Technology Inventory No. 01

Technologies for Scientific Mithun Production and Processing

ICAR-NATIONAL RESEARCH CENTRE ON MITHUN
(An ISO 9001:2015 Certified Institute)
Medziphema, Nagaland- 797106, India
https://nrcmithun.icar.gov.in

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Compiled & Edited by

Dr. J.K. Chamuah
Dr. Harshit Kumar
Dr. (Miss) Plabita Goswami
Dr. Girish Patil S.

Inventor team

Dr. Nazrul Haque
Dr. J.K. Chamuah
Dr. Debojyoti Borkotoky
Dr. (Miss) Plabita Goswami
Dr. S.S. Hanah
Dr. Vikram R.
Dr. S. Mukherjee
Dr. (Mrs). A. Mukherjee
Dr. K.C. Das
Dr. K.K. Baruah
Dr. G. Mukherjee
Dr. R.K. Singh
Dr. B. Chattopadhyay
Dr. Lalchamliani Chhangte
Dr. Bukya Prakash
Dr. C. Mondal
Dr. Saroj Toppo
Dr. H. Lalzampuia
Dr. B. Prakash
Dr. L. Sunitibala Devi
Dr. Vivek Joshi
Dr. Jyoti
Dr. Kobu Khate
Dr. K. Vupru
Dr. Esther Longkumer
Dr. B. Debnath
Dr. S. Chakraborty
Dr. G.K. Biswas
Dr. H.C. Yadav
Dr. Tasvina Rahman Borah
Dr. Rinku Bharali
Dr. M.H. Khan
Dr. Girish Patil S.
Dr. C. Rajkhowa
Dr. A. Mitra

Technical assistance by: Mr. Imnatemjen Aier

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DIRECTOR'S MESSAGE

Mithun (*Bos frontalis*) is a unique bovine species predominantly inhabiting the dense jungles of India's North-Eastern Hills Region (NEHR) of India, as well as scattered regions of Bhutan, Myanmar, China, and Bangladesh. Mithun holds a pivotal position in the lives of the tribal communities of NEHR, exerting a profound influence on their social, economic, cultural, and religious realms. Primarily raised for meat production, this remarkable livestock species also possesses untapped potential for milk and draught purposes.

According to the 20thLivestock census (2019), the Mithun population in the country stands at 3.9 Lakhs, reflecting a remarkable 30.6% increase from the previous census. Arunachal Pradesh boasts the highest population of Mithun at 89.7%, followed by 5.98% in Nagaland, 2.36% in Manipur, and 1.02% in Mizoram. Over the past 35 years, the ICAR-NRC on Mithun has not only accumulated invaluable scientific insights into this unique species but has also devised numerous conservation strategies and technological innovations. The Institute's dedicated conservation initiatives, including the domestication of Mithun and the introduction of semi-intensive rearing practices akin to other bovine species, have borne fruit, resulting in the species' successful domestication. With the constant research support and persuasion of ICAR – National Research Centre on Mithun, Nagaland, in the year 2023, Mithun has been included in the Domestic Animal Diversity Information System (DAD IS) of Food and Agricultural Organization and also has been recognized as food animal by Food Safety & Standards Authority of India, New Delhi.

This publication aims to serve as a comprehensive repository of the plethora of technologies and information generated by the ICAR-NRC on Mithun, providing a valuable resource for the scientific community and the stakeholders. The editors of this book have expended considerable effort to present brief details of the technologies developed by the Institute and to make it more accessible to the general public.

This book serves as a consolidated compendium of available technologies. Its intended audience spans researchers, farmers, educators, and extension workers, not only within India but also in the countries where Mithun populations exist. The data within this technology inventory promises to benefit not only regions

engaged in Mithun rearing but the nation as a whole. The dedicated inventors who toiled diligently in developing these technologies deserve our profound gratitude for elevating the ICAR-NRC on Mithun to a position of pride within the broader scientific community.

Girish Patil, S.
Director

PREFACE

Mithun (*Bos frontalis*), a distinctive bovine species native to northeastern India, possesses a rich historical connection with the ethnic and cultural traditions of the tribal communities inhabiting the North-Eastern hill States. The ICAR-NRC on Mithun stands as the world's sole institute fervently dedicated to the enhancement of this rare bovine species. Beyond serving as a vital source of meat for tribal populations, Mithun ownership reflects an individual's social standing. This enigmatic species holds tremendous potential for offering an alternative livelihood to the people of the North Eastern hilly region. Furthermore, Mithun farming not only bolsters nutritional security but also plays a pivotal role in preserving the region's socio-cultural diversity and agro-ecological equilibrium.

Currently, these animals are generally reared under free grazing conditions, thriving on jungle forages, tree fodders, shrubs, herbs, and other natural vegetation. However, the gradual shift towards urbanization, changing land-use practices, and forest fires have led to a progressive decline in grazing vegetation, necessitating alternative approaches to their rearing. The commendable work undertaken by the ICAR-NRC on Mithun to enhance this rare bovine species in the North-Eastern states of India is indeed praiseworthy. The Institute's innovative strategy of integrating scientific animal husbandry practices into traditional Mithun rearing within a free-range forest ecosystem offers a promising solution to address the challenges arising from diminishing grazing vegetation due to evolving land-use patterns.

The wealth of valuable technologies and knowledge generated by the Institute can greatly benefit farmers, students, and academicians, facilitating the establishment of sustainable and economically viable Mithun husbandry practices across the country. The Institute's

efforts also bear the potential to uphold the region's socio-cultural diversity and agro-ecological balance while simultaneously promoting environmental sustainability and profitability.

In sum, the unwavering commitment demonstrated by the Institute's Scientists and Technical staff in elevating the Mithun species is truly inspiring. Their endeavors serve as a model for conservation and livestock improvement programs worldwide, exemplifying the harmonious coexistence of tradition and innovation in safeguarding unique biodiversity. This technology inventory provides brief details of the technologies developed by the Scientists and Technical staff of the Institute. We hope that this document will be of use to Mithun farmers, policy makers and scientific community.

Authors & Inventors

LIST OF TECHNOLOGIES

INTRODUCTION

The Institute

ICAR-National Research Centre on Mithun, Medziphema, Nagaland was established in the year 1988 and the only research organization in the world that is exclusively working for the continual improvement and conservation of Mithun (*Bos frontalis*). During the last 35 years, the Institute has not only generated invaluable scientific data towards the understanding of this unique species but also developed several packages of practices and technologies. Conservation efforts, including taming of Mithun and demonstrating an alternative system of semi-intensive rearing of Mithun, like other bovine species, resulted in the complete domestication of the species. Popularization efforts led to the adoption of scientific rearing of Mithun by the tribal communities of the North Eastern Region (NER) with better returns with vision, mission, and with a clear mandate.

Vision

To preserve, conserve and propagate superior quality Mithun germplasm for a sustainable production system and subsequent utilization for better nutritional and socio-economic support to the farmers.

Mission

Formulation and adoption of scientific management, feeding practices, and advanced bio-techniques for reproduction and health with an ultimate objective to develop economically viable and sustainable technologies for the benefit of the farming communities rearing Mithun.

Mandate

The National Research Centre on Mithun is functioning for developing the scientific and sustainable Mithun rearing system and for catering to the needs of Mithun farmers with the following mandates

- Identification, evaluation, and characterization of Mithun germplasm available in the country.
- Conservation and improvement of Mithun for meat and milk.
- To act as a repository of information on Mithun.

1.0 Large Animal Ectoparasite Expeller Cum Drug Applicator

1	**Name of the technology**	**Large Animal Ectoparasite Expeller cum Drug Applicator**
2	Technology Related to	Mithun, Pig, Cattle, Buffalo, Horse, Sheep, Goat etc
3	Complete Details of Technology	Mithun, cattle, horses, sheep, goats, and pigs are susceptible to a wide range of arthropod ectoparasites and nuisance pests. Ectoparasites can cause significant economic losses and severely compromise the welfare of these animals. These ectoparasites, including ticks, mites, lice, flies, and leeches, take up residence on the hair, surface, and outer layers of the skin, where they feed on host tissues, blood, and associated secretions. Their presence typically triggers an inflammatory response, leading to intense itching and pain. Clinical manifestations of ectoparasite infestations include inflamed skin, discharges, hair loss, self-inflicted trauma, anemia, and, in severe cases, death. The product operates on the principle that the application of commercial spot-on topical products or drug paralyzes and loosens the grip of these ectoparasites on the skin. Additionally, the associated comb aids in mechanically removing the adult populations of these ectoparasites, further improving the effectiveness of the treatment.
4	Target users/stakeholders	Commercial andsmall scale livestock farmers
5	IPR Status	Design Registration No. 335631-001, Granted on 27.11.2020
6	ICAR Technology Certification	Technology certified by ICAR
7	Status of commercialization	Technology commercialized to Creative Displayers, Kolkata, West Bengal on 24.02.2023

Details of Inventors

1	**Principal Inventor**	**Dr. Debojyoti Borkotoky**
2	**Principal Inventor Designation**	Subject Matter Specialist (Animal Science)/ACTO
3	**Principal Inventor Email**	debojyoti.borkotoky@icar.gov.in
4	**Principal Inventor Address**	SMS, KVK Phek, Nagaland Present address: KVK North 24 Parganas (Addl.) ICAR-CRIJAF, Barrackpore
5	**Co-Inventor(s) Name**	Dr. Jayanta Kumar Chamuah Dr. Abhijit Mitra

Figure 1: Head of the Large Animal Ectoparasite Expeller cum Drug Applicator

Figure 2: Different side views of the Large Animal Ectoparasite Expeller cum Drug Applicator

Figure 3: Mode of use of the Large Animal Ectoparasite Expeller cum Drug Applicator

2.0 Innovative Meat Dryer

1	**Technology Name**	**Innovative Meat Dryer**
2	**Technology Related to**	Meat consumers of NEHR
3	**Complete Details of Technology**	Smoking of meat is a common practice in the rural households in Nagaland. Pork, beef and other meat are hung above any kitchen fire that slowly dry out and then smoke high above the flames. The meat turns black due to accumulation of carbon soot that is highly hazardous to health. Fungal growth and maggot accumulation is common due to high humidity and congenial substrate. Smoked meat is Heterocyclic Amines (HCAs) and Polycyclic Aromatic Hydrocarbons (PAHs) are both known carcinogens. Smoked meats are often related to cancer risks. The technology works on the Principle of Hot air drying of meat thought by continuous suction of air and the exit of heated air. ***Size of the model:*** • Length: 60 cm • Height: 55 cm • Breadth: 35 cm • Insulation wall gap: 4 cm • Base stand: 4 cm ***Material used:*** • Plywood (1 cm thick) • Wood • Aluminum sheets • Halogen tubes 200 w – Three no's • Axial fan • Iron Nets • Switches, plug and heating panel • Paint(Black) • Iron Handle • Aluminum hooks Stage 1: 4 dryings of 30 min duration at 6 hr interval per day for 1 week.(134-138^{0}F) Stage 2: 3 dryings of 30 min duration at 8 hrs interval per day for 1 week(150-160^{0}F) Stage 3: 4 dryings of 15 min duration at 6 hr interval per day for 1 week(165-170^{0}F)
5	**Target users/ stakeholders**	Ruralhouseholds and ethnic restaurants/hotels
6	**IPRs status**	Design Registration No. 330513-001;Granted on 27.06.2020
7	**ICAR Technology Certification**	Technology certified by ICAR in 2023

Details of Inventors

1	**Principal Inventor**	**Dr. Debojyoti Borkotoky**
2	**Principal Inventor Designation**	Subject Matter Specialist (Animal Science)/ACTO
3	**Principal Inventor Email**	debojyoti.borkotoky@icar.gov.in
4	**Principal Inventor Address**	Subject Matter Specialist (SMS), Krishi Vigyan Kendra, Phek Present address: KVK North 24 Parganas (Addl.) ICAR-CRIJAF, Barrackpore
5	**Co-Inventor(s) Name**	Dr. Nazrul Haque Dr. R.K. Singh Dr. T. Esther Longkumer Dr. Abhijit Mitra

Figure 4: Front view of the Innovative Meat Dryer

Figure 5: Top view of the Innovative Meat Dryer

Figure 6: Inside view of the Innovative Meat Dryer

3.0 Portable Mineral Block Dispenser With Height Adjustment Facility

1	**Technology Name**	**Portable Mineral block Dispenser with height adjustment facility**
2	**Technology Related To**	Mithun calves, Cattle, Buffalo, Goat and Sheep
3	**Complete Details of Technology**	Mineral imbalances (deficiencies or excesses) in soil and forages have long been held responsible for low production and reproductive problems in Mithun and other livestock species. In NEHR, due to heavy rains and leaching of soil, mineral deficiencies are very common. Hence, farmers provide salt licks, which does not contain all minerals in the required proportion. Dispensing mineral mix to Mithuns which are generally grazed in the forest is a challenge. To address this issue ICAR-NRC on Mithun, Medziphema has developed area-specific mineral mixture and prepared blocks for slow and controlled release by licking. Further, to dispense the mineral mix, a portable, durable, affordable stainless steel (304 grade) device has been developed which can hold the mineral blocks to be licked by the animals in free-range pasture as well as in the farm conditions. This invention can contribute to mitigating mineral deficiency of animals in forest, in free-range pasture, as well as in the farm condition increasing productive and reproductive performances. A Mithun / cattle / buffalo / sheep / goat can easily lick the mineral block placed inside the device, and fulfil its mineral requirements as per their needs, particularly in the area like North-Eastern hilly region where essential minerals are deficient in pastures as well as in animals due to leaching of soil with heavy rainfall. **Advantages of the portable mineral dispensers:** • Portable, durable and affordable • Controlled mineral supplementation in free range system • Protection of mineral supplements from drenching with rain • Respite from supplementation of minerals on daily basis • Dispenser can be set on the trunk or branches of the tree in the forest or on poles in pasture in free range system or in farm condition • Height of the dispensers can be adjusted as per the animal requirement
4	Target users/ stakeholders	Target groups are State Animal Husbandry Departments, Livestock owners, Institutions having Mithun/yak/cattle/sheep/goat/other livestock.
5	**IPRs status**	Design Registration No. 334974-001; Granted on 06.11.2020
6	**ICAR Technology Certification**	Technology certified by ICAR in 2023

Details of Inventors

1.	**Principal Inventor**	**Dr. Nazrul Haque**
2.	**Principal Inventor Designation**	Principal Scientist
3.	**Principal Inventor Email**	nazrulhaq63@gmail.com
4.	**Principal Inventor Address**	ICAR - NRC on Mithun, Nagaland
5.	**Co-Inventor(s) Name**	Mr. H.C. Yadav Dr. Debojyoti Borkotoky Dr. Soroj Toppo Dr. Abhijit Mitra

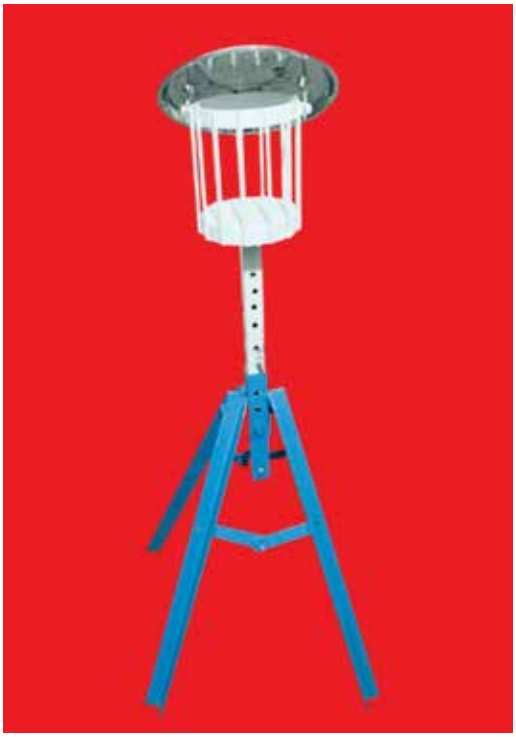


Figure 7: Front view of the portable Mineral block Dispenser with height adjustment facility

Figure 8: Top-open view of the portable Mineral block Dispenser with height adjustment facility

4.0 Desave Mineral Block Dispenser For Mithun, Cattle And Buffalo

1	**Technology Name**	**Desave Mineral block Dispenser for Mithun, Cattle and Buffalo**
2	**Technology Related To**	Mithun, Cattle, Buffalo, Goat and Sheep
3	**Complete Details of Technology**	Mithun (*Bos frontalis*) is a free range domesticated hill animal. The animal dwells in jungle in ranges with minimal human interventions like occasional supplementation of common salt spread on the rocks / boulders or palm-fed. Excess supplementation of minerals / salts when spread over the rocks / boulders or palm fed may lead to salt toxicities. Well established, area specific mineral mixture supplementation is imperative for optimum growth and productivity of the animal. ICAR-NRC on Mithun, Medziphema has developed area specific mineral mixture and prepared blocks for slow and controlled release by licking. Mithun ranges are remote and perilous where supplementation of minerals spreading on the rocks / boulders or palm-feeding on daily basis is a difficult proposition. Furthermore, mineral blocks are also often hygroscopic and loose its compactness due to consistent exposure to rain and highhumidity. To address this issue, a device suitable for mineral mixture dispensing forests/pastures has been developed. A portable, durable, affordable dispenser is made of stainless steel (304 grade) hold the mineral blocks to be licked by the animals in forest, in free-range pasture as well in the farm condition. The device can help in mitigating mineral deficiency of animals in forest, in free-range pasture as well in the farm condition increasing productive and reproductive performances. A Mithun / cattle / buffalo / sheep / goat can easily lick the mineral block placed inside the device, and fulfil its mineral requirements as per their needs, particularly in the area like North-eastern region where essential minerals are deficient in plants as well as in animals due to leaching of soil with heavy rainfall. **Advantages of the developed device:** • Portable, durable, affordable • Controlled mineral supplementation in free range system • Protection of mineral supplements from drenching with rain • Respite from supplementation of minerals on daily basis • Dispenser can be set on the trunk or branches of the tree in the forest or on poles in pasture in free range system or in farm condition
4	**Target users/ stakeholders**	Target groups are State Animal Husbandry Departments, Livestock owners, Institutions having Mithun/yak/other livestock.
5	**ICAR Technology Certification/**	Technology certified by ICAR in 2023

1	**Technology Name**	**Desave Mineral block Dispenser for Mithun, Cattle and Buffalo**
6	**IPRs status**	Design Registration No. 324931-001; Granted on 23.12.2019
7	**Status of Commercialization**	Technology commercialized to Creative Displayers, Kolkata, West Bengal on 16.07.2023

Details of Inventors

8	**Principal Inventor**	Dr. Nazrul Haque
9	**Principal Inventor Designation**	Principal Scientist
10	**Principal Inventor Email**	nazrulhaq63@gmail.com
11	**Principal Inventor Address**	ICAR NRC on Mithun, Nagaland
12	**Co-Inventor(s) Name**	Dr. Debojyoti Borkotoky Dr. Soroj Toppo Dr. Abhijit Mitra

Figure 9: Side view of the Desave Mineral block Dispenser for Mithun, Cattle and Buffalo

Figure 10: Buffaloes licking the mineral block from Desave Mineral block Dispenser for Mithun, Cattle and Buffalo

