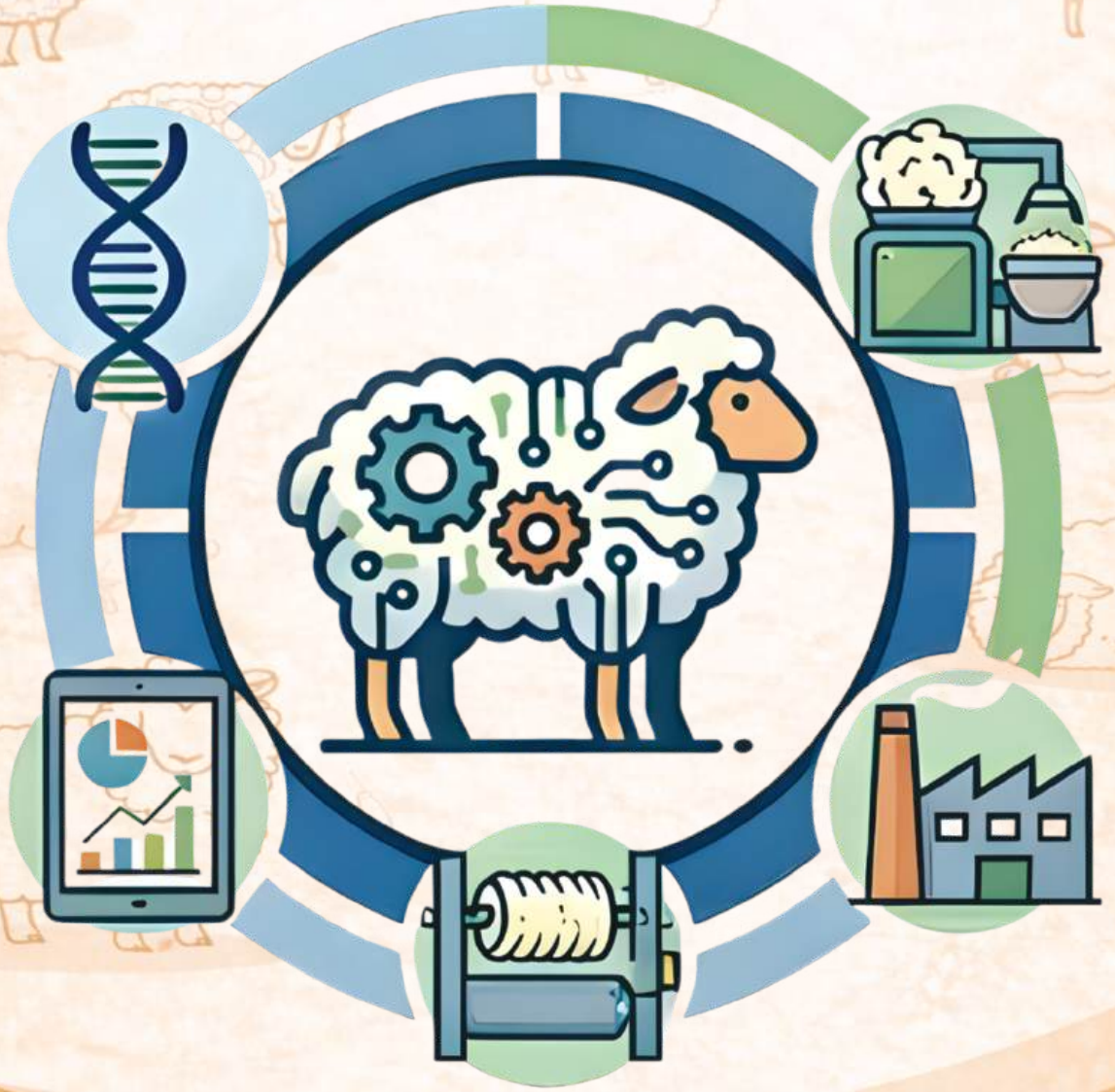
ICAR-CSWRI TECHNOLOGIES Bulletin



Indian Council of Agricultural Research

Central Sheep and Wool Research Institute (CSWRI)

D.A.R.E., Ministry of Agriculture and Farmers Welfare, Govt. of India

Avikanagar, Malpura-304 501, Tonk, (Rajasthan) INDIA

PREFACE

ICAR-Central Sheep and Wool Research Institute (CSWRI) is committed to advancing sustainable technologies and innovative solutions for improving sheep productivity, wool quality, and overall sector resilience. These technologies are developed by the scientists at the institute using innovative approaches and state-of-the-art facilities and are released to the stakeholders only after proper validation, ensuring their effectiveness and impact on the ground. The institute's research is driven by a holistic approach that integrates genetics, breeding, health management, and value addition in wool and sheep products.

Over the years, CSWRI has successfully transferred numerous technologies and improved breeds to farmers, cooperatives, entrepreneurs, and wool-based industries nationwide. Key innovations include advanced sheep breeding, assisted reproductive technology and value-added wool and health solutions boosting rural livelihoods and sector growth. CSWRI's strong emphasis on protecting intellectual property is reflected in the growing number of patents and copyrights granted for our technologies in recent years.

The institute's divisions work synergistically to deliver research outputs that address key challenges in sheep breeding, health, and wool processing. Simultaneously, extensive training programs, field demonstrations, and stakeholder engagement activities are prioritized, empowering farmers, researchers, and industry professionals with knowledge and skills.

In 2025, the institute was proud to be awarded ICAR Certification for three innovative technologies developed by its scientists: the Mobile Artificial Insemination Laboratory for Sheep (Avi MAIL); Avi-Batika, a green feed formulation designed to lower methane emissions and augment lamb production; and the Liquid Milk Formula (Memnaprash) for promoting higher growth and survivability in lambs and kids. Additionally, the institute released a new technology - Avi Shakti (Herbal Vitality Booster for Male Sheep), a pelleted feed supplement - aimed at enhancing reproductive health and productivity in rams.

The Institute Technology Management Unit (ITMU) at ICAR-CSWRI has compiled the technologies developed at the Institute in the form of a publication titled “ICAR-CSWRI TECHNOLOGIES Bulletin”. I appreciate the efforts of the scientists and their team in bringing out this publication. The document provides salient features of each of the technologies and will serve as a comprehensive ready reference to stakeholders. Entrepreneurs and industrial houses adopt these technologies to offer nutritious, sustainable, and value-added products to the consumers. I am sure that this publication will further strengthen the interface between innovators and industry and bridge the gap in knowledge generation and dissemination so as to usher a new era of cooperation between the institute and the industries, new-age start-ups, and other stakeholders in the sheep, livestock sector, and wool industry.

Director
(Dr. Arun Kumar)

Edited & Compiled by
Naresh Kumar, Vinod Kadam, C.P. Swarnkar, Seiko Jose, Ajit Singh Mahla and Arvind Soni
© 2026 ICAR–CSWRI, Avikanagar | All rights reserved.

Contents

ICAR-Central Sheep and Wool Research Institute

Year of establishment 1962

- Established in 1962 at Malpura, Rajasthan under the aegis of ICAR
- Asia's leading research institute in sheep science
- Spread across 1510 hectares (Main institute) & 3 Research stations across 724 hectares
- Expertise in research, training, extension, breed & product development in sheep husbandry
- Specializing in research and development of rabbit rearing
- Develops value-added post-harvest technologies related to wool, mutton, milk and manure
- Research hub for graduates and postgraduates of veterinary science and textile science
- Providing incubation services to entrepreneurs for agribusiness in sheep, goat & rabbit sector

VISION

Sustainable sheep production to address the issues and to inspire an exchange of ideas among experts, policy makers, stakeholders, industrial leaders and general public

MANDATE

Basic and applied research for improving sheep production, products processing and rabbit husbandry & Dissemination of technologies for sheep productivity enhancement and management

Objectives

- To undertake basic and applied research on all aspects of sheep and rabbit production
- To develop, update and standardize meat, milk and fibre technologies
- To impart trainings on sheep and rabbit production, health management and utilization
- To transfer improved technologies on sheep and rabbit production to stakeholders
- To provide referral and consultancy services on sheep production and products

Headquarter

ICAR-CSWRI
Avikanagar, Malpura, Rajasthan

Regional Stations

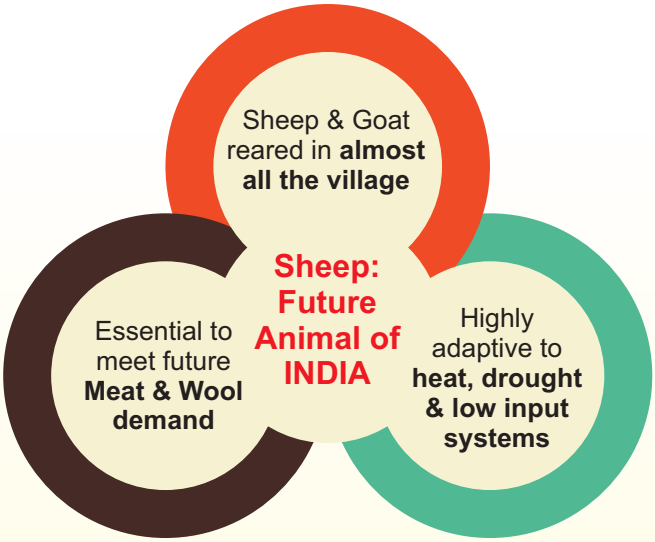
Northern Temperate Research Station	Arid Regional Campus	Southern Regional Research Centre
NTRS, Garsa, Himachal Pradesh	ARC, Bikaner, Rajasthan	SRRC, Mannavanur, Tamil Nadu

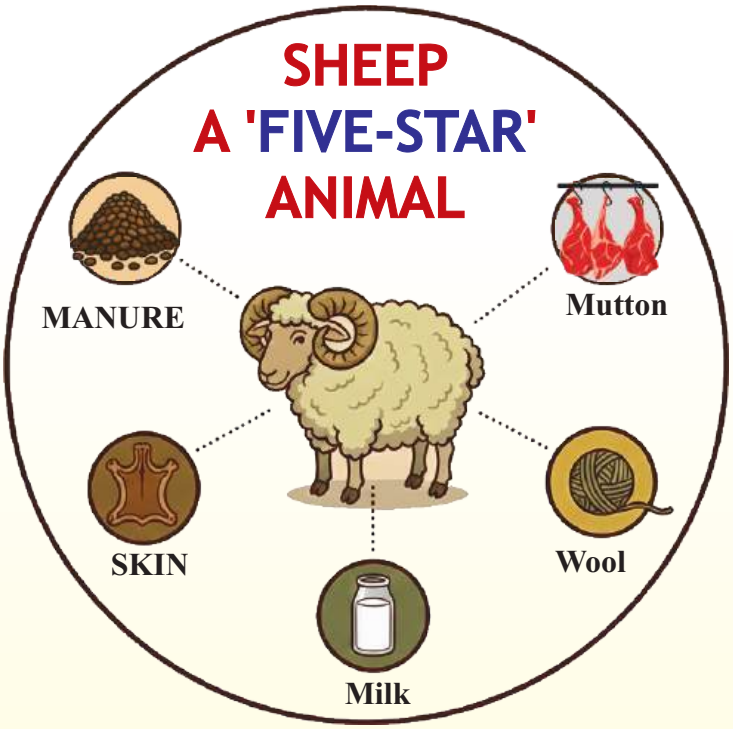
ICAR-CSWRI's Research Interventions

MORE SHEEP PER SHEEP

To double the farmer's income

- Sheep contribute to poverty alleviation
- Sheep is a livelihood source of thousands of families
- Multiple Outputs: Meat, wool, milk, skin, manure-ensuring regular income
- Walking ATM: Easily saleable at any stage-instant cash security
- CSWRI contributed to trigger sheep population by prolific sheep breed, better healthcare and improved rearing practices
- With R & D interventions of last several years, the body weight increased by 40-50%
- Institute also contributed to post harvest technology of sheep by value addition to meat, wool, milk and manure
- CSWRI developed improved sheep strains: Avishaan, AviHill, Bharat Merino, Avikalin, Malpura, Dumba, Patanwati etc
- Technologies for nutrition, health, reproduction & climate resilience
- Promoted complete feed blocks, fodder shrubs, low-cost housing and lamb rearing packages





Animal for poverty alleviation | Multiple Income Resources | ATM: Chalta-Firta Bank

ICAR- CSWRI Technologies For Licencing

01 **Liquid Milk Formula (Memnaprash)**
Scientifically developed milk supplement to enhance early-stage lamb growth and survival

02 **Avi-Batika**
Green feed for lowering methane emission and augmenting lamb production

03 **Avi MAIL: Mobile Artificial Insemination Laboratory for Sheep**
Portable, fully equipped lab for effective on-site artificial insemination in sheep

04 **Coarse Wool Sapling Bag Development**
Biodegradable nursery bags from waste wool, promoting sustainable plant growth and soil health.

