RESEARCH REPORT ON "CHOW CHOW GROWING ON SUSTAINABLE FARMING" IN LUNGDAI, DURTLANG & SIHPHIR VILLAGES OF AIZAWL DISTRICT IN MIZORAM

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P.C. VANLALRUATA
Minister
Agriculture & Farmers' Welfare
Irrigation & Water Resources
Cooperation

Room No. 003
Mizoram Secretariat
MINECO, Aizawl – 796001, Mizoram
Office: 0389-2322538
e-mail: ministeragriwrco@gmail.com

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MESSAGE

It is with great pride and profound appreciation that I extend my sincere acknowledgment to the authors and the entire research team behind this remarkable and timely publication, which addresses subject of deep concern to our agricultural community–the decline of chayote (Iskut) cultivation in Durtlang, Sihphir and Lungdai.

Chayote holds a special place in Mizoram's agrarian identity. Beyond being a staple crop, it has, for decades, shaped the socio-economic fabric of many farming households and supported local markets with its reliable yield and adaptability. The sharp decline in its cultivation in recent years, therefore, is not only a statistical shift but a wake-up call–one that compels us to investigate the underlying causes and take the meaningful action to restore the viability of this cherished crop.

This book presents a comprehensive and thoughtful exploration of the issue, grounded in rigorous fieldwork, scientific inquiry, and community engagement. What makes it truly valuable is its human-centred approach–it captures the lived experiences, knowledge systems and challenges of the farmers who have long nurtured the land with dedication and dignity. Their voices, echoed throughout the pages of this publication, remind us that policy must always be informed by the realities on the ground.

I would like to commend the Mission Foundation Movement (MFM) for its leadership in spearheading this study, and the Tribal Research Institute for its generous support as the funding partner. My appreciation also goes to the Department of Agriculture officials, the KVK Lengpui team and the Mizoram Iskut Growers Association (MIGA) for their technical inputs and facilitative roles throughout the research process.

This book I believe, is more than a documentation of decline–it is a call to revive, to innovate, and to recommit ourselves to sustainable and inclusive agricultural practices. It lays the foundation for informed policy design, targeted interventions and renewed collaborations between the government, civil society, researchers and most importantly, our farmers.

May this work serve as both a reference and a roadmap for future efforts to safeguard our traditional crops and secure the livelihoods that depend on them. I encourage all stakeholders, from academicians and extension workers to local leaders and entrepreneurs to engage with its finding and carry forward its vision.

I offer my heartfelt congratulations to the authors and all contributors. May your work continue to inspire and empower.

(PC VANLALRUATA)

ACKNOWLEDGEMENT

R. Vanlalzauva
Director, Mission Foundation Movement

Conducting a large-scale survey across diverse regions presents numerous challenges. As we reach the conclusion of this comprehensive research on sustainable chow chow farming, I would like to take a moment to reflect on the immense support and collaboration that made this endeavour possible. This study is not merely a compilation of data and analysis—it is a collective voice of the resilient farmers of Sihphir, Lungdai, and Durtlang who have for decades nurtured the land and upheld the tradition of chow chow cultivation.

My deepest gratitude goes to the farmers who welcomed us into their communities and generously shared their knowledge, challenges, and unwavering spirit. Your stories and efforts form the very heart of this report. I am also sincerely thankful to the Tribal Research Institute, our funding agency, whose support was vital to the successful execution of this project. Finally, I extend my heartfelt appreciation to the research team of Mission Foundation Movement (MFM) for their dedication and hard work throughout the course of this study.

I am also indebted to the Department of Agriculture, Government of Mizoram, for their technical inputs, soil testing support, and encouragement, as well as KVK (Krishi Vigyan Kendra), Lengpui. The contributions of the Mizoram Iskut Growers Association (MIGA), community leaders, and local authorities have been instrumental in connecting us with the field realities and ensuring smooth implementation of activities.

