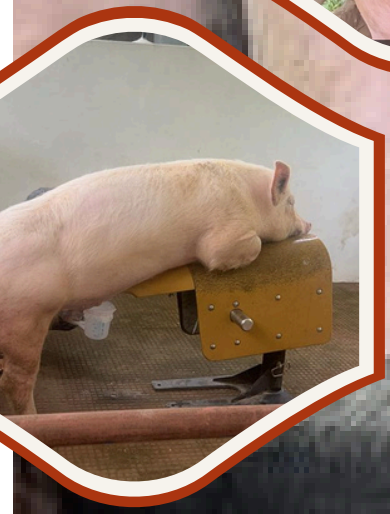
STUDY ON IMPACT OF BOAR SEMEN STATION UNDER SOCIETY FOR CLIMATE RESILIENT AGRICULTURE IN MIZORAM (SCRAM)



COLLEGE OF VETERINARY SCIENCES & ANIMAL HUSBANDRY
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FOREWORD

Pigs are the most lucrative livestock in Mizoram state, almost every family has at least one or two pigs to supplement their income or for consumption. Almost every family raises them in their backyards. Pig farming is one of the cash sources of income for subsistence farmers and also affects the purchasing power of families. Boar semen stations are specialized facilities dedicated to the collection, processing, storage, and distribution of boar semen for artificial insemination (AI) in pigs. These stations play a pivotal role in modern pig farming by enabling genetic improvement, enhancing reproductive efficiency, and controlling the spread of diseases. Moreover, it plays a crucial role in producing quality boar semen for artificial insemination.

To bridge the gap of this needs, Boar Semen Stations under the Fostering Climate Resilient Upland Farming System in the Northeast (FOCUS), Mizoram, were established in four location i.e. Kolasib, Serchhip, Mamit, and Champhai districts, among 11 districts of Mizoram. The establishment of these Boar Semen Stations is a stepping stone for the pig producers. The ultimate objective of this establishment under FOCUS is to achieve sustainability in pig farming, thereby, limiting the various constraints faced by the pig farming in regards to reproductive performance and to have a superior germplasm in the near future.

This study “Impact Studies on Boar Semen Station” provides the status of pig farmers and impact of Artificial Insemination in comparison to Natural service on the productive performance and profitability of the pig farmers of Kolasib and Mamit districts in State of Mizoram. The results depict comparative assessment of the various socio-economic attributes of the farmers and performance of pig farms before and after Artificial Insemination between these two districts.

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ACKNOWLEDGEMENT

It is a great pleasure and honor to deliver this study on "**Impact Study on Boar Semen Station**" on behalf of College of Veterinary Sciences & Animal Husbandry, Central Agricultural University (Imphal), Selesih, Aizawl, Mizoram to Society under Department of Agriculture- Society for Climate Resilient Agriculture in Mizoram (SCRAM), Govt. of Mizoram.

With profound gratitude and great humility, I extend my gratefulness to all the associated member who contributed to the study**Dr. Saidur Rahman**, Professor and Head, Dept. of Veterinary & Animal Husbandry Extension Education, **Dr. Jitendra Kumar**, Assistant professor, AGB Department, **Dr. Nancy Laldinpuii**, Assistant professor, Extension Department of C.V.Sc. & AH , Selesih, Aizawl, Mizoram andMr(s). Lalchhanhimi, Research Associate of the project. I also extend my sincere thanks to **Dr. David Lalthlamuana**, Manager, Boar Semen Station, Mamit District and Dr. **Vanlalhriatpuia**, Manager, Boar semen station Kolasib district who continually and convincingly conveyed a spirit of adventure of the research and providing all necessary information for the study.

I offer my sincere thanks to **Dr. Lalnuntluangi Hmar**, Dean, College of Veterinary Sciences & Animals Husbandry, Central Agricultural University (Imphal), Selesih, Aizawl, Mizoram for her inspiration and encouragement and allowing to conduct the study.

I also express my deepest gratitude **Dr. Suzzane Malsawmthangi**, Technical officer (Vety) and all staff of FOCUS for all necessary help throughout the study and moral support till completion of project.I am honour to acknowledge the warm and kind hospitality of the piggery farmers in the two district of study who have provided the needed information and their help during the course of the study.

Lastly, I would like to express my deepest gratitude to **Chief Executive Officer**, SCRAM & State Project Director, FOCUS-Mizoram for entrusting us with the project and providing funds to undertake the assignment.

Dr. Lalhumliana Tochhawng
Assistant Professor & PI of Project
CVSc& AH, CAU

ABBREVIATIONS

AI	Artificial insemination
AICPR	All India Coordinated Research Project
ASF	African Swine Fever
ATMA	Agriculture Technology Management Agency
BOD	Biological Oxygen Demand
CSF	Classical Swine Fever
FOCUS	Fostering Climate Resilient Upland Farming System
Ha	Hectare
ICAR	Indian Council of Agricultural Research
KVK	Krishi Vigyan Kendra
MPCE	Monthly per capita expenditure
NB	Natural Breeding
NLM	National Livestock Mission
NMPS	National Mission for Protein Supplement
NS	Natural Service
PRRS	Porcine Reproductive and Respiratory Syndrome
RKVY	Rashtriya Krishi Vikas Yojana
SCRAM	Society for Climate Resilient Agriculture in Mizoram
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
VFA	Veterinary Field Assistance
VO	Veterinary Officer

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EXECUTIVE SUMMARY

Executive Summary

The Fostering Climate Resilient Upland Farming System in the Northeast (FOCUS), Mizoram was started on January, 2018 as a Society under Department of Agriculture- Society for Climate Resilient Agriculture in Mizoram (SCRAM). FOCUS Project recognized that Artificial Insemination is the key in pig reproduction and therefore establish Boar Semen Stations in four (4) districts viz. Kolasib, Serchhip, Mamit and Champhai districts to cater the needs of the pig farmers.

The Impact Assessment conducted focused on comparing the impact Artificial Insemination to Natural breeding emphasizing primary data collection from pig farmers of Mamit and Kolasib districts of the State. The study involved interactions with beneficiaries and stakeholders to gather perspectives on the effectiveness of the interventions. The situational analysis of before and after the intervention of the Project in regards to the Boar Semen Station is not systematically captured and no such measurement has been undertaken to analyze the impact. However, monthly report on number of pigs inseminated with the Artificial Insemination Success Rate (%) has been recorded. The study was conducted by preparing a baseline indicating the level of improvement before the project intervention i.e. traditional practices of natural insemination by the farmers and comparing the AI success rate, litter size of the sow, cost effectiveness etc. in order to provide a significant outcome for the study. The study revealed a positive impact of Artificial Insemination on the livelihood and performance of pig production despite a sharp decline in pig production due to the African Swine Fever (ASF). It is observed that the intervention has significantly helped in increasing pig herd size, annual income and reduced the cost of breeding services. The intervention has improved the performance of pig production in the pig farms in parameters like the conception rate, herd size, litter size per sow, mortality rate, age of piglet at weaning, no. of litters weaned/sow and average weight of piglet at birth which are crucial for sustainability of pig farms in the state. The project has strengthened food security and livelihoods of the farmers. Major constraints in regards to AI services includes Less number of choice of boar from the Boar Semen station, Difficulty in pregnancy diagnosis, Lack of credit facilities, Lack of subsidies for AI and poor communication facilities

Recommendations & Way Forward

- **Scaling Up of the Intervention**: To maximize impact, the intervention should be scaled up to cover maximum pig farmers of the state.
- **Policy Support:** Policy support at the state and national levels is crucial to ensure the sustainability of project interventions and to attract further investment in this sector to make it more economically viable and competitive.
- **Capacity Building Programme:** Awareness /sensitization programme about the benefit of the AI, training especially on various reproduction characteristics and capacity-building programs on scientific pig farming for the piggery farmers and community members are essential to enhance the benefits of the project.
- **Monitoring and Evaluation:** A robust monitoring and evaluation framework should be established to continuously assess quality of the semen, storage facilities and laboratory; and skills of inseminators for better impact of project interventions.
- **ICT tools/software for data recording:** ICT tools/software can be utilized to keep the records of farmers as well as the pigs for effective monitoring and evaluation of the project intervention.
- **Community-Based Management:** Success of any intervention rely on the community's acceptance to the intervention. Involvement of community and promoting community participation is crucial for long-term sustainability project.