05 **Coarse Wool-Based Quilt Comforter**
Eco-friendly quilts using coarse wool for superior thermal comfort and sustainability

06 **Coarse Wool Fabric Reinforced High-Strength Composite**
Wool-enhanced composites for strong, eco-friendly for construction and insulation

07 **Thermal Conductivity Instrument for Porous and Non-Porous Materials**
Precision tool to test thermal conductivity of porous and non-porous materials of varied thickness

08 **Sound Transmission Loss Tester**
Compact, cost-effective device for measuring acoustic insulation of materials

09 **Portable Crate for Restraining Small Ruminants**
Foldable, adjustable crate ensuring safe handling and treatment of sheep and goats in the field

Licensing Details:

- License Type: Non-Exclusive, Duration: 5 Years
- Note: Fees and royalties vary depending on the technology + applicable taxes
- Special Provision: Fee relaxation of 25% for registered MSMEs

The above technologies will be licensed through Agrinnovate India Limited (AgIn), New Delhi for commercialization.

Express your Interest
www.agrinnovateindia.com

Liquid Milk Formula (Memnaprash)

Randhir Singh Bhatt, A. Sahoo and S. K. Sankhyan
Animal Nutrition Division
Email: randhir.bhatt@icar.org.in | Phone: 9413209790

The Liquid Milk Formula provides a practical, shelf-stable, and nutrient-rich alternative to ewe's milk, boosting lamb growth and survival when natural milk is insufficient. It is easy to prepare, offers superior performance outcomes, and supports healthier, more productive flocks.

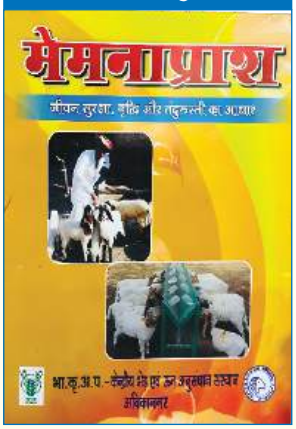
Technology Overview

The Liquid Milk Formula (LMF) is a scientifically developed powdered milk substitute for lambs, designed to closely mimic ewe's milk in protein and fat content (24–28% protein, 10–12% fat). Enriched with key nutrients for early rumen development, it's easy to prepare with warm water, has a long shelf life, and supports both bottle and feeding-stand administration—ideal for use when maternal milk is lacking or unavailable.

Unique Features & Benefits

- Precisely balances proteins and fats to support healthy lamb growth and immunity
- Promotes early rumen development, enabling efficient transition to solid feed
- Powder form allows for easy transport, storage, and rapid reconstitution without refrigeration
- Demonstrated to increase lamb weight gain and survivability, in multiple/ orphaned births
- Enhances overall flock productivity and farmer income

Trademark Registered



ICAR Certified Technology

Express your Interest

Licensing Terms:
License fee : ₹ 3.00 lakh (*India Territory*) & 15.00 lakh (global) with 5% Royalty + applicable taxes *(Non-Exclusive | 5-Year Term)*

Avi-Batika

Randhir Singh Bhatt and A. Sahoo
Animal Nutrition Division
Email: randhir.bhatt@icar.org.in | Phone: 9413209790

Avi-Batika is an innovative feed block that transforms crop residues into bioactive-rich, methane-reducing nutrition for ruminants- boosting animal productivity and sustainability. It's practical, eco-friendly, and represents a climate-smart solution for small and large livestock producers alike.

Unique Features

- Utilizes underutilized agro-residues, converting agricultural waste into valuable feed
- Fortified with natural plant bioactive compounds (such as tannins and saponins)
- Natural compounds inhibit methanogenesis in the rumen
- Compressed form of feed block offering balanced nutrition combined with methanemitigation

Benefits

- Reduce methane emission hence e more environment sustainable feed for lowering carbon footprint in livestock
- Improved average daily gain (ADG) and feed conversion ratio (FCR)
- Promotes sustainable use of agro-residues
- Conversion of waste to worth, ensuring feed security by substituting conventional feed resources
- Encourages climate-resilient livestock production

Patent Granted

ICAR Certified Technology

Licensing Terms:
License fee: ₹ 10.00 lakh with 5% Royalty + applicable taxes
(Non-Exclusive | 5-Year Term | India Territory) .

Express your Interest

Avi MAIL: Mobile AI Laboratory for Sheep

Ajit Singh Mahla, S.S. Dangi, Raghvendra Singh and Arun Kumar

Animal Physiology & Biochemistry Division

Email: dr.asmahla@gmail.com | Phone: 9521460095

Avi MAIL delivers a breakthrough in sheep reproductive management, making advanced AI services accessible, affordable, and effective for farmers in remote regions—driving genetic improvement and productivity in India's vast sheep sector.

Technology Overview

- Mobile lab for field-based AI in sheep, overcoming the limitations of stationary labs
- Enables direct, hygienic semen collection, processing, and insemination in the field
- Ensures contamination-free operation with features like a dynamic pass-box, HEPA and UV air purifiers, air curtain, and dedicated lab instruments (microscope, photo-colorimeter, pH meter)
- Includes a separate cleaning and sterilization unit with biosecurity features
- Multiple power sources: power generator, UPS, vehicle battery, and external power point
- Education and monitoring features: LED screen for farmer training, public address system
- CCTV, and internet connectivity

Key Advantages

- Fully integrated mobile AI lab, supporting field operations in challenging locations
- Hygienic, efficient semen processing and strict biosecurity maintenance
- Awareness and remote monitoring tools for farmer engagement and transparency
- Adaptable and cost-effective: lower cost than stationary labs
- Applicable to other livestock species like goats, pigs, horses, etc

Express your Interest

Licensing Terms:
License fee : ₹ 1.00 lakh with 5% royalty + applicable taxes
(Non-Exclusive | 5-Year Term | India Territory).

Coarse Wool Sapling Bag Development

Vinod Kadam, D.B. Shakyawar, Gaurav Parmar, Ajay Kumar, A. Sahoo and Arun Kumar

Textile Manufacture and Textile Chemistry Division

Email: vinod.kadam981@icar.org.in | Phone: 6377589466

The Coarse Wool Sapling Bag is a biodegradable, eco-friendly nursery bag made from waste wool that promotes healthy plant growth, enriches soil, and reduces plastic pollution.

Technology Overview

- Made from low-grade unutilised coarse wool. It is biodegradable and eco-friendly bag
- Porous design allows air and water flow, supporting healthy root development and preventing root circling
- Decomposes naturally within 60–90 days, enriching soil with nitrogen and micronutrients
- Provides a sustainable alternative that adds value to surplus wool and reduces plastic waste
- Suitable for nurseries, forest departments, and eco-conscious agricultural enterprises
- Developed with a scalable mass production process for wide adoption

Key Advantages

- Biodegrades fully in 2–3 months, improving soil health
- Enhances root growth and moisture retention, protecting saplings
- Helps reduce plastic pollution by replacing synthetic bags
- Supports rural economies by creating employment and utilizing waste wool
- Eligible for carbon credits as an eco-friendly product

ICAR Certified Technology

Patent Granted

Licensing Terms:
License fee: ₹ 1.40 lakh with 5% Royalty + applicable taxes
(Non-Exclusive | 5-Year Term | India Territory).

Express your Interest

Coarse Wool-Based Quilt Comforter

Vinod Kadam, Seiko Jose, Ajay Kumar, D.B. Shakyawar, N. Shanmugam, A. Sahoo and Arun Kumar

Textile Manufacture and Textile Chemistry Division

Email: vinod.kadam981@icar. org.in | Phone: 6377589466

The Coarse Wool-Based Quilt Comforter is an eco-friendly, affordable bedding solution made from underutilized coarse wool.

Technology Overview

- Coarse wool fibers processed into a nonwoven filling, encased between durable fabric layers
- Wool's crimped structure traps air, offering thermal insulation and allowing breathability across all seasons
- Regulates body temperature by wicking up to 30% moisture without feeling damp
- Naturally hypoallergenic, flame-resistant, odor and allergen resistant

Unique Advantages

- Enhances Sleep Quality : Maintains a breathable, worm microclimate to support deep sleep
- Superior Breathability & Moisture Control : Absorbs moisture, prevents overheating or sweating
- No Static or Skin Irritation : Wool is anti-static and gentle for sensitive skin
- All-Season Comfort : Insulating air pockets provide warmth in winter and cooling in summer
- Sustainable & Affordable : Utilizes low-cost wool, reduces environmental impact
- Accessible to a wide consumer base

ICAR Certified Technology

Patent Granted

Express your Interest

Licensing Terms:

License fee: ₹ 2.70 lakh with 5% Royalty + applicable taxes

(Non-Exclusive | 5-Year Term | India Territory).

Coarse Wool Fabric Reinforced High Strength Composites

Vinod Kadam, Seiko Jose, Ajay Kumar, D.B. Shakyawar, N. Shanmugam and Arun Kumar
Textile Manufacture and Textile Chemistry Division
Email: vinod.kadam981@icar.org.in | Phone: 6377589466

Technology Overview

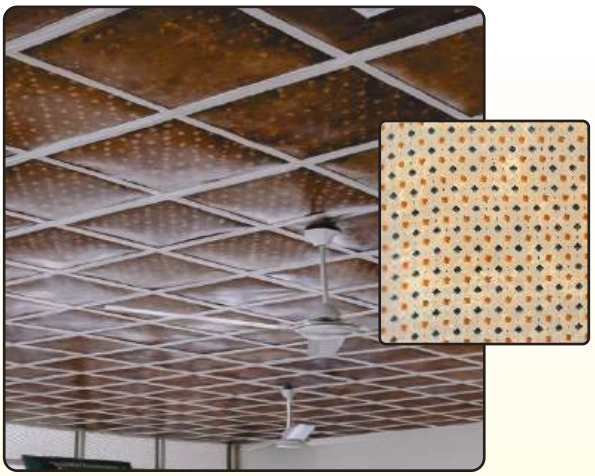
- High-strength composite reinforced with surface-modified, thermally treated coarse wool fabric
- Surface treatment improves resin penetration and bonding with resin
- Optimized resin-to-wool ratio to maximize the strength and durability of composites
- Suitable for automotive, construction, and insulation applications

Key Advantages

- Superior acoustic and thermal insulation: Wool fibers absorb sound and heat naturally
- High Energy Absorption and Impact Resistance: Crimped structure dissipates energy effectively
- Fire Retardancy: Wool's nitrogen and water content provide inherent flame resistance
- Eco-Friendly and Biodegradable: Sustainable alternative that reduces environmental impact
- Customizable Properties: Mechanical and insulation characteristics can be tailored

Patent Granted

ICAR Certified Technology



Licensing Terms:
License fee: ₹ 2.00 lakh with 5% Royalty + applicable taxes
(Non-Exclusive | 5-Year Term | India Territory).