5.0 Modified travis for Restraining of Mithun

1	**Technology Name**	**Modified Travis For Restraining of Mithun**
2	**Technology Related To**	Mithun, Cattle and Buffalo
3	**Complete Details of Technology**	Mithun, due to the massive and well-built body with a developed broad head with strong wide horn which extends outward and gently curving inward. The existing Travis does not suit Mithun spp., hence, the institute modified or fabricated a Travis based on the anatomical structure of Mithun. The modified structure is made in such a way that other livestock particularly cattle and buffaloes can also be suited for restraining. The developed Travis has been provided to the farmers' field of different Mithun rearing States of the North East India. The Mithun farmers reported that the Travis is very effective in restraining Mithuns during their treatment and management. **Objective of the product/technology** To ease in restraining of Mithun during the time of treatment, vaccination and artificial insemination in farmers' fields. **Details of the methodology of the proposed product/ technology:** The travis is fabricated from 3 mm thickness iron pipe having a diameter of 8 inch in rectangular shape, which is strong enough to hold the movement/sudden jerk of Mithun *Dimension:* • Length: 5.5ft • Height: 5.6ft • Length of back and front: 3ft • In the front side, hole between adjustable pipe: 5 inch (total six holes) **Uniqueness of the technology in comparison to existing ones:** Specifically designed for Mithun taking into consideration of anatomy of Mithun
5	**Target users/stakeholders**	Target groups are State Animal Husbandry Departments, Livestock owners, Institutions having Mithun/yak/other livestock.
6	**ICAR Technology Certification/**	Technology certified by ICAR in 2023
7	**IPRs status**	Design Registration No. 38107-001; Class No. 30-02; Granted on 08.03.2023

Details of Inventors

1	**Principal Inventor**	**Dr. Sapunii Stephen Hanah**
2	**Principal Inventor Designation**	Senior Scientist
3	**Principal Inventor Email**	Sapunii.Hanah@icar.gov.in
4	**Principal Inventor Address**	ICAR-NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Kezhavituo Vupru, (CTO) Dr. Kobu Khate (CTO) Dr. Laishram Sunitibala Devi, Scientist Dr. J.K. Chamuah, Sr. Scientist Dr. Girish Patil, S., Director

Figure 11: Front view of the Modified Travis for restraining of Mithun

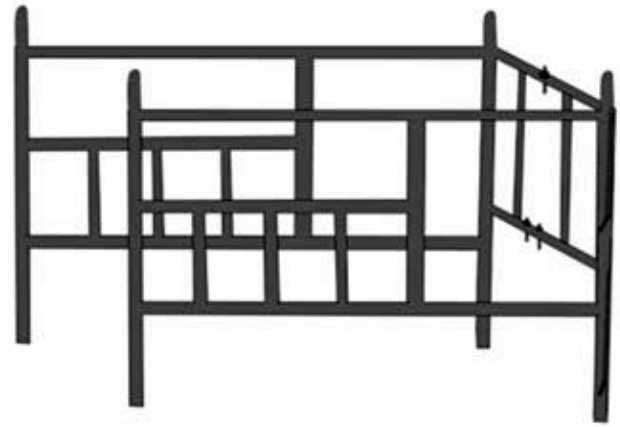


Figure 12: Side view of the Modified Travis for restraining of Mithun

Figure 13: Modified Travis installed in the farmer's field

6.0 Aging of Mithun By Dentition

1	**Technology Name**	**Aging of Mithun by dentition**
2	**Technology Related To**	Mithun Husbandry
3	**Complete Details of Technology**	**Dentition pattern** Dentition pattern of the Mithun have been recorded and compared with the dentition pattern of cattle. There are three types of teeth found in the Mithun: **incisors, premolars,** and **molars**. *Incisor* teeth are found in the *rostral* (front) portion of the mouth, but they are absent from the upper jaw. The *premolars* and *molars* (known as cheek teeth) are found in the *caudal* part of the mouth and are present in the upper (maxilla) and lower (mandible) jaws.

Table 1. Dentition pattern in Mithun (Source: Mondal et al., 2000)

Type of teeth	Time of eruption (Mithun)	Time of eruption (Cattle)
Temporary Incisors		
1st, 2nd and 3rd pair of incisors	Birth to one week	Birth to two week
4th pair of incisor	3 months and above	Birth to 2 weeks
Permanent Incisors		
1st pair of Incisors	22 months to 3 years	1.5 -2 years
2nd pair of Incisors	3-4 years	2-2.5 years
3rd pair of Incisors	4-6 years	3 years
4th pair of Incisors	6 years and above	3.5-4.0 years

		Temporary Teeth: The age of Mithun is determined chiefly by examination of the teeth. At birth, calves have deciduous (temporary, milk, baby) teeth. The deciduous teeth include central, 1st and 2nd lateral and corner. The deciduous teeth are lost as the animal ages and they are replaced by the permanent teeth. Temporary incisors or "milk" teeth are smaller than the permanent incisors. The temporary teeth are in part erupted at birth, and all the temporary incisors are erupted in nine day; the first, second and third pairs of temporary incisors are erupted in seven days. The last pair of temporary incisor appears when calf is three month of age. The teeth have grown large enough to touch each other by the sixth month. The first two central incisors gradually wear and fall in twenty two months and deciduous teeth are entirely replaced by the seventy to seventy two month.

		Deciduous (Temporary) Incisors versus Permanent Incisors: The deciduous incisors are much smaller than the permanent incisors. The crown (that part of the tooth that is covered with enamel) of the deciduous incisors are more narrow than the permanent incisors and they diverge more from the base (at the gum line) of the tooth to the apex when compared to the permanent incisors. • The first two central incisors are replaced with permanent teeth by 22 months to three years of age • By the age of more than six years the animals usually have a full-set of incisors with the corners fully developed • At four to six years the second set of intermediates are present • By the age of more than six years the animals usually has a full set of incisors with the corners fully developed An animal at 14 months of age would have a full set of deciduous incisors. All four pairs of teeth are temporary and firmly in place.
		The teeth are short, broad and usually have a bright, ivory color. There is usually space between the Di1 incisors. Other incisors may touch on the inside corner at the top of the tooth. As the animal ages, the deciduous teeth become loosely set in the jaw, especially the central two incisors. The teeth appear longer and narrower than in younger animals and the teeth may or may not be touching at the upper corners. An animal with this dentition is approximately 15 to 18 months of age old. **Age Determination in Mithun by Dentition:** Mithun depend on forages as their major source of nutrients. To be able to graze and physically break the roughage down into small particles, the animal's teeth must be in good condition. The age of a beef animal has a direct effect on the animal's teeth and subsequent productivity. Eruption times and wear of the teeth are the major factors used to estimate Mithun age. The definition of eruption is the *emergence, penetration or piercing* of the tooth or teeth through the *gingiva* (the gum line). Mithun have 32 teeth, including 6 incisors or biting teeth. The incisor teeth meet with the thick hard dental pad of the upper jaw. Mithun has 6 premolars and 6 molars on both top and bottom jaws for a total of 24 molars. The premolars and molars teeth of Mithun are designed primarily for grinding, and they use their rough tongues to grasp grass and then nip it off between their incisors and the dental pad.

		Importance: Differentiating age of Mithun is easily done at six-month intervals all the way to 72 months of age. Dentition is the means of doing so and is the commonly accepted standard. • Being able to estimate an animal's age is an important factor in making management decisions. • The animal's teeth are generally used as an indicator of age when actual birth dates are not known or available. • The time of eruption and the amount of wear are the major factors used to estimate age.
4	Target users/ stakeholders	Researchers/ Academicians, traders and Mithun farmers

Details of Inventors

1	**Principal Inventor**	Dr. S. Mukherjee
2	**Principal Inventor Designation**	Principal Scientist
3	**Principal Inventor Email**	Sabyasachi.Mukherjee@icar.gov.in
4	**Principal Inventor Address**	ICAR-NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. A. Mukherjee

Figure 14: Photo of dentition pattern of Mithun

Figure 15: Temporary Incisors of Mithun

Figure 16: Wearing of Temporary Incisors and eruption of 1st permanent incisor

7.0 Method of preparing mineral block added with environmental friendly material

1	**Technology Name**	**Method of preparing mineral block added with environmental friendly material**
2	**Technology Related to**	Mithun Nutrition
3	**Complete Details of Technology**	Mithun (*Bos frontalis*) is a free-range domesticated hill animal that inhabits jungles with minimal human intervention, primarily relying on occasional salt supplementation. However, excessive mineral/salt supplementation can lead to salt toxicity. To optimize growth and productivity, specific mineral mixtures are essential. ICAR-NRC on Mithun, Medziphema, has developed area-specific mineral mixture in block form for slow, controlled-release via licking. Mithun ranges are remote and challenging to access daily for mineral supplementation, and mineral blocks can become hygroscopic due to exposure to rain and humidity. **Objective:** To create organic mineral blocks with an eco-friendly binder suitable for organic production systems. To develop a method for preparing mineral blocks compatible with organic farming. **Detailed Methodology**: In this invention, a mineral block for cattle feed comprises mineral mixture powder and an organic binding agent—macerated plant bark extract, specifically from *Debregeasia orientalis*. The preparation method involves: Grinding dried *Debregeasia orientalis* barks and mixing with water (1:12 ratio) at room temperature. Mixing mineral mixture components: dicalcium phosphate, sodium chloride, manganese sulfate, copper sulfate, cobalt chloride, and sodium selenite. Combining mineral mixture with water-soaked ground bark (*80:10:3 ratio*). Pressing the mixture at 500 to 1000 psi. Drying in a hot air oven for 12 hours at 100°C. An oil-painted mineral block also includes *Debregeasia orientalis* plant bark.
4	**Target users/ stakeholders**	Target groups are State Animal Husbandry Departments, Livestock owners, Institutions having Mithun/yak/other livestock.

5	**ICAR Technology Certification/**	Technology certified by ICAR in 2023
6	**IPRs status**	Applied for patent, application no. 202111013662

Details of Inventors

1	**Principal Inventor**	Dr. Nazrul Haque
2	**Principal Inventor Designation**	Principal Scientist
3	**Principal Inventor Email**	Nazrul.Haque@icar.gov.in
4	**Principal Inventor Address**	Animal Nutrition Section, ICAR-NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Kobu Khate Dr. Debojyoti Borkotoky Dr. Saroj Toppo Dr. Abhijit Mitra

8.0 Process for drying agro-industrial by-products and using it as a component of animal feed block

1	**Name of the product/ technology**	**Process for drying agro-industrial by-products and using it as a component of animal feed block**
1	**Complete Details of Technology**	Mithun (*Bos frontalis*) is a free-range domesticated hill animal. The animal dwells in jungle in ranges with minimal human interventions like occasional supplementation of common salt spread on the rocks / boulders or palm-fed. Excess supplementation of minerals / salts when spread over the rocks / boulders or palm fed may lead to salt toxicities. Well established, area specific mineral mixture supplementation is imperative for optimum growth and productivity of the animal. ICAR-NRC on Mithun, Medziphema has developed area specific mineral mixture and prepared blocks for slow and controlled release by licking. Mithun ranges are remote and perilous where supplementation of minerals spreading on the rocks / boulders or palm-feeding on daily basis is a difficult proposition. Furthermore, mineral blocks are also often hygroscopic and loose its compactness due to consistent exposure to rain and high humidity. **Objective:** (i) To provide a process for obtaining dried biologically stable by-products (spent grains and/or wet cake). (ii) To provide a cost-effective process for obtaining dried spent grains and/or wet cake for their commercialization. (iii) To provide feed blocks from spent grains and/or wet cake and the process for preparation thereof. **Details methodology of the proposed product / technology:** A process has been developed to overcome the drawback of the prior art process, which allows for obtaining a biologically stable, commercially profitable, and environmentally safe product. The present invention is directed to the utilization of wet effluents obtained during the brewing process, which consists of spent grain / wet cake. In an embodiment of the present invention there is provided a process for drying spent grain / wet cake, obtained as by-products from brewing / distillery. The present invention provides a process for drying spent grain / wet cake obtained as by-products from brewing / distiller, wherein the dried spent grain/ wet cake have dryness lower than 15% moisture by weight. In the process of brewing, the main ingredients used are malt, water, yeast, and hop. Malt is made up with cereal grains, commonly barley, which are firstly germinated and then desiccated.

		Apart from barley, other malted or raw grains can be used as starch source, depending on the brewery. The process for drying spent grain/wet cake comprises component of dried hay / paddy straw. Therefore, the present invention provides a process for drying spent grain / wet cake obtained as by-products from brewing / distiller, wherein the process comprises providing spent grain/ wet cake along with dried hay / paddy straw. The stickiness character of spent grain / wet cake which is bottleneck for rotary drying, is utilized in the present process of drying, with high dry matter content fodders (paddy straw or hay) with mechanical pressure and sun-drying. The dried spent grain/wet cake obtained by the process is biologically stable and highly nutritious and is used as feed block. **The process for drying brewer's spent grains / wet cake comprises five steps.** **First Step** **Mixing and pressing:** During the first step, mechanical pressure of about 100 kg/cm^2 for about 1 minute is imparted by hydraulic press on a mixture of un-chaffed hay / paddy straw having dry matter content of 80% or more with spent grain / wet cake (moisture content about 80%) wherein a portion of the moisture contained in spent grain / wet cake is removed and spread over the hay /straw
		th minimum spillage avoiding nutrient loss. The ratio of the hay / paddy straw and spent grain / wet cake used in a ratio of 1:1.5 to 1:3 which on dry matter basis corresponds to 7:3 to 1.17:1. During this process some left out materials in spent grain like starches, protein, etc. and in wet cake protein etc., get stuck with hay / paddy straw. These left out materials is sticky in nature and acts as binder material. In the press, the mixed hay / paddy straw and brewer's spent grains / wet cake placed in a chamber and covered by a sliding door. The mixed material then passed through the chamber pushed by a piston of the hydraulic press against a holding part. It is placed at the end of the chamber with a facility for sliding it downward as well as upward for closing as well as opening the chamber to facilitate for imparting pressure by the piston; and releasing the pressed feeds and fodders or feed blocks prepared, respectively. A meter measures the pressure and duration of pressure imparted is also accounted. This way, the hydraulic press allowed to obtain pressed mixture of hay / paddy straw and brewer's spent grains / wet cake to facilitate a portion of the moisture contained in spent grain / wet cake removed and spread over the hay / straw; or to prepare compacted feed block where optimum ratio of roughage and concentrate along with suitable binder and moisture levels present. The moisture content of hay / paddy straw / the mixed dried material, at 50% or more is suitable for obtaining well-formed solid feed blocks after drying and subsequent pressing at 200 kg/cm^2 for 2 minutes.

Second Step

Drying of mixed ingredients: During the second step, a process of drying is affected by spreading the mixed hay /paddy straw and spent grain / wet cake in a polyhouse. During this step, the mixed and pressed hay / paddy straw and brewer's spent grains /wet cake is dried in a polyhouse, keeping the materials on racks made of bamboo covered with plastic mesh nets with hole size 1 mm x | mm. In an area of 16′ x 3′, 25 kg of the mixed material is spread. The materials are kept for drying till it reaches a dry matter content 85% or more by 3 to 4 days. (However, for continuous supply of dried mixed hay / paddy straw and brewer's spent grain / wet cake, 4 to 5 polyhouse with optimum capacity is suggested; depending on the capacity of the hydraulic press machine for production of pressed material per day). The polyhouse is made of iron poles and covered by polythene sheet which facilitates ample sunshine inside, barring 6 inches at the base of the wall in all the four sides, so that moisture is removed from the polyhouse though this vent at the base. Use of polyhouse makes drying possible even during rainy season. It was observed that spreading above mentioned mixed material as mentioned in First Step in an area of 16′ x 3′ in a polyhouse made of galvanized iron pipe, with a volume of size Height x Length x Width - 14'6" x 39" 3" x 19' 9", covered by polythene sheet, barring 6" at the base of the wall in all four sides, leads to drying with dry matter content of 85% or more by 3-4 days also helps preservation of the material with minimum microbial load.

Third Step

Enrichment of mixed material with further addition of agro-industrial by-products:

To enrich the nutrient quality of the feed block made from dried spent grain / wet cake the mixture of First Step having 7:3 ratio is mixed again with spent grain / wet cake, which is about 1.5 time to its weight. The above enriched mixture of brewer's spent grains / wet cake comprises hay / paddy straw and brewer's spent grains / wet cake in a ratio of about 1:3 to 1:4 which on dry matter basis corresponds to 4:3 to 1:1.

The enriched mixture is then further pressed at about 100 kg/cm2 for about 1 minute as mentioned in first step and dried as per the procedure mentioned in second step. The ratio of the hay / paddy straw and spent grain / wet cake depends on the moisture content of the agro-industrial by-products. However, care must be taken to avoid or to minimize the spillage of moisture/water along with nutrients during pressing and drying.

		Fourth Step **Chaffing of mixed hay / paddy straw and spent grain / wet cake:** The dried and mixed hay / paddy straw and spent grain / wet cake are chaffed at a length of 2 cm or less in a chaffing machine. The hay / paddy straw is chapped at a length of 2 cm or less in a chaffing machine at the initial stage and steps followed from First Step to Third Step. **Fifth Step** **Pressing mixed ingredients for preparing feed blocks:** The dried chaffed hay / paddy straw and spent grain / wet cake of step four is mixed with desired levels of other supplements as per the requirements of the animals to fed with and pressed at 200 kg/cm^2 for about 2 minutes in the feed block machine as mention in first step. In a preferred embodiment of the present invention there is provided a feed block made of the dried spent grain / wet cake and the process for preparation thereof. The present invention provides a process for preparation of cattle feed block from the dried spent grain / wet cake, wherein the method comprises mixing the dried chaffed hay / paddy straw and spent grain / wet cake with desired levels of other supplements as per the requirements of the animals to fed with and pressed at 200 kg/cm^2 for about 2 minutes in the feed block machine.
22	Target users/ stakeholders	State Animal Husbandry Departments, Livestock owners, Institutions having Mithun/yak/other livestock.
	IPRs status	Applied for patent, application no. 202331027331

Details of Inventors

1	**Principal Inventor**	Dr. Nazrul Haque
2	Principal Inventor Designation	Principal Scientist
3	**Principal Inventor Email**	Nazrul.Haque@icar.gov.in
4	Principal Inventor Address	Animal Nutrition Section, ICAR-NRC on Mithun, Medziphema, Nagaland
5	Co-Inventor(s) Name	Dr. Kobu Khate Dr. Tasvina Rahman Borah Dr. Saroj Toppo

9.0 INNOVATIVE APPROACH FOR REARING OF MITHUN BASED ON SEMI INTENSIVE SYSTEM

1	**Technology Name**	**Innovative approach for rearing of Mithun**
2	**Technology Related To**	Mithun farmers
3	**Complete Details of Technology**	Mithun are traditionally reared in a free-range manner within community forests, without shelter, mineral supplements, or fencing. This has resulted in poor growth, high mortality rates, especially during outbreaks of diseases like Foot-and-Mouth Disease (FMD), and frequent predator attacks, particularly targeting young calves. Additionally, during the winter season when fodder becomes scarce, Mithun often trespass into agricultural fields, leading to conflicts between Mithun farmers and agriculturalists. In response to these challenges, the Institute has developed an alternative system for Mithun rearing is known as Semi-Intensive Mithun Rearing. **Objective of the Product/Technology:** The objective is to facilitate the monitoring of Mithun for growth, healthcare (including treatment, vaccination, and artificial insemination), breeding, and protection from adverse weather conditions, and predators, as well as to prevent trespassing into agricultural fields. **Detailed Methodology:** The specified area will be enclosed with barbed wire fencing. Night shelters will be constructed for different categories of Mithun, equipped with feeding troughs and waterers. **Benefits and Savings:** ➢ Water, Labor, Time, and Energy: Reduces the labor and time required for monitoring, treatment, and vaccination. ➢ Conservation of Soil: Mithun farm waste (dung, urine, etc.) can be used to improve soil structure. ➢ Efficiency: Requires less manpower, as a single herdsman can care for multiple Mithun.