The Impact Assessment on Artificial Insemination through Boar Semen Station in these two districts i.e Mamit and Kolasib highlighted the significance of AI in improving the piggery sector in the state which is intrinsically woven with its culture, tradition and livelihood of the people in Mizoram.

INTRODUCTION

1. Introduction

There are 9.06 million pigs in India overall, as per the 20thLivestock Census, with roughly 90% of them from rural areas and only about 10% from urban areas. Pigs contribute about 1.7% per cent of India's total livestock. Of all the pig population, 79% is indigenous/nondescript animals, and 21% is exotic/cross-bred animals. The North-Eastern (NE) states of India account for over 47% of the Indian pig population. From the total meat production in India, pork production contributes nearly 5% and the annual meat production in India in 2019-20 is 8.6 MT. A positive growth at 5.98% is seen in pork production during 2019-20. However, the total pig population in the 20thLivestock census 2019 decreased by 12% over the previous livestock census (2012) (Thomas *et al*., 2021). Pig rearing is a significant source of income for the tribal population in India's North-Eastern area, and it is closely associated with the region's socio-cultural fabric. People in this area consume over 75% of the country's pork production (Khan and Bisht, 2020). Around 90% of the pigs in India are raised by smallholder farmers with low resources and use them as a key source of their income and dietary protein, unlike other livestock sectors the pig sector is neither well-developed nor suitably organized in India (Misha *et al*., 2022).

The 20th Livestock Census 2019 shows that Mizoram has 0.29 million pig population. Piggery or pig farming is a popular form of animal rearing in Mizo society, from time immemorial and is vital to livelihood of the small farmers. Pigs are the most lucrative livestock in the state, almost every family has at least one or two pigs to supplement their income or for consumption. Majority of farmers raise them in their backyards in confinement structure made of woods and bamboo on an elevated platform. The majority of farmer rear pigs that are cross-bred. All of the farmers practiced stall feeding and fed their pigs kitchen waste with certain weeds after boiling, but only half of them fed concentrate feeds (Rahman *et al*., 2008). Pig farming is one of the cash sources of income for subsistence farmers and also affects the purchasing power of families (Vanlalmalsawma *et al*., 2021).

Because of the growing human population, there is a constant demand for pork. To reduce its negative environmental effects, pig farming needs to be competitive, efficient, and sustainable. There is argument to keep fewer breed able animals to produce more numbers of

piglets (FAO 2003). In India, pig rearing is still done on traditional manner with low productivity (Singh *et al.* 2019a). Artificial insemination (AI) is the best reproductive technology available in the current scenario for enhancing the efficiency of pig production in a sustainable way (Singh *et al.,* 2019b). The Artificial insemination (AI) is the method in which semen is collected from the male, processed in the laboratory and deposited artificially into female reproductive tract. Since the late 1940s, artificial insemination has been a commonly used technique in breeding programs for the development of livestock (Singh et al., 2014). The ability to gather, prepare, store, and implant spermatozoa into the reproductive system of female animals has made this feasible. For the majority of domestic livestock species, the technology has been standardized with species-specific modifications. This is being widely used in cattle, buffalo, sheep, goat and pig in all over the world. AI in pig is widely used on commercial scale in the countries with intensive pig rearing (Maes *et al.,* 2011). It is being used in more than 90% pig in Western Europe (Gerrits *et al.,* 2005). In India, hardly 1 to 2% of breed able pigs are covered by AI. Introduction of new germplasm over a short period of time, extensive use of superior boars, disease control and extensive record keeping are some of the benefits of artificial insemination over the natural breeding (Singh *et al.,* 2018). Furrowing rate of 86% and litter size of 14 piglets had been reported by use of AI in pig (Yeste *et al.,* 2014; Singh *et al.,* 2018). It is a relatively simple, cost effective with a lot of potential for resource poor pig farmers. AI in pig involve use of freshly diluted liquid semen, transported on same day of collection or stored at 17ºC for three to ten days before use depending upon the extender (Singh *et al.,* 2018a). Nowadays, two to three billion spermatozoa are employed in each AI dosage because of the pig's lengthy uterine horn and prolonged ovulation.

In NEH region, tribal farmers generally keep one boar for 4–5 villages for breeding purpose and they have to transport female pig at the time of oestrus which further adds cost to the farmers (Singh *et al.,* 2019b). For all the above mentioned felt needs, artificial insemination is the easiest way to improve the local germplasm in the shortest way with very low input costs. Compared with natural mating, artificial insemination is the better way to introduce superior genes into sow herds, with a minimal risk of disease. The genetic selection programme in pig based on AI helped in improving economic traits such as growth rate, higher feed conversion efficiency, carcass trait, mothering ability and litter size. AI in pig is widely practiced throughout the world and is a very useful tool to introduce superior genes into sow herds, with minimal risk

for disease transmission (Maes *et al.*, 2011, Knox 2016). Initially AI was more focused on to improve breeding management and preventing the spread of venereal diseases rather than a mean to accelerate genetic progress. Artificial insemination coupled with oestrus synchronization is very useful in planned and controlled breeding. Artificial insemination also helps in avoiding inbreeding due to repeated use of same boar in natural mating. It will also eliminate the need of keeping boar at every farm or household for breeding purpose which will lower the cost of production (Singh *et al.*, 2019b). Also, AI helps in better maintenance of record at the farm. Semen from a single ejaculate can be used for breeding 10 to 20 females. With the availability of long-term extenders, AI in pig has been adopted on a wider scale (Knox 2016). Long term extender could be of immense help in country like India having hilly terrain, sparsely located pig population in NEH region, and less-developed transportation systems. In addition to the above-mentioned benefit, AI helps in control of venereal diseases. It will allow maintenance of close nucleus herd and therefore prevent entry of diseases. AI allows better maintenance of record and save the labour involved in natural mating.

AI of swine was initiated by Ivanow in Russia in the early 1900s. More than 90% of sows are bred by AI in Western Europe (Gerrits *et al.*, 2005). In the USA too, more than 70% pigs were bred through AI in the year 2000. Despite the world scenario, AI in pig in India has not yet received adequate attention due to lack of awareness among the farmers, policy makers and there are inadequate infrastructure facilities at field level (Singh *et al.*, 2019d). AI in pigs in India has mostly been just at an academic interest level until recently. National Research Centre on Pigs (NRCP), Rani, Guwahati successfully introduced AI technology at field level in Assam. Artificial insemination in Nagaland is being undertaken successfully under ICAR Mega Seed Project on Pig (Singh 2018). Recently, there is a renewed impetus under AICRP on pig breeding for adoption of AI at farm level. However, except for North East India, there are no reports of using AI in pig at field level. Non availability of basic infrastructure support like electricity, distilled water, BOD incubator at the field levels are the specific reasons for non-adoption of AI in pig. Also, lack of technical knowledge at the field level poses a major hindrance for spread of this technology. Singh (2018) recorded furrowing rate of 89.48% in farmer's field in Nagaland with average litter size of 10.06 with the use of AI. AI in pig has immense potential in empowering the tribal farmers and developing them into potential entrepreneur (Singh *et al.*, 2017). ICAR Nagaland has carried out a total of around 2500 inseminations from 2013 till 2019