Express your Interest

Thermal Conductivity Instrument for Porous and Non-Porous Materials of Various Thicknesses

Vinod Kadam, Mitul Shah, Arun Kumar, Ajay Kumar, Iti Dubey, Neel Patel, Vatsal Parmar and Anjali Kulkarni

Textile Manufacture and Textile Chemistry Division

Email: vinod.kadam981@icar.org.in | Phone: 6377589466

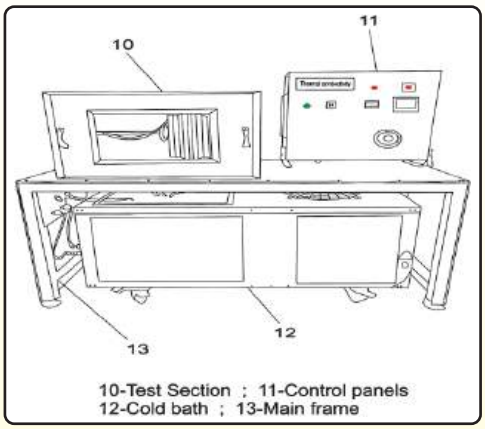
An indigenous thermal conductivity measurement system designed for both porous and non-porous materials across a wide thickness range (0.1 mm to 10 cm+), with dual-sample capacity and multi-point temperature sensing for high accuracy and throughput. It is developed in collaboration with Inner Engineering Pvt. Ltd., Ahmedabad.

Technology Overview

- Material compatibility: Porous and non-porous (i.e.: textiles, composites, rubber, wood)
- Thickness range: 0.1 mm to 10 cm
- Tests two samples simultaneously (300 × 300 mm each) for increased throughput
- Sensors: 16-point temperature detection for accurate gradients
- Design: Closed-loop system with fast thermal stabilization
- Output: Thermal conductivity (W/m·K) and temperature profile
- Features: Modular, easy to maintain, and upgrade-friendly

Key Advantages

- Dual-Sample Measurement : Increases testing efficiency and material representativeness
- Wide Material & Thickness Compatibility : Accommodates both soft/flexible and rigid/thick samples
- High Accuracy: 16-point temperature sensing for detailed thermal profiling
- Faster Results : Rapid stabilization and measurement due to efficient thermal design
- User-Friendly & Scalable : Modular build ensures easy operation, maintenance, and upgrades



Licensing Terms:

License fee: Zero with 50% Royalty + applicable taxes (commission-based model)

(Non-Exclusive | 5-Year Term | India Territory)

Express your Interest

Sound Transmission Loss Tester

Vinod Kadam, Deepak Bhati, Sushma Rani, N.L. Meena, Ajay Kumar, N. Shanmugam and Arun Kumar

Textile Manufacture and Textile Chemistry Division

Email: vinod.kadam981@icar. org.in | Phone: 6377589466

A compact, cost-effective device for evaluating Sound Transmission Loss (STL) in various materials using small test samples, ideal for sustainable acoustic research and development.

Technology Overview

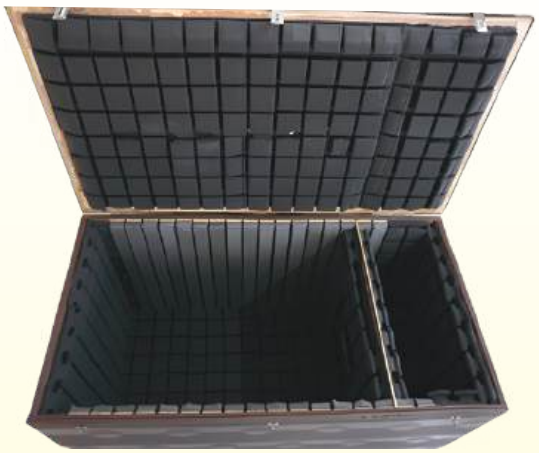
- Sample Size : 20×20cm
- Suitable for materials such as : Textiles, composites, wood, fiberboard, glass, biopolymers, metals etc
- Frequency Range : 50 Hz – 20,000 Hz (adjustable)
- Sound Sources : Synthetic (white/pink noise, sine), real-world (voice, tools)
- Microphone with computer interface, Two-chamber sealed sample holder
- Output : STL (dB) vs Frequency (Hz)

Key Advantages

- Compact, portable design requires minimal space and supports easy relocation
- User-friendly operation with simple calibration and quick testing process
- Affordable alternative to bulky reverberation chambers and costly impedance tubes
- Modular construction allows easy maintenance and future upgrades
- Complies with ASTM E90 standards for reliable testing
- Supports sustainable innovation by testing natural fiber composites like coarse wool
- Uses small test specimens, making testing economical and convenient

Patent Granted

ICAR Certified Technology



Express your Interest

Licensing Terms:

License fee: Zero with 50% Royalty + applicable taxes (commission-based model)

(Non-Exclusive | 5-Year Term | India Territory)

Portable Crate for Restraining Small Ruminants

Ajit Singh Mahla, S.S. Dangi and Arun Kumar
Animal Physiology & Biochemistry Division
Email: dr.asmahla@gmail.com | Phone: 9521460095

Technology Overview

- Portable, foldable, and customizable crate designed for restraining dummy animals during semen collection and sick animals during treatments
- Lightweight and easy to transport, enabling semen collection directly at farms or in the field
- Need of eliminating animal transport to fixed stations
- Adjustable dimensions to fit different sheep and goat breeds safely and comfortably
- Minimizes animal movement and stress, enhancing semen donation quality and animal welfare
- Sturdy construction with smooth edges ensures safety for animals and handlers
- Facilitates training of young males in familiar environments, reducing psychological stress

Unique Features & Benefits

- Field-based operation improves semen collection efficiency by removing dependence on fixed stations
- Foldable, transport-friendly design supports mobile veterinary units and remote field applications
- Customizable size enhances versatility across animal sizes and breeds
- Prioritizes animal safety, comfort, and stress reduction during procedures
- Supports stress-free training for younger males, improving reproductive success
- Saving time and resources for farmers and veterinarians
- Revolutionizes small ruminant reproductive and medical care in field conditions
- Improving accessibility, animal welfare, and breeding program efficiency in rural and remote areas

Licensing Terms:
License fee : ₹ 00.50 lakh with 20% royalty + applicable taxes
(Non-Exclusive | 5-Year Term | India Territory).

Express your Interest

CSWRI Recent Technologies

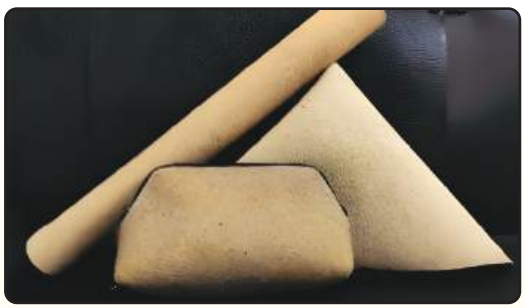
1. Coarse Wool/Natural Rubber Flexible and Biodegradable Composite for Fashion Accessories
2. Handcrafted Woolen Flowers with Lasting Fragrance and Capable of Indoor Air Purification
3. AviShakti : Herbal Vitality Booster for Male Sheep

Coarse Wool/Natural Rubber Flexible & Biodegradable Composite for Fashion Accessories

Seiko Jose, Ajay Kumar, Vinod Kadam and Vandana Gupta

Technology Overview

- Flexible composites developed using coarse wool fibres in combination with natural rubber
- Rubber coating is compatible with woven, non-woven, and felted wool fabrics
- The rubber–wool fibre ratio can be tailored to meet the requirements of different end-use products



Key advantages

- Made entirely from biomaterials, offering a high degree of biodegradability
- Can be produced as long continuous sheets, enabling mass-scale manufacturing
- Exhibits good flexibility and high mechanical strength
- Screen printing, rubber printing, and laser printing are feasible on the composite surface
- Suitable for developing sustainable products such as shopping bags, clutches, wallets, and upholstery

Handcrafted Woolen Flowers with Lasting Fragrance

Vinod Kadam, Seiko Jose, Ajay Kumar and Arun Kumar

Technology Overview

- Handcrafted flowers made from wool felt with a long-lasting aroma
- Aroma finish is imparted through microencapsulation technology
- A sustainable and eco-friendly alternative to natural flowers and bouquets

Key Advantages

- Long-lasting fragrance and extended product life
- Biodegradable, providing value addition to coarse wool
- High potential for employment generation among rural women
- Easy availability of raw materials; a true Make in India product
- A wide range of aroma fragrances can be incorporated
- Suitable for both formal and informal occasions

AviShakti (Herbal Vitality Booster for Male Sheep)

A.S. Mahla, Srobana Sarkar, R.S. Bhatt and Arun Kumar

Scientifically formulated herbal supplement containing bioactive-rich medicinal herbs and essential micronutrients.

Rich in bioactive components, including proteins, essential fatty acids, and minerals such as copper, zinc, cobalt, manganese, and selenium.

Technology Overview

- Improves male reproductive performance by enhancing semen quality and hormonal balance
- Acts as a potent antioxidant, supporting overall reproductive health

Key Advantages

- Enhances libido, Shortens reaction time
- Boosts ejaculation frequency, Increases semen volume
- Elevates sperm count, Raises testosterone levels
- Reduces oxidative stress

GERMPLASM : EVOLVED & IMPROVED


Avishaan


Avihill


Avikalin


Bharat Merino


Dumba


Malpura


Marwari


Chokla


Patanwadi


Magra


Sheep Disease Resistant


Sirohi Goat

Avishaan: A Prolific Sheep

The development of the prolific sheep at ICAR-CSWRI, Avikanagar was initiated in 1997 with the objective of improving prolificacy in Indian sheep while retaining adaptability to the semi-arid and other Indian agro-climatic condition. The breeding programme started by crossing prolific Garole (G) rams from West Bengal, carrying the Booroola fecundity gene (*FecB*), with local non-carrier Malpura (M) ewes to produce prolific Garole x Malpura (GM) halfbreds. The *FecB* mutation was successfully introgressed and expressed in their progenies, resulting in increased litter size and improved reproductive efficiency. To further enhance growth rate and body size and reduce the level of Galrole inheritance, GM rams were backcrossed with Malpura ewes to produce the GMM (GM x Malpura) prolific sheep. Subsequently, to improve milk production, Patanwadi (P), thereby producing a three-breed composite (GMM x P) cross that combined prolificacy with better milk yield, body weight, and survivability. This composite cross (GMM x P), Avishaan was developed and officially released by ICAR-CSWRI on 04th January 2016.