I also extend my heartfelt appreciation to:

Mr. P.C. Vanlalruata, Hon'ble Minister, Department of Agriculture
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Mr. V. Lalhuma, Vice President, MIGA
Mr. Laltanpuia Pachuau, General Secretary, MIGA
Mr. R. Lalthansanga, Asst. Secretary, MIGA
Mr. H. Rodinga, Treasurer, MIGA
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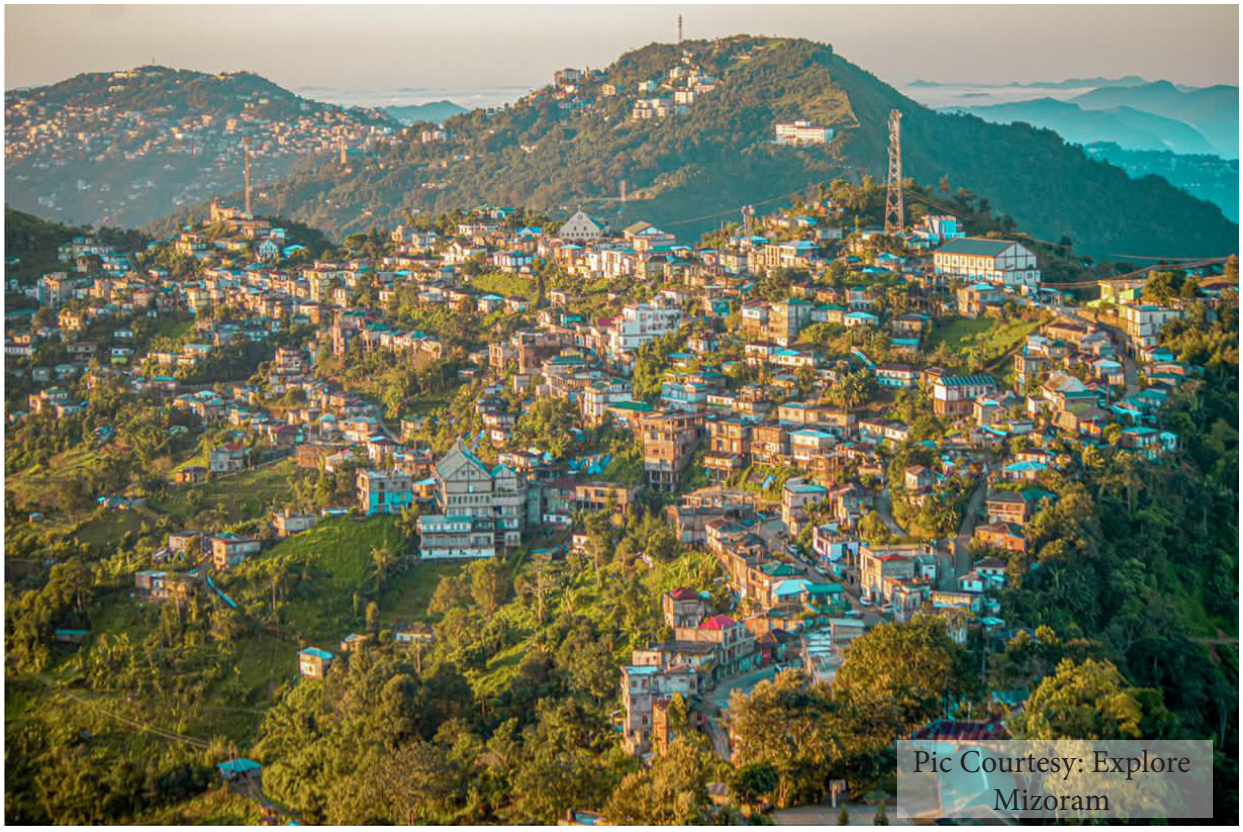
TABLE OF CONTENTS

1 BACKGROUND OF THE STUDY

This is a report prepared in accordance with the record of chow chow growing on sustainable farming in Lungdai, Durtlang and Sihphir villages of Aizawl district of Mizoram.