and produced around 20000 piglets of improved germplasm. The average litter size has increased from 7.15 to 10.21 as compared to natural mating. The furrowing rate has also stayed at an average of around 80% through this period. The cost of AI is also 1/10th of the cost of natural service in Nagaland. Due to limit on storage time of liquid boar semen, adoption rate of AI is higher in districts near to ICAR farm in Nagaland (Singh *et al.*, 2019b). In Mizoram, pigs farming cooperative societies are carrying out AI extensively and are becoming an enormous success. It is also the first state in the country to start AI programmed. ICAR Umiam is also carrying out AI in pig in Meghalaya. However, In India, hardly 1–2% of breed able pigs are bred through artificial insemination. Kadirvel *et al.,* (2012) observed the following benefits of AI for tribal farmers', viz. timely availability of superior germplasm for breeding, economical in comparison to natural breeding and prevention of inbreeding. In addition to genetic improvement of nondescript local pigs, AI can help in overcoming breeding constraints faced by tribal farmers who practices low input backyard pig farming. There is urgent need to take up this technology to the farmers.

Boar semen stations are specialized facilities dedicated to the collection, processing, storage, and distribution of boar semen for artificial insemination (AI) in pigs. These stations play a pivotal role in modern pig farming by enabling genetic improvement, enhancing reproductive efficiency, and controlling the spread of diseases. Moreover it plays a crucial role in producing quality boar semen for artificial insemination. This facility also serves as a training centre for technicians in artificial insemination. There is need to develop the basic infrastructure at ground level for adoption of AI in India. Establishment of satellite AI centre in remote areas in collaboration with main boar station is the need of hour.

Boar Semen Station In Mizoram

The regional Boar Semen Station in Mizoram was established in the year 2013 under RKVY (NMPS) located at AH &Vety farm complex Selesih, Aizawl and started functioning in the year 2014.In Mizoram, the establishment of boar semen stations has significantly improved pig farming practices. Although these establishments have a great impact, the set up in the state could not carter the needs of the piggery farming in the whole state of Mizoram especially the other district beyond Aizawl due to various reasons.

Boar Semen Station under FOCUS

To bridge the gap of this needs, Boar Semen Stations under FOCUS were built in four location i.e. Kolasib, Serchhip, Mamit, and Champhai districts, among 11 districts of Mizoram. AH &Vety Department, Govt. of Mizoram started civil construction of all the structures in coordination with the National Livestock Mission (NLM), which accounts for 61.70% of the project's total cost. FOCUS provided material equipment, propulsion costs, salaries for technical and non-technical staff, and other operating costs, making up 38.30% of the overall cost. The establishment of the Boar Semen Station is a fortunate development for both the Department of AH &Vety and the piggery producers. Pig producers employed breeding boars for reproduction when Artificial Insemination was not available, which is a time- and money-consuming process that is associated with the risk of contracting diseases. The ultimate objective of this establishment under FOCUS is to achieve sustainability in pig farming thereby limiting the various constraints faced by the pig farming in regards reproductive performance and to have a superior germplasm in the near future.

Boar Semen Station- Kolasib

The Boar Semen Station in Kolasib started functioning under the project since April,2021 serving farmers from different villages within the district by providing timely Artificial Insemination with superior semen quality. Primary data obtained from the records of Boar semen station in Kolasib reveals that a total of 5071 AI were performed from inception i.e April, 2021 till June, 2024. A total of 23402 piglets were conceived through AI of which 11943 were male and 11459 were female piglets. The success rate of conception from inception till June, 2024 was calculated to be 67.08 %. It may also be noted that there was outbreak of ASF in the district which also affected the boar semen station and therefore no AI were performed during April, 2022 - December 2022 leading to complete halt of the Boar Semen Station which remain closed for 7 months. No piglet were conceived through AI during August, 2022 to April, 2023. The total revenue generated during the financial year April, 2023 - March 2024 was Rs. 7,27,290.00

Figure 1: Kolasib Boar semen station

The following observation were recorded during investigation

1. Breeds maintained : Large white Yorkshire
2. No. of Boars maintained: 4 nos. (2 year of age – 2 and 1 year of age - 2)
3. Average no. of collection of semen/boar/week : 1.5 time/week/boar
4. Average number of insemination carried out per sow : 1
5. No. of sperm per dose : >3 billion count
6. Average volume of diluted semen dose: 60 ml
7. Type of insemination performed: performed: single
8. Type of cathedral used : Golden pig
9. Average fee collected for single dose: Rs. 1000

The major constraints on part of the boar semen station, Kolasib were late reports from the farmers and the prevailing ASF cases in the district. Late reports from the farmers led to untimely insemination of semen through AI thereby affecting the outcome of success rates. This issues might be addressed through awareness and training programme among the pig farmers in the district. Other constraints perceived were non functioning of the photometer for semen count and semen viability and absence of proper sterilization in the semen processing unit.

Boar Semen Station- Mamit

Boar Semen Station in Mamit was established in 9th November, 2021. Due to unavailability of breed able Boar, AI started functioning from 16th March, 2023. A total of 449 AI were conducted from March, 2023 till May, 2024 and 2589 piglets were conceived through AI. The low AI performance in the district may be attributed to ASF disease outbreak from March, 2023-September, 2023 where only few AI were performed during the period. The success rate of conception from inception till June, 2024 is calculated to be 63.07 %. This centre has 5 inseminators (2 for Zawlnuam block and 3 for Mamit block).

The following observation were recorded during investigation

1. Breeds maintained : Large white Yorkshire
2. No. of Boars Maintained: 2 nos. (3 year of age – 1 and 1.5 year of age - 1)
3. Average no. of collection of semen/boar/week : 2 time/week/boar
4. Average number of insemination carried out per sow : 1
5. No. of sperm per dose : >3 billion count
6. Average volume of diluted semen dose: 60 ml
7. Type of insemination performed: performed: single
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Main constraints of the boar semen station in Mamit is the poor power supply to the semen processing unit as the solar power supply was not functioning during the period of study and the prevailing ASF cases in the district. Other constraints includes awareness for the farmers about AI centre and timely detection of heat for AI, improper fencing for bio-security measures and lack of equipment such as semen analyzing microscope for semen evaluation.