		Uniqueness of the Technology: Under the semi-intensive system, Mithun are provided with night shelters. During the day, they are allowed to graze freely, but in the evening, they are brought back to the shelter, where they can be fed supplementary items like fodder grass, paddy straw, and a small amount of concentrate feed. This system enables individual monitoring of animals, allowing for additional feeding, watering, medication, and timely activities such as vaccination, breeding, and healthcare. This regular oversight and management set it apart from traditional free-range rearing methods, contributing to the overall well-being and productivity of the Mithun herd.
	Target users/ stakeholders	Mithun farmers, State Govt. owning Mithun breeding farm
	IPRs status	• Copyright for cinematograph film Promotional video on semi-intensive Mithunfarming (Registration No. CF-5014/2021) • Copyright applied for artistic work for "semi-intensive rearing model", Diary Number: 26993/2022-CO/A

Details of Inventors

1	**Principal Inventor**	Dr. Sapunii Stephen Hanah
2	**Principal Inventor Designation**	Senior Scientist
3	**Principal Inventor Email**	Sapunii.Hanah@icar.gov.in
4	**Principal Inventor Address**	ICAR-NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. M.H. Khan Dr. Kezhavituo Vupru Dr. Kobu Khate Dr. J.K. Chamuah Dr. L Sunitibala Devi

10.0 AREA SPECIFIC MINERAL MIXTURE FOR MITHUN

1	**Technology Name**	**Mineral Mixture Feeding of Area specific mineral mixture**
2	Technology Related to	Mithun Nutrition
3	Complete Details of Technology	
	The availability of minerals to animals in appropriate quantity is a prerequisite for better health and production. Further, minerals are liable to form bonds and negatively interact more than any other nutrient substances. Nevertheless, the absorption of minerals is highly variable with the dietary nutrient content. For instance, high fiber reduces the availability of Ca. Similarly, diet with optimum protein content enhances the absorption of minerals in livestock. Thus, an efficiency of absorption of many minerals differs greatly among the ruminants. However, the mineral contents of the plants vary widely with season, place and among plant species. Hence, the commercial mineral mixture that are being used in Mithun inhabited places without understanding the mineral profile of forest based foliage would surely be an obsolete in the era of feeding area specific mineral mixture, which is at wider applicability and adaptability. Forest based foliage were collected and screened for the mineral content (Table 1-3), the scientific names of the forest based foliage were identified by the Botanical Survey of India, Shillong.	

Table 1. Minerals concentration in forest based foliages collected from Arunachal Pradesh

Name of the forest-based foliage		**Macro-mineral (% DM basis)**					**Micro-mineral (mg/kg)**			
Local Name	**Botanical Name**	**Ca**	**P**	**Mg**	**Na**	**K**	**Cu**	**Fe**	**Mn**	**Zn**
Tao	*Ficus roxburghii*	2.31	0.18	0.82	0.040	2.11	7.70	460	102	63.1
Taachin	*Ficus racemosa*	3.10	0.40	0.55	0.031	1.93	15.1	183	110	79.3
Nyeihi	*Ficus hirta*	2.08	0.24	0.31	0.026	1.83	7.35	210	144	51.6
Aa-hate	*Dendrocalamus hamiltonii*	2.70	0.16	0.45	0.028	1.95	12.3	461	74.2	23.6
Taan yaan	*Pouzulzia sanguinea*	2.12	0.22	0.74	0.029	2.73	11.7	218	112	35.8
Hara	*Macaranga denticulata*	1.98	0.27	0.63	0.041	0.71	10.8	310	117	72.9
Dae-dasa	Melastomia sp.	2.36	0.23	0.50	0.027	1.35	5.70	361	123	34.0
Rudie	*Phegopeteris auritica*	2.07	0.20	0.83	0.011	2.11	6.31	231	84.0	211
Tayir	*Litsea cintreta*	2.91	0.33	0.32	0.026	1.94	14.6	219	91.4	35.9
Perelough	*Sita acuta*	2.06	0.21	0.28	0.015	2.13	12.3	195	102	48.7
Yal	*Trema orientalis*	3.41	0.38	0.70	0.025	1.87	11.0	282	38.7	430
Gansap	*Crassocephalum craposids*	1.07	0.17	0.72	0.036	2.21	7.91	179	42.1	127
Remter	*Mastersia assamica*	2.11	0.23	0.34	0.034	3.10	6.34	163	112	163
Yare	*Piper peticellosum*	1.07	0.27	0.18	0.017	2.47	7.88	217	156	125
Nik-nare	*Oreochnide integrifolia*	1.23	0.31	0.34	0.036	2.27	9.62	121	60.8	71.0

Name of the forest-based foliage		Macro-mineral (% DM basis)					Micro-mineral (mg/kg)			
Local Name	**Botanical Name**	**Ca**	**P**	**Mg**	**Na**	**K**	**Cu**	**Fe**	**Mn**	**Zn**
Donyibubch	*Lenia indica*	1.75	0.14	0.69	0.027	1.91	7.31	179	76.0	61.4
Pahe	*Seteria pamifolia*	1.35	0.23	0.24	0.012	1.67	11.3	210	89.7	48.9
Ekembin	*Polygonum runcinatum*	1.60	0.31	0.37	0.061	2.18	14.6	186	103	121
Leanyetoku	*Ficus fistulosa*	2.11	0.34	0.54	0.007	2.39	11.3	172	57.1	34.8
Gahorisopa	*Magnolia pterocarpa*	3.14	0.12	0.57	0.026	2.38	10.4	137	67.0	47.6
Koplopya	*Daubanga grandiflora*	2.79	0.24	0.81	0.200	2.70	19.6	119	107	55.2
Byake	*Solanum kurzii*	2.91	0.31	0.50	0.038	2.37	18.2	210	120	107
Chuchum	*Ficus.sp.*	2.35	0.27	0.37	0.040	2.86	11.3	213	62.6	111
Donyichurd	*Mussanda roxburghii*	2.02	0.30	0.71	0.020	2.52	7.25	281	123	108
Tale	*Wallichia densiflora*	1.78	0.19	0.64	0.008	2.04	11.8	211	91.4	113
Telpep	*Hedychium spicatum*	2.34	0.23	0.52	0.050	2.66	13.6	186	180	123
Jehea	Thysaloena sp.	1.75	0.31	0.84	0.050	2.30	10.3	133	74.0	107
Echintayin	*Costus specious*	1.64	0.24	0.34	0.020	2.76	14.2	128	41.9	116
Hujhobup	*Polygonum sp.*	2.12	0.28	0.17	0.040	2.68	8.64	148	109	76
Tatumnalu	*Pilea glaberrima*	1.94	0.20	0.30	0.036	2.08	10.5	214	81.1	113
Paph	*Hedychium flavum*	2.19	0.34	0.27	0.047	1.17	13.5	181	52.0	81.0
Kuto	*Ficus sp.*	2.79	0.23	0.39	0.010	1.58	7.61	182	82.4	73.7
Poahibu	*Thumbergia*	3.10	0.18	0.34	0.031	1.61	18.6	163	44.6	46.8
Baum	*Angiopetris evecta*	2.33	0.16	0.78	0.024	2.05	9.61	175	34.1	35.4
Phapumlalu	*Sterculia villosa*	2.71	0.30	0.17	0.035	1.82	7.26	257	32.3	41.5
Techir	*Pinnaga gracilis*	2.04	0.28	0.23	0.010	1.36	6.21	237	76.0	127
Puprarninch	*Saurauia roxyburglis*	2.94	0.19	0.34	0.024	1.35	10.3	169	61.4	104
Tago	*Brassigophis hainla*	1.93	0.24	0.81	0.010	2.58	12.2	267	69.5	63.7

Table 2. Macro-mineral and micro-mineral concentration in some of selected foliage of Medziphema area of Nagaland

		Macro-mineral (% of DM)					Micro-mineral (mg/kg)			
Local name	**Botanical Name**	**Ca**	**P**	**Mg**	**Na**	**K**	**Cu**	**Fe**	**Mn**	**Zn**
Thumero	*Lagerstroemia speciosa*	1.93	0.38	0.51	0.028	1.83	8.27	132.2	144[g]	51.52
Thedie	*Trema orientalis*	3.32	0.47	0.68	0.026	1.95	10.9	271.7	36.6	424.4
Pre	*Ficus bengalensis*	1.62	0.26	0.22	0.028	0.71	15.1	310.1	120	51.35
Dzapri	*Oroxylum indicum*	2.56	0.22	0.84	0.041	2.47	7.34	325.8	168	108.4
Khusia	*Melia azadiracta*	2.66	0.40	0.59	0.027	2.73	12.1	467.3	71.1	107.5
Tego	*Bauhinia hookeri*	2.11	0.29	0.52	0.011	2.49	14.6	184.3	206	224.6
Rambeinei	*Ficus elmeri*	2.40	0.24	0.81	0.092	2.21	5.70	594.7	103	77.70
Heratunei	*Ficus dalhousiae*	3.11	0.41	0.57	0.038	1.97	19.2	184.8	110	68.10

		Macro-mineral (% of DM)					Micro-mineral (mg/kg)			
Local name	**Botanical Name**	**Ca**	**P**	**Mg**	**Na**	**K**	**Cu**	**Fe**	**Mn**	**Zn**
Regapa	*Bauhinia variegata*	2.80	0.24	0.41	0.015	2.11	6.30	210.1	52.7	79.10
Tambuinei	*Callicarpa vestita*	3.30	0.37	0.57	0.036	3.10	17.1	178.0	69.4	118.7

Table 3. Macro and micro mineral concentration in some of selected foliage of Manipur

Local Name	**BotanicalName**	**Micro (mg/kg)**			**Macro (%)**				
		Zn	**Fe**	**Cu**	**Ca**	**P**	**Mg**	**Na**	**K**
Nake	Calicarpa arborea	92	267	18	2.10	0.11	0.26	0.01	2.10
Lingshi	*Sarcochlamys pulcherrima*	83	219	7	2.00	0.30	0.14	0.03	2.16
Shontakhao	-	58	181	6	1.77	0.21	0.57	0.02	1.13
Nehei	*Tithonia rotundifolia*	63	280	12	1.95	0.11	0.25	0.04	1.75
Anshunglung Lhempa	*Elastostema spp*	59	208	5	3.10	0.17	0.63	0.07	1.70
Vaopa	Bauhinia hookeri	85	168	9	2.65	0.28	0.11	0.06	2.02
Shilgil	*Calicarpa macrophylla*	82	302	7	2.50	0.30	0.58	0.02	2.01
Chelmanchak	Urena lobata	78	268	11	2.10	0.24	0.95	0.05	2.40
Theiba	Ficus spp	77	180	13	1.65	0.24	0.21	0.01	1.81
Boapha	*Gentiana spp*	77	195	19	1.56	0.11	0.07	0.05	1.61
Theichang	Ficus incurva	66	168	7	2.10	0.12	0.24	0.03	1.40
Shakhikeng	*Solanum spp*	53	175	8	2.35	0.11	0.61	0.01	1.75
Lhakhai	*Urtica dioica*	87	291	7	2.65	0.10	0.11	0.02	1.31
Thom	*Leucosceptrum canum*	63	221	6	2.20	0.23	0.17	0.04	1.25
-	*Sarcochlamys spp*	66	241	12	3.10	0.20	0.14	0.07	1.50
Antheichan	*Ficus silhetensis*	76	265	14	3.10	0.19	0.24	0.02	2.44
Teithing	-	61	188	11	1.63	0.20	0.22	0.01	1.67
Chepi	*Sauriara panduana*	85	203	9	2.14	0.13	0.17	0.03	2.15
Mongche	*Ficus spp*	57	146	12	2.20	0.21	0.19	0.04	1.65
Longlao	*Neyraudia reynaudiana*	37	225	9	2.10	0.33	0.27	0.01	2.14
Kaichin	*Rubus spp*	70	265	13	2.00	0.20	0.34	0.02	1.35
Gongngal	Thysalona agrostis	85	156	10	2.30	0.12	0.11	0.03	2.10
Anthudul	*Herpetospermum spp*	65	198	8	2.14	0.20	0.10	0.07	1.35
Khaogui	*Vitex spp*	75	253	10	2.50	0.30	0.71	0.05	2.01
Belkan	*Verbena spp*	86	255	5	1.65	0.34	0.09	0.08	1.65
Chinge	-	71	177	12	1.47	0.28	0.12	0.08	1.24
Theijon	Ficus hirta	74	296	9	1.90	0.36	0.17	0.01	2.14
Cmuntheh	-	81	221	11	1.71	0.20	0.24	0.05	1.99

Local Name	BotanicalName	Micro (mg/kg)			Macro (%)				
		Zn	Fe	Cu	Ca	P	Mg	Na	K
Phaileng	Imperata cylindrica	76	210	6	2.01	0.13	0.31	0.04	1.05
Sheijeplhem	*Herpetospermum spp*	65	177	8	2.50	0.31	0.42	0.03	1.52
Uilivun	*Passiflora foetida linn*	57	265	9	2.35	0.11	0.24	0.01	1.68
Ngalbu	*Cynodon dactylon*	98	156	10	1.95	0.30	0.31	0.01	1.74
Louthul	Allium spp	73	168	7	2.65	0.21	0.65	0.04	0.95

The forest based foliage contained Ca and K above the normal required range for ruminants (McDowell, 1997). P content is found to be within the normal required range, but the Na content is deficient in most of the foliage. The deficiency of Na in the foliage may be the reason that Mithuns under free-grazing condition show the salt hunger behavior. Further, the Ca P ratio is found to be much higher in all the foliage than that recommended for ruminants (McDowell, 1997). It is likely that Ca:P ratio would be wider if animals thrive solely on these foliage. The wider Ca:P ratio may create problem with vitamin D metabolism (ARC, 1984). High Ca level may lower P absorption as a result of the formation of an insoluble complex of Ca and P. The level of Fe, Mn and Zn is higher in all the species compared to the normal required range, but Cu content is within the required range. High level of Fe may interfere with the Cu absorption and metabolism. Higher Mg content in the foliage may interfere with the absorption of Ca.

The availability of minerals to animals in appropriate quantity is a prerequisite for better health. Mineral content of the tree leaves are much higher. But, minerals are liable to form bonds and interact more than any other nutrient substances. Thus, an efficiency of absorption of many minerals differs greatly among the ruminants. However, the mineral contents of the plants vary widely among plant species and different places. Hence, the commercial mineral mixture that are being used in Mithun inhabited places without understanding the mineral profile would surely be an obsolete in the era of feeding area specific mineral mixture, which is at wider applicability and adaptability. Therefore, an area specific mineral mixture was computed as follows.

1. Different forest based foliage were screened for mineral contents
2. Bio availability of each mineral from the tree leaves was calculated basing on the available literature
3. Based on the daily nutrient intake and bio availability of minerals, an actual mineral requirement was calculated for Mithun

4. Likewise for some of the elements were calculated net requirement basing on the available information published in annual reports and mineral composition of foliage from the different sources and the composition of computed the mineral mixture for 100 g as follows.

Chemicals	Quantity (grams)
Di-calcium phosphate	41.52
Copper sulfate	3.987
Manganese sulfate	4.610
Cobalt chloride	0.0239
Sodium selenite	0.0217
Sodium chloride	49.84

4	**Target users/stakeholders**	Mithun farmers
5	IPRs status	Trademark granted on 13.08.2015

Details of Inventors

1	**Principal Inventor**	Dr. Bukya Prakash
2	**Principal Inventor Designation**	Ex Scientist of ICAR-NRC on Mithun, Nagaland
3	**Principal Inventor Email**	drbhukyaprakash@gmail.com

Figure 17: Preparation of the area specific mineral mixture mix

Figure 18: Packaging of the area specific mineral mixture mix

11.0 STANDARDIZATION OF CRYOPRESERVATION PROTOCOL FOR MITHUN EMBRYOS

1	**Technology Name**	**Standardization of cryopreservation protocol for Mithun embryos**
2	**Technology Related to**	Mithun reproduction
3	Complete Details of Technology	After recovery from the donors animal, the embryo was evaluated and washed in DPBS medium followed by embryo equilibration in solution -1 for 5 min (10% glycerol + 0.125M sucrose + 0.125M Dextrose +10%FCS in PBS) and in solution -2 for 5 min (10% glycerol +10% ethylene glycol + 0.25M sucrose +0.25M Dextrose + 10% FCS in PBS). After that embryo was placed in pre-cooled (4°C) virtification solution (20% glycerol + 20% EG + 0.375M sucrose +0.375M dextrose +10% FCS in PBS). Immediately aspiration of embryos (within 60 sec) in a 0.5 ml French straw loaded with 0.5M sucrose and sealed with PVA powder. The straw was kept on liquid nitrogen vapour for 1 min then plunged into LN2 (-196°C). On the 100th day, the embryo was transferred into a recipient animal and MOHAN, the first Mithun calf was born on May, 12, 2012 through embryo transfer technology (ETT) from a cryopreserved embryos.
4	**Target users/ stakeholders**	Mithun Scientists/breeders

Details of Inventors

1	**Principal Inventor**	Dr. M. H. Khan
2	**Principal Inventor Designation**	Principal Scientist
3	**Principal Inventor Email**	Haider.Meraj@icar.go.in
4	**Principal Inventor Address**	ICAR-NRC on Mithun, Nagaland
5	**Co-Inventor(s) Name**	Dr. Vikram R.