Breed Highlights

- A composite cross having 12.5% Garole, 37.5% Malpura and 50% Patanwadi inheritance in which FecB gene has been introgressed successfully
- Possesses the traits of high prolificacy, more litter weight, more milk, high ewe productivity and adaptable to harsh climatic conditions
- It has high EPE at weaning, having 45% gains over locally available monotocous Malpura sheep
- Achieves higher prolificacy, with average litter size of 1.81 and shows higher adult body weights compared to local Malpura sheep
- A flock of 100 Avishaan ewes produces 170–180 lambs, compared to about 85 lambs from single-bearing Malpura ewes, making them a highly profitable choice for commercial sheep farming

Bharat Merino : Fine Wool Producing Sheep of India

Bharat Merino is India's finest apparel-grade wool sheep, developed through systematic crossbreeding of Rambouillet with native indigenous breeds. Initiated in 1962 and unified into a single strain in 1982, it represents one of the country's most successful fine-wool genetic improvement programmes.

Bharat Merino flocks are maintained in both hot semi-arid (Avikanagar) and cold temperate (Mannavanur, Garsa) regions, producing high-quality fine wool suitable for India's apparel and textile industry.

Breed Highlights

- Produces fine apparel wool, comparable to exotic Merino.
- Attains body weights of ~19 kg at 3 months, ~25 kg at 6 months, and ~35 kg at 12 months under cold climatic conditions.
- Rams and ewes yield approximately 1.83 kg and 1.67 kg clean wool, respectively, with ~20 µm fibre diameter, <1% medullation, and ~8 cm staple length.
- Widely used for upgrading Bannur/Mandya sheep, improving both meat and wool productivity.
- Highly preferred by farmers due to excellent adaptability and superior wool quality.

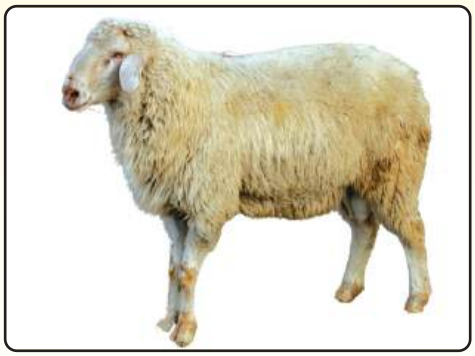
Avihill (Gaddi Synthetic): Fine Wool Sheep for Temperate Regions

Avihill is a crossbred sheep developed for fine wool production in temperate regions. It is well suited to hill ecosystems and exhibits good growth and wool performance. Superior animals are supplied from NTRS, Garsa, Kullu (Himachal Pradesh) to farmers for the genetic improvement of local flocks.

Breed Highlights

- Body weights: 14 kg (3 months), 19 kg (6 months), and 26 kg (12 months)
- Wool production: First six-month GFY: 0.8 kg, Adult annual GFY: 1.8 kg
- Wool characteristics (six-month clip): Staple length: 3.2 cm, Fibre diameter 19.4 µm, Medullation: 0.06%
- Distributed to hill farmers for enhancing fine wool quality in their flocks

Avikalin: A Dual-Type Crossbred Sheep for Carpet Wool and Mutton



Avikalin is a dual-purpose sheep strain developed at ICAR-CSWRI, Avikanagar, through a crossbreeding programme initiated in 1964–65. The programme involved crossing Rambouillet (a fine-wool breed) with Malpura (a native coarse-wool breed) to improve wool production and quality under semi-arid conditions.

The half-breds were pooled and interbred, and the stabilized strain-comprising 50% Rambouillet × 50% Malpura-was officially named Avikalin in 1977. The objective was to develop sheep yielding about 2 kg greasy fleece annually with approximately 30 µm fibre diameter and 30% medullation, while also performing well as a mutton-type animal.

Breed Highlights

- Growth performance (semi-arid region): Birth: 2.8 kg, 3 months: 17.2 kg, 6 months: 29.9 kg, 9 months: 33.3 kg, 12 months: 37.2 kg
- Produces ~80% more wool than native Malpura sheep
- Wool production: First six-month GFY: 1 kg, Adult annual GFY: 1.4 kg
- Wool characteristics (adult): Fibre diameter: 35.8 µm, Medullation: 36.2%, Staple length: 5.4 cm

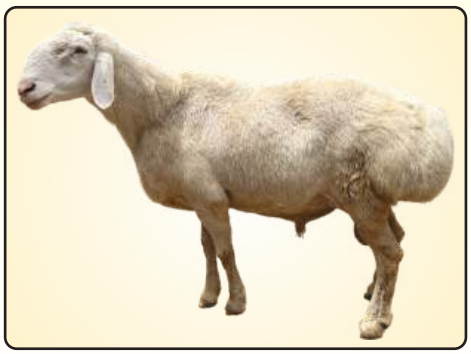
Disease Resistant (DR) Sheep: A Sustainable Genetic Solution for Parasite Management

Disease Resistant (DR) Sheep represent a sustainable genetic solution to manage *Haemonchus contortus*, a major gastrointestinal parasite responsible for severe productivity losses and mortality in sheep. Developed by ICAR–CSWRI since 2004 through long-term selective breeding in Malpura and Avikalin (Malpura × Rambouillet) sheep using Fecal Egg Count (FEC) as an indirect marker, resistant (R) and susceptible (S) lines were established under natural grazing conditions.

- Maintains consistently low parasite burdens (FEC below ~2,000 epg) without anthelmintic treatment, while control flocks require routine deworming
- Resistant animals naturally shed fewer parasite eggs, reducing pasture contamination and interrupting the parasite life cycle, thereby benefiting the entire flock
- Despite the absence of chemical intervention, it shows growth, wool production, and reproductive performance comparable to conventional sheep
- Validated in semi-arid conditions at ICAR-CSWRI, Avikanagar, and further confirmed through multi-location testing at NTRS, Garsa (Himachal Pradesh), demonstrating stable resistance across climates
- By exploiting the moderate to high heritability of parasite resistance, it provides a permanent, eco-friendly alternative to chemical control, reducing costs, labor, drug residues, and anthelmintic resistance
- Dissemination of resistant germplasm offers a scalable solution to improve flock health and productivity, supporting sustainable and organic sheep farming systems

Dumba (Fat-Tail Sheep): Breed four Extraordinary Growth

Fat-tail Dumba sheep are highly valued for their large body size, rapid growth, and distinct aesthetic and religious significance in India. Institute surveys indicate that entrepreneurs and traders rear these sheep specifically for premium niche markets, where they command very high prices.



Breed Highlights

- High market value: adult males: ₹1.00–1.50 lakh, adult females: ₹0.70–0.80 lakh, lambs: ₹ 0.15–0.50 lakh
- Maintained under stall-feeding conditions at the Institute since 2013, with pure breeding practiced conserving the characteristic fat-tail (Dumba) traits

Growth traits	Male (kg)	Female (kg)	Reproduction traits	Average (days)
Birth weight	4.5±0.21	4.1±0.28	Age at first service	312.8
3 month weight	32.8±2.43	31.0±1.22	Age at first lambing	465.5
6 month weight	48.2±3.00	45.0±2.02	Inter-lambing period	283.4
9 month weight	68.3±4.05	56.1±2.11		
12 month weight	79.3±4.52	66.7±1.67		

Malpura: A High-Mutton-Producing Sheep

Genetically improved Malpura sheep germplasm (rams) has been developed to enhance farmers' flocks for higher mutton production, improved reproductive efficiency, and better survivability. Continuous selective breeding has led to substantial gains in growth performance, lambing percentage, wool yield, and overall flock productivity.

- Marked improvement in 6-, 9- and 12-month body weights, indicating strong genetic gain.
- Higher adult survivability and lambing percentage, ensuring better flock productivity
- Enhanced wool yield and quality with reduced medullation percentage
- Positive genetic trend with consistent annual genetic progress

Chokla: Best Carpet Wool Breed of Rajasthan

Chokla is an important carpet-wool sheep breed of Rajasthan. A superior flock is maintained at ARC, Bikaner, where rams are selected using a performance index based on 6-month body weight and wool yield. Continuous intensive selection and improved management practices since 1992 have resulted in significant enhancement of the breed's growth performance.

Breed Highlights

- Carpet-wool breed with high commercial value.
- Wool characteristics: fibre diameter ~30 µm, 30% medullation, and >6.0 cm staple length.
- Growth performance: 17.1 kg at 3 months, 24.8 kg at 6 months, and 32.2 kg at 12 months.
- Six-month body weight improved from 16.5 kg to 24.8 kg through systematic selection since 1992.
- Three shearings per year, yielding approximately 2.4 kg annual greasy fleece.

Magra: A Lustrous Carpet-Quality Wool Sheep

Magra sheep, renowned for their lustrous carpet wool, are maintained and genetically improved through selective breeding at ARC, Bikaner. Their wool is highly valued in the carpet industry due to its natural sheen. The breed exhibits good growth performance and produces superior-quality carpet wool under arid conditions.

Breed Highlights

- Renowned for lustrous carpet wool, resulting in high demand in the carpet industry
- Body weights: 24 kg at 6 months and 32 kg at 12 months
- Three shearings per year practiced at ARC, Bikaner
- Produces about 2.3 kg annual greasy fleece yield
- Wool characteristics: fibre diameter 32 µm, staple length 6 cm, medullation 40–45%
- 80–90 superior rams supplied annually to farmers for improving field flocks

Marwari: A Robust Sheep Breed of the Arid Zone

Marwari is an important carpet wool–producing sheep breed of the north-western arid and semi-arid regions of India. The breed is hardy, drought-tolerant, and well adapted to the harsh climatic conditions of the hot arid zone. A superior flock is maintained at ARC, Bikaner, where intensive selection and improved management practices have significantly enhanced its productivity.

Breed Highlights

- Well adapted to extreme heat and arid climatic stress
- Six-month body weight improved by 56.4% (from 15.9 kg to 24.9 kg) through selective breeding since 1993
- Adult annual greasy fleece yield (GFY) improved from 1,209 g to 1,526 g, showing a 26.2% gain
- Produces about 1.5 kg wool annually in two clips
- Wool characteristics: Fibre diameter: 35–38 µm, Staple length: 5 cm, Medullation: 55%

Patanwadi Sheep: A Dual-Purpose Breed for High Milk and Mutton Production

Patanwadi Sheep is an important indigenous dual-purpose breed of the Saurashtra region of Gujarat, valued for high milk yield and superior mutton production, with some ewes producing ~1 kg milk per day or more. Genetically improved Patanwadi sheep have been developed through sustained selective breeding for enhanced milk yield and increased live body weight, resulting in measurable genetic gains.

Breed Highlights

- Higher milk yield ensures healthier lambs, leading to reduced neonatal morbidity and mortality, better growth, and improved overall productivity
- Total milk yield has shown significant improvement at 30, 60, and 90 days of lactation, reflecting strong genetic progress
- Body weights at 3, 6, 9, and 12 months of age have increased markedly, indicating better growth performance.
- Higher weaning weights and improved average daily gain (ADG) are closely associated with increased milk production
- These improvements establish Patanwadi sheep as a sustainable and profitable option for farmers, supporting both milk and mutton production across diverse production systems

Sirohi Goat: A Premier Dual-Purpose Germplasm for Higher Chevon (meat) and Milk Yield

Sirohi is a premier medium-to-large goat breed native to Rajasthan, genetically refined by ICAR-CSWRI, Avikanagar, to meet the growing global demand for high-quality animal protein. It is popular for its remarkable "dual-purpose" capability - delivering high yields of both chevon (meat) and milk.

