Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 02, Issue: 06 (NOV-DEC, 2022)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Small Ruminants Housing Systems under Different Agro-Climatic Zones

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Abstract
Small ruminant rearing is the primary source of income for many landless labourers and their survival is depended on it. Sheep farming has been mostly traditional in nature and thus greatly impacted by the agro-climatic conditions of the region. The goal of housing design is to minimise stress levels in the animals and improve comfort levels so that maximum productivity can be reached.

Keywords: Housing management, agro-climatic zones, small ruminants, farmers

Introduction
Two third of rural population in India depend on small ruminants for their sustenance and thus play a pivotal role in the rural economy. Sheep and goat are mostly reared in the arid/semi-arid and mountainous regions of the country for the production of milk, meat, wool, skin and dung. As these animals require minimal initial investment and are easy to rear, sheep and goat acts as major source of income for poor and marginal farmers. They can efficiently survive in unfavorable environmental conditions of scanty vegetation and water. The agro-climatic conditions of the region have a major impact on the livestock production systems.

Importance of housing for small ruminants
India experiences hot and humid summer season while the winter season is comparatively calmer owing to its tropical climate. The best strategy to safeguard small ruminants from unfavorable weather conditions is to provide them with proper housing. Comfort of animals, provision of fresh air and sufficient ventilation, protection from bad weather and control of parasitic infections are the primary criteria that should be kept in mind while designing an animal house.

Agroclimatic zones in India
A geographical area having climatic conditions which is favourable for a specific crop or cultivar is called an agro-climatic zone. Soil types, availability of water, temperature and rainfall forms the basis of these agro-climatic conditions which are crucial to attain sustainable production. 15 agro-climatic regions make up India's geographical landscape (Balasubramanian, 2013):

1. The Western Himalayas: Jammu and Kashmir, Himachal Pradesh and parts of Uttarakhand are included in this zone. The average temperature during summer ranges from

5°C-30°C but the winter months are extremely cold ranging from 0°C-4°C. Average rainfall ranges from 75-150 cm per year.

2. The Eastern Himalayas: Sikkim, parts of West Bengal particularly Darjeeling, Hills of Assam, Meghalaya, Tripura, Mizoram, Manipur, Nagaland and Arunachal Pradesh are covered in this zone. Sub-humid climatic conditions prevail with topography being rugged. Average annual rainfall is above 200 cm. In July the temperature ranges from 25-33°C while the variation in January is between 11°C-24°C. The brownish soil is not highly fertile.

3. The Lower Gangetic Plains: Eastern parts of Bihar, West Bengal and Assam valley are covered under this region. Temperature range between 26°C-41°C in July and 9°C-24°C in January. On an average 100-200 cm of rainfall occurs per year.

4. The Middle Gangetic Plains: Uttar Pradesh and Bihar are included in this region. The monthly temperature in July is between 26°C-41°C while it varies between 9°C-24°C in January. On an average 100-200 cm of rainfall occurs per year.

5. The Upper Gangetic Plains: Region of central and western Uttar Pradesh. With the average temperature in January varying between 7°C-23°C and 26°C-41°C in July, the climatic conditions are sub-humid. On an average 75-150 cm of rainfall occurs per year.

6. The Trans-Ganga Plains: Extending over Punjab, Haryana, Delhi, Chandigarh and Ganganagar district of Rajasthan, the region is semi-arid with temperatures in July between 26°C-42°C and 7°C-22°C in January. The region receives an average rainfall of 70-125 cm per year.

7. The Eastern Plateaus and Hills: Area included in this zone are Chotanagpur plateau, extending over Rajmahal Hills in Jharkand, Chhattisgarh and Dandakaranya. Temperature range between 26°C-34°C in July and 10°C-27°C in January. On an average 80-150 cm of rainfall occurs per year.