Pic Courtesy: Explore Mizoram

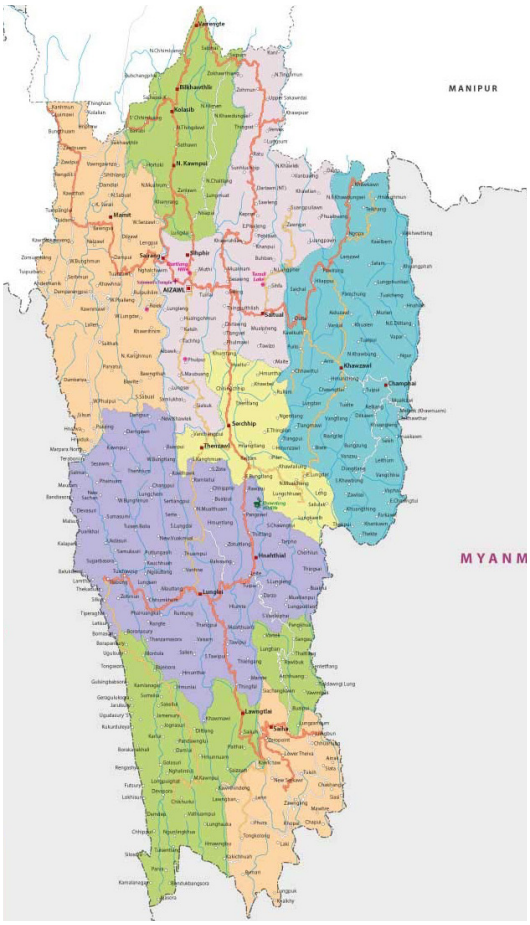
2 OVERVIEW OF CHOW CHOW FARMING

Chow chow is a member of the Cucurbitaceous family also known as chayote or squash in North- eastern regions of India or Iskut in Mizoram. Chow chow (Sechium edule) is a climbing vine native to Central America. It is known for its nutritious green fruits, which are often used in cooking, particularly in salads, stews and dishes. It thrives in well drained, fertile soils and requires a warm, sunny environment. The vine itself is typically supported by trellises, and the fruits grow in clusters, requiring adequate spacing between plants for optimal growth and fruit development.

Former President APJ Abdul Kalam visit local Development Work at Sihphir Village on 17th October 2006

3 ABOUT MIZORAM

Mizoram is one of the leading states in respect of area, production and productivity of chow-chow. The crop is widely cultivated by farmers in the backyards and Jhum lands for its tender leaves, fruits, stems and tuberous roots, none of the plant parts of chow- chow is wasted in Mizoram where the crop has an immense food and feed value. Chow chow is mostly being cultivated on hilly terrain and the vines are trained over bower system, and even the hills having more than 100 percent slope, where no cultivation is possible.



Chow-chow can be grown in both tropical and sub-tropical regions. It requires a medium high altitude site (800-2000 meters above sea level), it thrives well in moderate temperature of 13-21 degree Celsius, high relative humidity of 80-85%, well distributed annual rainfall of 1500-2500 mm and 12 hours of daylight to grow and fruit. Fruits exposed to sunlight are yellowish in colour and vines grow under the shade produce dark green fruits.

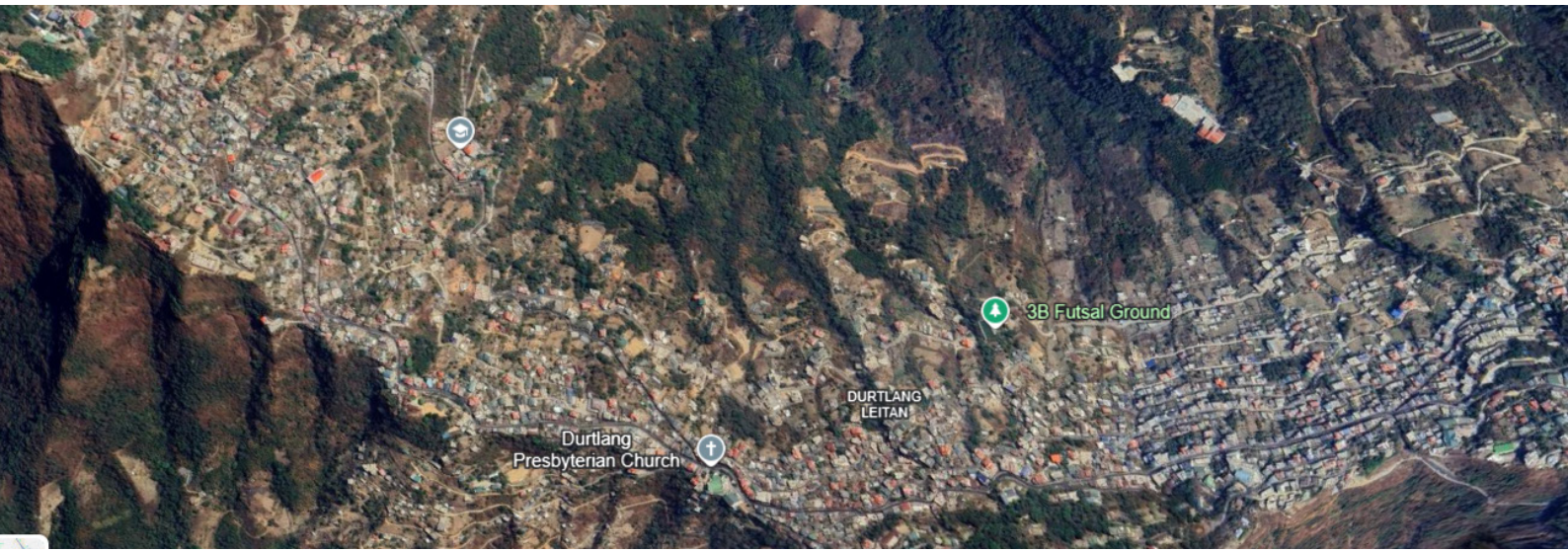
This crop does not survive in extreme dry wind during summer. Frost conditions in winter should be avoided as this crop is very sensitive to frost. A well grown plant of one year yields around 200-300 fruits. Chow chow is a semi perennial crops lasting 2-3 years. In Mizoram the fruits are generally available in the markets from July-December, while tender shoots and leaves from June-December. Nevertheless, tuberized roots are generally dug out from the aged vineyard, second year onwards when the vines are completely dry (January-March). The chow chow plant is widely available in the markets for almost 10 months of a year ie., June-March.