Key Features & Highlights

- Genetically improved over ~50 years through rigorous scientific selection for meat and milk traits with complete pedigree records, ensuring stable and heritable superior performance
- Promising growth with ~25 kg body weight at 6 months; adult weight ~55 kg in males and ~40 kg in females; pre-weaning ADG ~130 g/day with a consistent positive genetic trend
- Good milking ability with ~1.0 litre/day during the first 3 months of lactation; peak yield up to ~2.1 litres/day; total lactation yield ~130 litres over ~170 days
- High reproductive efficiency with 90–95% kidding rate, average litter size ~1.24; age at first service ~450 days and age at first kidding ~600 days
- Highly resilient and hardy, well adapted to hot, arid and semi-arid climates; water-efficient, good disease resistance, high survivability, and capable of performing on poor quality feed

CSWRI's Other Developed Technologies

A Reproductive & Genetic Technologies

1. AVIKESIL-S – Progesterone Impregnated Vaginal Sponges for Oestrus Synchronization
2. ReproAssist- A Mobile Application for Assisted Reproductive Techniques
3. Laparoscopic Artificial Insemination (LPAI) Technique in Sheep
4. AVISOL – Synthetic Membrane Stabilizer for Enhanced Semen Preservation
5. FTA Card Blood-based Fecundity Booroola (FecB) Genotyping
6. Recombinant Kisspeptin with Enhanced Half-life

B Nutrition, Feed & Manure Technologies

1. Avikaminmix – Area-Specific Mineral Mixture
2. Avikhad – Organic Sheep Manure from Wool Waste
3. AviShakti : Herbal Vitality Booster for Male Sheep (in Recent Technology)

C Wool, Fibre & Textile Technologies

1. Woollen Handicrafts from Coarse Wool
2. Biomaterials as Colourant, Anti-microbial and Anti-moth for Woollen Products
3. Shawls from Pure Pashmina & Angora Blend Wool
4. PCR-based Technology for Purity Estimation of Pashmina Wool
5. Coarse Wool–Natural Rubber Foam Dual-Purpose Bed

D Animal Health, Management & Digital Tools

1. Planned Flock Health Programme
2. Targeted Selective Treatment (TST) Approach for Haemonchosis Management
3. FROGIN – Forecasting for Rajasthan on Ovine Gastrointestinal Nematodiasis (Software)
4. Low-cost Indigenous Cradle for Safe Restraining of Sheep for Pregnancy Diagnosis

E Sheep Milk and Meat Value-added Technologies

1. Value Added Sheep Meat Products
2. Functional Mutton Sausage Incorporated with Sheep Plasma Protein Hydrolysates
3. Millet-incorporated Mutton Cookies
4. Pet Food Developed using Rabbit Offal
5. Value Added Sheep Milk Products

AVIKESIL-S : Progesterone Impregnated Vaginal Sponges for Oestrus Synchronization

Avikesil-S is an indigenously developed progesterone-impregnated intravaginal sponge designed for estrus synchronization in sheep and goats. It enables controlled breeding, planned lambing/kidding, and efficient implementation of Artificial Insemination programmes. The technology offers a low-cost, effective, and farmer-friendly method for synchronizing estrus based on nutritional availability and market demand.

Key Features

- Simplifies breeding management and supports both natural mating and fixed-time Artificial Insemination (FTAI).
- Each sponge is inserted into the vagina using a speculum and plunger and kept in situ for 12 days.
- Estrus occurs 36-60 hours after sponge withdrawal, enabling precise planning of insemination.
- FTAI with chilled semen can be performed at 48 and 56 hours after sponge removal without estrus detection.

Advantages

- Facilitates concentrated and timely breeding.
- Reduces labor and time required for heat detection.
- Helps achieve three lamb crops in two years under proper management.
- Low-cost and suitable for field use; success rate of aprox 90% reported under field conditions.

Cost: Rs. 998 per kit *(25 sponges + 1 speculum + 1 plunger)*

ReproAssist- A Mobile Application for Assisted Reproductive Techniques

A mobile application to assist in dissemination of reproductive techniques at farmers' flock for enhancing reproductive outcomes and boosting productivity in the small ruminant sector

- Easy-to-use mobile application for farmers to request estrus synchronization and AI services
- Notifications for all key reproductive events, including sponge insertion and removal, AI schedules, heat detection, pregnancy diagnosis, and post-partum re-breeding
- Web-based platform for managing service requests, scheduling activities, and assigning tasks to field officers
- Mobile application providing access to farmers' addresses and GPS locations for easy navigation to the doorstep
- Tools for semen collection and preparation, including a dilution rate calculator which gives an estimation of the extender required, number of doses prepared and number of females that can be inseminated

Laparoscopic Artificial Insemination (LPAI) Technique in Sheep

- Conventional Artificial Insemination through the vaginal or cervical route is ineffective in sheep due to their complex cervical structure, making frozen semen insemination unsuccessful
- The Laparoscopic Artificial Insemination technique allows frozen–thawed ram semen to be deposited directly into the uterus through small abdominal keyholes using a laparoscope
- This is the first standardized Laparoscopic Artificial Insemination protocol in India, achieving 50–60% pregnancy rates in ewes using frozen semen
- Standardization included optimization of the carbon dioxide flow rate and pneumoperitoneum pressure (7 mmHg) suitable for indigenous sheep
- The optimal semen dose was established as 100 million spermatozoa in French mini straws

AVISOL - Synthetic Membrane Stabilizer for Enhanced Semen Preservation

AVISOL is a synthetic sperm membrane stabilizer developed to improve the fertility of both liquid and cryopreserved ram semen. Since fertility rates with conventional extenders are low in sheep, this formulation helps minimize sub-lethal sperm damage and enhances semen quality, thereby supporting wider adoption of Artificial Insemination at the field level.

Key Features

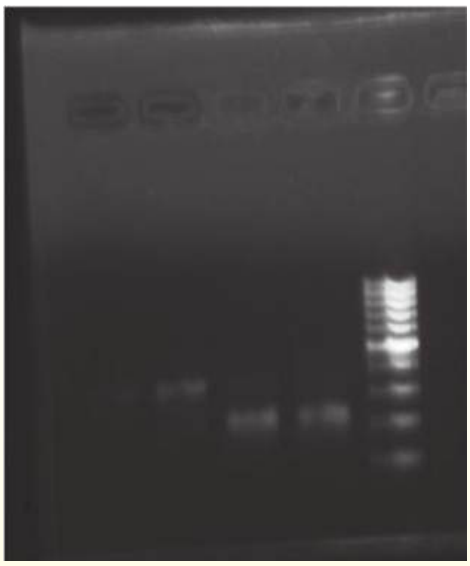
- Developed as a synthetic alternative to egg yolk in extenders used for liquid storage and cryopreservation of ram semen
- Liposomal formulation composed of egg lecithin, cholesterol, and vitamin E in a defined proportion
- Improves sperm quality of liquid-preserved semen
- Enhances fertility rates of 48-hour liquid-preserved semen
- At 5% (w/v) concentration in cryopreservation extender, it improves post-thaw semen quality and reduces sub-lethal damage
- Helps achieve acceptable fertility rates (>30%) when liquid-preserved ram semen is used within 48 hours under field conditions

FTA card blood-based Fecundity Booroola (FecB) genotyping

- A protocol was standardized for FecB genotyping using genomic DNA extracted from dried sheep blood on FTA™ cards
- DNA obtained from FTA cards showed high purity and adequate concentration, comparable to DNA from whole blood using commercial kits
- Blood samples on FTA cards can be collected on-farm and sent to laboratories at room temperature, even from distant locations
- Saves labour, time, water, and energy due to easy transport and no refrigeration requirement
- Requires only two drops of blood, reducing handling and ensuring farmer-friendly sampling
- Allows large numbers of samples to be stored in small space at room temperature, improving lab efficiency
- A cost-effective method with favourable benefit–cost ratio

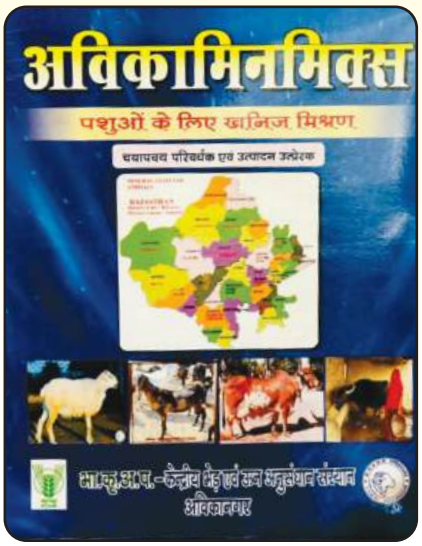
Recombinant Fusion Protein and Method of Production Thereof

- Kisspeptins are important therapeutic molecules with roles in puberty initiation, sub-fertility treatment, anestrus management in animals, anti-metastatic activity, and several emerging applications such as IVF support, egg maturation, behavioural modulation, and pregnancy maintenance
- The technology provides a novel method for producing recombinant kisspeptin by fusing it with an albumin-binding domain and a purification tag
- The fusion protein exhibits a significantly increased half-life compared to natural kisspeptin, improving biological availability and effectiveness
- The enhanced stability broadens its potential therapeutic applications in reproductive and metabolic biology



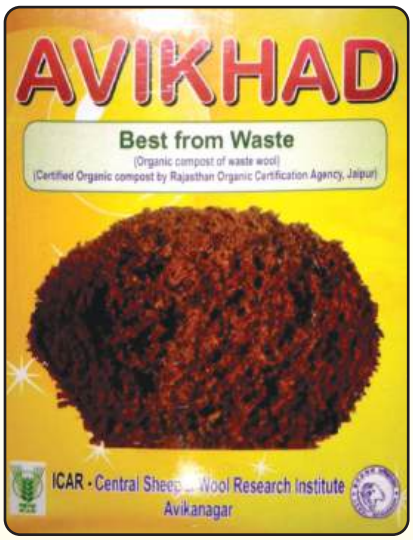
Avikaminmix - Area-Specific Mineral Mixture

- Avikaminmix is an area-specific mineral mixture developed for livestock in the semi-arid region of Rajasthan
- Available in powder and pelleted/tablet forms for convenient and accurate micronutrient delivery
- Formulated to improve health, reproduction, and production in sheep, goats, cattle, and buffaloes
- Particularly useful for flocks not receiving concentrate feed, helping correct regional mineral deficiencies
- Pelleted form ensures quantifiable and complete micronutrient intake
- 1 kg packet can meet the mineral requirements of a 100-200 sheep flock



Avikhad: Organic Sheep Manure from Wool Waste

- A composting technology developed to convert wool waste (30%), sheep manure (50%), and crop waste (20%) into an organic manure named "Avikhad"
- Wool waste adds major benefits such as longer water-holding capacity, high natural potash content, improved soil fertility, reduced evaporation, and extended irrigation intervals
- Helps reduce environmental pollution by utilizing waste materials and lowering dependence on chemical fertilizers
- Application of Avikhad has shown excellent results in crop productivity, supporting sustainable cultivation of horticultural crops, ornamentals, and nursery plants