12.0 OVULATION PREDICTOR AND TIMING OF ARTIFICIAL INSEMINATION CHART FOR MITHUN

1	**Technology Name**	**Ovulation predictor and timing of artificial insemination chart for Mithun**
2	**Technology Group**	Novel method
3	Technology Related to	Timely artificial insemination
4	**Complete Details of Technology:** The duration of estrous is in the range of 36-84 h in Mithun. The ideal time of insemination relative to ovulation is important to obtain higher conception rates. The cervical mucus changes (colour, consistency and fern pattern)arebeneficial to determine the ideal time of insemination and predict ovulation time. Ovaries of Mithun cows were examined every 3rd hour by transrectal ultrasound from mid-estrus thereafter until ovulation. The cervical mucus was collected daily morning and evening by mid-cervical aspiration using sterile blue sheathsfrom the start of estrus to ovulation.The characteristic caseous or white-coloredthick consistency cervical mucus was observed during met-estrous in 66.66% estrous cycles along with ovulation or ovulation occurring within the range of 4.5 - 7.5 h after the appearance of white mucus. Microscopically mucus showed an absence of fern pattern and polymorphonuclear neutrophils (PMN) infiltration. The appearance of characteristic sticky caseous white cervical mucus during metestrus can be used as a tool to predict ovulation time under physiological conditions.	
5	**Brief Description of Technology including Salient Features:** The ovulation predictor and timing of artificial insemination (AI) chart for Mithun is beneficial for determining the ideal time for AI relative to ovulation in Mithun. The cervical mucus changes (colour, consistency and fern pattern)can be used to inseminate during mid-estrus to obtain higher conception rates.	
6	**Target users/stakeholders**	Veterinary professionals
7	**IPRs status**	Copyright applied for artistic work for "Ovulation predictor and timing of artificial chart for Mithun", Diary Number: 30715/2021-CO/A

Details of Inventors

1	**Principal Inventor**	Dr. Vikram R.
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	Vikram.r@icar.go.in
4	**Principal Inventor Address**	Scientist, ICAR-NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. M. H. Khan

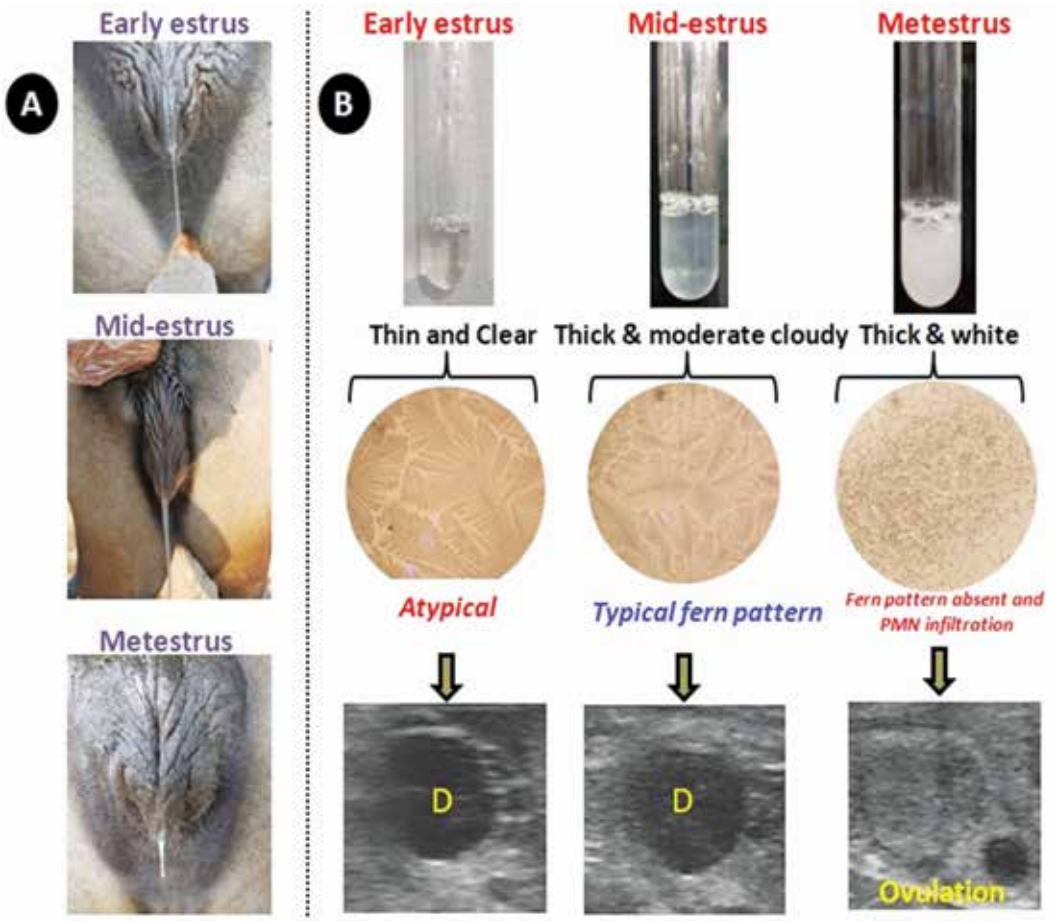


Figure 19. A: Appearance of mucus at different phases of estrous immediately after transrectal examination in Mithun. B: Cervical mucus characteristics such as colour, consistency and arborization/fern pattern at different phases of estrous corresponding to dominant follicle status.

13.0 COLLECTION BY ELECTRO-EJACULATION TECHNIQUE IN MITHUN

1	**Technology Name**	**Semen collection by Electro-ejaculation technique in Mithun**
2	**Technology Group:**	**Novel method/process**
3	**Technology Related to:**	**Genetic Improvement of a breed**
4	Complete Details of Technology: The semen was collected once in a week by Electro-ejaculation (EE) method. The preputial area was cleaned, washed with 1:1000 potassium permanganate solution and dried using paper towels. A gloved and lubricated hand was inserted trans-rectally to evacuate the dung and to sexually stimulate the bull for 4–5 min. An electro-ejaculator (ElectroJac 6, Model no: Z46724N, Neogen® Corporation, Lansing, USA) was used to collect semen. Probe length, probe diameter and electrode (three longitudinal) length were 33 X 5.1 X 28 cm respectively. The probe was inserted and controlled by a trained technical person. The EE was set on automatic mode; the electric current was passed into the probe starting with 1 volt (each volt lasted for 2 sec.) and gradually increased from 1 volt per 2 sec. till it reaches a maximum of 40 Volts. Following the insertion of the rectal probe, EE was switched on and continued until ejaculation. The initial clear watery discharges were avoided, and thicker milky ejaculates were collected. The animals which failed to ejaculate in single stimulation were subjected to second stimulation.	
5	**Target users/stakeholders**	Scientific professional
6	**ICAR Technology Certification**	Technology certified by ICAR in 2023
7	**IPRs status**	Copyright applied for cinematograph film for "Collection, Evaluation and Freezing of Mithun Semen", Diary Number: 19872/2022-CO/CF

Details of Inventors

1	**Principal Inventor**	Dr. M. H. Khan
2	**Principal Inventor Designation**	Principal Scientist
3	**Principal Inventor Email**	Haider.Meraj@icar.go.in
4	**Principal Inventor Address**	Principal Scientist, ICAR-NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Vikram R. Dr. Kobu Khate Dr. Sapunii Stephen Hanah

Figure 20: Semen collection by Artificial Vagina (AV) and Electro-Ejaculation (EE) methods

14.0 MITHUN AS A DRAUGHT ANIMAL

1	**Technology Name**	**Mithun as a draught animal**
2	**Technology Related to**	**Mithun farmers**
3	**Complete Details of Technology**	North-Eastern regions are known for its hilly terrain and due to this, utilization of mechanized agricultural implements is very difficult in agricultural activities like ploughing especially in those terrain. However, Mithun which are reared on this difficult terrain are able to walk swiftly without any difficulty. So, in order to utilize this magnificent animal in ploughing operation, ICAR-NRC on Mithun has started training of selected Mithun bulls from a young age for easy control of animals. As we know that Mithun are reared mostly for meat purpose, however it has potential for draught purpose also. For those poor farmers residing in hilly areas and who has Mithun along with agricultural lands can efficiently utilize this animal in ploughing operation. Apart from ploughing, Mithun bulls can also be used in carting operation with proper training. Mithun cart can be useful in the transportation of goods, food grains and supplies in village areas where automobile facilities are minimal. Utilization of this animal apart from meat, it can help in improving the income generation source of farmers from the available resources.
4	**Target users/ stakeholders**	Mithun farmers

Details of Inventors

1	**Principal Inventor:**	Dr. Laishram Sunitibala Devi
2	**Principal Inventor Designation:**	Scientist
3	**Principal Inventor Email:**	sunitibala.laishram@icar.gov.in
4	**Principal Inventor Address:**	ICAR-NRC on Mithun, Medziphema
5	**Co-Inventor (s) Name:**	Dr. S.S Hanah Dr. Kezhavituo Vupru Dr. Nazrul Haque Dr. H. Lalzampuia

Figure 21: Mithuns bulls being used and trained as draught animals

15.0 MITHUN BODY CONDITION SCORING SYSTEM (MBCSS)

1	**Technology Name**	**Mithun Body Condition Scoring System (MBCSS)**
2	**Technology Related to**	**Mithun especially lactating Mithun cows**
3	**Complete Details of Technology**	Mithun body condition scoring system (MBCSS) is the most practical management tool designed to assess body fat accumulation and nutritional status of Mithun cows. It is a numerical rating system based simply on a visual appraisal of key anatomical sites. The scale for MBCSS ranges from 1 to 5 with midrange score 3 representing ideal body condition, lower scores (1, 2) representing thin or very thin conditions and higher scores (4, 5) indicating excessive body fat. With practice, MBCSS is easy to learn and apply in farm/field/free-range conditions and can be readily incorporated into physical examination to assess the health and nutrition of Mithun cows. MBCSS technology is useful for Mithun farmers, veterinary professionals and farm personnel for immediate assessment of body reserves and overall health status of Mithun cows.
4	**Target users/stakeholders**	Mithun farmers, Traders and Veterinary professionals
5	**IPRs status**	Copyright applied for artistic work for "Mithun Body Condition Scoring System (MBCSS)", Diary Number: 21591/2022-CO/A

Details of Inventors

1	**Principal Inventor**	Dr. Vivek Joshi
2	**Principal Inventor Designation**	Scientist (Veterinary Medicine)
3	**Principal Inventor Email**	joshignet@gmail.com
4	**Principal Inventor Address**	ICAR-Indian Veterinary Research Institute, Itanagar, Bareilly, Uttar Pradesh 243 122
5	**Co-Inventor(s) Name**	Dr. J. K. Chamuah Dr. Vikram R. Dr. Kobu Khate

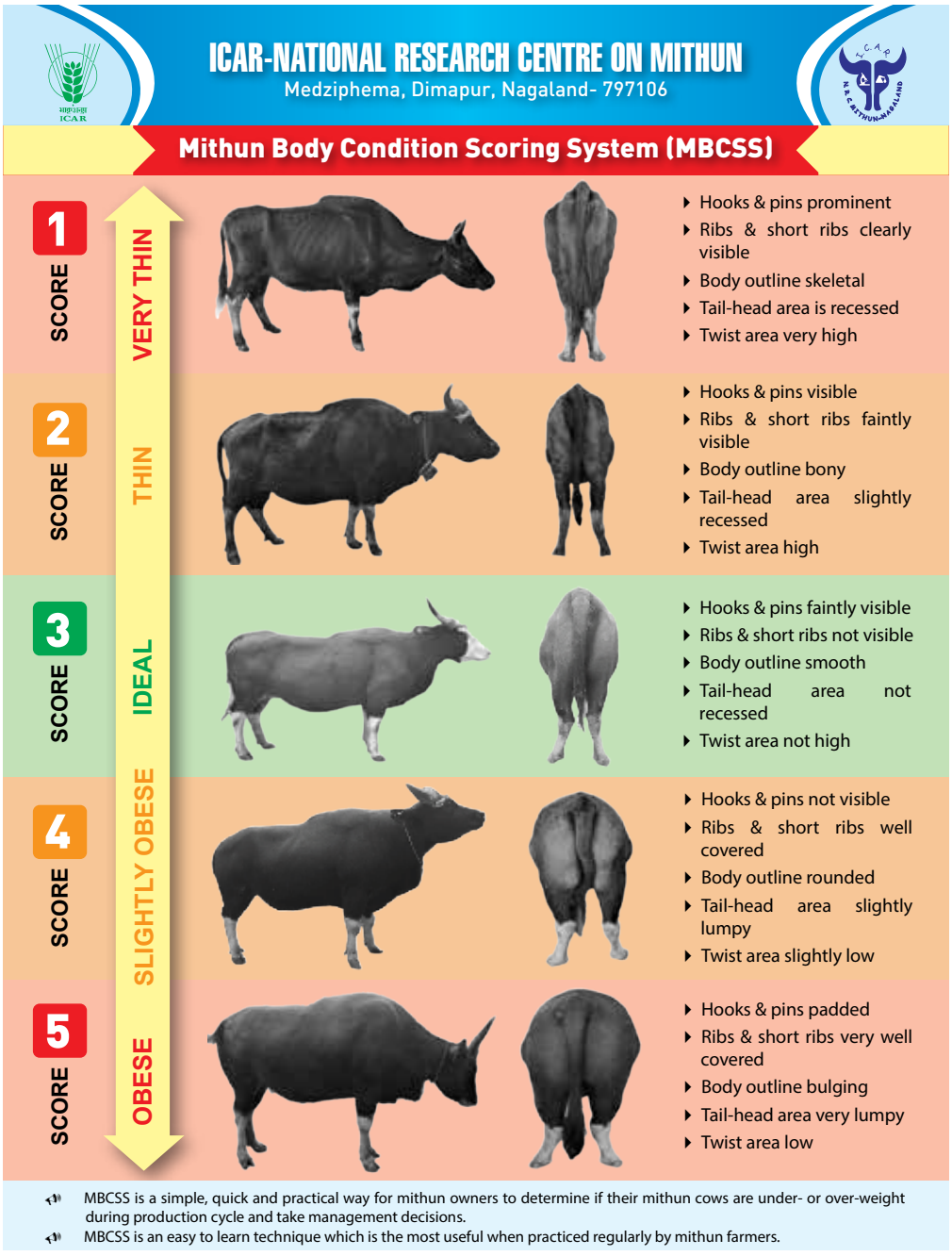


Figure 22: Chart for Mithun Body Condition Scoring System (MBCSS)

16.0 A METHOD FOR BIO-PRESERVATION OF MITHUN HIDES

1	**Technology Name**	**A method for bio-preservation of Mithun hides**
2	**Technology related to**	**Leather industry**
3	**Complete Details of Technology**	Treating raw hides with the solutions standardizedby the inventors for one hour has been demonstrated to effectively preserve the hides or skins for extended periods, often lasting for several months. Moreover, these solutions exhibit a remarkable capacity to rehydrate hides and skins with exceptional efficiency. Furthermore, these solutions facilitate the depilation process with great ease. When an aged solution of wheat bran is introduced to the composition and screened appropriately, a notably improved and clean depilation outcome can be achieved. The research materials employed in this study encompassed pure bacterial cultures, including Lactobacillus plantarum T-105 in desiccated form sourced from Warminsko-Mazurski University, along with Lactobacillus rhamnosus strains denoted as "PEN," "EN," and "OXY," which are integral components of Lakcid forte medicine commercially available in drugstores. The nutritional support for these bacteria consisted of MRS Agar and MRS Broth, manufactured by Fluka Co. To assess the survival rate of the bacteria in an acidic pH environment, inoculation of the bacteria's inoculum was carried out using MRS liquid nutrient at a concentration of 10^{10} CFU per 1 ml. The pH levels of the environment were controlled by adjusting with varying amounts of lactic acid, and measurements were conducted using the potentiometric method. A given pH range within the spectrum of 2-6 was stabilized using Titrisol buffer solution provided by Merck Co. The bacterial culture of Lactobacillus plantarum T-106 was maintained at a temperature of 30°C, while the bacterial culture treated with Lakcid nutrient was cultivated at a temperature of 37°C, both for a duration of 48 hours.

		Subsequently, both cultures were subjected to room temperature conditions for a period extending to one month. The quantification of viable bacteria was executed utilizing the flooding method for inoculation onto Petrie's plates. Simultaneously, the quantification of viable bacteria in distinct pH media was conducted through nephelometric analysis employing a wavelength of 660 nm (λ: 660 nm). In order to assess the impact of environmental pH on the survival rate of the selected lactic acid bacteria, a two-factor variance analysis with repetitions was conducted using the Excel '97 spreadsheet.
4	Target and stake holders	Entrepreneurs and Mithun farmers
5	IPRs status	Patent granted on 11.12.2019, Patent No. 1402/KOL/2012

Details of Inventors

1	**Principal Inventor**	Dr. G. Mukherjee
2	**Principal Inventor Designation**	Professor
3	**Principal Inventor Email**	gmclt@hotmail.com
4	**Principal Inventor Address**	Government College of Engineering and Leather Technology, LB Block, Sector - III, Salt Lake City, Kolkata - 700 098
5	**Co-Inventor(s) Name**	Dr. K.K. Baruah Dr. C. Rajkhowa

17.0 A METHOD FOR PROCESSING RABBIT PELTS AND FUR

1	**Technology Name**	**A method for processing rabbit pelts and fur**
2	**Technology Related to**	Leather Industry
3	**Complete Details of Technology**	The invention pertains to a straightforward tanning method that can be easily executed even by unskilled farmers. Rabbit pelts have limited demand, especially those of young rabbits (referred to as "baby prime" up to 12 weeks old) which are not highly valued in the fur industry. "Junior prime" (up to five months old) is occasionally used, but "senior prime" (adult) is preferred. Homestead rabbit raisers aiming for the commercial market often face a challenge because most rabbits have small, thin pelts, and homesteaders typically butcher their rabbits for meat between 6 to 10 weeks of age, yielding 2 to 2-1/2 pounds of cleaned meat. A compromise between pelt quality and meat production can be achieved by butchering rabbits at 12 to 16 weeks of age, producing 3- to 4-pound "roasters" with thicker skins, although such fur is not commercially desirable. Additionally, rabbit hides undergo seasonal cycles. Winter pelts, obtained from fully mature rabbits during the coldest months, are ideal for the commercial market. However, summer pelts, while less valuable in the fur trade, can be useful for items like moccasins that require sturdy leather. Fur type and color are more important to fur buyers than to homesteaders. Raising mixed-color rabbits with "Normal" fur, about an inch in length with fine wool close to the skin and longer guard hairs, is common. "Satin" fur, also about an inch long, is intensely colored and lustrous due to thin hair shafts encased in a transparent shell. **Tanning Process Overview:** Sacrifice the rabbit and remove its head. Suspend the rabbit by one or both back legs to allow blood drainage. Flay the rabbit by cutting around each hind foot and slitting the hide inside each leg. Strip the skin from the carcass, being careful not to slice into the meat. Use fingers or a sharp skinning knife to loosen difficult spots. Soak the freshly flayed hide in cold water while processing the meat.