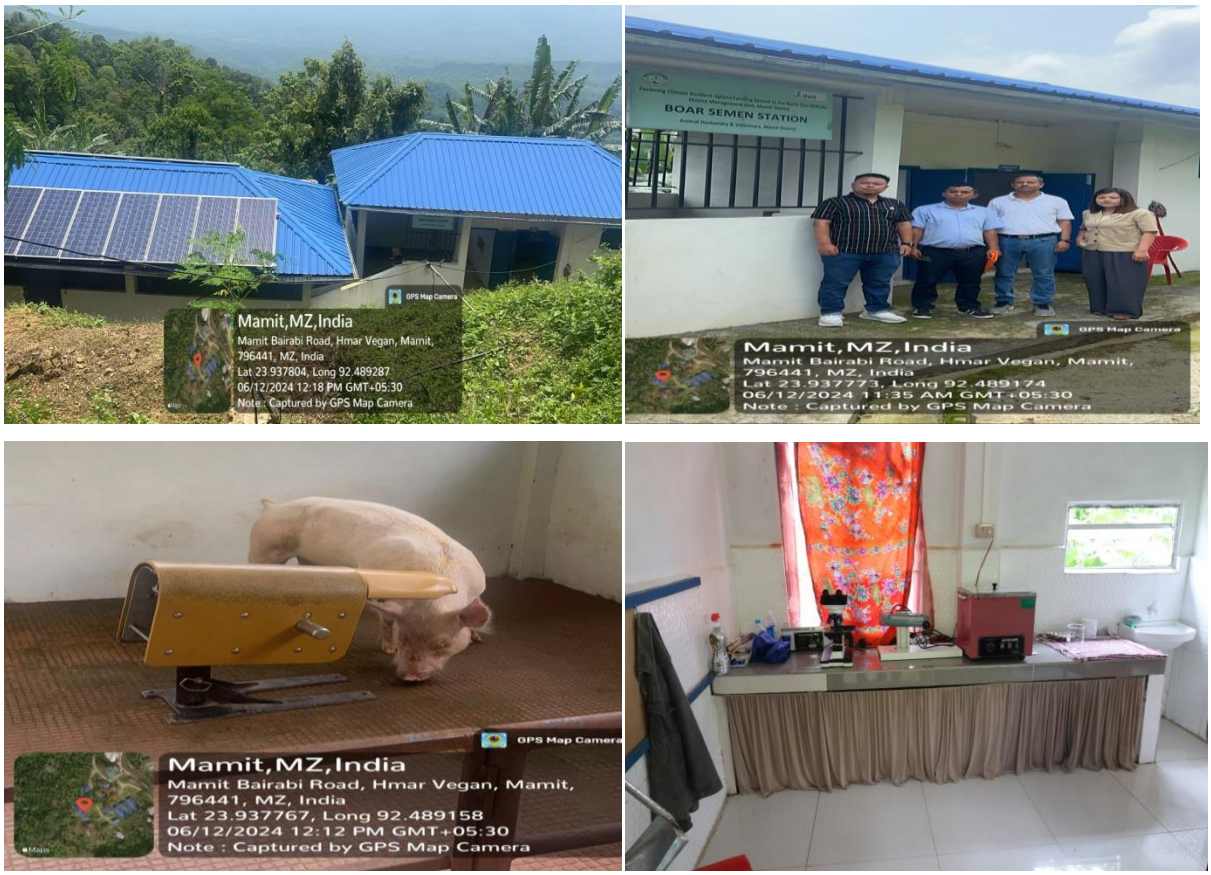

Figure 2 : Mamit Boar semen station

Objectives of the Impact Assessment study

The study was conducted to with the following specific objectives

1. To study the socio-economic, personal and psychological impact on the farmers
2. To study the success rate of conception (%) as perceived by pig farmers
3. To study the growth rate and weaning age of the piglets
4. To understand the Existing pig rearing practices followed by the pig farmers
5. To elicit the constraints of AI in pig farming in the study area

Limitation of the study

The African Swine Fever (ASF) outbreak which was still prevalent in the state of Mizoram during the study period had a significant influence on the piggery farmers, who suffered enormous losses. This, in turn, made the farmers skeptical to meet unknown people and staff of the veterinary department and expose their farms for fear of spread of the ASF in their farms which resulted in difficulty of primary data collection during interview schedule collection. However all effort were taken to make this study as comprehensive as possible.

change, with the summer temperature crossing 30 degrees Celsius and winter temperatures varying from 7 to 22 °C (45 to 72 °F). Mizoram receives rainfall averages about 100 inches (2500mm) annually, with most brought by the southwest monsoon (which blows from May to September).

2.2.2 A brief description of Mamit District

Mamit is the 4th largest district in Mizoram. The district is bounded on the north by Hailakandi district of Assam state, on the west by North Tripura district of Tripura state and Bangladesh, on the south by Lunglei district and on the east by Kolasib and Aizawl districts. According to the 2011 Census of India, Mamit has a population of 86,364. The district occupies an area of 3025.75 sq. km. There are four Rural Development Blocks i.e., West Phaileng, Reiek, Zawlnuam and Kawrtethawveng.

2.2.3 A brief description of Kolasib District

Kolasib is a town located in the northern part of Mizoram.The district is bounded on the north and northwest by Hailakandi district of Assam state, on the west by Mamit district, on the south and east by Aizawl district and on the northeast by Cachar district of Assam State. It is located 52.6 miles (84 km) south of the state capital Aizawl. The district occupies an area of 1382.51 sq. km (533.79 sq mi). As of the 2011 Census of India, Kolasib has a population of 83,955. There are two Rural Development Blocks i.e., Thingdawl and Tlangnuam.

2.2.4 A brief description of Mizoram

Mizoram's population is almost entirely comprised of Scheduled Tribes. The majority of the population is Tibeto-Burman, and they speak Mizo, a dialect that is closely related to or similar to that of the region. "Highlanders" is the local term for these communities, which they are referred to as Mizo. According the 2011 census, the state total population is 10,97,206, with 5,55,339 males and females 5,41,867. This shows a 23.48 per cent increase from the 2001 census; Mizoram remains the second least populated state in India. The state has a higher sex ratio than the national average of 940, with 976 women for every 1000 men. There are 52 people living per square kilometer. Over one-third of Mizoram's population resides in the district of Aizawl, home to the capital. The percentage of Mizoram's population that lives in urban areas is 52.00%, which is higher than the national average. Mizoram had the second-

METHODOLOGY

2. Approach and methodology adopted for this study

The investigation has been organized under the sub-heads given below:

2.1 Study location

2.2 Description of the study area

2.3 Sampling procedure

2.4 Parameters studied

2.5 Method of Data Collection

2.6 Data Processing and Statistical Analysis

2.1 Study Location

The planned research was conducted in the state of Mizoram. The study was conducted in purposively selected two districts of Mizoram, namely, Mamit and Kolasib district. These two districts had been chosen based on the term of references highlighted by Society for Climate Resilient Agriculture in Mizoram (SCRAM)

2.2 Description of the study area

Mizoram is one of the seven states in India's North Eastern region. It is the fifth smallest state in India with 21,087 km^2 (8,142 sq m). It extends from Latitude 21°58' & 24°35'N and Longitude 92°15' & 93°29'E (Economic Survey of Mizoram, 2021-2022). Within India's northeast region, it is the southernmost landlocked state, sharing borders with three of the Seven Sisters States, namely Tripura, Assam and Manipur. The state is also sandwiched between Myanmar in the east and south and Bangladesh in the west. Mizoram is gifted with vast forests resources including a variety of flora and fauna. According to the Forest Survey of India, 2021 the forest cover percentage of Mizoram is 84.53% and has the highest forest cover as a percentage of the total geographical area.

2.2.1 Climatic pattern of the state:

The climate in Mizoram is pleasant; moderately hot during summer and extreme cold is unusual during winter. During summer it is relatively cool with the temperature ranging from 20-29 °C (68 to 84 °F), there is a gradual increase in the temperature resulting from climate

change, with the summer temperature crossing 30 degrees Celsius and winter temperatures varying from 7 to 22 °C (45 to 72 °F). Mizoram receives rainfall averages about 100 inches (2500mm) annually, with most brought by the southwest monsoon (which blows from May to September).

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highest literacy rate in all of India in 2011 with 91.33 per cent, higher than the 74.04 per cent national average.