Woollen Handicrafts from Coarse Wool

- The handmade felt viz. Namda is one of the handicraft products which are made from non-apparel or carpet grade wool with traditional design
- Innovative and durable handicrafts and wall hangings are developed from handmade felts into valuable products
- Different home furnishing articles like handmade painting, soft toys, wall hangings and useable households are developed by using modified manufacturing technique
- The technology is also adopted by and rural artisans of Tonk district
- This is economical utilization of coarser wool
- It is a good opportunity to women/artisans to improve their livelihoods
- A start-up is established by young entrepreneurs for marketing of handicrafts
- This technology has good potential to develop a business plan for young entrepreneurs









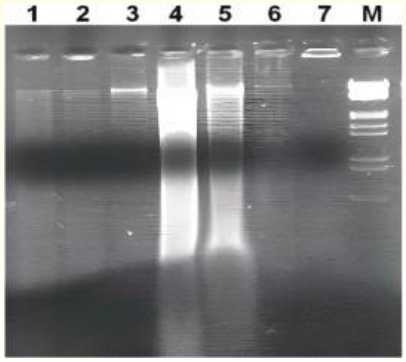
Biomaterials as Colourant, Anti-microbial and Anti-moth for Woollen Products

- Peanut and chickpea husk yield bright colour
- Walnut husk and pomegranate rind extract gives good antimicrobial efficacy against S. aureus and E. coli
- Silver oak leaves, walnut husk, pomegranate rind extract and nanokaolinite provides good anti moth efficacy
- Silver oak, walnut husk and seasome leaves: high tannin content (40%) imparts moth resistance
- Biomaterials ensure sustainable processing of textiles

Shawls from Pure Pashmina & Angora Blend Wool

- Carrier fibre technique for pashmina spinning is developed
- Carrier spun pashmina shawls are comparable with traditional hand spun shawls in terms of their strength, handle and other performance properties
- Angora blended shawl shows 30% higher whiteness and 20% higher softness compared to the conventionally produced shawl
- Angora blended shawls prepared using Indigenous fine cross bred wool for blending in place of imported Merino wool

PCR-based technology for purity estimation of Pashmina wool



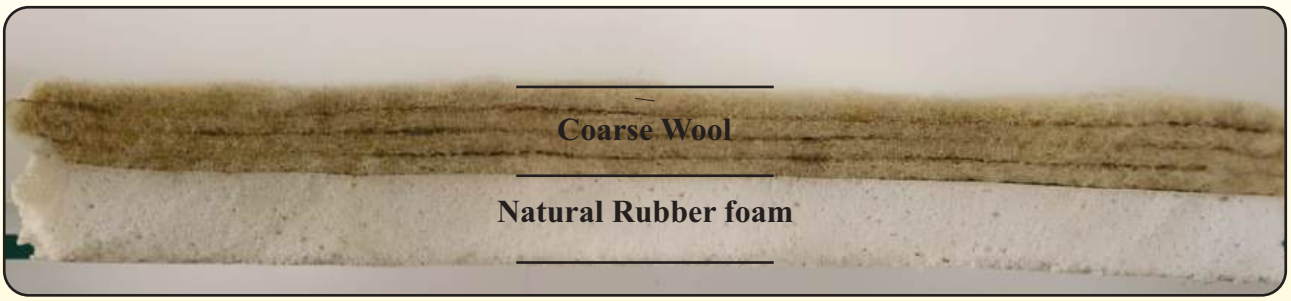
Pashmina is a premium specialty fiber sourced from Changthangi goats; however, its limited availability and high price make it vulnerable to adulteration, especially with cheaper sheep wool. Currently, no cost-effective and reliable method exists for routine detection of such adulteration. This technology provides a PCR-based, species-specific DNA analytical method to accurately identify the purity of Pashmina fiber.

Key Points

- Pashmina's high value and limited supply lead to frequent adulteration with sheep wool
- No practical and affordable method was previously available to detect adulteration in Pashmina products
- A species-specific PCR technique has been developed to distinguish genuine Pashmina from other visually similar fibers
- Ensures authenticity verification for producers, traders, and consumers

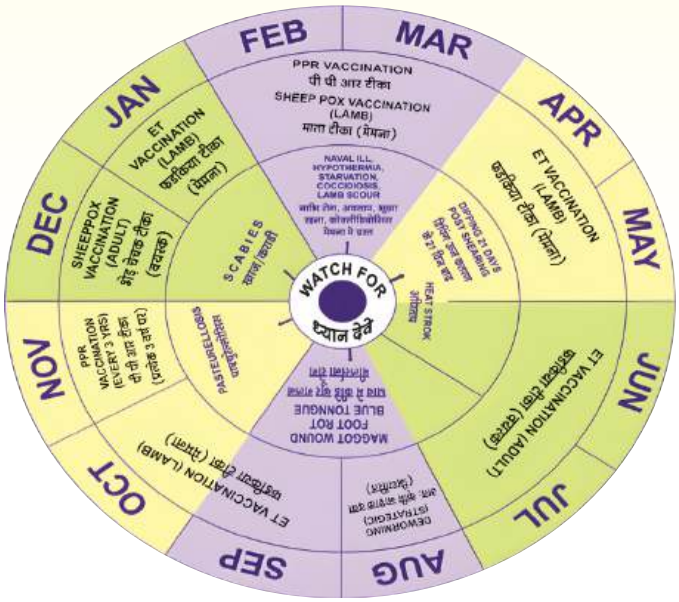
Coarse Wool-Natural Rubber Foam Dual-Purpose Bed

- A sustainable and eco-friendly dual-purpose mattress developed using natural rubber latex combined with coarse wool
- Latex is compounded with additives (vulcanising and foaming agents) in a planetary mixer to achieve uniform foaming
- The foamed latex is poured into a 6×4 ft mould and overlaid with wool nonwoven fabric before vulcanisation
- Vulcanisation is carried out using steam at 100–110 °C for 30 minutes, followed by washing, squeezing, and oven drying to obtain the final product



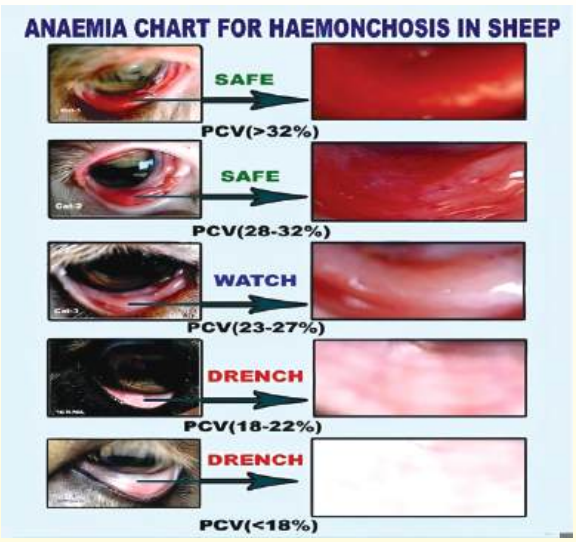
Planned Flock Health Programme

- A prophylactic health calendar has been developed based on the epidemiology of major sheep diseases, covering timely vaccination, drenching, dipping, and tactical health care.
- Implementation of this programme has reduced flock mortality to around 6%, significantly lowering disease-related losses.
- Adoption of the health calendar enables farmers to prevent mortality, improve body weights, enhance wool yield, and achieve better lambing performance.



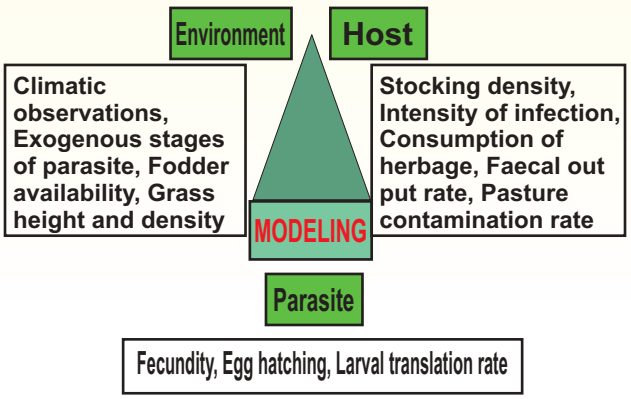
Targeted Selective Treatment (TST) Approach for Haemonchosis Management

- TST is a simple system that categorizes sheep based on the color of the conjunctival mucosa, using a 1 to 5 scale: 1: red (non-anaemic), 2: red-pink (non-anaemic), 3: pink (mild anaemia), 4: pink-white (anaemic), 5: white (severe anaemia)
- Animals in categories 1–3 are considered normal, while those in categories 4–5 are treated with anthelmintics, particularly during wormy seasons
- Under TST, only about 17% of sheep in a flock require drenching annually, compared to 100% in the modified approach or 200–300% in the conventional approach
- This method reduces expenditure on anthelmintics from ₹ 9.00 (conventional) and ₹ 5.85 (strategic) to just ₹ 1.02 per head per year using the TST approach



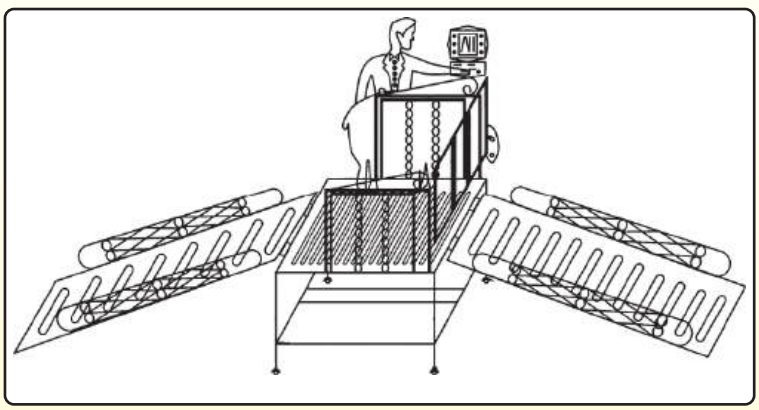
FROGIN - Forecasting for Rajasthan on Ovine Gastrointestinal Nematodiasis (Software)

- FROGIN is a computer-based mathematical model developed to forecast the population dynamics of *Haemonchus contortus* across different zones of Rajasthan
- A user-friendly simulation software, designed in a wizard format with step-by-step instructions for easy operation by farmers, veterinarians, and field staff
- Stores all simulation data in its database, enabling users to retrieve and review previous forecasts for better decision-making
- Helps users determine the optimal number and timing of anthelmintic treatments to ensure effective worm control and prevent injudicious use of dewormers



Low-cost Indigenous Cradle for Safe Restraining of Sheep for Pregnancy Diagnosis

- Designed to allow a single operator to safely and efficiently scan over 100 sheep per day without risk of abortion or injury
- Conventional scanning methods may cause stress, injury, or abortion; this cradle provides safe immobilization to protect ewe productivity
- Constructed using light yet strong hollow spherical and rectangular iron rods that support the left, right, lower body, and neck regions of the sheep
- Features parallel inner and outer frames; the inner frame can glide to adjust according to the animal's width
- A front gate with two gliding rods securely restrains the neck without discomfort
- By actuating the side gliding rods, front gate rods, and chest support rods, the sheep is safely immobilized on the platform
- Enables the operator to accurately perform pregnancy diagnosis by placing the ultrasound probe in the groin region with ease and precision