Mizoram is the 23rd and one of the smallest states in India having an area of approximately 21,087 square kilometres with a population of 10.97 lakhs according to census 2011. Mizoram is rural in character and agriculture occupies a very important place around 60 percent of the state population engaged in agriculture and its allied activities. Most of the farmers practiced Jhum or shifting cultivation and with dominant features of hill and mountain farming in Mizoram are small holdings, sloping marginal farmlands and cultivation under rainfed farming. Subsistent farming on these farmlands is still dominating featured where both the production and productivity were low. Chow chow commercial cultivation is confined in Sihphir area, Aizawl district in Mizoram, where the growing area contributes to an extent of 72% area and 80% production.

4 STUDY AREA

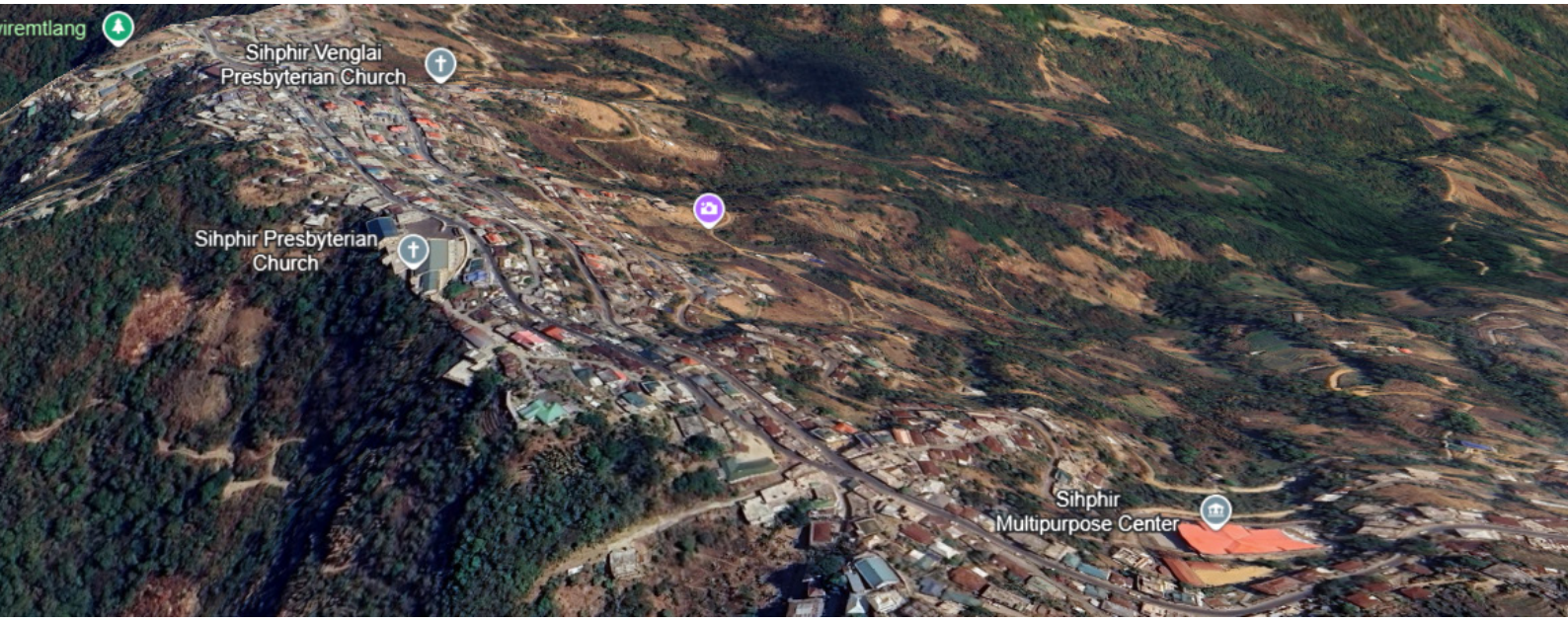
Lungdai, Durtlang and Sihphir villages are located in Aizawk District, Mizoram, with an average altitude of 900-1200 meters above sea level. The region experiences a subtropical climate with ample rainfall, making it suitable for chow chow farming.