Figure 3: Map of Mizoram

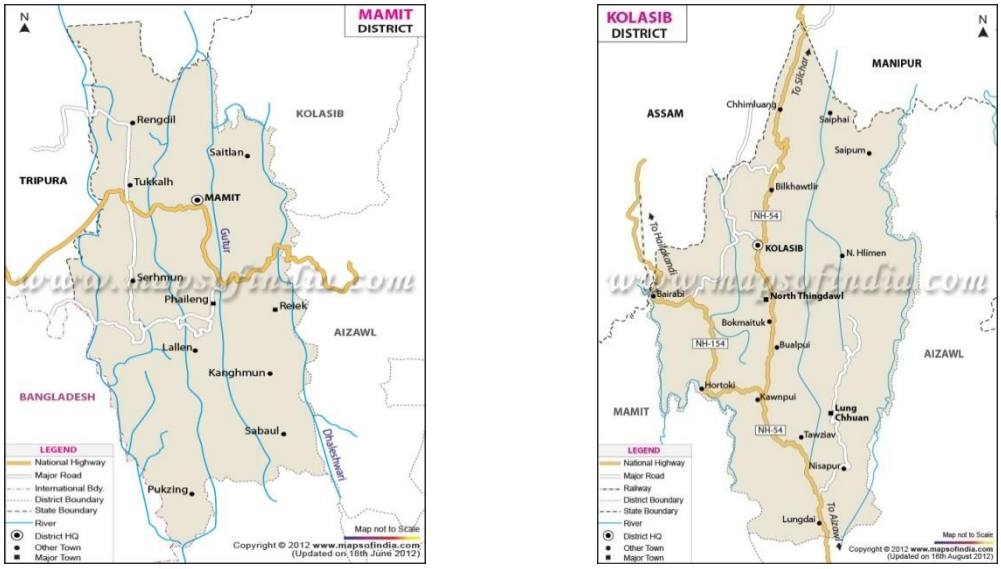

Figure 4: Map of the study area

2.3 Sampling Procedure

The study was conducted purposively in selected two districts of the state as per the terms of references provided by FOCUS, namely Mamit and Kolasib. The selection of villages and farmers were obtained from the primary data recorded by the boar semen station in the district. Other information in relation to the study areas were gathered through consultation Department of Veterinary and Animal Husbandry officials and In charge, Boar Semen Stations officials. Sample households were subsequently selected randomly. A list was prepared based on discussions with the Village Chairperson, Veterinary Field Assistants and Livestock Service Providers of the concerned villages. A total of 300 sample households were interviewed from both districts (150 from Mamit and 150 from Kolasib district) using a structured interview schedule.

List of Villages:

District	Village	Household
Mamit	Mamit	95
	Zawlnuam	20
	Rengdil	5
	Dapchhuah	4
	Tuidam	8
	Kawrthah	8
	Kanhmun	10
Kolasib	Kolasib	115
	Buhchangphai	2
	Thingdawl	15
	Bilkhawthlir	2
	Bairabi	4
	Rengtekawn	6
	Pangbalkawn	6

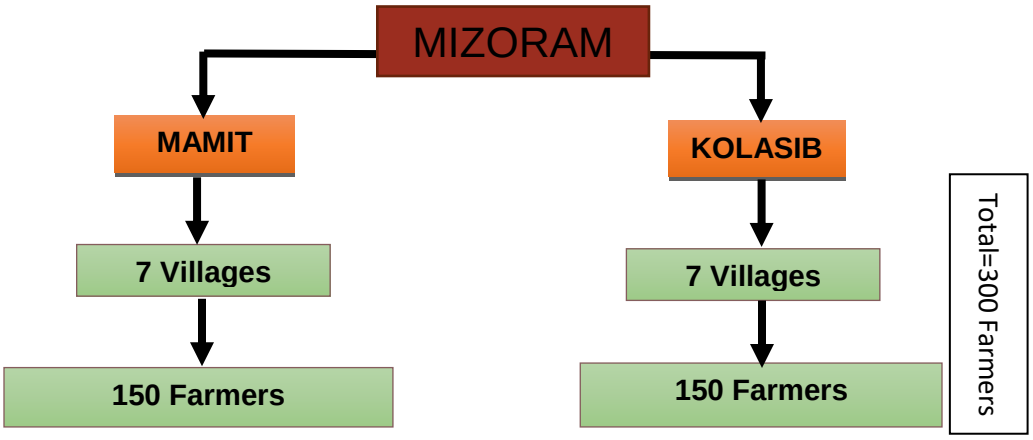

Figure 5: Schematic representation of sample plan in two districts of Mizoram.

2.4 Socio economic personal, psychological and other parameters

Parameters given below were studied and recorded as per specific objectives.

2.4.1 Socio-economic profile of the pig farmers

Information on the socio-economic status of piggery farmers was collected by interviewing the farmers from the two selected districts. The list of variables used for the study is mentioned below:

Table 1 :Socio-economic Variables

Sl.No.	Variables
1	Age
2	Gender
3	Family size
4	Family type
5	Educational Qualification
6	Farming Experience
7	Total Operational landholding
8	Occupational status of the farmer
9	Training
10	Extension Contact
11	Annual income
12	Herd size
13	Economic motivation
14	Attitude towards pig farming

2.4.1.1 Age

Age is the number of years an individual has lived. The age of the respondent at the time of investigation was recorded by direct questioning. The categorization of the age of the respondent was done by following the Census Report 1981, Government of India.

Sl.No	Category	Age
1	Young	Upto 35 years
2	Middle	36-50 years
3	Old	Above 50 years

2.4.1.2 Gender

The socially constructed characteristics of women and men, such as norms, roles and relationships within and between groups of women and men, are referred to as gender. The respondents were put into two categories, namely male and female.

2.4.1.3 Family Size

The size of a family is determined by how many people are currently living together. The families were categorized in accordance with Majunder (2020) classification.

Category	Members
Small	Below 5
Medium	6-9
Large	Above 9

2.4.1.4 Family type

Family is the group defined by sex relationship sufficient precise and enduring to provide for the procurement and upbringing of children. In the present study, family refers to whether it is nuclear or joint family system in the respondent's family. A family was considered as nuclear when it consisted of husband, wife and unmarried children. A joint family consisted of other blood relatives also.

The scoring patterns develop by Pareek and Trivedi (1964) in their "socio-economic status scale-rural" was followed to quantify the family type of the livestock owners.

Nuclear family – 1
Joint family – 2

2.4.1.5 Educational Qualification

It refers to the respondent's formal education-based qualifications.

Category	Years of Schooling	Score
Illiterate	No formal education	1
Functionally literate	No formal education	2
Primary School	1-5	3
Middle School	6-8	4
High School	9-10	5
Higher Secondary	11-12	6
Graduate and above	Above 12	7

2.4.1.6 Farming experience

Farming experience refers to the total number of years the pig farmer was involved in pig farming. The respondents were categorized into the following three groups using the mean and SD.

Category	Years
Low	Up to 7 years
Medium	7-23 years
High	Above 23 years

2.4.1.7 Total Operational land holding

Land is one of the most significant and vital scarcity elements in production. It referred to the whole area of land owned and operated for agricultural purposes by a single family. The respondents were classified into landless, marginal, small, semi-medium and large as per government classification.

Sl. No	Category	Size of land holding
1	Landless	Landless
2	Marginal	Below 1 ha
3	Small	1-2 ha
4	Semi-medium	2-4 ha
5	Medium	4-10 ha
6	Large	10 ha or above

2.4.1.8 Occupational status of the farmer

Occupation is a way to earn a living. It is a method of generating income for farmers. The type of income-generating operations conducted by respondents is highlighted by occupation status, which also determines the extent to which farmers are involved in farm activities. It was measured by direct questioning at the time of interview.

Sl.No	Categories
1	Pig farming as sole occupation
2	Pig farming + Agricultural labourer
3	Pig farming + Business/Government servant

2.4.1.9 Training

Training is a structured activity with the goal of transferring knowledge and skills to modify trainees' attitudes and behaviors and improve their performance in order to produce

competent conducts. It refers to whether the farmers have received any training on improved piggery farming practices during the last five years.