Value Added Sheep Meat Products

- Emulsion-based mutton products: Ready-to-eat/ready-to-serve items packaged in unit pouches, suitable for shallow-fat frying or serving with gravy, offering convenience and versatility
- A wide range of mutton-based products has been developed, including sausages, patties, nuggets, loaves, enrobed products, croquettes, kababs, koftas, pickles, and mutton soup
- Meat and meat products are rich sources of high-quality protein and health-promoting components such as conjugated linoleic acid (CLA) and essential minerals
- Functional, inulin-fortified, low-fat mutton nuggets developed with an improved nutritional profile
- Dietary fibre enrichment of mutton nuggets achieved using 5% seedless date paste
- Tenderization of cull sheep meat accomplished using *Cucumis trigonus Roxb*. (kachri) powder and papain
- Mutton-based snacks and biscuits developed with a shelf life of up to 45 days
- Vacuum packaging enhances the keeping quality of mutton snacks during ambient storage

Mutton Sausages

Mutton Nuggets

Mutton Patties

Mutton Salami

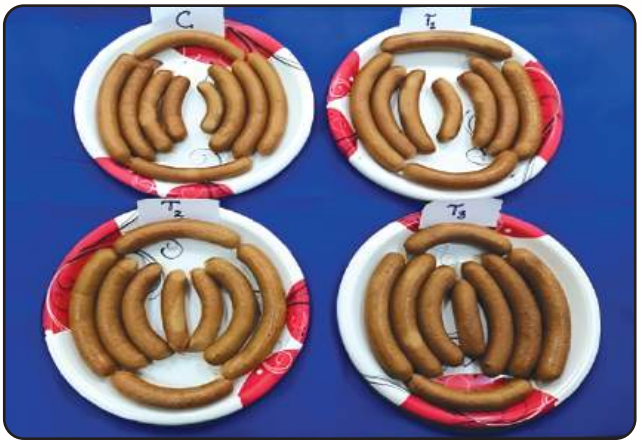
Mutton Bites

Mutton Kebab

Mutton Cookies

Functional Mutton Sausage Incorporated with Sheep Plasma Protein Hydrolysates

- Sheep Plasma Protein Hydrolysates (SPPH), produced through in-vitro gastrointestinal digestion, exhibit antioxidant, antimicrobial, anti-obesity, and lipid-oxidation inhibitory properties useful for improving mutton product quality
- Antioxidant and antimicrobial activities of SPPH show a positive correlation with the degree of hydrolysis and digestion duration, indicating enhanced functionality over time
- SPPH demonstrates a strong inhibitory effect on pancreatic lipase and cholesterol esterase, highlighting its potential as a functional ingredient
- Exhibits higher oil-holding capacity than untreated sheep plasma protein (SPP), particularly at one hour of hydrolysis
- Shows improved foaming properties at alkaline pH with increased digestion time, while emulsifying activity and stability decrease as hydrolysis progresses
- Acts as a natural preservative by inhibiting lipid oxidation, thereby enhancing the shelf-life and oxidative stability of functional mutton sausages
- Recovery and utilization of SPPH provide a cost-effective and sustainable strategy for developing value-added meat products with improved storage quality

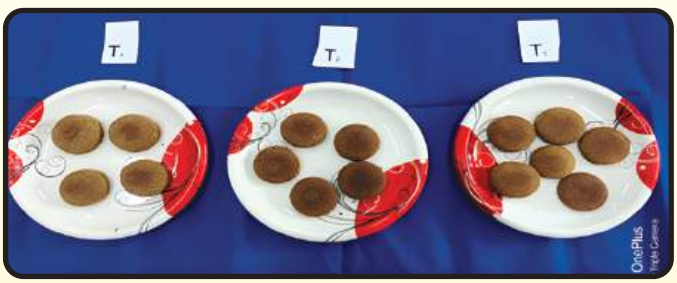


Millet-incorporated Mutton Cookies

Millet-incorporated mutton cookies were developed using a base formulation of 25% wheat flour and 25% mutton powder (Control). In the treatment variants, refined wheat flour was partially replaced with 25% pearl millet flour (T1), 25% ragi flour (T2), or a blend of 12.5% pearl millet + 12.5% ragi flour (T3). These cookies were evaluated for physico-chemical, sensory, and microbiological qualities during 60 days of aerobic storage.

Functional Benefits

- Provide nutritional enhancement with high protein and better fibre and mineral content (iron and zinc)
- Offer functional health advantages due to the inclusion of millets with a low glycaemic index
- Deliver improved sensory qualities and strong consumer appeal
- Support product diversification, making them suitable for convenience food markets.



Pet Food Developed using Rabbit Offal

Pet cookies were developed using rabbit offal such as liver, heart, kidney, and intestine as value-added ingredients. The control formulation contained 65% refined wheat flour, while treatment formulations replaced 40% of the flour with either a blend of liver–heart–kidney (T1) or intestine powder (T2). The products were evaluated over 60 days of aerobic storage.

Key Features

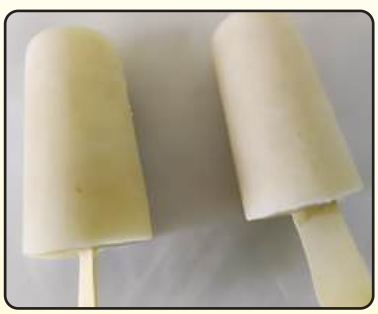
- Utilizes rabbit offal (liver, heart, kidney, intestine) to prepare nutritionally enriched pet cookies
- Treatment formulations incorporate 40% offal powder, providing a cost-effective method of value addition and waste utilization
- Cookies remained stable during 60 days of aerobic storage, ensuring safe shelf-life

Functional Benefits

- Provides high-quality protein, essential fatty acids, vitamins (including B12), and minerals
- Offers better palatability and digestibility, making the product more appealing to pets
- Supports sustainable meat processing by converting lower-value offal into a nutritious and useful pet food product

Value Added Sheep Milk Products

- Sheep milk contains about one-third more energy than cow and goat milk
- Mozzarella cheese prepared from sheep milk is protein-rich, containing approximately 33% protein
- Paneer obtained from sheep milk contains about 26% protein and 11% fat, with a cooking yield of 18%
- Gulab jamun prepared using sheep milk–based khoa shows a khoa yield of 22.4%
- Processing techniques and formulations have been optimized for converting sheep milk into kulfi



List of Patents Granted

1 **Recombinant Fusion Protein and Method of Production Thereof**
Vijay Kumar Saxena, Raghvendar Singh
Patent No. 574469, Granted on: 25.11.2025

A Complete Feed Block (Avi-Batika) and a Method for Preparing the Same
R. S. Bhatt, A. Sahoo
Patent No. 555623, Granted on: 29.11.2024

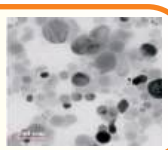
2

3 **Liquid Milk Formula**
R. S. Bhatt, A. Sahoo, S. K. Sankhyan
Patent No. 511439, Granted on: 16.02.2024

Coarse Wool Fabric Reinforced High Strength Composite and Its Preparation Process
Vinod Kadam, D. B. Shakyawar, N. Shanmugam, Ajay Kumar, Seiko Jose
Patent No. 497204, Granted on: 10.01.2024

4

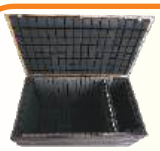
5 **Sperm Membrane Stabilizer**
R. K. Paul, R. Singh, Davendra Kumar, Arun Kumar
Patent No. 470546, Granted on: 20.11.2023



Quilt Comforter & Manufacturing Method for Same
D. B. Shakyawar, N. Shanmugam, Ajay Kumar, Vinod Kadam,
Seiko Jose, Arun Kumar, A. Sahoo
Patent No. 555623, Granted on: 29.11.2024

6

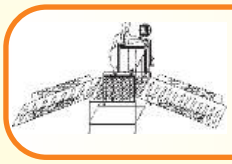
7 **Sapling Bag & Method of Manufacturing Thereof**
Vinod Kadam, D. B. Shakyawar, Parmar Gaurav, A. Sahoo, Arun Kumar
Patent No. 434645, Granted on: 14.06.2023



Sound Transmission Loss Tester
Vinod Kadam, Deepak Bhati, Sushma Rani, N. L. Meena, Ajay Kumar, N. Shanmugam
Patent No. 41467, Granted on: 15.12.2022

8

9 **Identification of Cashmere (Pashmina) Fibre from Processed Textile Products by Polymerase Chain Reaction-Based Technique**
Rajiv Kumar, D. B. Shakyawar, P. K. Pareek, L. L. L. Prince, A. S. Meena, Satish Kumar,
A. S. M. Raja, S. A. Wani, S. A. Karim
Patent No. 340284, Granted on: 02.07.2020



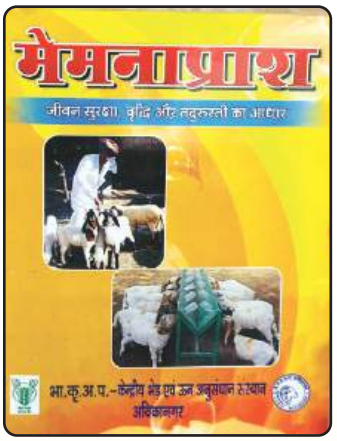
Low Cost Indigenous Cradle for Safe Restraining of Sheep for Pregnancy Diagnosis
V. P. Maurya, V. Sejian, S. M. K. Naqvi, S. A. Karim
Patent No. 344857, Granted on: 24.08.2020

10

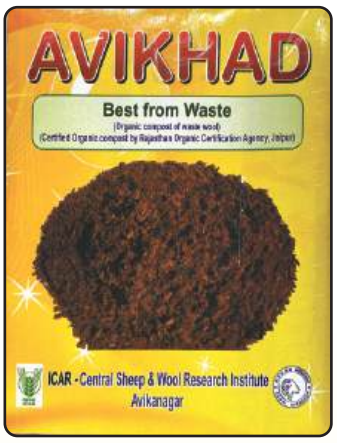
COPYRIGHT GRANTED

CF-4501/2019	Memnaprash (Cinematograph film)	R.S. Bhatt
CF-4449/2019	Methane emission by sulphur hexachloride tracer technique (Cinematograph film)	R.S. Bhatt
CF-3786/2014	Seman collection and artificial insemination (AI) in sheep (Cinematograph film)	S.M.K. Naqvi
SW-8118/2014	FROGIN (Forecasting for Rajasthan on Ovine Gastrointestinal Nematodiasis) (Computer software)	C.P. Swarnkar Dhirendra Singh F. A. Khan, V. K. Singh
CF-3785/2014	Estrus Synchronization in Sheep and Goats (Cinematograph Film)	S. M. K. Naqvi