		Washing and Cooling the Skin: Rinse skins thoroughly in cold water to cool them quickly. Ensure all blood is washed away as it can cause permanent stains. Squeeze (do not wring) excess water from the pelt. Skins can be preserved by freezing, bio preservation, drying on a stretcher, or salting and drying. **Drying and Fluffing:** Hang pelts in the shade until they are almost dry. Finish drying in an electric dryer with no heat to make the fur easier to work with.
		Working the Leather: Stretch partially dried hides in all directions to soften the leather, a process known as breaking the skin. Be firm but avoid excessive force to prevent tearing. Tack "broken" hides to a board or frame to encourage flat drying. **Finishing and Storage:** Brush the fur with a small hairbrush. Massage mink oil into the skin side for softness. Buff the leather with pumice or fine sandpaper for a soft, velvety feel. Store rabbit pelts in a cardboard box with a bar of soap to repel insects. Sewing Rabbit Fur: Create a pattern for each piece to be cut. Organize pattern pieces on the skin side of the pelt. Sew pelts together if needed. Sew by hand or machine using appropriate needles and thread. Flatten seams and hem edges with a warm, damp cloth. **Alternative Tanning Processes:** • The described method is chemical tanning. • Vegetable and oil tanning are not suitable for rabbit skins. • Other chemical processes require additional equipment and complicated ingredients. • Note: Prevent hairslip by ensuring the tanning solution contacts all parts of each hide, avoiding storing pelts in the solution above 80°F, and trimming away damaged sections if hairslip occurs.
5	**Target users/ stakeholders**	Leather Industry
6	**IPRs status**	Patent application under process, application No. 1334/KOL/2012

Details of Inventors

1	**Principal Inventor**	Dr. R. K. Singh
2	**Principal Inventor Designation**	Senior Scientist & Head
3	**Principal Inventor Email**	rksingh3@gmail.com
4	**Principal Inventor Address**	KVK, Phek, Nagaland
5	**Co-Inventor(s) Name**	Dr. C. Rajkhowa Dr. K.K. Baruah Dr. G. Mukherjee

18.0 A METHOD OF PROCESSING RABBIT FUR ON LEATHER

1	**Technology Name**	**A method of processing rabbit fur on leather**
2	**Technology related to**	Leather industry
3	**Complete Details of Technology**	The rabbit hides undergo a specific preservation methodology, with minimal mechanical action for optimal finishing effects. All percentages are calculated based on the dried weight of the hides. **Application of Specially Formulated Paste for Rabbit Hides:** 1st Step: Dispersing Agent: 1% Water: 800% Tumble for 10 minutes per hour in a tumbler soaked overnight using this method. 2nd Step: Pre Tan Paste: 5% Water: 60% Tumble for 10 minutes per hour in a tumbler for 6-8 hours, then soak overnight in a bath. Next day, run the tumbler briefly. Maintain pH: 2.2-2.5 3rd Step: Tan I Paste: 400 parts Water: To make a paste Apply the paste on the flesh side and leave it overnight, flesh to flesh. µ Tan II Paste Application: The next day, apply the 2nd specially formulated paste as follows: Tan II Paste: 500 parts Water: To make a paste Apply the paste on the flesh side and leave it for several hours with moderate penetration. Application of Fresh Specially Formulated 3rd Paste: Apply the 3rd paste with the following chemicals: Tan III Paste: 350 parts Preservative: 0.2% Water to make a paste Apply the solution on the flesh side and leave it for 5 hours.

		Composition Details of Pre Tan and Tan Pastes: 1. Pre Tan Paste: Water: 60% Common Salt: 7% Sodium Formate: 1% Formic Acid: 0.75% Sulphuric Acid: 0.75% 2. Tan I Paste:
		Vegetable-based weak cationic fat: 200 parts Chronic dispersing agent: 50 parts Basic Chrome Sulphate: 400 parts Sulphuric Acid: 20 parts 3. Tan II Paste: Vegetable-based amphoteric fat: 200 parts Sulphited fish oil: 200 parts Chrome dispersing agent: 50 parts Basic Chrome Sulphate: 300 parts 4. Tan III Paste: Basic chrome salt: 200 parts Sodium formate: 150 parts Sodium Sulphate: 150 parts Please note that these detailed processes and compositions are essential for preserving and tanning rabbit hides effectively.
4	**Target and stake holders**	Leather industry
5	**IPRs status**	Patent granted on 15.05.2023, Patent No. 192/KOL/2013

Details of Inventors

1	**Principal Inventor**	Dr. G. Mukherjee
2	**Principal Inventor Designation**	Professor
3	**Principal Inventor Email**	gmclt@hotmail.com
4	**Principal Inventor Address**	Government College of Engineering and Leather Technology LB Block, Sector - III, Salt Lake City, Kolkata - 700 098
5	**Co-Inventor(s) Name**	Dr. C. Rajkhowa Dr. R. K. Singh Dr. K.K. Baruah Dr. B. Chattopadhyay

19.0 A METHOD OF REMOVAL OF CHROMIUM FROM CHROME LIQUOR OBTAINED AFTER PROCESSING OF MITHUN HIDES

1	**Technology Name**	**A method of removal of chromium from chrome liquor obtained after processing of Mithun hides**
2	**Technology related to**	Leather industry
3	**Complete Details of Technology**	Eco-friendly treatment of exhaust chrome liquor for removal of chromium and recycling the float" process: • Chromium Removal: Exhaust chrome liquor from tanning hides is mixed with conventional exhaust soak liquor and refluxed. This process precipitates chromium, leaving a clear supernatant. • Simplicity and Efficiency: The treatment is straightforward, allowing unit operation wastewater to react effectively, reducing pollution levels. • Water Conservation: The process significantly reduces water consumption by recycling bathwater from soaking, pickling, chrome tanning, basification, and wash operations, helping to combat groundwater depletion. • Improved Water Quality: The treated water contains no chromium and can have a reduced COD (Chemical Oxygen Demand) value, enhancing its quality. • Chromium Recovery: Precipitated chromium can be recovered and reused for tanning, eliminating the disposal issue. **Ease of Operation**: The treatment process is operator-friendly and easy to manage. **pH Independence**: Unlike conventional methods, this process is not pH-dependent, simplifying maintenance. In both conventional and eco-friendly chrome tanning processes, steps like liming, soaking, and tanning are carried out, with eco-friendly methods streamlining operations, improving water quality, and conserving resources.
4	**Target & stake holders**	Leather industry
5	**IPRs status**	Patent granted on 02.08.2023, Patent No. 183/KOL/2013

Details of Inventors

1	**Principal Inventor**	Dr. G. Mukherjee
2	**Principal Inventor Designation**	Professor
3	**Principal Inventor Email**	gmclt@hotmail.com
4	**Principal Inventor Address**	Government College of Engineering and Leather Technology LB Block, Sector - III, Salt Lake City, Kolkata - 700 098
5	**Co-Inventor(s) Name**	Dr. C. Rajkhowa Dr. K.K. Baruah Dr. K. C. Das Prof. G. K. Biswas Dr. B. Chattopadhyay Dr. S. Chakraborty

20.0 A NOVEL METHOD OF CHROME TANNAGE OF MITHUN HIDES WITH GLYOXALIC ACID

1	**Name of the technology**	**A novel method of chrome tannage of Mithun hides with Glyoxalic Acid.**
2	**Technology Related To**	**Leather Industry**
3	**Complete Details of Technology**	Glyoxalic acid, typically found in a 40% aqueous solution with a clear, pale yellow color and a sharp odor resembling formic acid, plays a crucial role in exhaustion chrome tannage. It possesses the characteristics of a typical organic acid, such as forming salts, esters, and amides. Its unique ability to react with metals and form complexes through the carboxylic acid group is essential in tanning. The key to glyoxalic acid's chrome-saving and chrome-fixing properties lies in the combination of two functional groups: the carboxylic acid and aldehyde groups. Aldehydes are highly reactive, and glyoxalic acid's electron-withdrawing carboxyl group enhances this reactivity. This unique combination allows glyoxalic acid to efficiently interact with chrome in tanning processes. Collagen, the main protein in hides and skins, contains various amino acids categorized into non-polar, polar, acidic, and basic groups. The basic amino acids, such as lysine and hydroxylysine, are of primary interest. Glyoxalic acid reacts with these basic amino acids, converting them into carboxylic acids. This reaction is vital in tanning processes. In collagen fibrils, binuclear chrome complexes link two polypeptide chains from different fibrils. The binding sites for these complexes are the carboxylic groups of glutamic and aspartic acids. This interaction contributes to the tanning process.
4	**Target users/ stakeholders**	Leather industry
5	**IPRs status**	Patent application under process, application No. 1276/ KOL/2012

Details of Inventors

1	**Principal Inventor**	Dr. G. Mukherjee
2	**Principal Inventor Designation**	Professor
3	**Principal Inventor Email**	gmclt@hotmail.com
4	**Principal Inventor Address**	Government College of Engineering and Leather Technology, LB Block, Sector - III, Salt Lake City, Kolkata - 700 098

5	**Co-Inventor(s) Name**	Dr. C. Rajkhowa Dr. K.K. Baruah Dr. K. C. Das Dr. C. Mandal Dr. B. Debnath Dr. B. Chattopadhyay

21.0 A PROCESS OF MAKING LEATHER WITHOUT ANY LARGE MACHINERY

1	**Technology Name**	**A process of making leather without any large machinery**
2	**Technology Related to**	Leather Industry
3	**Complete Details of Technology**	This invention presents a method for producing leather from Mithun hides, including the following steps: soaking the hides in a µ Pre Tan dispersing agent, treating them with µ Tan I, µ Tan II, and µ Tan III pastes consecutively, subjecting the leather to a drying and brushing process, and conducting moisture and chrome content analysis on the resulting leather. **Detailed Description of the Invention:** In this method, Mithun hides are initially soaked using a conventional µ Dispersing Agent. Subsequently, the soaked hides undergo treatment with µ Tan I, µ Tan II, and µ Tan III pastes in sequence, with intermediate piling up of the processed hides. The leather is then softened and brushed after drying. **Composition of Pastes:** **µ Pre Tan–Paste** Water: 60% Common Salt: 7% Sodium Formate: 1% Formic Acid: 0.75% Sulphuric Acid: 0.75% **µ Tan I Paste** Vegetable-based weak cationic fat: 200 parts Chrome dispersing agent: 50 parts Basic Chrome Sulphate: 400 parts Sulphuric Acid: 20 parts **µ Tan II Paste** Vegetable-based amphoteric fat: 200 parts Sulphited fish oil: 200 parts Chrome dispersing agent: 50 parts Basic Chrome Sulphate: 300 parts

		µ Tan III Paste Basic Chrome salt: 200 parts Sodium formate: 150 parts Sodium Sulphite: 150 parts **Analysis and Evaluation:** Chromium content in both experimental and conventional processes is analyzed in exhaust chrome liquor bath and leather samples. Shrinkage temperature, a measure of hydrothermal stability, is determined using a Theis shrinkage meter.
		Wastewater is analyzed for COD, TS, and TDS values in all unit operations up to tanning. Input-output audits are conducted for raw materials, water, chemicals, and associated products for both processes. Physical properties of the leather, including tensile strength, elongation at break, tear strength, softness, fullness, grain tightness, smoothness of grain, and general appearance, are evaluated following IULTCS norms. The tissue structure of tanned wet blue leather is compared between the experimental and conventional processes. Physical properties such as tensile strength, stitch tear strength, grain crack strength, and ball bursting strength are evaluated for all crust leathers. **Physical Properties Evaluation:** Symbols, such as + or –, are used to assess properties, with more symbols indicating better performance. **Note:** The description provides an overview of the invention's methodology, including the use of specific pastes and analysis of various properties and characteristics in the leather production process.
4	**Target users/ stakeholders**	
5	**IPRs status**	Patent granted on 19.05.2023, Patent No. 360/KOL/2012

Details of Inventors

1	**Principal Inventor**	Dr. K.C. Das
2	**Principal Inventor Designation**	Principal scientist
3	**Principal Inventor Email**	kcdasicar@gmail.com
4	**Principal Inventor Address**	Ex Scientist of ICAR-NRC on Mithun, Nagaland
5	**Co-Inventor(s) Name**	Dr. G. Mukherjee Dr. K.K. Baruah Dr. A. Mukherjee Dr. C. Rajkhowa Dr. B. Prakash

22.0 AN ENERGY EFFICIENT POST TANNING PROCESS FOR MITHUN HIDES

1	**Technology Name**	**An energy efficient post tanning process for Mithun hides**
2	**Technology Related To**	Leather industry
3	**Complete Details of Technology**	Mithun wet blues are divided into two groups: left sides processed conventionally (control), and right sides processed using an energy-efficient method. The focus is on three key aspects: Neutralization and Re-tanning: Provides stability and durability. Dyeing: Achieves desired fashion shades. Fat Liquoring: Gives softness and desired texture. A mild deacidification and masking process is applied to chrome leather, preserving grain quality. The energy-efficient process allows customization of chemicals for various leather characteristics. Temperature control impacts softness or grain tightness. Dyeing with soluble dyes results in brilliant shades and better fastness when dyes penetrate into the leather. Combining salt-free re-tanning agents with electrolyte-stable dyes is beneficial. Salt-free re-tanning agents and stable fat liquors yield positive results. However, dyeing and fat liquoring simultaneously affect shade intensity. Low-fat liquor concentrations aid dye penetration, while high concentrations reduce dye fixation, causing unleveled dyeing and poor fastness. Adding a bit of dye with fat liquor as an auxiliary can be considered.
4	**Target users/ stakeholders**	Leather industry
5	**IPRs status**	Patent granted on 13.04.2023, Patent No. 1277/KOL/2012

Details of Inventors

1	**Principal Inventor**	Dr. G. Mukherjee
2	**Principal Inventor Designation**	Professor
3	**Principal Inventor Email**	gmclt@hotmail.com
4	**Principal Inventor Address**	Government College of Engineering and Leather Technology LB Block, Sector - III, Salt Lake City, Kolkata - 700 098

5	**Co-Inventor(s) Name**	Dr. C. Rajkhowa Dr. K.K. Baruah Dr. K.C. Das Dr. C. Mandal Dr B. Debnath Dr. B. Chattopadhyay

23.0 AN IMPROVED METHOD FOR CHROME TANNING MITHUN HIDES

1	**Technology Name**	**An improved method for chrome tanning Mithun hides**
2	**Technology Related to**	Leather Industry
3	Complete Details of Technology	The improved chrome tanning process directly produces wet blue leather from limed hides. This innovation offers several advantages: Elimination of Unit Operations: Deliming, pickling, and basification processes are omitted, reducing pollution and conserving water. Better Leather Quality with Less Chrome: Despite using less chrome tanning agent, the leather quality improves, leading to reduced material consumption. Higher Chrome Content: The method increases the chrome content in leather while reducing chrome in the exhaust bath. Improved Fullness: Swollen limed hides result in fuller and denser leather. Tanning Versatility: Properties of the wet blue can be adjusted during tanning. Simpler Process: The method is easy to operate and handle. Instant Chrome Fixation: Significantly more chrome salt is fixed to the collagen matrix instantaneously. Unique Alkaline pH: The process is carried out at an alkaline pH of 12, deviating from the conventional acidic pH. The process involves liming, followed by immersion in a chrome liquor with basic chromium sulfate. The formula is tailored to maintain liquor strength and minimize chrome discharge. After 7-8 hours of treatment, the leather's thermal stability is checked. The key innovation lies in modifying the electro-chemical behavior of basic chromium sulfate, allowing for improved chrome tannage by altering its electro-chemical properties. In this method, basic chromium sulfate exhibits changed electro-chemical behavior due to rapid hydrolysis upon dilution with water, moving away from its positive electro-chemical nature.

4	**Target & stake holders**	Leather industry
5	**IPRs status**	Patent application under process, application No. 1197/ KOL/2012

Details of Inventors

1	**Principal Inventor**	Dr. G. Mukherjee
2	**Principal Inventor Designation**	Professor
3	**Principal Inventor Email**	gmclt@hotmail.com
4	**Principal Inventor Address**	Government College of Engineering and Leather Technology, LB Block, Sector - III, Salt Lake City, Kolkata - 700 098
5	**Co-Inventor(s) Name**	Dr. C. Rajkhowa Dr. K.K. Baruah Dr. K.C. Das Dr. C. Mandal Dr B. Debnath Dr. B. Chattopadhyay

24.0 MITHUN MEAT SOUP

1	**Technology Name**	**Mithun meat soup**
2	**Technology Related to**	Mithun meat value added products
3	**Complete methodology of Technology**	Extract the Mithun broth/ stock by simmering the Mithun bones. Filter the broth using thin sieve or muslin cloth. Boil the pork broth and equal amount of water separately. Fry the condiments (onion: garlic: ginger-3:1:1) in a pan/ kadhai on medium flame till they become slightly golden brown in color. Add spice mixture and continue frying. Pour the broth into frying pan and boil. After boiling, filter the contents and keep them aside. With continuous stirring, dissolve corn flour and salt in the boiled water. Add the filtered broth and heat the content for 2-3 minutes under simmer condition. Finally, add citric acid and take out the content after 30 seconds. Serve hot after garnishing with coriander leaves and pepper powder. Suitable garnish add greatly to the enjoyment of soup. Addition of bits of meat, shreds of cheese and corn makes soup more nutritive and attractive.
4	**Target users/ stakeholders**	Farmers, Entrepreneurs and Self Help Groups
5	**Status of commercialization**	Technology transfer on 01.09.2023 to Life Ministry Learning Centre (LMLC), Ruve Khel, Naga United Village, 4th Mile, Dimapur 797115

Details of Inventors

1	**Principal Inventor**	Dr. Jyoti
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	jyoti1@icar.gov.in
4	**Principal Inventor Address**	ICAR NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Lalchamliani Chhangte Dr. Sapunii Stephen Hanah Dr. Sunitibala Devi Dr. Girish Patil, S.

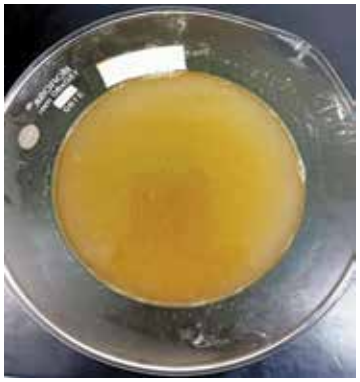


Figure 23: Mithun meat soup

25.0 MITHUN MEAT NUGGETS

1	**Technology Name**	**Mithun meat nuggets**
2	**Technology Related To**	Mithun meat value added products
3	**Complete methodology of Technology**	Mince the meat in a meat mincer. For aged animals, repeat mincing. Add the minced meat to a bowl chopper, keeping the temperature below 10 °C. Mix well. Add 1.5-2% salt, 10% ice, 0.5% sodium tri-poly phosphate, 0.39% sugar, and 150 ppm or 150 mg sodium nitrite per kg meat (dissolved in chilled water).Close the lid of the bowl chopper and run for 6-7 minutes, keeping the temperature of the meat below 10°C. Add 3% egg, 10% refined oil, 3-3.5% onion and garlic paste, 3.5% wheat flour, and 1.5-2% spices. Mix well. Put the emulsified meat in a container smeared with refined oil. Tie the box with rope. Keep the container in an autoclave at 10 psi for 10 minutes and 8 psi for 35 minutes. Switch off the autoclave and let the steam gradually dissipate. Remove the meat from the container and chop into small pieces. The meat nugget is now ready for packaging and consumption. Store in the fridge.
4	**Target users/ stakeholders**	Farmers, Entrepreneurs and Self Help Groups
5	**Status of commercialization**	Technology transfer on 01.09.2023 to Life Ministry Learning Centre (LMLC), Ruve Khel, Naga United Village, 4th Mile, Dimapur 797115

Details of Inventors

1	**Principal Inventor**	Dr. Jyoti
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	jyoti1@icar.gov.in
4	**Principal Inventor Address**	ICAR NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Lalchamliani Chhangte Dr. Sapunii Stephen Hanah Dr. Sunitibala Devi Dr. Girish Patil, S.