2.4.1.10 Extension Contact

Extension contact refers to the pig farmer's closeness and frequency of meeting with the extension worker such as Veterinary Officer (VO), Veterinary Field Assistant (VFA), KVK, ATMA and others. The respondents were classified into three categories i.e. low, medium and high extension contact using mean and SD. Four points continuum viz., Regularly, Occasionally, Rarely and Never with a scoring of 4,3,2,1 was used to measure the frequency of contact with the extension agent.

Sl. No.	Extension personnel	Daily	Biweekly	Weekly	Monthly	Rarely	Never
		5	4	3	2	1	0
1	Neighbours/friends						
2	V.O						
3	VFA						
4	KVK						
5	ATMA						

2.4.1.11 Annual income

It refers to the respondent household's annual income from pig farming and other sources. The respondents were categorized into low, medium and high-income groups based on poverty line and average monthly per capita expenditure (MPCE).

Category		Income (in ₹)
Low		<69,300
Medium		69,300 – 1,06,950.6
High		>1,06,950.6

2.4.1.12 Herd size

It refers to the total number of pigs (Sow, Piglet, Fattener and Gilt) owned by the household. This was measured by direct questioning.

2.4.1.13 Economic Motivation

Economic motivation was operationalized in terms of profit maximization and relative value placed by a farmer on economic ends. The scale developed by Supe (19690 was followed with modification.

The scale consisted of six statements of which the first five were positive and the last one negative. These items were rated on a five-point continuum which ranged from strongly agree to strongly disagree. The following scoring procedure was followed.

Response	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Positive items	7	5	4	3	1
Negative items	1	3	4	5	7

The scores obtained for each statement were summed up to get the total score. The maximum score one could obtain was 42, while the minimum was six. Further the respondents were categorized into low, medium, and high level by using mean and standard deviation.

2.4.1.14 Attitude towards AI in pig

It is proposed that an "attitude is the mental state of readiness" (Allport, 1935). It is the learned predispositions towards various aspects of our environment. They may be positive or negatively directed towards certain aspect of AI in pig farming. Farmers attitude towards AI was explored using Diekman *et al.,* (2009) with modification.

A schedule was developed to measure the attitude of the pig farmers towards Artificial Insemination practice in pig. The scale consists of 8 statements. The statement was rated in three-point response categories ranging from agree to disagree.

There were 5 positive statements and 5 negative statements in the scale. The scores obtained for each statement were summed up to get the total score. The maximum score one could obtain was 42, while the minimum was six. Further the respondents were categorized into low, medium, and high level by using mean and standard deviation.

2.4.1.15 Cost of AI and cost of natural breeding

The average monetary expenses incurred for performance of AI and Natural breeding were taken into consideration and documented.

2.4.2 Success rate of conception

Success rate of conception was measured using the following Index

$$\text{Conception success rate} = \frac{\text{No of conception}}{\text{Total No. of Services}} \times 100$$

2.4.3 Growth rate and weaning age

$$\text{Pre-weaning mortality\%} = \frac{\text{number born alive} - \text{number weaned} \times 100}{\text{Number born alive}}$$

Furrowing rate: The percentage of sows that furrow to a given number of matings.

$$\text{Litters per sow a year} = \left\{\frac{\text{Total litters furrowed in a time period} \times 12}{\text{Average number of sows over the same time period}}\right\} \Big/ \text{number of months.}$$

Weaning age = age at weaning in days

Other Production parameters

The different production parameters in relation to Artificial Insemination, Litter index, Growth performance such as total number of AI performed, number of conceived through AI, Litter size, weaning to next mating, age at weaning, piglet mortality, litter weaned/sow, litter/sow/year, weight at 1st week, weight at weaning and weight at marketing of fattener were taken and similar data were compared with natural breeding.

2.4.4. Existing management practices in pig farming

Recommended pig farming practices in the subject area of housing, feeding, breeding, health and disease management practices were selected in consultation with subject matter specialized, field veterinarians and relevant literature.

2.4.5 Constraints as perceived by the Piggery Farmers

Constraints faced by the piggery farmers were identified by open ended questions. The selected items were divided into the following heads: Health care, economic, breeding and other miscellaneous constraints. The respondent response was taken against each of the practice on four points continuum with scores of 4, 3, 2 and 1 respectively. Respondents were asked to rank these listed constraints. The order of the merits given by the respondents was changed into ranks using the following formula:

$$\text{Percent position} = \frac{100\,(R_{ij}-0.50)}{N_j}$$

Where R_{ij} = Rank given for the i^{th}item by j^{th} individual

N_j= Numbers of items ranked by j^{th} individual

The per cent position of each rank was converted into scores (Garrett,1981). For each item, the scores of individual respondents were added together and divided by the total number of respondents. The mean scores for all the items were ranked by arranging in descending order.

2. Socio-economic, personal and psychological impact of Artificial Insemination through Boar semen station

To assess the impact of Artificial Insemination, data was ascertained from Before AI intervention and after AI intervention.

2.5. Method of Data Collection

For data collection, personal interview and observation method was employed to collect data from the respondents. Secondary data was collected from the Boar semen station of the respective districts.

2.6 Data Processing and Statistical Analysis

The collected data were scored, complied, tabulated using frequency, mean, standard deviation and subjected to various appropriate statistical tools such as Statistical Package for Social Sciences (SPSS version 17), Microsoft Excel, etc. to draw the logical conclusions.

Figure 6 :Processing of Boar semen

RESULTS AND DISCUSSION

3. Analysis of socio-economic,personal and psychological impact

3.1. Socio-economic personal and psychological profile of the farmers

The following presents the results obtained from the respondents' socio-economic profile:

3.1.1. Age

Age is one important aspect influencing a person's exposure, experience, thinking and decision- making abilities as well as their degree of maturity. Table 2 data reveals that majority of the respondents (50.66%) are in the middle age group between 36-50 years, followed by the old age group (32.66%) and the young age group (16.66%).

Table 2: Age of the respondents

Category	District		Total (N=300)
	Mamit (n=150)	Kolasib (n=150)	
Young (Up to 35 years)	40 (26.66)	10 (6.66)	50 (16.66)
Middle (36-50 years)	70 (46.66)	82 (54.66)	152 (50.66)
Old (Above 50 years)	40 (26.66)	58 (38.66)	98 (32.66)

**Figures in parenthesis indicates percentage

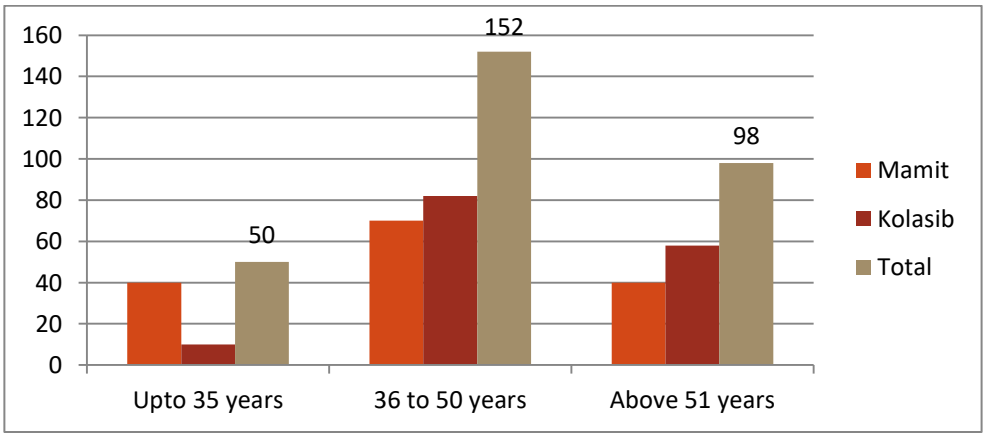

Figure 7 Age-wise distribution of the respondents

3.1.2. Gender

The data revealed that majority (54%) of the respondents were male while 41.00 per cent were female. This suggests that men were more involved than women when it comes to piggery farming which may be due to labour intensity of the farming system.

