



Farmers' Perception of the Feasibility of Mithun (*Bos frontalis*) Farming and its Constraints in Nagaland, India

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Authors' contributions

This work was carried out in collaboration between all authors. Author KPB under the guidance of authors DB and AM designed the study, performed the statistical analysis, and wrote the protocol and the first draft of the manuscript. Authors LSD and KK assisted in the primary data collection from the mithun farmers as well as conducted the literature searches of the study. All authors read and approved the final manuscript.

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ABSTRACT

The present study was conducted on a sample of 126 mithun farmers randomly drawn from three districts of Nagaland to assess the perception of the farmers regarding the feasibility of mithun farming and its constraints that can contribute to a better understanding of the mithun production systems and its declining population in Nagaland. The farmer's perception of the feasibility of mithun farming and its constraints was measured using a 3 and 5 point continuum Likert scale, respectively, drawing various inferences based on the respondents' responses. A low mean perception score (MPS) of 1.06, reveals that the majority (99.21%) of the respondents are in disagreement with the statement that mithun farming is not profitable. Mithun farming according to them is very profitable which needs the right hand-holding support from financial institutions for the exploitation of its marketable potential. Due to the lack of institutional efforts in promoting mithun rearing as bankable

and insured schemes, 99.21 percent of farmers held a strong perception ($MPS=2.98$) that mithun farming, in the long run, may not be feasible and may result in discontinuity of mithun farming in some villages. Also, the high cost of inputs for fencing ($Mean\ value=3.91$) and constant predator attack on the animal particularly the young calves ($Mean\ value= 3.88$) renders mithun farming difficult with the existing system of rearing. The findings indicate that though mithun farming is profitable, there is a strong need to promote a scientific and alternative semi-intensive method of mithun rearing and encourage the diversified use of mithun for meat, milk, hide, and draught potential to stop the slaughter of mithun for table purpose only. Therefore, considering the socio-cultural linkages of the tribes with the mithun proper strategies and policies are essential for its conservation.

Keywords: Mithun farming; perception; feasibility; constraints.

1. INTRODUCTION

Mithun (*Bos frontalis*), the unique and magnificent bovine species of North East (NE) India is believed to be domesticated since 8000 years ago [1]. It is considered as one of the most important cultural resources of the tribes of NE and is deeply rooted in the mythology and folklore of the cultural life of the tribes. Due to its inherent socio-cultural importance and economic potential, it plays a multidimensional role amongst the mithun rearing tribes. Mithun ownership is considered as a pride possession symbolizing wealth, power, and status [2]. The wealth of a person is often gauged by the number of mithun one possesses and it determines the social status and socio-economic superiority of a person over others in the village [3].

Mithun the majestic ruminant inhabiting hilly subtropical forests of the NE is found at an altitude of 1000-3000m (MSL) [4]. It is a mammalian species belonging to family bovidae and order ungulate (hoofed animal). Mithun appears somewhat similar to that off Gaur (Indian bison) but are smaller in size, strongly built, large sized fleshy animal with an average weight of 400-650 kg [5]. The characteristic feature of mithun lies in the head which has well developed broad frontal bone with flat shaped faced and from the front view, it appears like an inverted triangle. The most conspicuous feature of mithun is its prominent dorsal ridge that is flat and tapering on the shoulder and extends up to the middle of the back [6].

Mithun husbandry constitutes a significant source of annual income for the tribal farmers of Nagaland [7]. It also provides a means of social security to meet any future uncertain exigencies, for instance, health problems in families and other household-related problems [3].

Traditionally it is reared under a free-range system as a community herd in designated forest area specified by the village society with minimum input except for occasional salt lick, fencing, and labor involved in fencing the mithun rearing area. Mithuns are primarily reared for meat purposes; however, it also serves as a marriage gift and sacrificial animal for various social and cultural ceremonies amongst the tribes [8]. In Nagaland, mithun is sacrificed at the 'Feast of Merit which are a series of gradual feast carried out over a period of several years. This permits a man to advance in social and economic position and raises his status in the society [9].

Mithun is predominantly found in four states of NE India (viz., Arunachal Pradesh, Manipur, Mizoram, and Nagaland) and parts of Southeast Asia viz., Bangladesh, Myanmar, and Bhutan. NE India, with an estimated population of 3.9 lakh mithuns, accounts for 98 per cent of the global population of mithun [10]. The mithun population in the country has registered an increase of 29.5 percent during the last inter-census period (2012-2019). Nagaland, however, recorded a decline in the mithun population from 34.87 to 23.14 thousand (Appendix Fig 1), a decrease of 33.69 percent from the last inter-census.