Location : 1) Durtlang



Name of the village	Durtlang
Population	6760
Code No	20
No of A PL	1402
No of BPL	215
Male Total	3250
Female total	3500
Total number of farmers	30
Total number of family	876
Annual rainfall	345mm
Major crop	Chow chow, Broccoli, Bean
Past crop	Chow chow

Durtlang, perched along the northern ridge of Aizawl city, is a prominent locality known for its serene atmosphere, educational institutions, and expanding residential settlements. It is home to several key establishments, including hospitals, nursing schools, and faith-based organizations, making it a center for both healthcare and learning. With its cool climate, hilly terrain, and scenic vistas, Durtlang offers a unique blend of urban proximity and rural charm. While agriculture was once a central part of daily life, recent shifts in land use and occupation patterns have led to a gradual decline in traditional farming practices—most notably in the cultivation of chayote, which was once widely grown in the area.



Location : 2) Sihphir

Name of the village	Sihphir
Population	6528
Code No	02
No of APL	969
No of BPL	15
Male Total	3260
Female total	3268
Total number of farmers	15
Total number of family	1349
Annual rainfall	212mm
Major crop	Chow chow, Bean
Past crop	Chow chow

Sihphir, nestled in the northern fringes of Aizawl district, is a picturesque and progressively developing village known for its harmonious blend of tradition and modernity. The community is dynamic and closely-knit, supported by essential infrastructure such as schools, health centers, and well-maintained road networks, making it one of the more accessible and forward-moving rural hubs in Mizoram. Agriculture remains the backbone of the local economy, with many families depending on farming for their livelihood. Notably, chow chow (chayote)—once a signature crop of Sihphir and a vital source of income for local farmers—has witnessed a sharp and concerning decline in recent years.

Former President APJ Abdul Kalam with Iskut Growers Association at Sihphir, 17th October 2006

Location : 3) Lungdai

Name of the village	Lungdai
Population	1868
LGD Code	264641
No of APL	477
No of BPL	86
Male Total	1320
Female total	1240
Total number of farmers	20
Total number of family	563
Annual rainfall	230mm
Major crop	Chow chow, Bean, Broccoli
Past crop	Chow chow

Lungdai is a peaceful village located about 16 km from Aizawl in the Tlangnuam block of Mizoram. Known for its high literacy rate and strong community values, it is home to around 1,800 residents, most of whom belong to Scheduled Tribes. The local economy is largely agrarian, with many villagers engaged in cultivation and agricultural labor. While Lungdai lacks major infrastructure, its proximity to Aizawl ensures access to essential services. Though farming remains vital, chayote cultivation—once common in surrounding areas—has seen limited presence in the village.

5 OBJECTIVE OF THE STUDY

A. To study the socio-economic profile of the Chow-chow farmers in the proposed area.

B. To find out the cause of decline in chow-chow production and suggest appropriate cultivation practices.

C. Upgrading skills and providing them appropriate technology for taking up production activities through input support.

D. To influence farmers to take up chow-chow cultivation for upliftment of theirs and state income through promotion of chow chow cultivation.

The purpose of this visitation was to understand the cultivation practices, challenges and success factors for farmers involved in the production of chow chow (Squash), a green, edible gourd-like vegetable commonly grown in tropical and subtropical regions like Mizoram.

Chow Chow farms in Lungdai

6 METHODOLOGY

The research methodology includes field surveys, interviews with farmers, soil analysis and data collection on cultivation techniques. The study was conducted in Lungdai, Durtlang and Sihphir villages using qualitative and quantitative research methods. Data was collected through :

- Structured interviews with 60 farmers from Iskut (chow-chow) growers' society of Durtlang, Sihphir and Lungdai villages.
- Field observations to assess soil quality and crop health.
- Review of agricultural reports and government policies.
- Focus group discussions with local agricultural experts.