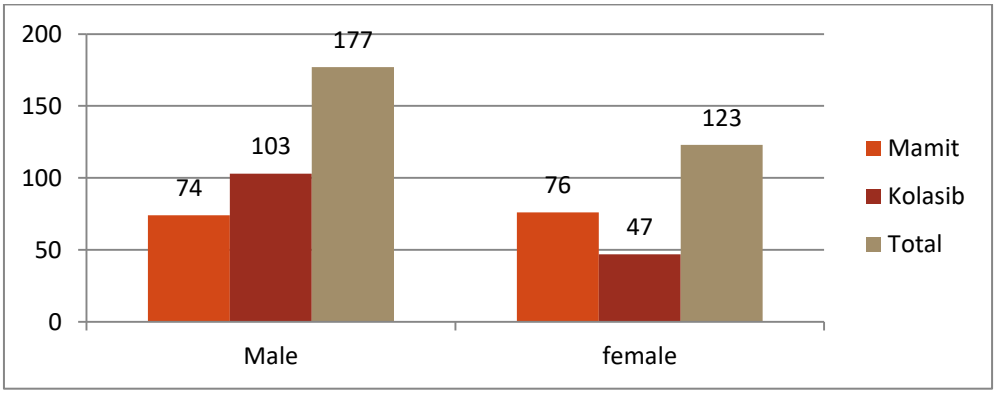

Figure 8: Frequency distribution of gender of the respondents

3.1.3 Family Size

A family size influences numerous factors including the amount of labour a family can provide, annual income and so forth. Table 3 shows that majority (77%) of the respondents had medium sized family of 4-5 members in a family followed by large (19.66%) and small (3.33%) sized family respectively.

Table 3: Family size of the respondents

Family Size	Districts		Total (N=300)
	Mamit (n=150)	Kolasib (n=150)	
Small (<3 member)	5 (3.33)	5 (3.33)	10 (3.33)
Medium (4-5 members)	101 (67.33)	130 (86.66)	231 (77.00)
Large (>5 members)	44 (29.33)	15 (10)	59 (19.66)

**Figures in parenthesis indicates percentage

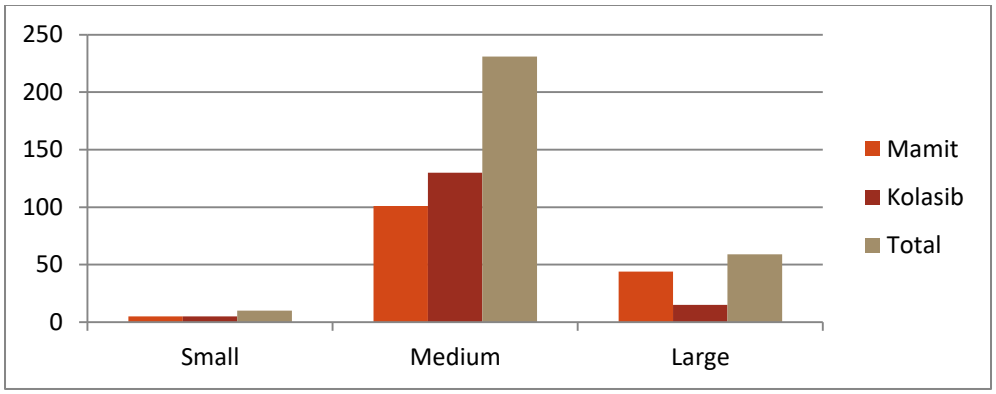

Figure 9: Frequency distribution of family size of the respondents

3.1.4. Family type

The data in table 4 showed that an overwhelming percentage of the family are of nuclear type (98.66%) in both the district.

Table 4: Family type of the respondents

Family type	Districts		Total (N=300)
	Mamit(n=150)	Kolasib (n=150)	
Nuclear	149 (99.33)	147 (98.00)	296 (98.66)
Joint	1 (0.66)	3 (2.00)	4 (1.33)

**Figures in parenthesis indicates percentage

3.1.5 Educational Qualification

Education level has been considered a key component of a society's socio-economic progress. From the data obtained, majority of the respondents were educated upto high school (34 %) which was followed by higher secondary (21.33%) and middle school (18.33%). The high literacy of the state may be attributed to the results obtained.

Table 5: Educational qualification of the respondents

Education	Districts		Total (N=300)
	Mamit (n=150)	Kolasib (n=150)	
Illiterate	0	0	(2)
Functionally literate	2 (1.33)	19 (12.66)	19 (6.33)
Primary school	0	25 (16.66)	25 (8.33)
Middle school	21 (14.00)	34 (22.66)	55 (18.33)
High school	62 (41.33)	40 (26.66)	102 (34.00)
Higher secondary	41 (27.33)	23 (15.33)	64 (21.33)
Graduate and above	24 (16.00)	9 (5.83)	29 (9.66)

**Figures in parenthesis indicates percentage

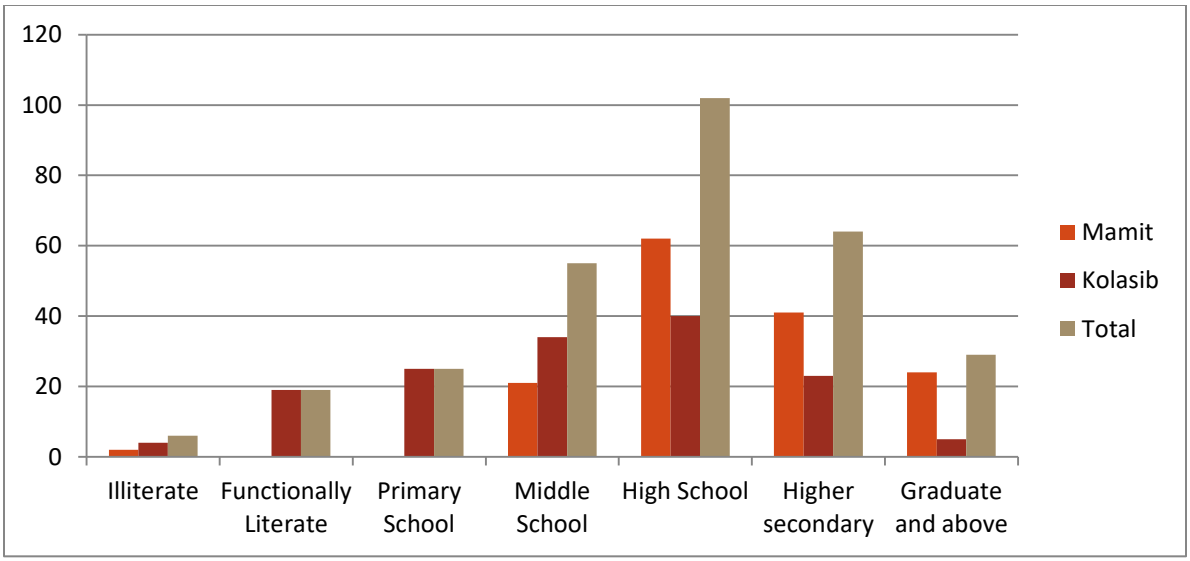

Figure 10: Frequency distribution of educational qualification of the respondents

3.1.6 Farming experience

The data in Table 6 showed that 44 per cent of the respondents were rearing pig for 6-19 years followed by up to 6 years (37.33%) while the remaining 18.66 per cent had long farming experience above 19 years. This indicates that pig farming plays a vital role in the livelihood of the mizo society.