Figure 24: Mithun meat nuggets

26.0 MITHUN MEAT PICKLE

1	**Technology Name**	**Mithun meat pickle**
2	**Technology Related To**	Mithun meat value added products
3	**Complete methodology of Technology**	The preparation of Mithun pickle involves heating minimum quantity of oil (mustard oil) in a deep bottom pan/ kadhai and then frying cooked meat on medium flame till it become slightly brown in color. Set apart the fried Mithun meat. This step may take approximately 10-15 minutes. Fry ginger-garlic paste for few minutes till becomes golden brown and keep aside. Then, fry the dry spice mix, chilli powder, turmeric powder, cumin seed powder, mustard seed powder, fenugreek seed powder, asafoetida etc. for few minutes till oil separates and keep separately. Once all the ingredients are ready, take some oil in a fresh pan/ kadhai and mix fried spices, condiment paste and all other ingredients and add the fried pork pieces. Since all the ingredients are already fried and cooked, heat only for few minutes with intermittent mixing. After cooling add 20% v/w of vinegar. Remaining amount of mustard oil may be added after cooling and may be packed in polyester/polyethylene laminate pouches or PET bottles and stored at room temperature. If required additional amount of vinegar may be added to ensure the final pH of less than 5.0. Pork pickle prepared from meat extracted from deboned frames using vinegar as per standard procedures under hygienic conditions can be stored for a minimum of 3 months in sealed polyester/polyethylene pouches or PET bottles at room temperature.
4	**Target users/ stakeholders**	Farmers, Entrepreneurs and Self Help Groups
5	**Technology Developed has Commercial Potential**	Mithun meat pickle has significant commercial potential due to a number of factors, including high demand, convenience, versatility, affordability. In addition to these general factors, there are a number of specific trends that are driving the commercial potential of meat pickle. For example, the growing popularity of convenience foods is leading to increased demand for pre-cooked and ready-to-eat meat pickles. Additionally, the rising demand for healthier food options is driving the development of new meat pickles that are lower in fat and calories.
6	**Status of commercialization**	Technology transfer on 01.09.2023 to: M/s. North East Animal Farming Initiative LLP, First floor, Reid marwet, next to boos lodge, Opp CRPF 2nd gate, 9th mile, Ribhoi, Meghalaya&Life Ministry Learning Centre (LMLC), Ruve Khel, Naga United Village, 4th Mile, Dimapur 797115

Details of Inventors

1	**Principal Inventor**	Dr. Jyoti
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	jyoti1@icar.gov.in
4	**Principal Inventor Address**	ICAR NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Lalchamliani Chhangte Dr. Sapunii Stephen Hanah Dr. Sunitibala Devi Dr. Girish Patil, S.

Figure 25: Mithun meat pickle

27.0 ENROBED MITHUN MEAT PRODUCTS

1	**Technology Name**	**Enrobed Mithun meat products**
2	**Technology Related To**	Mithun meat value added products
3	**Complete methodology of Technology**	Process of enrobing involves preparation of the batter, application on the meat or meat nuggets and frying. The battering and breading process involves: Portioning (cuts); pre-dust with flour (pickup ~ 6%); battering (pickup ~ 5%) and breading (pickup ~ 25%). Total pickup should not exceed 30% in coated products. Coated products are fried for short time (par-frying) at 190 ^{0}C for 30-55 seconds or long period of time for full cooking depending on market requirements. Frying solidify the coating systems to adhere the breading to the surface and develop attractive brown color. After frying the product is usually frozen in order to preserve freshness, appearance and crispiness.
4	**Target users/ stakeholders**	Farmers, Entrepreneurs and Self Help Groups
5	**Technology Developed has Commercial Potential**	Mithun meat pakoda is a versatile food that can be enjoyed by people of all ages and is a good source of protein and other nutrients. Meat pakoda is also relatively affordable, making it accessible to consumers of all income levels. Additionally, meat pakoda can be easily customized to meet the dietary needs of different consumers. For example, businesses can develop meat pakodas that are gluten-free, dairy-free, or low-sodium. Overall, the commercial potential of meat pakoda is strong, and there are a number of opportunities for businesses to capitalize on this trend.
6	**Status of commercialization**	Technology transfer on 01.09.2023 to Life Ministry Learning Centre (LMLC), Ruve Khel, Naga United Village, 4th Mile, Dimapur 797115

Details of Inventors

1	**Principal Inventor**	Dr. Jyoti
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	jyoti1@icar.gov.in
4	**Principal Inventor Address**	ICAR NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Lalchamliani Chhangte Dr. Sapunii Stephen Hanah Dr. Sunitibala Devi Dr. Girish Patil, S.

Figure 26: Enrobed Mithun meat products

28.0 MITHUN MEAT BALLS

1	**Technology Name**	**Mithun meat balls**
2	**Technology Related To**	Mithun meat value added products
3	**Complete methodology of Technology**	Mince the meat in meat mincer (For aged animal repeat mincing). Add the minced meat in bowl chopper (Temperature shouldn't cross 10 °C) Mix well. Add (1.5-2) % salt, ice (8%), Sodium tripoly phosphate (0.5%), Sugar (0.3%), 150 ppm or 150mg sodium nitrite per kg meat (1.5g in 10kg meat) (dissolved in chilled water). Close the lid of bowl chopper and run for (6-7) min (temperature of the meat should not go beyond 10°C) then add 3% egg, refine oil (10%), onion and garlic paste (3-3.5%),wheat flour (3.5%), spices (1.5-2)%. Mix it properly. Emulsified meat is evenly rolled into ball. Heat water with salt (5%) to (65-70°C). Put the meat balls in the heated water and once the water reaches 80°C take out and cool it
4	**Target users/ stakeholders**	Farmers and Entrepreneurs
5	**Technology Developed has Commercial Potential**	Mithun meat balls have significant commercial potential due to a number of factors, including high demand, convenience, versatility, affordability. In addition to these general factors, there are a number of specific trends that are driving the commercial potential of meatballs. For example, the growing popularity of convenience foods is leading to increased demand for pre-cooked and ready-to-eat meatballs. Additionally, the rising demand for healthier food options is driving the development of new meatballs that are lower in fat and calories.
5	**Status of commercialization**	Technology transfer on 01.09.2023 toLife Ministry Learning Centre (LMLC), Ruve Khel, Naga United Village, 4th Mile, Dimapur 797115

Details of Inventors

1	**Principal Inventor**	Dr. Jyoti
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	jyoti1@icar.gov.in
4	**Principal Inventor Address**	ICAR NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Lalchamliani Chhangte Dr. Sapunii Stephen Hanah Dr. Sunitibala Devi Dr. Girish Patil, S.

Figure 27: Mithun meat balls

29.0 MITHUN MILK LASSI

1	**Technology Name**	Mithun milk lassi
2	**Technology Related To**	Mithun milk value added products
3	**Complete methodology of Technology**	Add 1kg Mithun milk yogurt in 600ml water and stir properly. Add 8% Sugar to the yogurt solution. Blend the mixture with a hand blender and add flavor.
4	**Target users**	Farmers and Entrepreneurs
5	**Technology Developed has Commercial Potential**	A number of specific trends that are driving the commercial potential of Mithun milk lassi. For example, the growing popularity of healthy and functional beverages is leading to increased demand for milk lassi. Additionally, the rising demand for ethnic foods is driving the development of new milk lassi products that are inspired by different cuisines around the world.

Details of Inventors

1	**Principal Inventor**	Dr. Jyoti
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	jyoti1@icar.gov.in
4	**Principal Inventor Address**	ICAR NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Lalchamliani Chhangte Dr. Sapunii Stephen Hanah Dr. Sunitibala Devi Dr. Girish Patil, S.

Figure 28: Mithun milk lassi

30.0 MITHUN MILK PANEER

1	**Technology Name**	Mithun milk paneer
2	**Technology Related To**	Mithun milk value added products
3	**Complete methodology of Technology**	Take fresh Milk. Heat till it reaches 90°C.Keep the milk in 90°C for 2 minutes or 1st Bubble. Cool down the milk to 70-75 °C. Boil (300-400) ml water in a different beaker and add 2g Citric acid (1.5-2%) after the temperature come down to 70-75°C in 2 litre milk. Add citric acid solution to the milk. Continuously stir until a curd is separated from whey. Allow the mixture to settle down and drain the whey with help of a muslin cloth. The collected curd wrapped in muslin cloth is pressed with weight (1:5) for 10-15 min Package the paneer and store at 4°C.
4	**Target users/ stakeholders**	Farmers and Entrepreneurs
5	**Technology Developed has Commercial Potential**	A number of specific trends that are driving the commercial potential of Mithun milk paneer. For example, the growing popularity of vegetarian and vegan diets is leading to increased demand for paneer, as it is a good source of protein for people who do not eat meat or animal products. Additionally, the rising demand for ethnic foods is driving the development of new paneer products that are inspired by different cuisines around the world.

Details of Inventors

1	**Principal Inventor**	Dr. Jyoti
2	**Principal Inventor Designation**	Scientist
3	**Principal Inventor Email**	jyoti1@icar.gov.in
4	**Principal Inventor Address**	ICAR NRC on Mithun, Medziphema, Nagaland
5	**Co-Inventor(s) Name**	Dr. Lalchamliani Chhangte Dr. Sapunii Stephen Hanah Dr. Sunitibala Devi Dr. Girish Patil, S.

Figure 29: Mithun milk paneer cubes

31.0 INNOVATIVE CHICKEN KILLING CONE

1	**Technology Name**	**Innovative chicken killing cone**
2	**Technology Related to**	Household and smaller poultry slaughter unit
3	**Complete Details of Technology**	The Killing Cone for Chickens is designed to meet the needs of backyard farmers and small-scale commercial units. It operates on the principle of neck dislocation, causing a rupture of the spinal cord, cessation of breathing, and disruption of blood flow to the brain by rupturing blood vessels. **Specifications:** Length: 15.5 cm Height: 40 cm Thickness: 2 cm Foot Hold: 30x28 cm **Materials Used:** Wood (2 cm thick) Aluminum sheets 2 Bolts Nails
5	**Target users/stakeholders**	Domestic and Small Scale poultry Slaughter Unit
6	**ICAR Technology Certification**	Technology certified by ICAR in 2023
7	**IPRs status**	Design No. 330515-001;Granted on 02.02.2021

Details of Inventors

1	**Principal Inventor**	Dr. Debojyoti Borkotoky
2	**Principal Inventor Designation**	Subject Matter Specialist (Animal Science)/ACTO
3	**Principal Inventor Email**	debojyoti.borkotoky@icar.gov.in
4	**Principal Inventor Address**	SMS, KVK Phek Present address: KVK North 24 Parganas (Addl.) ICAR-CRIJAF, Barrackpore
5	**Co-Inventor(s) Name**	Dr. Nazrul Haque Dr. R. K. Singh Dr. Rinku Bharali Dr. Abhijit Mitra

Figure 30: Left side view of innovative chicken killing cone

Figure 31: Right side view of innovative chicken killing cone

Figure 32: Top cone view of innovative chicken killing cone

32.0 POULTRY MAIZE FEEDER CUM DRINKER

1	**Technology Name**	**Poultry Maize Feeder cum Drinker**
2	**Technology Related to**	Household and smaller poultry unit
3	**Complete Details of Technology**	This feeding system operates on the principle of vertical grain drainage through a restricted aperture, using gravity. It offers several advantages for feeding maize to birds, particularly suitable for backyard farmers and small-scale poultry operations: Fungal Growth Prevention: Exposing shelled maize to sunlight and air helps hinder fungal growth, eliminating the need for regular maize shelling. Visual Quantity Assessment: Marked side bars allow for a visual assessment of the remaining maize quantity. Reduced Aggressive Behavior: Birds can self-dispense grain while pecking, reducing fighting and aggressive pecking behavior. Easy Refilling: A funnel is provided for easy pouring of grain, simplifying the refilling process. Hydration and Well-being: The system includes two drinkers, ensuring access to wholesome water for the birds, promoting their hydration and well-being. Medication and Supplementation: Facilitates easy medication and supplementation for the birds' health. Cost-Effective: Accommodates 12-15 birds per feeder, making it a cost-effective solution. Portability: The system is portable, easy to handle, and environmentally friendly, providing convenience and sustainability. **Specifications:** Length: 60 cm Width: 60 cm Thickness: 4 cm Wire Mesh Gap: 2 cm Base Stand: 2 cm **Materials Used:** Wood (2 cm thick) Aluminum sheet Plastic bottles (2) Wire mesh (0.5-inch mesh, 19 gauge)
4	**Target users/ stakeholders**	Backyard poultry farmers and Small scale poultry units
5	**ICAR Technology Certification**	Technology certified by ICAR in 2023
6	**IPRs status**	Design No. 330514-001, granted on 27.06.2020

Details of Inventors

1	**Principal Inventor**	Dr. Debojyoti Borkotoky
2	**Principal Inventor Designation**	Subject Matter Specialist (Animal Science)/ACTO
3	**Principal Inventor Email**	debojyoti.borkotoky@icar.gov.in
4	**Principal Inventor Address**	SMS, KVK Phek Present address: KVK North 24 Parganas (Addl.) ICAR-CRIJAF, Barrackpore
5	**Co-Inventor(s) Name**	Dr. Nazrul Haque Dr. R.K. Singh Dr. Hannah K Asangla Dr. Abhijit Mitra

Figure 33: Front view of the poultry maize feeder cum drinker

Figure 34: Side view of the poultry maize feeder cum drinker

Preventing Parasites in Mithun (*Bos frontalis*): Proven Practices for Control

1	**Name of the Technology**	**Package of Practices for Control of Parasites in Mithun (*Bos frontalis*)**
2	**Technology Related To**	Mithun, Cattle, Buffalo, Yak
3	**Details of the Technology**	Mithun plays a very important significant role in tribal society of North-East India. The NEH region has a relative humidity of 80%, an atmospheric temperature of 15-35°C and varying soil pH of 6.5-8.5 that are conducive for optimum development of different parasite larvae and thus making it a safe haven for parasites. Ectoparasite Control Spraying of Amitraz (12.5%), or Ivermectin 1ml/50 kg body weight subcutaneously against different hard ticks. In forest, use of repellent like neem oil and citronella oil in animals body in order to avoid land leech infestation. Use of Leachia grass oil, tobacco and soapnuts are useful for controlling of both land and aquatic leech infesting mite. **Helminthiasis Control** Albendazole @ 15 mg/kg body weight orally as a broad-spectrum anthelmintic. Ivermectin @ 1ml/50 kg body weight subcutaneously as a broad-spectrum anthelmintic. Fenbendazole and Praziquantel combination @ 10-20 mg/kg body weight orally for monieziasis. Piperazine @ 200 mg/kg body weight orally in calves for *Toxocara vitulorum* infection, or treatment of pregnant mother with Levamisole @ 7-15mg/kg body weight subcutaneously. Protozoal Disease Control Sulfaquinoxaline (6 mg/lb/day for 3–5 days) and Amprolium (10 mg/kg/day for 5 days) for coccidiosis. Preventive Measures Regular anthelmintic before pre-monsoon and post-monsoon season. Maintaining the hygiene and sanitation of the environment. Bio-fencing of the farms with tick repellent trees.
4	**Target Users/ Stakeholders**	Livestock Entrepreneurs
5	**IPR Status**	NA
6	**ICAR Technology Certification**	NA
7	**Status of Commmercialization**	Technology utilized for standardization of the protocols followed for parasite control in mithun farm, Medziphema and mithun-rearing areas.

1	Prinicipal Inventor	Dr. Jayanta Kumar Chamuah
2	Principal Inventor Designation	Senior Scientist (Animal Health)
3	Principal Inventor Email	drjayantavet@gmail.com
4	Principal Inventor Address	ICAR-NRC on Mithun, Medziphema, Nagaland-797106
5	Co-Inventor(s) Name	Dr. Plabita Goswami Dr. Kobu Khate Dr. Girish Patil Shivanagowda

INTELLECTUAL PROPERTY OF ICAR-NRC ON MITHUN

No. Patent granted: 05

S. No.	Date of filling Application IPR title (Provisional/ Complete)	Application Number allotted by the issuing Authority	Developing Institute	Title	Innovators	Patent number	Status of Application
1	13.12.2012	1402/KOL/ 2012	ICAR-National Research Centre on Mithun, Nagaland and College of Engineering and Leather Technology, Kolkata	A method for bio-preservation of Mithun hides	Dr. C. Rajkhowa Dr. G. Mukherjee Dr. K.K. Baruah Dr. B. Chattopa dhyay	327187	Granted on **11.12.2019**
2	07.11.2012	1277/KOL/ 2012	ICAR-National Research Centre on Mithun, Nagaland and College of Engineering and Leather Technology, Kolkata	An energy efficient post tanning process for Mithun hides	Dr. C. Rajkhowa Dr. G. Mukherjee Dr. K.K. Baruah Dr. K.C. Das	428786	Granted on **13.04.2023**
3	30.03.2012	360/KOL/2012 (Transferred to L.S. Davar)- Complete filed on 1st April 2013	National Research Centre on Mithun, Nagaland and College of Engineering and Leather Technology, Kolkata	A process of making leather without any large machinery	Dr. K.C. Das Dr. G. Mukherjee Dr. C. Rajkhowa Dr. B. Prakash Dr. K.K. Baruah Dr. A. Mukherjee Dr.	432257	Granted on **19.05.2023**
4	19.02.2013	192/KOL/2013	National Research Centre on Mithun, Nagaland and College of Engineering and Leather Technology, Kolkata	A method of processing rabbit fur on leather	Dr. C. Rajkhowa Dr. G. Mukherjee Dr. K.K. Baruah Dr. R. K. Singh Dr. B. Chattopadhyay	431823	Granted on **15.05.2023**

S. No.	Date of filling Application IPR title (Provisional/ Complete)	Application Number allotted by the issuing Authority	Developing Institute	Title	Innovators	Patent number	Status of Application
5	18/02/2013	183/KOL/2013	National Research Centre on Mithun, Nagaland and College of Engineering and Leather Technology, Kolkata	A method of removal of chromium from chrome liquor obtained after processing of Mithun hides	Dr. C. Rajkhowa Dr. G. Mukherjee Dr. K.K. Baruah Dr. B. Chattopadhyay Dr. S. Chakraborty	442476	Granted on **02.08.2023**

Patent under Process: 05

S. No.	Application/ Registration No	Name of Innovation/ Technology/Products/Verities	Date of Filling/ Registration	Status
1	**1334/KOL/2012**	A method for processing rabbit pelts and fur	20/11/2012	Application in Hearing
2	**1276/KOL/2012**	A novel method of chrome tannage of Mithun hides with Glyoxalic Acid	07/11/2012	Application in Hearing
3	**1197/KOL/2012**	An improved method for chrome Tanning Mithun hides	17/10/2012	IN ORDER FOR GRANT UNDER SECTION 43,AWAITING NBA APPROVAL
4	**202111013662**	Method of preparing mineral block added with environment friendly materials	27.03.2021	Applied
5	**202331027331**	Process for drying agro-industrial by-products and using it as a component of animal feed block	13.04.2023	Applied

No. of design granted: No.07

S. No.	Name of design	Design registration number	Application date	Date of submission of reply to FER	Date of Grant of the Design Registration
1	**HUMANE CHICKEN KILLING CONE in Class 08-05 (330515-001)**	330515-001	27.06.2020	22.10.2020	Granted on 02.02.2021
2	**POULTRY MAIZE FEEDER for Backyard Chicken in Class 30-03 (330514-001)**	(330514-001)	27.06.2020	22.10.2020	Granted on 04.01.2021
3	**DRYER Class 15-05(330513-001)**	330513-001)	27.06.2020	22.10.2020	Granted on 18.03.2021
4	**Portable mineral block dispenser with adjustable height**	334974-001	06.11.2020	21.04.2021	Granted on 10.11.2021
5	**De-Save Portable Mineral Block Dispenser for Animals**	324931-001	23.12.2019	08.12.2020	Granted on 11.11.2022