7 PROPOSED PROJECT

The project is proposed to be implemented in Sihphir area. Sihphir area is located in Tlangnuam RD Block of Aizawl district, Mizoram India. It is situated 18 km away from sub district headquarter. As per census 2011 Sihphir has a total of 1349 families residing with the population of 6528 peoples, out of the male population is 3,268 while female population is 3260. As per constitution of India and Panchayati Raj Act, sihphir village is administrated Sarpanch (Head of Village) who is elected representative of village. The area has cooler climate and good annual rainfall of 2500-3000 mm.

The farmers of sihphir village (Aizawl district) initiated the cultivation of chow chow in organized way for their livelihood in the year 1982. The Govt. Of Mizoram helped the farmers in the marketing of their produce by providing price support subsidy during 1990's. This helped the farmers in the commercialization and export of chow-chow fruits to the neighbouring North-east states, West Bengal and Bangladesh. It is the only vegetable in Mizoram which has an organized marketing system. A well organized association known as 'Iskut Growers Association' is managing the marketing of chow chow especially its export to other states.

However, in recent years there has been a drastic decrease in the production of chow-chow in Sihphir area due to which many of the farmers give up on the production and take up other crops which is far lower than the income generated from chow chow production. Majority of the chow chow growers in Sihphir area lacked trained man power, appropriate technical transfer, limitation of resources and lack of financial resources for sustainable development in the cultivation practices of chow chow. As the production is greatly reduced, priority is given on to study the cause, analyse, finding the solution and to nurtured the already existing system to become more sustainable and dependable and uplift the economy of the chow chow growers.

The farming scenario and agriculture marketing in Mizoram is still in a very basic and has been a challenge as compared to the rest of Indian State or even the North Eastern State. Most of the farmers are still marginal farmers with minimal land holding and production was low. However chow chow crop with proper plant management practice, has the potential for improving the socio-economic status of the tribal community. A project on system of chow chow growing on sustainable farming in Mizoram will not only be an alternative to shifting cultivation but also help in sustaining the farmer's livelihood reducing the runoff and soil erosion. The success of these progressive growers will influence their fellow farmers to take up chow chow cultivation as one of the subsidiary incomes which in turn will uplift the farmers economy and the State as a whole.

8 KEY FINDINGS

Farming practices

Land Preparation: Farmers prepare the land by clearing vegetation and creating mounds, rained beds or terrace farming cultivation because of the mountainous area to enhance drainage and root development.

Planting

Chayote is typically propagated using the whole fruit, which is planted directly into the soil. The planting is typically done during the monsoon season to take advantage of the natural rainfall.

Support Structures : To support the climbing vines, farmers use materials like bamboo poles or G.I wire, facilitating vertical growth and improving air circulation.

Irrigation : While Chow Chow (chayote) is relatively drought tolerant, farmers in Sihphir often rely in monsoon rains for irrigation. However, inadequate rainfall can lead to reduced yields.

Economic Impact

In 2013, Sihphir farmers cultivated chayote over 251hectares, producing 45,742 quintals and earning approximately 2.61 crore.

Chow Chow Farm with Trellis system at Sihphir, Mizoram

9 CHALLENGES FACED BY THE FARMERS IN SIHPHIR

Climate Variability : Inconsistent rainfall pattern can adversely affect chow chow production, with recent years having inconsistent rainfall and climate changes in Mizoram leading to crop failures.

Water Access : The region faces challenges due to scarcity of water which impacts chow chow cultivation. In 2014, chow chow growers in Sihphir experience a sharp decline in harvests due to insufficient monsoon rainfall, affecting crop yields.

Shifting Cultivation Practices:The traditional practice of shifting cultivation or Jhum involves clearing forested land for agriculture, leading to soil degradation and reduced fertility overtime. This method has been associated with lowered soil fertility, increased soil erosion, and reduces annual crop yields.

Market Access : Farmers often depend on distributors or middlemen for marketing their produce, which can lead to reduced profit margins and limited market reach. While some chayote is exported, the process is typically managed by intermediaries, restricting farmers direct access to boarder markets.

Technical Knowledge : A need for enhanced training in modern agricultural practices exists to improve productivity and sustainability. Expanding training programs to cover advanced agricultural techniques, pest management and sustainable farming.

techniques can empower farmers with the necessary skills. By enhancing education and providing access to modern agricultural resources, farmers can improve productivity and economic outcomes.