Table 6:Farming experience of the respondents

Farming experience	District Mamit (n=150)	Farming experience	District Kolasib (n=150)	Total (N=300)
Low (Upto 6)	96 (64.00)	**Low (Upto 7)**	16 (10.67)	112 (37.33)
Medium (6-19)	25(16.67)	**Medium (7-19)**	107 (71.330	132 (44.00)
High(Above 19)	29(19.33)	**High(Above 19)**	27 (18.00)	56 (18.66)

** Figures in parenthesis indicate percentage

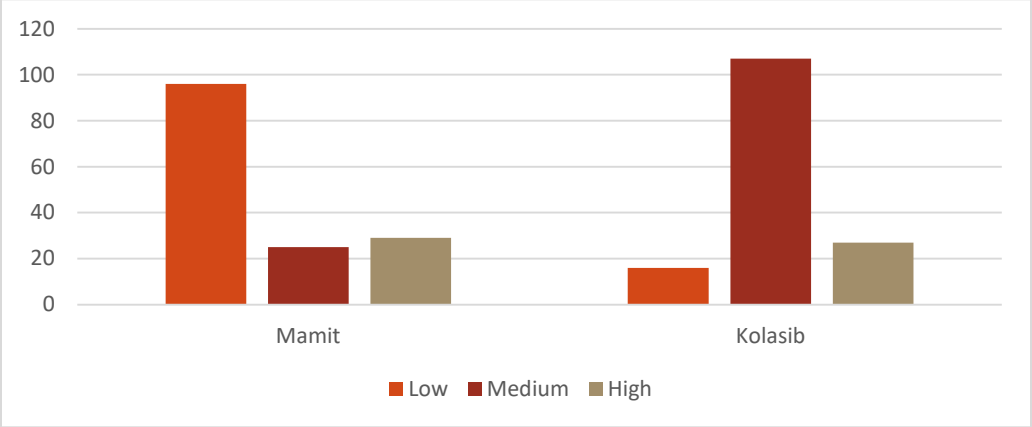

Figure 11: Frequency distribution of farming experience of the respondents

3.1.7 Land holding of the farmers

Pooled sample indicated that majority of the farmers were small farmers having 1-2 hectares (54%) of land followed by marginal farmers having below 1 hectare of land.

Table 7: Land holding of the respondents

Land holding	Districts		Pooled (N=300)
	Mamit (n=150)	Kolasib (n=150)	
Marginal (Below 1 ha)	105 (70.00)	57 (38.00)	162 (54.00)
Small (1-2 ha)	41 (27.33)	65 (43.33)	106 (35.33)
Semi-medium(2-4 ha)	4 (2.66)	28 (18.66)	32 (10.66)

**Figures in parenthesis indicates percentage

3.1.8 Occupational status of the farmer

Occupation refers to the main source of income. The data in Table 8 showed that majority (37.33%) of the respondents had taken up piggery faming with agriculture, (31.66%) of the respondents were engaged in piggery farming alone while (31.00%) of the respondents practiced piggery farming along with other activities such as shops, daily labour, Government services etc. The observation on piggery opted as the main source of income indicates a good market of pork and piglets, high and fast return of investment and profitable nature of pig farming.

Table 8: Occupational status of the respondents

Source of livelihood	Districts		Pooled (N=300)
	Mamit(n=150)	Kolasib(n=150)	
Only piggery farming	59 (39.33)	36 (24.00)	95 (31.66)
Piggery farming+Agricultural activities	44 (29.33)	68 (45.33)	112 (37.33)
Piggery farming + Others	47 (31.33)	46 (30.66)	93 (31.00)

**Figures in parenthesis indicates percentage

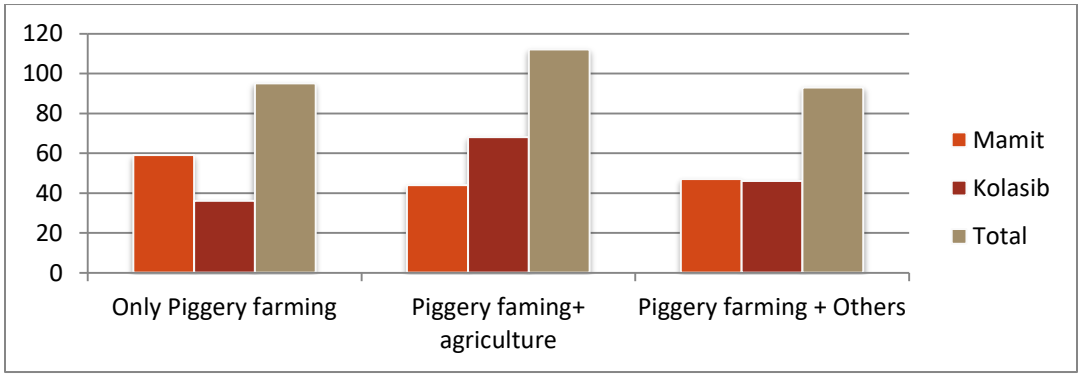

Figure 12: Frequency distribution of occupation of the respondents

3.1.9 Training programme

Training of the respondents received was based on last two years from the date of interview. It was observed that only 32.00% of the farmers received training while the remain 68% of the farmers did not receive any training.

Table 9: Training participation of the respondents

Participation in training programme	Districts		Total (N=300)
	Mamit(n=`150)	Kolasib (n=150)	
Yes	52 (34.66)	44 (29.33)	96 (32.00)
No	98 (65.33)	106 (70.66)	204 (68)

**Figures in parenthesis indicates percentage

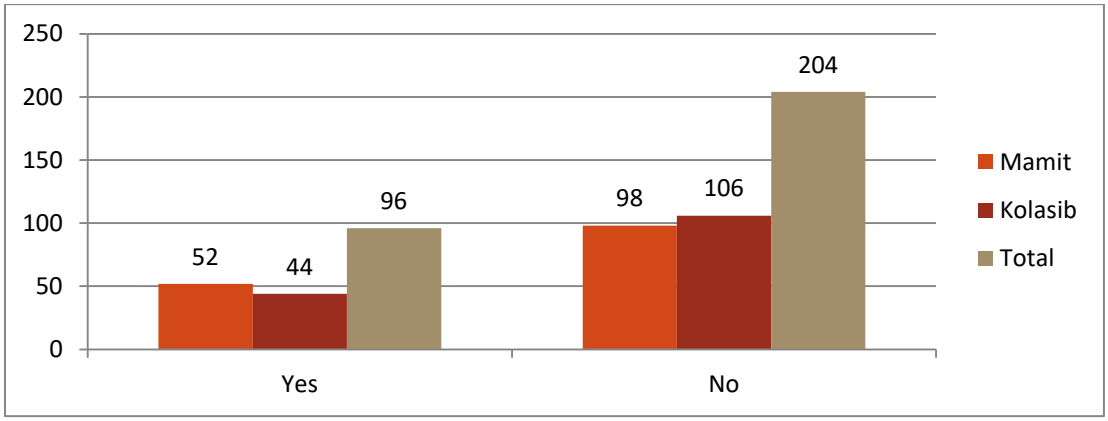

Figure 13: Frequency distribution of farmers participation in training programme

3.1.10 Extension contacts

Extension contact is the term used to describe the familiarity and regularity with which respondents communicate with agents such as neighbours or friends, veterinary officer (VO), Veterinary Field assistant (VFA), KVK, ATMA etc in order to obtain information..Majority of the respondents (52%) were found to have low level of extension contact with functionaries. Data analysis reveals that most of the pig farmers contacted para veterinarians for associated problems in regards to pig farming.