Mithun rearing involves very minimal input due to its free ranging nature, only salt is fed once in every fortnight due to its high affinity towards salt [8], however, there are still villages that have stop rearing mithun due to reasons unknown. Therefore, understanding the factors and constraints resulting in this change and the decline in the mithun population is imperative at this stage to ensure that mithun rearing is continued and is conserved. Keeping this in mind, and the uniqueness of the species, the present study is conducted to assess the

perception of the farmers regarding the feasibility of mithun farming and its constraints that can contribute to a better understanding of the mithun production systems and its declining population in Nagaland so that necessary policies can be formulated.

2. METHODOLOGY

2.1 Description of the Study Area

The study was conducted in the state of Nagaland, which is a vibrant hill state located in the far North-Eastern part of India and lies approximately between 25.6°N and 27.4° N latitude and between 93.20° E and 95.15° E longitude.

2.2 Sampling

A multi-stage stratified random sampling framework was followed to select the mithun rearing households, which represented the ultimate sampling units. The districts in the state were classified into three quartiles based on the mithun population. A district with the highest mithun population from each quartile was then selected purposively, viz. Phek, Kohima, and Peren districts. Three villages were then randomly selected from each of the districts viz. Mesulumi, Porba and Upper Khomi villages from Phek district, Jotsoma, Khonoma and Mezoma villages from Kohima district and Nzong, Nzau and Tening villages from Peren district.

The estimated sample size covered in the study was determined as per the formula described by Kaps and Lamberson [11]:

$$n = \frac{z^2 pq}{M.E^2}$$

where,

n = the required sample size,
 Z = Z-value (at 95% confidence interval, i.e. 1.96),
 p = 4.4% (Proportion of mithun rearing farm per 100 households obtained from published National Sample Survey Office 2013 {NSSO} survey report),
 q = 1-p = 1- 0.044 = 0.956
 M.E = Margin of error (4%)

A total of 14 farmers who owned and reared mithuns, only, were randomly selected from each sample village. Thus, a total of 126 respondents were interviewed. Personal interviews of the head of selected households were held using a pre-tested interview schedule consisting of both close-ended and open-ended questions. The interviews were supplemented with focus group discussion with the mithun society members to collect the primary data using an analytical framework.

2.3 Socio-economic Profile of Sample Households

For the study, selected socio-economic characteristics of the sampled households were documented to understand the profile of the respondents. The information on chronological age, education, primary occupation, landholding, and annual income were collected. The landholding was classified into different categories, as per the framework given by Tongoe et al. [12].

2.4 Analyzing Perception and Constraints in Mithun Rearing

Perception is defined by the Longman Dictionary of Contemporary English [13] as the way an individual thinks about an object and their idea of what it is like. In the present study, the perception was defined as the respondents' attitude or opinion towards the feasibility and sustainability of mithun farming. The perception was measured with the help of respondents' responses to Likert-type scale [14]. The scale is a 3 point continuum and employs an ordinal level of measurement i.e. not agree (NA), somewhat agree (SA), and agree (A) with corresponding weightage scores of 0, 1, and 2. The weighted mean perception score (MPS) for each statement was calculated to assess the perception of the mithun farmers. The reliability of the interview schedule was determined using the test and retest technique described by Surya et al. [15]. Following upon, necessary changes were made to improve the clarity and understandability by the respondents. Using the method adopted by Surya *et al.* [15] the calculated Cronbach alpha reliability coefficient of the scale for assessing the perception of farmers was 0.717.

Similarly, using a Likert scale adopted by Uebersax [14], the constraints in mithun farming were determined on a 5-point continuum, wherein the responses required from the

respondents were ranked and scored. The responses were grouped as very serious (VS) =5, serious (S) =4, moderately serious (MS) = 3, least serious (LS) = 2 and not serious (NS) =1. For a given constraint, the weighted average score was computed by taking the sum of the products between the number of responses and grade point and then divided by the total number of responses. The importance of specific constraints, using this method, was judged by the weighted score as mentioned above; a score of less than 3 was construed as not an important constraint, while a score of more than 3 signified as a serious constraint as adopted by Ekunwe et al. [15].

3. RESULTS AND DISCUSSIONS

3.1 Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents are presented in Table 1. The average age of the respondents was 48.48 years with 64.46 percent of them belonging to the middle age group. About 31.75 percent of the respondents had a high school level of education. Farming was the major primary occupation (65.08%) of the respondents, 28.57 percent of whom fall under the small land-holding

category that practiced subsistence agriculture in jhum fields. The majority (74%) of the respondents belong to medium-income families. Similar findings was reported by Prasad et al. [7].