Overall, chow chow cultivation in Sihphir, Mizoram plays a vital role in the local economy, providing income and employment opportunities. Addressing the challenges faced by farmers through improved infrastructure, water resources, market access and agriculture training could further enhance the benefits of chayote farming in the region.

Chow-chow cultivation on the arid, steep slopes of Sihphir exemplifies the transformation of inhospitable terrain into productive agricultural land.

9.1 . CLIMATE RELATED CHALLENGES

Erratic Rainfall Patterns

Chayote requires consistent rainfall of around 1500-2000 mm annually. However with climate change and inadequate rainfall patterns in Sihphir have become more erratic, with dry spells during the monsoon and intense rainfall in short periods. This can lead both water scarcity and flooding, both of which harm the crop.

During prolonged dry spells, chayote plants experience water stress, leading reduced yields. Since chayote requires a relatively high level of moisture, a lack of consistent rainfall directly affects the plant health and production.

Temperature Variations

Rising temperatures due to climate change can cause heat stress, which affects plant development , flowering and fruit set. Excessive heat can lead to a decrease in yield and affect the overall quality of the crop. Higher temperature may lengthen growing seasons, but they can also lead to premature flowering and fruiting, affecting the plant's ability to produce optimal-sized fruit. Additionally, prolonged heat can result in higher transpiration rates, causing dehydration and stress on the plants.

Humidity Fluctuations

Climate change can lead to fluctuations in humidity, either causing too much moisture in the air which can increase the risk of fungal infections or little leading to dehydration and plant health. Both extremes have adverse effects on growth and yield. High humidity coupled with warm temperatures created a conductive environment for fungal diseases like powdery mildew and root rot. These diseases can significantly reduce the crop yield and affect the marketability of the harvest.

Extreme Weather Events

Intense rainfall and storms due to climate change can cause flooding which may lead to soil erosion, especially in areas with sloped terrains like Sihphir. This can wash away valuable topsoil, disrupt root systems and damage chayote crops. Mizoram is susceptible to tropical cyclones, which can bring strong winds and heavy rains. These can physically damage the plants, break trellises and reduce the quality and quantity of the harvest.

10 SOIL AND FERTILITY ISSUES

Soil Quality and Ph levels

The prevalent practice of shifting cultivation or jhum has led to soil degradation. Shortened fallow periods results in reduced soil fertility, increased soil erosion and diminished crop yields. Studies indicate that soils in Mizoram, including in areas like Sihphir are typically acidic with ph levels ranging from 4.7 – 5.5 and medium in phosphorus and potash content. This acidity can hinder nutrient availability and overall soil health. The region's steep terrain and heavy monsoon rains contribute to significant topsoil erosion, further depleting soil fertility.

Fertilization challenges

Limited financial resources hinder farmers from investing in quality fertilizers and necessary tools affecting the effectiveness of fertilization. Moreover, many farmers have not received formal training on fertilizer practices which can hinder their crop production.

Loss of fertility resulting in Yellowing of leafs

Soil erosion and drainage problems

Mizoram hilly landscape, characterized by steep slopes, is prone to soil erosion, especially during monsoon rains. This erosion leads to loss of fertile topsoil, adversely affecting chayote growth. Traditional shifting cultivation or Jhum involves clearing forests for agriculture, which can exacerbate soil erosion. The removal of vegetation reduces oil stability, increasing susceptibility to erosion.

In region with heavy rainfall such as Sihphir, the absence of proper drainage systems can lead to waterlogging. Excessive water around chayote roots can cause root rot and hinder plant development. Continuous cultivation without adequate soil management can lead to soil compaction, reducing water infiltration and drainage. This impedes root growth and waterlogging issues.

11 WATER SUPPLY AND IRRIGATION PROBLEMS

- Water scarcity and irrigation issues and impact on crop yield
- Managing water stress in chayote plants
- Cost and accessibility of Irrigation Systems
- Dependance on adequate water supply for healthy crops.

Mizoram including Sihphir has a tropical climate with a monsoon season that spans from May to October. While the monsoon brings heavy rains, It is often unpredictable in terms of intensity and duration. This can result in periods of drought or water shortages during the dry season (November to April), which affects irrigation crops like chayote.

Collection of soil sample at Sihphir

Sihphir, being a hilly and mountainous region, has limited flat land for water storage for irrigation systems. The natural water resources like rivers, streams and springs may not be consistent throughout the year, which contricts farmer's ability to irrigate crops during dry spells.