S. No.	Name of design	Design registration number	Application date	Date of submission of reply to FER	Date of Grant of the Design Registration
6	**Large Animal Ectoparasite Expeller cum Drug Applicator**	335631-001	27.11.2020	08.01.2021	Granted on 16.08.2022
7	**Travis for restraining of bovines**	38107-001; Class No. 30-02	08.03.2023	-	Granted on 25.05.2023

Copy right: No.04

Name of Copyright	Copyright Registration No	Name of Innovation/ Technology/Products/ Verities	Date of Filling/ Registration	Date of grant of Copyright
Cinematograph Film	12786/2021-CO/CF	Promotional video on semi-intensive Mithun farming (Registration No. CF-5014/2021)	09.06.2021	Granted on 25.08.2021
Mithun Mitra App	7076/2020-CO/SW SOFTWARE	MITHUN MITRA APP (Registration number: SW-13613/2020)	28.05.2020	Granted on 17.08.2020
Cinematograph Film	Diary Number: 23232/2021-CO/CF	Documentary on NICRA Intervention: 2012-2020 KVK Phek	24.09.2021	Granted on 31.12.2021
Cinematograph Film	Diary Number: 19874/2022-CO/CF	Estrus detection and Artificial Insemination (AI) in Mithun	20.09.2022	Granted

Copyright: No.06 (Under process):

Name of Copyright	Application/ Registration No	Name of Innovation/ Technology/Products/ Verities	Date of Filling/ Registration	Status
Artistic works	Diary Number: 30715/2021-CO/A	Ovulation predictor and timing of artificial chart for Mithun	18.12.2021	Under process
Cinematograph Film	Diary Number: 19876/2022-CO/CF	Diversified Uses of Mithun	20.09.2022	Applied

Name of Copyright	Application/ Registration No	Name of Innovation/ Technology/Products/ Verities	Date of Filling/ Registration	Status
Cinematograph Film	Diary Number: 19872/2022-CO/CF	Collection, Evaluation and Freezing of Mithun Semen	20.09.2022	Applied
Cinematograph Film	Diary Number: 19871/2022-CO/CF	Foot and Mouth Disease (FMD) in Mithun: A Farmer's Guide	20.09.2022	Applied
Cinematograph Film	Diary Number: 19874/2022-CO/CF	Estrus detection and Artificial Insemination (AI) in Mithun	20.09.2022	Applied
Artistic works	Diary Number: 21591/2022-CO/A	Mithun Body Condition Scoring System(MBCSS)	14.10.2022	Applied
Artistic work	Diary Number: 26993/2022-CO/A	Semi-intensive rearing model	23.12.2022	Applied

List of Trademark: 07

IPRs	Trademark Registration No	Name of Innovation/ Technology/Products/ Verities	Granted on
Trademark	2264166	µLEDER, (class 18) Leather product: jacket, shoes, wallet, hand bags, suitcase, belt and key ring	15.10.2015
	2265996	µthimin (class 5), mineral Mixture	13.08.2015
	2272256	Logo of Mithun head (class 5, 18, 29)	14.10.2015
	2272257	NRCM (class 5, 18, 29)	14.10.2015

Technology commercialization: 03

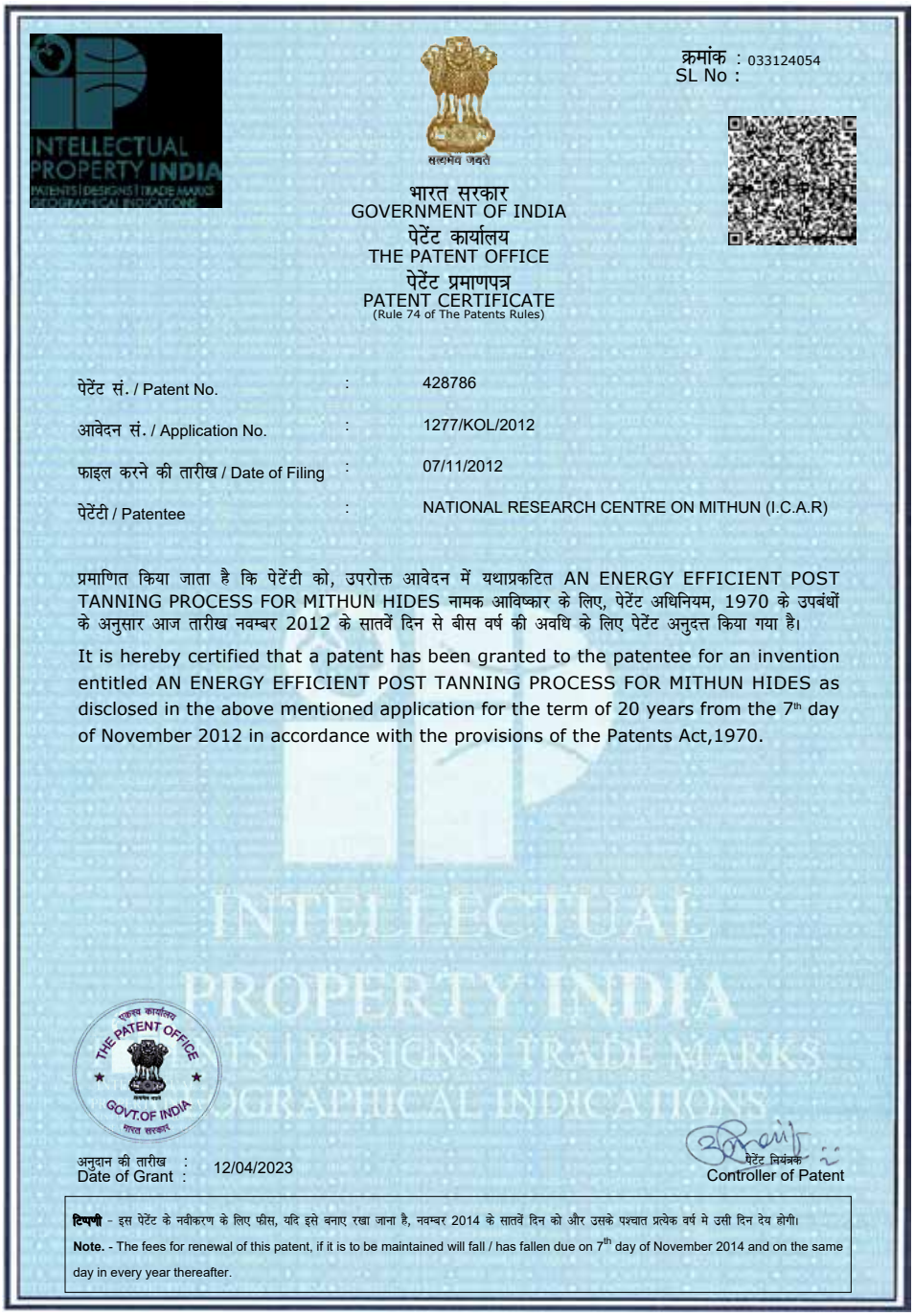
S. No.	Name of the technology	Commercialized through party	Date
01	**Large Animal Ectoparasite Expeller cum Drug Applicator**	Creative Displayers, West Bengal	24.02.2023
02	**De-Save Portable Mineral Block Dispenser for Animals**	Creative Displayers, West Bengal	16.07.2023
03	**Production of Value Added Products from Mithun Meat and Providing Incubation Services**	M/s. North East Animal Farming Initiative LLP, First floor, Reid marwet, next to boos lodge, Opp CRPF 2nd gate, 9th mile, Ribhoi, Meghalaya & Life Ministry Learning Centre (LMLC), Ruve Khel, Naga United Village, 4th Mile, Dimapur 797115	01.09.2023

List of technologies approved by ICAR

S. No.	Name	Year of certification	Lead Developer	Associate Developer
1	**Innovative Chicken Killing Cone**	2023	Dr Debojyoti Borkotoky (Lead),	Dr Nazrul Haque Dr Rinku Bharali Dr Abhijit Mitra
2	**Poultry Maize Feeder**	2023	Dr Debojyoti Borkotoky	Dr Nazrul Haque Dr Hannah K. Asangla Dr Abhijit Mitra
3	**Meat Dryer**	2023	Dr Debojyoti Borkotoky	Dr Nazrul Haque Dr. T.Esther Longkumer Dr Abhijit Mitra
4	**Portable mineral block dispenser with adjustable height**	2023	Dr. Nazrul Haque	Dr Debojyoti Borkotoki Dr. Saroj Toppo Dr Harish Chandra Yadav Dr Abhijit Mitra
5	**De-Save Portable Mineral Block Dispenser for Animals**	2023	Dr. Nazrul Haque	Dr Debojyoti Borkotoki Dr. Saroj Toppo Dr Harish Chandra Yadav Dr Abhijit Mitra
6	**Large Animal Ectoparasite Expeller cum Drug Applicator**	2023	Dr Debojyoti Borkotoky	Dr Jayanta Kumar Chamuah Dr Abhijit Mitra
7	**Travis for restraining of bovines'**	2023	Dr.Sapunii Stephen Hanah	Dr.KezhavituoVupru, Dr.KobuKhate Dr.LaishramSunitibala Devi, Scientist Dr. J.K. Chamuah Dr. Girish Patil,
8	**Method of preparing mineral block added with environment friendly materials**	2023	Dr. Nazrul Haque,	Dr Kobu Khate Dr Debojyoti Borkotoki Dr. Saroj Toppo Dr Abhijit Mitra
9	**Preg-DM: Urine-based pregnancy diagnosis kit for Mithun**	2023	ICAR-NRCM Dr. Vikram R. ICAR-CIRB Dr. Ashok Kumar Balhara	ICAR-NRCM Dr. M. H. Khan Dr. Abhijit Mitra ICAR-CIRB Mrs. Suman Sangwan Dr. S K Phuli Dr. R K Sharma Dr. Sajjan Singh Dr. T K Datta

S. No.	Name	Year of certification	Lead Developer	Associate Developer
10	**Mithun Semen collection by electro-ejaculation technique and cryopreservation**	2023	Dr. M. H. Khan	Dr. Vikram R. Dr. A. Mitra

Glimpse of Registration Certificates



क्रमांक : 033124054
SL No :

सत्यमेव जयते

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No.	:	428786
आवेदन सं. / Application No.	:	1277/KOL/2012
फाइल करने की तारीख / Date of Filing	:	07/11/2012
पेटेंटी / Patentee	:	NATIONAL RESEARCH CENTRE ON MITHUN (I.C.A.R)

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित AN ENERGY EFFICIENT POST TANNING PROCESS FOR MITHUN HIDES नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख नवम्बर 2012 के सातवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled AN ENERGY EFFICIENT POST TANNING PROCESS FOR MITHUN HIDES as disclosed in the above mentioned application for the term of 20 years from the 7th day of November 2012 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख :
Date of Grant : 12/04/2023

पेटेंट नियंत्रक
Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, नवम्बर 2014 के सातवें दिन को और उसके पश्चात प्रत्येक वर्ष मे उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on 7th day of November 2014 and on the same day in every year thereafter.

क्रमांक : 033124503
SL No :

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No.	:	432257
आवेदन सं. / Application No.	:	360/KOL/2012
फाइल करने की तारीख / Date of Filing	:	30/03/2012
पेटेंटी / Patentee	:	NATIONAL RESEARCH CENTRE ON MITHUN, (ICAR)

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित LEATHER MATERIAL DERIVED FROM THE HIDE OF THE BOVINE SPECIES OF MITHUN AND A METHOD FOR PREPARING THE SAME IN RURAL INDUSTRY नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख मार्च 2012 के तीसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled LEATHER MATERIAL DERIVED FROM THE HIDE OF THE BOVINE SPECIES OF MITHUN AND A METHOD FOR PREPARING THE SAME IN RURAL INDUSTRY as disclosed in the above mentioned application for the term of 20 years from the 30th day of March 2012 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख : 19/05/2023
Date of Grant :

पेटेंट नियंत्रक
Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, मार्च 2014 के तीसवें दिन को और उसके पश्चात प्रत्येक वर्ष मे उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on 30th day of March 2014 and on the same day in every year thereafter.

क्रम सं/SL No :03312693

INTELLECTUAL PROPERTY INDIA

पेटेंट कार्यालय,भारत सरकार
The Patent Office, Government Of India

पेटेंट प्रमाण पत्र | Patent Certificate

(पेटेंट नियमावली का नियम 74) | (Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No. : 442476

आवेदन सं. / Application No. : 183/KOL/2013

फाइल करने की तारीख / Date of Filing : 18/02/2013

पेटेंटी / Patentee : NATIONAL RESEARCH CENTRE ON MITHUN (I.C.A.R)

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित *A METHOD OF REMOVAL OF CHROMIUM FROM CHROME LIQUOR OBTAINED AFTER PROCESSING OF MITHUN HIDES.* नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख फरवरी 2013 के अठारहवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

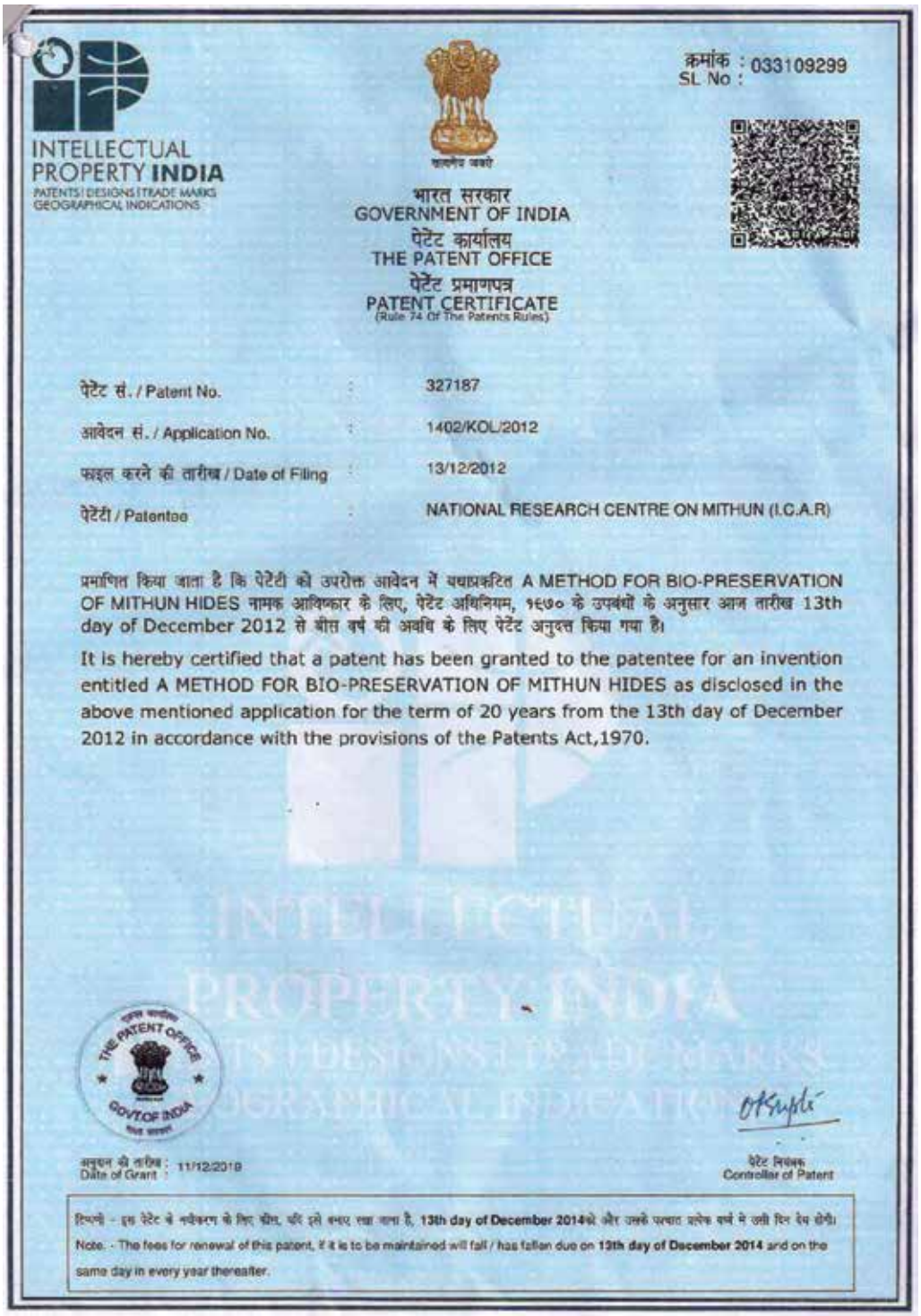
It is hereby certified that a patent has been granted to the patentee for an invention entitled *A METHOD OF REMOVAL OF CHROMIUM FROM CHROME LIQUOR OBTAINED AFTER PROCESSING OF MITHUN HIDES.* as disclosed in the above mentioned application for the term of 20 years from the 18th day of February 2013 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख : 02/08/2023
Date of Grant :

नियंत्रक
Controller of Patents

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि देय बनती रखी जाना है, फरवरी 2015 के अठारहवें दिन को और उसके पश्चात प्रतिवर्ष उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 18th day of February 2015 and on the same day in every year thereafter.



INTELLECTUAL PROPERTY INDIA
PATENTS | DESIGNS | TRADE MARKS
GEOGRAPHICAL INDICATIONS

क्रमांक : 033109299
SL No :

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 Of The Patents Rules)

पेटेंट सं. / Patent No.	:	327187
आवेदन सं. / Application No.	:	1402/KOL/2012
फाइल करने की तारीख / Date of Filing	:	13/12/2012
पेटेंटी / Patentee	:	NATIONAL RESEARCH CENTRE ON MITHUN (I.C.A.R)

प्रमाणित किया जाता है कि पेटेंटी को उपरोक्त आवेदन में यथाप्रकटित A METHOD FOR BIO-PRESERVATION OF MITHUN HIDES नामक आविष्कार के लिए, पेटेंट अधिनियम, १९७० के उपबंधों के अनुसार आज तारीख 13th day of December 2012 से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled A METHOD FOR BIO-PRESERVATION OF MITHUN HIDES as disclosed in the above mentioned application for the term of 20 years from the 13th day of December 2012 in accordance with the provisions of the Patents Act,1970.

THE PATENT OFFICE GOVT OF INDIA

अनुदान की तारीख : 11/12/2019
Date of Grant :

पेटेंट नियंत्रक
Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, **13th day of December 2014** को और उसके पश्चात प्रत्येक वर्ष में उसी दिन देय होगी।
Note. - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on **13th day of December 2014** and on the same day in every year thereafter.