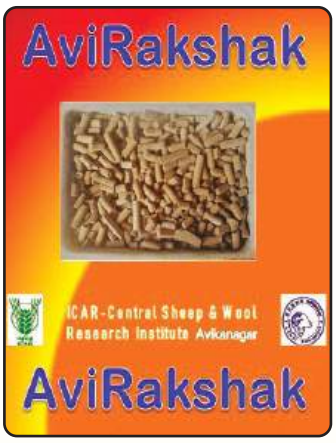
TRADEMARKS REGISTERED



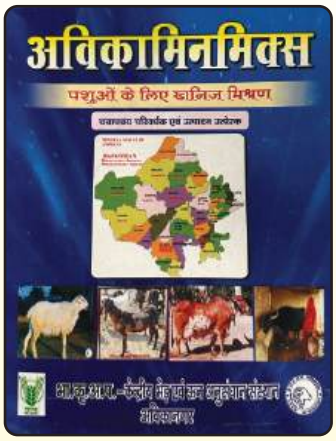
Memnaprash



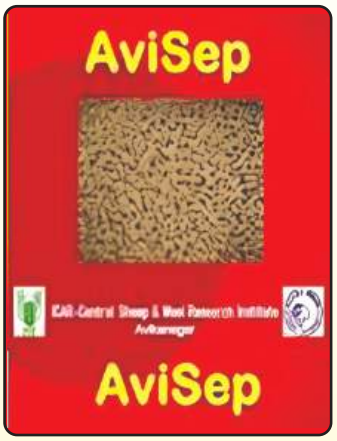
Avikhad



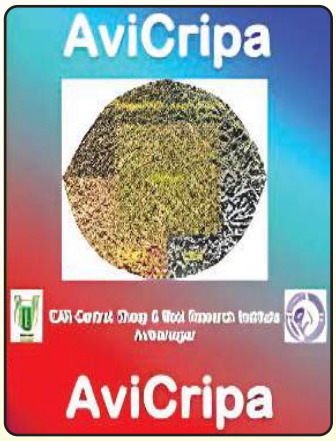
AviRakshak



Avikaminmix



AviSep



AviCripa

Avikesil-S

ICAR CERTIFIED TECHNOLOGIES/PRODUCTS

Type	Title	Contributors
Technology	Sound transmission loss testing apparatus	VV Kadam, D Bhati, S Rani, NL Meena, Ajay Kumar, N Shanmugam, Arun Kumar
Product	Coarse wool fabric reinforced	VV Kadam, DB Shakyawar, N Shanmugam, Seiko Jose, Ajay Kumar, Arun Kumar
Product	Eco-friendly coarse wool sapling bag	VV Kadam, DB Shakyawar, G Parmar, A Sahoo, Ajay Kumar, Arun Kumar
Product	Coarse wool-based lightweight quilt comforter	DB Shakyawar, N Shanmugam, Ajay Kumar, VV Kadam, Seiko Jose, A Sahoo, Arun Kumar
Technology	A method of lustre measurement of textile fibers	Ajay Kumar, DB Shakyawar, Rajiv Kumar, NL Meena, Ashish Chopra, AS Meena, Arun Kumar and a mounting platformM Uttam, P Vishnoi, R Sonkar, Raghvendar Singh
Technology	PCR-based quality estimation technology for purity of Pashmina wool	Rajiv Kumar, DB Shakyawar, PK Pareek, LL L Prince, AS Meena, Satish Kumar, ASM Raja, SA Wani, SA Karim, Ajay Kumar, Arun Kumar
Technology	Ram semen cryopreservation method	RK Paul, Raghvender Singh, D Kumar
Technology	Sperm membrane stabilizer	RK Paul, Raghvender Singh, D Kumar, Arun Kumar
Technology	Mobile Artificial Insemination Laboratory for Sheep (Avi MAIL)	Ajit Singh Mahla, Arun Kumar, S.S. Dangi, Raghvendar Singh
Technology	Avi-Batika: Green Feed for Lowering Methane Emission and Augmenting Lamb Production	R.S. Bhatt, A. Sahoo, Srobana Sarkar, Arun Kumar
Technology	Liquid Milk Formula (Memnaprash) for Higher Growth and Survivability in Lambs/Kids	R.S. Bhatt, A. Sahoo, S.K. Sankhyan, Srobana Sarkar, Arun Kumar

Products Available for Sale

A. Blankets, Quilts & Bedding

1 Plain Blanket
2 Check Blanket
3 Camel Wool Blanket
4 Single Bed Quilt (Fine Wool Mix)
5 Double Bed Quilt (Fine Wool Mix)
6 Namda (7' × 5')
7 Carry Bag for Mat / Blanket

B. Mats, Namda & Flooring

8 Footmat (2.75' × 1.75')
9 Footmat (Malpura–Chokla wool felt based)
10 Hand Woven Mat (6' × 2.5')
11 Braided Mat (6' × 2.5')
12 Felt Mat (6' × 3')
13 Felt Mat dyed with Natural Colour (6' × 3')
14 Namda Sheet
15 Ply Sheet

C. Shawls, Stoles & Apparel

16 Pashmina Shawl
17 Ladies Shawl (Plain / Design)
18 Gents Shawl
19 BM Wool–Angora Blended Shawl / Stole
20 Double Hump Camel / Bharat Merino Wool Shawl
21 Design Ladies Stole
22 Camel Woollen Jacket

D. Fabrics & Textile Materials

23 Linen–Wool / Angora (70:30) Fabric
24 Linen–Wool / Single Hump Camel (70:30) Fabric
25 BM Wool–Dromedary Camel Wool Blended Fabric

E. Bags, Purses & Utility Items

26 Ladies Bag
27 Ladies Clutch Bag
28 Ladies Purse
29 Sapling Bag (6" × 7")
30 Sapling Bag (7" × 9")
31 Coarse Wool Sapling Bag
32 Wool–Latex Coated Computer Mouse Pad

F. Handicrafts & Decorative Items

33 Felt Sheet–Based Single Flower Stick
34 Felt Sheet–Based Single Flower with Pot Stand
35 Felt Sheet–Based Three Flower Bouquet
36 Felt Sheet–Based Six Flower Bouquet

Meat Value Added Products (Sheep, Goat, Rabbits)

37. Nuggets / Sausages / Salami
38. Patties / Kabab / Croquettes
39. Pickle
40. Meat Soup
41. Meat-based Snacks / Cooked Products

Milk Value Added Products (Sheep and Goat)

42. Paneer
43. Peda
44. Cheese
45. Gulab Jamun
46. Khoya
47. Kulfi
48. Whey Drink
49. Shrikhand

Rabbit Fur Products

50. Doll (Small)
51. Doll (Big)
52. Cap
53. Purse (Small)
54. Purse (Big)
55. Key Ring

Rabbit Meat & Services

56. Rabbit Meat
57. Slaughter Charge (Rabbit)

Sheep Manure Value Added Products

58. Avikhad – Organic Sheep Manure from Wool Waste

Reproductive and Nutritional Products

59. AVIKESIL-S – Progesterone Sponges for Estrus Synchronization
60. Avikaminmix – Area-Specific Mineral Mixture
61. Liquid Milk Formula (Memnaprash)

Institute-developed products, technologies and innovations available for purchase on the CSWRI Avi-Products Portal (cswri.in).

Scan me

Website : cswri.in

CSWRI Testing Services

A. Fibre Properties

1 Fibre diameter and modulation (IS 744, ASTM D 2130)

2 Staple length (ASTM D 1234)

3 Single fibre length (ASTM D 5103)

4 Bundle strength (ASTM D 2524-95)

5 Single fibre strength (ASTM D 3822)

B. Yarn Properties

6 Yarn linear density / count (ASTM D 1907)

7 Yarn twist – single / plied (ISO 2061 / ASTM D 1423)

8 Single yarn strength and elongation (ASTM D 2256)

C. Fabric Properties

9 Fabric tear strength (IS 6489 / ASTM D 2261)

10 Fabric friction test (ASTM D 1894)

11 Fabric bursting strength (ASTM D 3786 / D 3786M)

12 Fabric flammability – burn length (ASTM D 6413)

13 Fabric thermal insulation (ASTM D 1518-1985)

14 Fabric drape coefficient (IS 8357:1977)

15 Fabric pilling resistance (BS 5811:1986 / ISO 12945)

16 Fabric computer colour matching system (L*, a*, b*, K/S) (ISO 105)

17 Dyed fabric washing fastness (ISO 105)

18 Fabric bending length, rigidity and modulus (ASTM D 1388)

19 Fabric tensile properties – strength / modulus / elongation (ASTM D 5035)

20 Fabric abrasion properties – Martindale test (IS 12673:1989)

21 Fabric thickness (ASTM D 1777)

22 Anti-moth test (Wool / Yarn / Fabric) (ISO 399 / AS 2001)

23 Lustre (Fibre / Yarn / Fabric)

D. Carpet Properties

24 Carpet thickness / pile height (ISO 1766 / ASTM D 6859)

25 Carpet compressibility and resiliency (ISO 2094 / ASTM)

26 Abrasive loss of carpet pile (first 1000 cycles)

27 Abrasive loss of carpet (up to backing)

28 Tuft withdrawal strength to backing

29 Carpet thickness loss under dynamic loading

E. Chemical Analysis

30 Light absorbance (UV Spectrophotometer)

31 Spectra of dyes and chemicals (FTIR)

32 Moisture content (ASTM D 2654), Vegetable matter content (IS 1349), Identification of wool in blend (IS 667)

33 Scouring yield / clean fleece yield (IS 1349)

34 Grease content (IS 1349)

F. Composite Testing (Flexible / Hard)

35 Tensile strength of composite (ASTM D 412, ASTM D 624)

36 Flexural strength of composite (Flexible / Hard)

37 Sound transmission loss / insulation (Fabric / Composite) (ISO 10140 / ASTM E90)

38 Thermal conductivity / insulation (ASTM D 1518)

G. Biotechnological Testing

39 Detection of Pashmina fibre by PCR technique

40 FecB Gene Testing

H. Laboratory Facilities / Services

41 Compression moulding

42 IR dyeing (per run – max. 10 samples)

43 Small-scale dyeing machine (40 L capacity) per run

44 Padding mangle with dryer

45 Pad-dry-cure

I. Needle Punching Facility (CFC Model)

46 Raw wool scouring and anti-moth treatment charges for needle-punched sheet (per kg)

47 Needle punching charges (per kg)

Technology License Agreements (TLAs) Signed with Industry Partners

The following technologies were licensed:

Sr.	Licensee	Technology
1	Bharat Livestock Enterprise and Innovations Pvt. Ltd., Thane	Liquid Milk Formula (LMF / Memnaprash)
2	Regenerative Textiles Pvt. Ltd., Pune	Coarse Wool Quilt Comforter
3	Regenerative Textiles Pvt. Ltd., Pune	Coarse Wool Sapling Bag
4	International Surgical Co., Jaipur	Portable Crate for Restraining Small Ruminants
5	Rohit Coach Engineers, Jaipur	Avi MAIL: Mobile Artificial Insemination Laboratory for Sheep

TLAs were signed on ICAR Foundation Day (16 July 2025) at New Delhi, in the august presence of Hon'ble Union Minister Shri Shivraj Singh Chouhan, Hon'ble Minister of State Shri Bhagirath Choudhary, Shri Devesh Chaturvedi, Secretary (Agriculture), and Dr. M. L. Jat, DG, ICAR.

TLAs were signed during the National Symposium on "Empowering Sheep Tech: Wool, Mutton, Milk & Sustainability for Viksit Bharat" (22 December 2025) at ICAR–CSWRI, Avikanagar, in the presence of Shri Naresh Pal Gangwar, Secretary, DAHD; Dr. Praveen Malik, Animal Husbandry Commissioner; Dr. B. Muthukumarasamy, Joint Secretary, DAHD; Shri Ritesh Chauhan, Secretary, AHD Himachal Pradesh.

Contact Us

Dr. Vinod Kadam
Principal Investigator

Dr. Arun Kumar Tomar
Director

Institute Technology Management Unit (ITMU)
ICAR-Central Sheep and Wool Research Institute
Avikanagar, Malpura-304 501, Tonk, (Rajasthan) INDIA

cswri.itmu@gmail.com 01437-225212, 220162 www.cswri.res.in
cswri.avikanagar icar_cswri ICARCSWRI icar_cswri

Printed by Shiva Offset, Jaipur : 0141-2365721