3.2 Farmer's Perception of the Feasibility of Mithun Farming

A MPS of 2.98 (Table 2) revealed that the farmers held a strong perception that mithun farming, in the long run, may not be feasible because of a lack of institutional support in promoting mithun rearing as bankable and insurable schemes. The farmers believe that this may result in discontinuity of mithun farming. A majority (99.21%) of the farmers agreed to this statement reflecting the unfavorable perception among the mithun farmers. They believe that mithun, like all other livestock, should be insured against any calamities particularly from losses due to predator attacks. They are of the opinion that credit/loan should be made available for undertaking mithun farming or for supporting the already existing mithun farming. Similar findings were reported by Joshi et al. [16]. Regarding the perception that mithun farming is not profitable, a majority (99.21%) are in disagreement with the statement which is evident from the low MPS (1.02). This is because mithun since ages has been a constant source of livelihood generation

Table 1. Socio-economic characteristics of the respondents

Characteristics	Range	Frequency	Mean (SD)
Age	Young (<35yrs)	22 (17.46)	48.48 (13.71)
	Middle (35-62yrs)	85 (64.46)	
	Old (>62yrs)	19 (15.08)	
Education	Illiterate	4 (3.17)	
	Primary	26 (20.63)	
	Intermediate	36 (28.57)	
	High school	40 (31.75)	
	Graduate	18 (14.29)	
	PG & above	2 (1.59)	
Primary occupation	Farming	82 (65.08)	
	Dairy farmer	1 (0.79)	
	Daily laborer	3 (2.38)	
	Business	10 (7.94)	
	Government Service	32 (25.4)	
Land-holding	Landless (0)	1 (0.79)	
	Marginal (<2.5 acres)	28 (22.22)	
	Small (2.6-5 acres)	43 (34.13)	
	Medium (5.1-10 acres)	39 (30.95)	
	Large (>10 acres)	15 (11.90)	
Annual Income (Rs)	Low (<63456)	9 (7.14)	276030.95
	Medium (63456-488606)	93 (74.00)	(212575.09)
	High (>488606)	24 (19.05)	

***Figures in parenthesis indicates the percentage*

and support to the mithun farmers. This statements are in agreement with the findings of Prasad et al. [7]. Similarly, 65.08 percent of the respondents did not agree that the younger generation will not be willing to take up mithun farming as a profession. They believe that mithun ownership has been handed down generations after generations from their forefathers and this practice will continue irrespective of the time considering how important mithun is to their socio-cultural and economic livelihood. However, there is a conflict of choices towards the perception of the farmers on the feasibility of mithun farming because of the increasing undeterred human activities leading to an increasing trend in deforestation/encroachment of forest areas resulting in dwindling mithun habitat causing a threat to its extinction. About 56 percent of the respondents were not in favor of this statement while 23.02 percent agree that such activities have had an impact on the feasibility of mithun farming in the present and maybe in the future too. Hence, they feel an alternative and sustainable system for rearing mithun is the need of the hour. Mithun for the tribes is an important asset among all livestock. In case of any exigencies, mithun is the first livestock to be sold in order to support their livelihood. Similar findings were observed by Moyong [3].

3.3 Constraints in Mithun Farming

The results in Table 3 revealed that high input prices for fencing the jungles rank first among various constraints with a mean value of 3.91. Since ages, mithun is reared under-free range systems that are fenced to prevent any major mithun-human conflict due to the destruction of crops by the mithuns. Construction and repairing of this fencing is an annual activity carried out by the mithun community/society and is a very important activity to prevent the fall of the mithun from the rugged topography as they are free ranging in nature. They utilize locally available

