Minnamaram* (*Premnaser ratifolia*) will be constructed to regulate the movement of animals in and outside of the paddock.

c. Establishment of upper tier of vegetation

In the Korangadu land where rainfall is minimal, natural vegetation of Velvel (*Acacia leucophloea*) is common. In their early stages of growth these thorny trees escapes browsing by livestock and when they were seven to eight years old they bear fruits and pods that fall on the ground during February to April. The dried pods obtained from these trees are relished by Kangayam cattle. When they relish the pods of *Acacia*, the seeds are passed undigested and spread through the dung. Farmers usually maintain an optimum density of 20 trees in one acre or 60 – 70 Velvel trees in two ha land of Korangadu.

A grown up Velvel tree will yield around 40 – 50 kg of pod per

annum which contains 14.86 per cent crude protein (Roy and Singh, 2013)^[8] and it not only serves as good feed during dry summer season but also provide shade to the animals at day time.

As there is no rainfall during summer months, the growth of the *Cenchrus* grass is poor or almost nonexistent and at that time, falling pods of *Acacia* tree will provide good feed for animals. Whenever summer rains or unseasonal rains occur, this pasture land will have regrowth of vegetation and thereby serve as fodder source for livestock. Excess pods will be collected from the field and stored. Such pods will be mixed with sorghum grain to feed the cattle. The fruits of *Moringa* provided additional income to the farmers.

d. Establishment of water sources

In older time, farmers dig wells inside the Korangadu paddocks to draw water for animals. In 1881, there were 9,835 wells which irrigated 18799 hectares of land at an average of 1.9 hectares per well (Nicholson, 1887)^[6]. Currently as the ground water table went below more than 1000 feet, stone / cement troughs within the paddock were constructed and drinking water for the livestock is fetched from the nearby source and filled in it.

4. Livestock keeping and their system of grazing in Korangadu

The management of Kangayam grazing lands today is the accumulation of a sequence of worthy practices followed by the farmers over one hundred and fifty years. The paddock system of grassland management was evolved from the wasteland through an organized system of management.

Korangadu is a typical paddock system with a small bamboo gate to allow the animals to enter inside. The grazing land is conveniently divided into paddocks of two to five ha of land, although very large paddocks also exist. The paddocks are separated by straight rows of *Commiphora berryii*.

Livestock are not permitted to graze in the grass land for the first year after initial sowing of grass and legumes in order to ensure their growth but are allowed in the second year of establishment onwards. From June to September and from October to January, the animals were left inside the pasture land alone on rotational basis between various paddocks based on the availability of fodder. Nicholson (1887)^[6] also reported that grazing in these paddocks were regulated, pastures not overstocked and manure not removed from the ground, which resulted in excellent pasturage.

During March to June, when there is no grass in the pasture land the cattle feed upon the pods of Velvel tree (*Acacia leucophloea*). Whenever summer rains or unseasonal rains occur, this pasture land will have regrowth of vegetation and thereby serve as fodder source for livestock at least eight to ten months in a year. No supplementary feed will be provided to the livestock during this period. The excess fodder is harvested and stored as hay for feeding the animals during off-season. *Ad-libitum* drinking water is provided in the troughs in each of the individual plots for the animals. Dung is not removed and left in the land itself which resulted in excellent pasturage. There is no external application of chemical fertilizer in the grassland. Farmers collect the excess pods of Velvel tree (*Acacia leucophloea*) and store and such pods will be mixed with sorghum seeds to feed calves and lambs during lean season. It was reported that four hectares of Korangadu farm land would suffice to maintain four adult Kangayam cattle plus four calves or 40 sheep or six buffaloes. The animals are kept within the paddock day and night for months together and they are rotated between the paddocks as per the fodder availability. Male calves of Kangayam cattle are being reared in these grasslands with special care and sold as young bullocks. They fetch a premium price in annual cattle fairs or in village shandies.

In addition to Kangayam cattle, many farmers possessed graded Murrah buffalo for milk production. Sheep are the choice of animal reared in paddocks which are far off and because they are hardy, less demanding, and take very little of the farmers' time. Goats were not preferred in the Kangayam grassland as they demand constant attention of their keepers and damage the live fences of *Commiphora berryii*. During discussion with the farmers it was found that several village panchayats of the area had resolved in the past to banish goats from the region and impose heavy fines on the keepers whose goats were found straying into the grazing paddocks.

4.1 Distribution of respondents based on the Korangadu silvi-pasture system

The data regarding management of Korangadu farming land viz., land area, nature of inheritance, experience, location and management procedures like method of land preparation, type of vegetation, nature of fencing method, grazing system, provisions for housing and watering the animals, stocking capacity, etc., were accrued through discussion along with semi structured interview schedule from the respondents and the results are presented in Table 1.3

Table 1.3: Distribution of respondents based on the Korangadu silvi-pasture system N = 50