8. The Central Plateaus and Hills: Bundelkhand, Baghelkhand, Malwa plateau, Vindhyachal hills and eastern parts of Madhya Pradesh are included in this region. Climatic condition in the region is semi-arid. The monthly temperature in July is between 26°C-40°C and for the month of January 7°C-24°C. The mean annual rainfall is 50-100 cm.

9. The Western Plateaus and Hills: This includes the Deccan plateau and the southern portion of the Malwa plateau. The soil found in this region is black soil. The temperature ranges from 24°C-41°C and 6°C-23°C, in July and January, respectively. The area enjoys 25-75 cm of annual rainfall.

10. The Southern Plateaus and Hills: This area encompasses Karnataka, Andhra Pradesh, Tamil Nadu and some parts of southern Maharashtra. The average temperature in January varies between 13°C-21°C and 26°C-42°C in July. 50-100 cm is the annual rainfall for this region.

11. The East Coastal Plains and Hills: This area encompasses the plains of Coromandel and Northern Circar coasts. Climatic conditions are sub-humid maritime with mean annual rainfall between 75-150 cm. The temperature ranges from 26°C-32°C and 20°C-29°C, in May and January, respectively.

12. The Western Coastal Plains and Western Ghats: This area encompasses the Sahyadris plains and the Malabar and Konkan coasts. With the average temperature in January varying between 19°C-28°C and 26°C-32°C in July, the climatic conditions are humid. The soil found in this region is laterite and coastal alluvials. The mean annual rainfall is above 200 cm.

13. The Gujarat Plains and Hills: Fertile valleys of the Mahi and Sabarmati rivers and regions of Kathiawar comprise this zone. The climate is arid and semi-arid with monthly temperature in July varying between 26°C-42°C while in January 13°C-29°C. 50-100 cm of rainfall on average occurs per year.

14. The Western Dry Region: Rajasthan and west of the Aravallis are included in this region. It comprises of hot sandy desert and variable annual rainfall with average of less than 25 cm. It is further characterised by lack of perennial rivers, little vegetation, having high evaporation and a stark difference in temperature which ranges between 28°C-45°C in June and 5°C-22°C in January.

15. The Island Region: This covers the equatorial-climate islands of Lakshadweep and Andaman-Nicobar. It rains more than 200 cm on average each year. The average temperatures of Port Blair in July and January are 30°C and 25°C, respectively.

Temperate zone: Closed buildings are preferred. The height of roof is 3 m. Floor is made of wood which provides a good insulation particularly in pens of young early weaned kids. A 15 cm wide continuous slot is present on the top of both longitudinal walls for efficient ventilation. Walls and roofs made of straw which provides good insulation properties.

Humid zone: Dampness in the house should be avoided as much as possible. The height of roof is 3 m. Traditional stilted-type goat houses of Malaysia and Indonesia are well suited for humid tropics. Elevated floor – approx. 1-1.5 m, slatted floor for hot humid and clay floor for hot dry climate, made of bamboo, wooden slats, or plastics. The roof overhang is 1 m.

Semi-arid and arid zone: Based on housing practises adopted by sheep farmers in Tamil Nadu (Usha *et al.*, 2022):

The extensive system of sheep rearing was followed. Construction of sheep sheds was in east-west orientation and houses were closed with open space. Kutcha floor was found in most of the sheep sheds. Sheds with thatched roof were made. Based on housing practises adopted by sheep farmers in Rajasthan (Naruka *et al.*, 2015), the following observations were made: Average flock size: 88 animals (range: 39 to 259 animals) in which males: 1-7 and females: 38-255. Open paddocks, protective boundary of 5-6’ in height and made from thorny bushes. In sheep and goat mixed flocks of smaller size, hut or thatched structure in the centre/corner of the paddock. Orientation of the paddocks was in east-west.

Conclusion

Small ruminants are a source of income generation for many. They are kept for milk, meat, and wool production purpose. Proper animal housing design is necessary to ensure welfare of animals and minimum production losses.

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