क्रमांक : 033124445
SL No :

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No.	:	431823
आवेदन सं. / Application No.	:	192/KOL/2013
फाइल करने की तारीख / Date of Filing	:	19/02/2013
पेटेंटी / Patentee	:	NATIONAL RESEARCH CENTRE ON MITHUN (I.C.A.R)

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित A METHOD OF PROCESSING RABBIT FUR ON LEATHER नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख फरवरी 2013 के उन्नीसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled A METHOD OF PROCESSING RABBIT FUR ON LEATHER as disclosed in the above mentioned application for the term of 20 years from the 19th day of February 2013 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख :
Date of Grant : 15/05/2023

पेटेंट नियंत्रक
Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, फरवरी 2015 के उन्नीसवें दिन को और उसके पश्चात प्रत्येक वर्ष मे उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on 19th day of February 2015 and on the same day in every year thereafter.

(160)

प्ररूप ओ - 2
FORM O-2

बौद्धिक सम्पदा, भारत
Intellectual Property, India

भारत सरकार
GOVERNMENT OF INDIA
व्यापार चिन्ह रजिस्ट्री
TRADE MARKS REGISTRY

क्रमांक
No. 1240166

व्यापार चिन्ह अधिनियम, 1999
Trade Marks Act, 1999

व्यापार चिन्ह के रजिस्ट्रीकरण का प्रमाणपत्र, धारा 23 (2) नियम 62 (I)
Certificate of Registration of Trade Mark, Section 23 (2), Rule 62 (1)

व्यापार चिन्ह संख्या / Trade Mark No.	दिनांक/ Date	ज.संख्या/ J.No.
2264166	10/01/2012	1667

यह प्रमाणित किया जाता है कि जिस प्रकार चिन्ह की समाकृति इसके साथ संलग्न है, वह ..... के बारे में दिनांक ..... नाम से रजिस्ट्रीकृत हो चुका है।

Certified that the Trade Mark / a representation is annexed hereto, has been registered in the name(s) of

NATIONAL RESEARCH CENTRE ON MITHUN, (ICAR), JHARNAPANI,MEDZIPHEMA,DIST.DIMAPUR,NAGALAND-797106,INDIA, Indian., Manufacturer & Merchant, (Body Incorporate)

In Class 18 **Under No.** 2264166 **as of the Date** 10 January 2012 **in respect of**

Leather product- Jacket, Shoes, Wallet, Hand bags, Suitcase, Belt and Key ring included in class 18"

व्यापार चिन्ह रजिस्ट्री TRADE MARKS REGISTRY MUMBAI मुंबई

As Annexed

मेरे निदेश पर आज ..... के ..... मास के ..... वे दिन को इस पर मुद्रा लगायी गई।
Sealed at my direction, this 15th **day of** October , 2015

व्यापार चिन्ह रजिस्ट्री, **KOLKATA**
Trade Marks Registry,

व्यापार चिन्ह रजिस्ट्रार
Registrar of Trade Marks

रजिस्ट्रीकरण आवेदन की तारीख से १० वर्ष के लिए है और तदुपरान्त वह १० वर्ष की कालावधि के लिए और प्रत्येक १० वर्ष की कालावधि के अवसान पर नवीनीकृत किया जा सकेगा।
Registration is for 10 years from the date of application and may then be renewed for a period of 10 years and also at the expiration of each period of 10 years.

यह प्रमाणपत्र विधि कार्यवाही में प्रयोग के लिये या विदेश में रजिस्ट्रीकरण अभिप्राप्त करने के लिये नहीं है।
This certificate is not for use in Legal proceedings or for obtaining Registration abroad.

टिप्पणी - इस व्यापार चिह्न के स्वामित्व में कोई परिवर्तन होने पर, या कारोबार के मुख्य स्थान के पते में या भारत में तामील के लिये पते में परिवर्तन होने पर परिवर्तन के लिये आवेदन तुरन्त किया जाना चाहिये।
Note : Upon any change of ownership of this Trade Mark, or change in address, of the principal place of business or address for service in India a request should AT ONCE be made to register the change.

Copyright Office
Government of India

सत्यमेव जयते

Extracts from the Register of Copyrights

Dated : 25/08/2021

1.	Registration Number	:	**CF-5014/2021**
2.	Name, address and nationality of the applicant	:	DIRECTOR, ICAR-NATIONAL RESEARCH CENTRE ON MITHUN , ICAR-NATIONAL RESEARCH CENTRE ON MITHUN MEDZIPHERNA NAGALAND, INDIA-797106 INDIAN
3.	Nature of the applicant's interest in the copyright of the work	:	OWNER
4.	Class and description of the work	:	CINEMATOGRAPH FILM WORK
5.	Title of the work	:	PROMOTIONAL VIDEO ON SEMI-INTENSIVE MITHUN FARMING
6.	Language of the work	:	NAGAMESE (ENGLISH SUBTITLES)
7.	Name, address and nationality of the author and if the author is deceased, date of his decease	:	KAMNI PAIA BHAM , SCIENTIST ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN DR. MERAJ HAIDER KHAN , DIRECTOR ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN DR. STEPHEN SAPUNII HANAH , SCIENTIST ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN DR. KOBU KHATE , CHIEF TECHNICAL OFFICER ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN DR. NAZRUL HAQUE , PRINCIPAL SCIENTIST ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN DR. JAYANTA KUMAR CHAMUAH , SCIENTIST ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN MS. ALOLI RENGAM , AAO ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN SHRI. UTPAL GHOSH , AF & AO ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN DR. ABHIJIT MITRA , DIRECTOR ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN
8.	Whether the work is published or unpublished	:	UNPUBLISHED
9.	Ye… first publication and name, address and …lisher	:	N.A.
10.	…subsequent publications, if any, and names, …es of the publishers	:	N.A.
11.	…tionalities of the owners of various rights …t in the work and the extent of rights held …particulars of assignments and licences, if …	:	DIRECTOR, ICAR-NATIONAL RESEARCH CENTRE ON MITHUN , ICAR-NATIONAL RESEARCH CENTRE ON MITHUN MEDZIPHERNA NAGALAND, INDIA-797106 INDIAN
12.	Names, addresses and nationalities of other persons, if any, authorised to assign or licence of rights comprising the copyright	:	N.A.
13.	If the work is an 'Artistic work', the location of the original work, including name, address and nationality of the person in possession of the work. (In the case of an architectural work, the year of completion of the work should also be shewn).	:	N.A.

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Copyright Office
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Extracts from the Register of Copyrights

Dated : 30/12/2021

1.	Registration Number	:	**CF-5056/2021**
2.	Name, address and nationality of the applicant	:	DIRECTOR, ICAR-NATIONAL RESEARCH CENTRE ON MITHUN , ICAR-NATIONAL RESEARCH CENTRE ON MITHUN MEDZIPHERNA NAGALAND, INDIA-797106 INDIAN
3.	Nature of the applicant's interest in the copyright of the work	:	OWNER
4.	Class and description of the work	:	CINEMATOGRAPH FILM WORK
5.	Title of the work	:	DOCUMENTARY ON NICRA INTERVENTION: 2012-2020 KVK PHEK
6.	Language of the work	:	ENGLISH
7.	Name, address and nationality of the author and if the author is deceased, date of his decease	:	DR. DEBOJYOTI BORKOTOKY , KVK-PHEK, ICAR-NRC ON MITHUN, PORBA, PFUTSERO, NAGALAND, INDIA-797107 INDIAN DR T. ESTHER LONGKUMER , KVK-PHEK, ICAR-NRC ON MITHUN, PORBA, PFUTSERO, NAGALAND, INDIA-797107 INDIAN DR RINKU BHARALI , KVK-PHEK, ICAR-NRC ON MITHUN, PORBA, PFUTSERO , NAGALAND, INDIA-797107 INDIAN DR HANNAH K ASANGLA , KVK-PHEK, ICAR-NRC ON MITHUN, PORBA, PFUTSERO , NAGALAND, INDIA-797107 INDIAN MISS VESALU KHAPE , KVK-PHEK, ICAR-NRC ON MITHUN, PORBA, PFUTSERO , NAGALAND, INDIA-797107 INDIAN DR. MERAJ HAIDER KHAN , DIRECTOR ICAR-NATIONAL RESEARCH CENTRE ON MITHUN, MEDZIPHEMA NAGALAND, INDIA-797106 INDIAN
8.	Whether the work is published or unpublished	:	UNPUBLISHED
9.	Year and country of first publication and name, address and nationality of the publisher	:	N.A.
10.	Years and countries of subsequent publications, if any, and names, addresses and nationalities of the publishers	:	N.A.
11.	Names, addresses and nationalities of the owners of various rights comprising the copyright in the work and the extent of rights held by each, together with particulars of assignments and licences, if any	:	DIRECTOR, ICAR-NATIONAL RESEARCH CENTRE ON MITHUN , ICAR-NATIONAL RESEARCH CENTRE ON MITHUN MEDZIPHERNA NAGALAND, INDIA-797106 INDIAN
12.	Names, addresses and nationalities of other persons, if any, authorised to assign or licence of rights comprising the copyright	:	N.A.
13.	If the work is an 'Artistic work', the location of the original work, including ... address and nationality of the person in possession of ... case of an architectural work, the year of ... k should also be shown).	:	N.A.
14.	... work' which is used or capable of being ... oods or services, the application should ... om the Registrar of Trade Marks in terms of ... tion (1) of Section 45 of the Copyright Act.	:	N.A.
15.	If ... istic work', whether it is registered under the Design ... d if yes give details.	:	N.A.
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CERTIFICATE OF REGISTRATION OF DESIGN

Design No.	**330515-001**
Date	**27/06/2020 20:17:00**
Reciprocity Date*	
Country	

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Date of Issue 02/02/2021 17:15:33

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Design No.	335631-001
Date	27/11/2020 14:09:50
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Date of Issue 16/08/2022 13:08:55

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Design No.	**330513-001**
Date	**27/06/2020**
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Date of Issue 18/03/2021 13:25:27

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CERTIFICATE OF REGISTRATION OF DESIGN

Design No.	**334974-001**
Date	**06/11/2020 16:10:10**
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Country	

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Date of Issue 10/11/2021 16:10:24
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CERTIFICATE OF REGISTRATION OF DESIGN

Design No.	**330514-001**
Date	**27/06/2020**
Reciprocity Date*	
Country	

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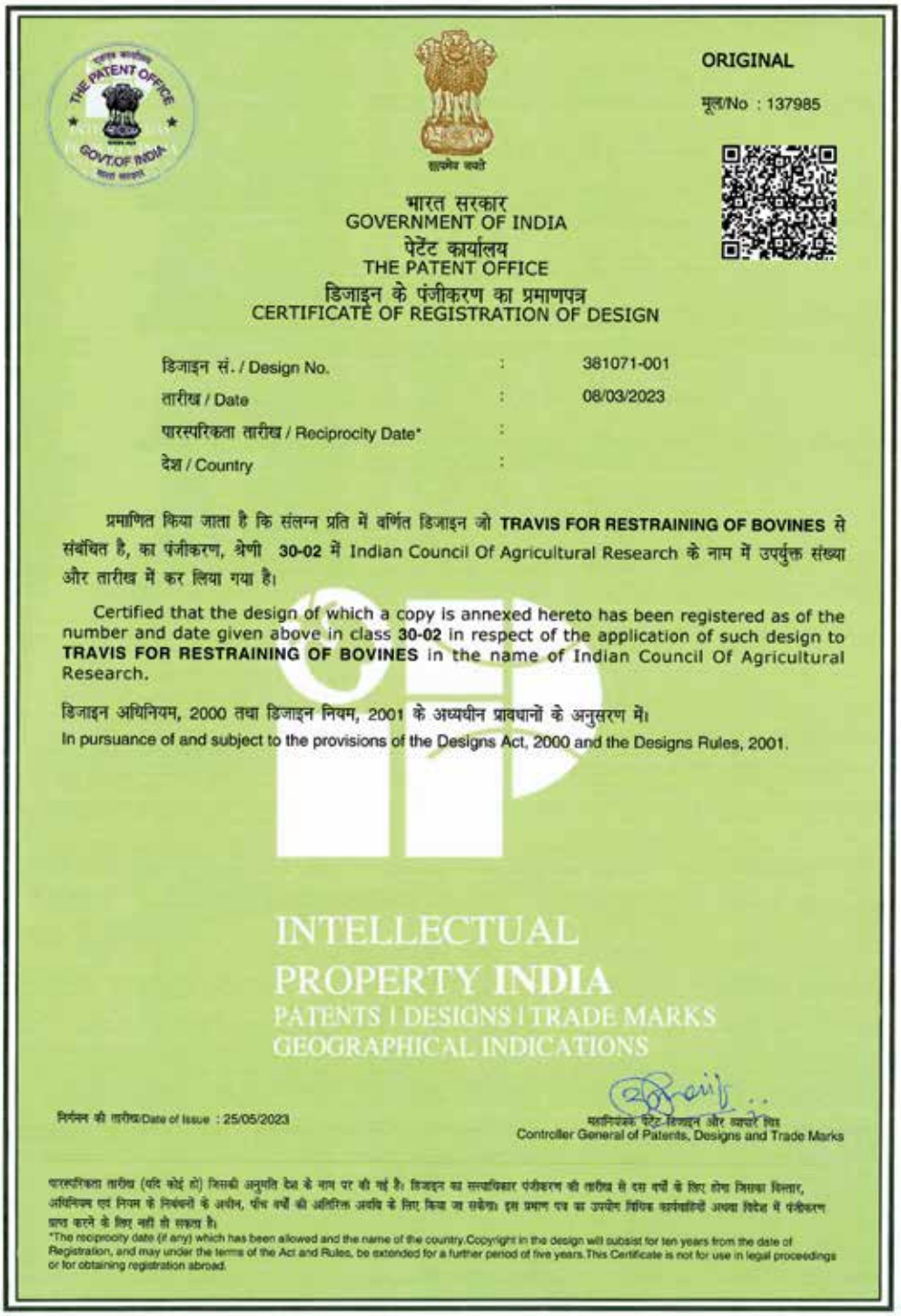
Date of Issue 04/01/2021 15:36:53



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डिजाइन के पंजीकरण का प्रमाणपत्र
CERTIFICATE OF REGISTRATION OF DESIGN

डिजाइन सं. / Design No.	:	381071-001
तारीख / Date	:	08/03/2023
पारस्परिकता तारीख / Reciprocity Date*	:	
देश / Country	:	

प्रमाणित किया जाता है कि संलग्न प्रति में वर्णित डिजाइन जो **TRAVIS FOR RESTRAINING OF BOVINES** से संबंधित है, का पंजीकरण, श्रेणी **30-02** में Indian Council Of Agricultural Research के नाम में उपर्युक्त संख्या और तारीख में कर लिया गया है।

Certified that the design of which a copy is annexed hereto has been registered as of the number and date given above in class **30-02** in respect of the application of such design to **TRAVIS FOR RESTRAINING OF BOVINES** in the name of Indian Council Of Agricultural Research.

डिजाइन अधिनियम, 2000 तथा डिजाइन नियम, 2001 के अध्यधीन प्रावधानों के अनुसरण में।
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निर्गमन की तारीख/Date of Issue : 25/05/2023

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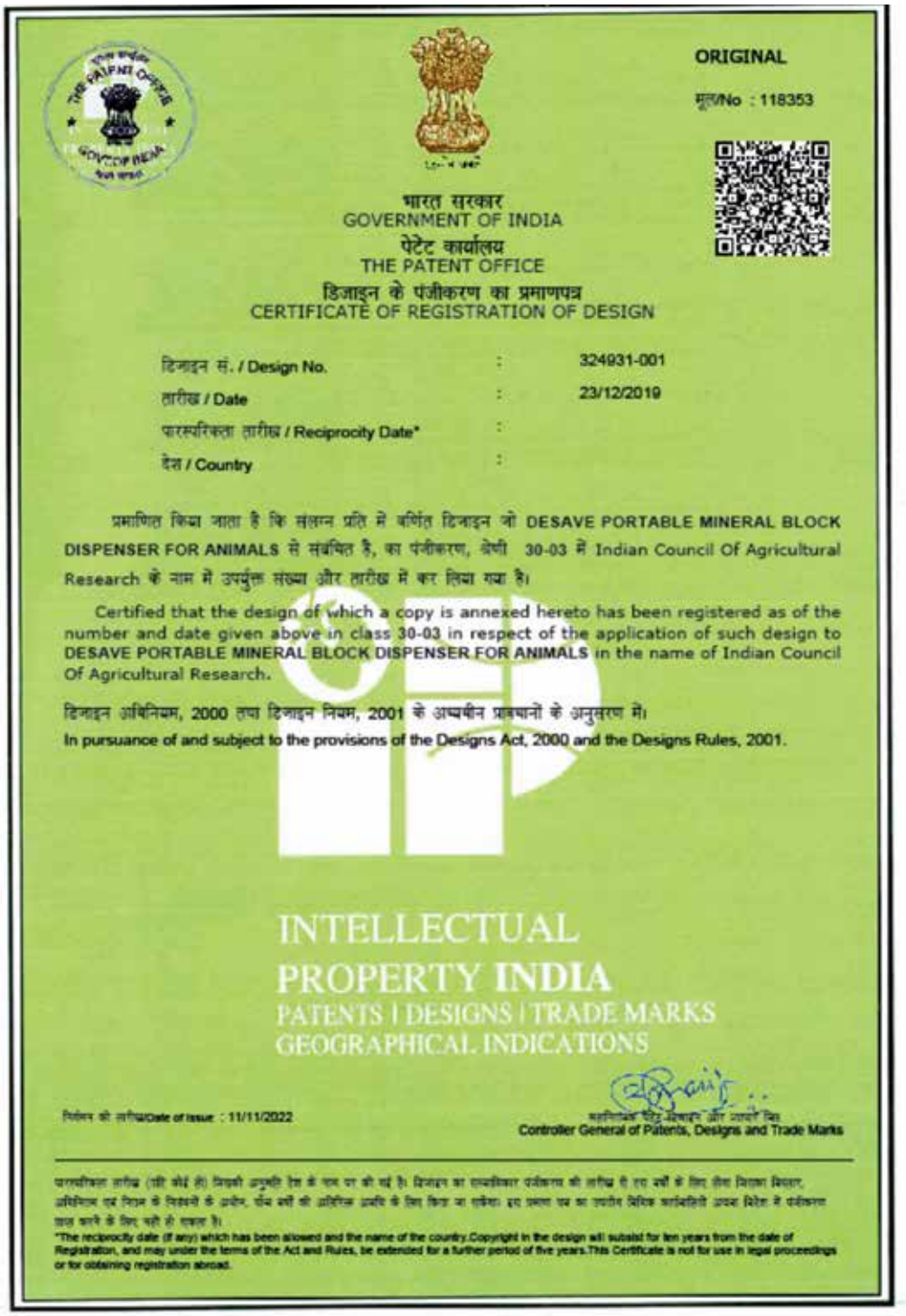

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डिजाइन सं. / Design No.	:	324931-001
तारीख / Date	:	23/12/2019
पारस्परिकता तारीख / Reciprocity Date*	:	
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प्रमाणित किया जाता है कि संलग्न प्रति में वर्णित डिजाइन जो DESAVE PORTABLE MINERAL BLOCK DISPENSER FOR ANIMALS से संबंधित है, का पंजीकरण, श्रेणी 30-03 में Indian Council Of Agricultural Research के नाम से उपर्युक्त संख्या और तारीख में कर लिया गया है।

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डिजाइन अधिनियम, 2000 तथा डिजाइन नियम, 2001 के अध्यधीन प्रावधानों के अनुसरण में।
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