resources such as tree branches, bamboos, and digging of trenches as fencing material that are not durable. Every year, before the onset of the rainy season, repairing of these fencings is carried out. Due to low purchasing power, the mithun farmers are not in a position to construct permanent fenced enclosures. The absence of such enclosures results in a high predator attack on calves (3.88). Based on the focus group discussion conducted during the survey, it was reported that every year about 8-10 calves are lost due to attack by predators such as wild dogs, jackal and wolves. Lack of vaccination/health cover (3.87), leech and tick infestation (3.85), and disease infection, particularly recent outbreaks of Foot and Mouth Disease (3.82) were identified as the major healthcare-related constraints. The findings were similar to that of Dhali et al. [17], who reported that leech and tick infestation was a major constraint in rearing mithun under free range eco-system. One of the major reasons for the lack of vaccination/health cover may be due to the difficulty in reaching out to the mithun pockets that are located in far-flung villages where accessibility across the rough terrains to carry out vaccinations regularly becomes a herculean task for the veterinarians. Similar findings were observed by Joshi *et al.* [16]. In most marriages in Nagaland, a mithun is presented to the groom as a bridal gift wherein the best bull is slaughtered for the feast. As a result, the farmers are always compelled to sell the best bull subsequently leading to the loss of a superior mating bull for feast which otherwise could have been used for breeding to improve the genetic makeup of the future progeny. The findings are in line with the study by Mephuo and Saharia [8]. These constraints in mithun farming discussed in Table 3 may be the probable reasons for the significant decline in the mithun population and needs to be addressed immediately by the policy makers considering the socio-cultural linkages and importance of mithun to the tribes rearing mithun.

Table 2. Farmer's perception of the feasibility of mithun farming

Items	NA	SA	A	MPS
Mithun farming is not profitable	99.21	0	0.79	1.02
Younger generation not willing to take up mithun rearing as profession	65.08	28.57	6.35	1.41
Improving education level of younger generations offering them other professional avenues	65.08	27.78	7.14	1.42
Increasing trend in deforestation/ encroachment of forest area	55.56	21.43	23.02	1.67
No institutional efforts in promoting mithun rearing as bankable and insured schemes resulting in discontinuity of mithun farming	0.79	0	99.21	2.98

Table 3. Constraints in mithun farming

Constraints	Mean value
High inputs price for fencing of jungles	3.91
Predator attack on calves	3.88
Lack of vaccination/health cover to the mithun	3.87
Leech and tick infestation	3.85
Diseases infection (Foot and Mouth Disease, Hemorrhagic Septicaemia)	3.82
Increase conflict with crop/horticultural activity	3.05
Compulsion to sell the best bull only	2.95
Lack of manpower for rearing mithun everyday	2.39
Shrinkage in mithun habitat due to deforestation and encroachment of protected forest	1.57
Little negotiation power when selling	1.01
Non-regular out-flow of animal for sale, but concentrated during Festivals/Marriages/Social gatherings	1.10
Inability to detect heat	0.84
Shortage of fodder during the winter season	0.79

4. CONCLUSION

The study concluded that, a majority of the respondents are in disagreement with the statement that mithun farming is not profitable. The farmers strongly believe that mithun farming is very profitable and with the right hand-holding support from financial institutions, it can be fully exploited to its marketable potential. The farmers fear that in the long run, the lack of institutional efforts in promoting mithun rearing as bankable and insured schemes will make mithun farming not feasible and result in discontinuity of mithun farming by some villages. The constraints of the high cost of inputs involved in fencing and predator attack may be mitigated using bio-fencing. Hence, there is a need to promote a scientific and alternative semi-intensive method of rearing and to encourage the diversified use of mithun for meat, milk, hide, and draught potential. The state government should work for inclusion of mithun under the National Livestock Mission and take initiatives to frame policies, strategies and legislative laws to control the indiscriminate sale and slaughter of mithun and support the farmers through various employment schemes so that they will not be entirely dependent on mithun alone for their livelihood security.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

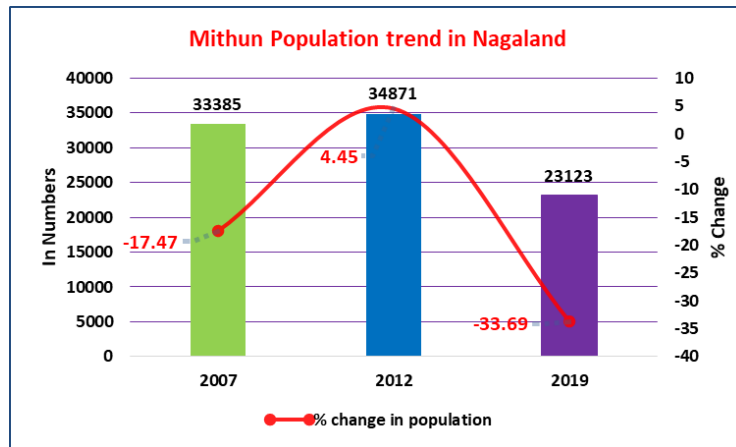


Fig 1. Change in mithun population from 2007 to 2019
(Source: Livestock Census 2007, 2012, 2019) [19,20,10]

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