Sl. No	Korangadu silvi-pasture system parameters	Frequency (f)	Percentage (%)
1	Area of possession of Korangadu farm land (in Acres)		
	a) Low	16	32.00
	b) Medium	28	56.00
	c) High	6	12.00
	Mean = 6.84 S.D. = 1.25		
2	Nature of possession of Korangadu farm land		
	a) Own Korangadu farm land	34	68.00
	b) Leased land	10	20.00
	c) Both	6	12.00
3	Experience in Korangadu farming in years		
	a) Low	11	22.00
	b) Medium	13	26.00
	c) High	26	52.00
	Mean: 18.04 S.D.: 6.34		
4	Nature of inheritance of Korangadu farm land		
	Inherited through ancestors	42	84.00
	Instigated by own effort	8	16.00
5	Location / distance between the residence and Korangadu farm land		
	Within one km	8	16.00
	One km to three km	24	48.00
	Three km to five km	15	30.00
	More than five km	3	6.00
6	Korangadu farm land Management procedures		
	a) Method of land preparation		
	i) Ploughing by using Kangayam cattle	26	52.00
	ii) Ploughing by using tractors	16	32.00
	iii) Both	8	16.00
	b) Time of ploughing		
	i) Soon after summer showers	50	100.00
	ii) Other days	0	0.0
	c) Time of Sowing of <i>Cenchrus</i> grass (lower tier)		
	i) During September – October	50	100.00
	ii) Other months	0	0.0
	d) Time of planting the Kiluvai / Mullukiluvai (<i>Commiphora berryii</i>) as live fencing (Middle tier)		
	i) During July – August	50	100.00
	ii) Other months	0	0.0
	e) Gap filling of Kiluvai / Mullukiluvai (<i>Commiphora berryii</i>)		
	i) During the month of June – July	50	100.00
	ii) Other months	0	0.0

f) Source of drinking water inside the Korangadu paddock			
i)	Well / Bore wells	12	24.00
ii)	Cement tanks / plastic troughs, etc.	38	76.00
g) Density of Velvel (<i>Acacia leucophloea</i>) tree (Upper tier)			
i)	Upto 20 trees/ acre of paddock	41	82.00
ii)	More than 20 trees/ acre of paddock	9	18.00
h) Livestock stocking density			
i)	Four adult Kangayam cattle plus four calves or 40 sheep or six buffaloes per four hectares of Korangadu farm land	36	72.00
ii)	More than four adult Kangayam cattle plus four calves or 40 sheep or six buffaloes per four hectares of Korangadu farm land	14	28.00

A perusal of Table 1.3 reveals that, above one-half (56.00 per cent) of the respondents possessed medium level of Korangadu farm land with a mean of 6.84 acres of land. Most of them (68.00 per cent) had own Korangadu farm land and about 20.00 per cent had leased land and the rest 12.00 per cent had both own and leased land. With regard to experience in Korangadu farming, Just above one-half (52.00 per cent) had high level of experience (Mean: 18.04 years) followed by medium level (26.00 per cent) and low level (22.00 per cent) of korangadu farming experience. A high majority of the respondents (84.00 per cent) inherited their Korangadu land from their ancestors and the rest 16.00 per cent taken up the Korangadu farming on their own. Majority (64.00 per cent) of the respondents had Korangadu farm land within three kilometer distance from their residence.

With regard to Korangadu farm land management procedures, all the respondents (100.00 per cent) ploughed their korangadu farm land soon after summer showers and for this activity majority of the respondents (52.00 per cent) prepared their land by using Kangayam cattle and all the respondents (100.00 per cent) sowed *Cenchrus* grass during September – October

months. All the respondents reported that they developed live fencing by using Kiluvai / Mullukiluvai (*Commiphora berryii*) and this activity was carried out during July – August months and gap filling in the subsequent years will be undertaken during the months of June – July.

It could be further observed from the Table 1.3 that, most of the respondents (76.00 per cent) installed Cement tanks / plastic troughs, etc., inside the Korangadu farm land as a source of drinking water to the animals. About 82.00 per cent of the respondents had up to 20 Velvel (*Acacia leucophloea*) trees per acre of land. With regard to the livestock stocking density, majority (72.00 per cent) of the respondents had allowed four adult Kangayam cattle plus four calves or 40 sheep or six buffaloes per four hectares of their Korangadu farm land.

4.2 SWOC analysis of instituting and further management of Korangadu Silvo pasture land

A SWOC analysis was conducted with the participation of the respondents and the data obtained were triangulated with the subject matter specialist and the results are presented hereunder.

Strength	Weakness
- If good monsoon is received in right time, nutritious fodder will be available throughout the year for Kangayam cattle - The pods from Acacia trees and the legumes grown along with the grasses are rich in protein.	- Growth of <i>Cenchrus</i> grass and other legumes largely depends on monsoon as there is no irrigation practices - During the initial years of establishment, growth of fodder in all the three tier is inadequate without external irrigation
The live fence of <i>Commiphora berryii</i> will also act as a source of fodder	Maintenance of live fence - Kiluvai / Mullukiluvai (<i>Commiphora berryii</i>) is a laborious job which are usually performed by male labourer and involve high cost
- Required comparatively less investment to establish a Korangadu - Easy maintenance as regular ploughing, weeding, irrigation, application of artificial fertilizer etc., are not followed hence, more profitable	Presence of biological predators would be a threat to livestock especially to the young ones when they are left in the paddock during night times
Opportunity	Challenges faced
Conversion of waste land into useful pasture land with low investment	- Converting Korangadu lands into mono-croppings of cotton, maize, horticultural species etc., and establishment of industrial units in many places. - Younger generations are no longer interested in maintaining pasture lands
- More suitable for dry land since the seeds were drought resistant - Establishment of pasture lands may reduce the dependency on agricultural labour	- Traditional grassland systems have not been incorporated into the development programmes meant for animal husbandry - Land ceiling act by the government has discouraged farmers from keeping large areas of grazing land.
Increasing trend of rearing indigenous animals.	Continuous failure of monsoon for two to three years, would lead to drying of the live fence. This in turn facilitates invading of other animals into the pasture land.

Conclusion

Kangayam cattle population is reducing at a very high rate in the last few decades, mainly because of decreasing draught utility of the indigenous cattle along with shrinking Korangadu grazing

land. To overcome this crisis, efforts should be made to constitute organised market for Kangayam cattle products with the promotion of organic Kangayam cattle farming supported with appropriate incentives.

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