Topography

The hilly terrain in Mizoram poses significant challenges in setting up irrigation infrastructure. Traditional irrigation methods such as drip or sprinkler systems may not be feasible or cost-effective for small-scale farmers in this region. Gravity-fed irrigation systems are often difficult to establish in the mountainous areas due to uneven land and the lack of sufficient water channels

Inadequate irrigation infrastructure

There is often lack of modern irrigation infrastructure in rural areas like Sihphir, Chayote being a climbing plant that thrives in well-irrigated, well-drained soils. However the steep slopes make it challenging to establish effective irrigation systems that can reach all areas of the farms, Without proper infrastructure, farmers face difficulty maintaining consistent moisture levels for crops.

Lack of water causing to leaves drying up

11. 1 COST AND ACCESSIBILITY OF IRRIGATION SYSTEMS

This is a present significant challenge for farmers, particularly given the region's geographic, economic and infrastructural limitations. The financial burden of installing irrigate ion systems can be high especially for small-scale farmers in rural areas like sihphir.

11. 2. DEPENDANCE ON ADEQUATE WATER SUPPLY FOR HEALTHY CROPS

Chayote heavily depends on an adequate water supply to ensure healthy crops growth, yield and quality. It is a perennial vine that thrives in humid, well- watered conditions making consistent moisture levels crucial for its cultivation. Chow chow requires moist soil for proper germination and early vine establishment. Inadequate water can lead to slow growth and weak vines reducing productivity. Water stress during the flowering can lead to poor pollination, reducing fruit set and drought conditions can cause deformed or undersized chow chow fruits. Moist soil allows efficient nutrient absorption, especially for essential elements like potassium and nitrogen and proper irrigation enhances fruit size, texture and flavour, consistent watering ensures larger and more uniform fruit.

11.3. PAST PRODUCTION

Mizoram is one of the leading producers of chayote in Northeast India, with the crop being widely cultivated in regions like Sihphir and Lungdai. Mizoram produces a significant amount of chayote which is supplied to states like Assam, Tripura and even exported to Bangladesh. In 2013 alone, the farmers in Sihphir cultivated Iskut in an area of land extending 251 Ha from which they earned Rs. 2,61,55,332 by marketing 45,742 quintals of squash. The chow chow were sold at wholesale rate between Rs.5 and Rs.6 per kg, the farmers estimated.

Former President APJ Abdul Kalam visit local Development Work at Sihphir Village on 17th October 2006

12 FIELD VISITATION

Leave sample collection in Sihphir

Research Methodology

The study is conducted through a sample of 60 chayote farmers in Sihphir ,Lungdai and Durtlang area through a structured questionnaire. It is estimated that there are approximately 300 chayote farming families in Sihphir area out of which 33 families from sihphir were selected and 10 families from sihphir vengthar were selected, around 30 family in Lungdai out of which 15 families were selected and 2 families from Durtlang were selected as well. Therefore, the sample size covers 60 percent of the total chayote farmers in the area under study. Face to face interview was conducted among the Mizoram Iskut Growers Association members. This paper tries to find the socio-economic profile of the farmers, to find the cause of decline in chow chow production and how to suggest appropriate cultivation practices.

13 TO STUDY THE SOCIO-ECONOMIC PROFILE OF THE CHOW-CHOW FARMERS IN THE PROPOSED AREA

Socio-economic profile of the farmers

The following Table 1 shows the general profile of the chow chow farmers in Sihphir , Lungdai and Durtlang area. Farming in this region are mainly family based activity that has been going on for generations with both men and women participating. Farmers have basic moderate levels of education with some having completed primary or secondary schooling with 50% finishing their matriculate. Most chow chow farmers are middle-aged to elderly with modernity taking over and the younger generations persuing higher education though some younger individuals may be involved due to the crop's commercial viability.

13. 1 DEMOGRAPHIC PROFILE

CHARACTERISTICS	DETAILS/PERCENTAGE
Age Group	18-30 years (12%), 31-50 years (15%), 51+ years (73%)
Gender	Male (85%), Female (15%)
Education Level	No formal education (45%), Primary (30%), Secondary (15%), Higher (10%)
Household Size	1-3 members (30%), 4-6 members (50%), 7+ members (20%)
Use Of Organic Fertilizer	Yes (85%), No (15%)
Average Annual Income	Around 240,000/-
Govt. Subsidy Loans	0 %

Stakeholder meeting with Chow Chow Farmers at Durtlang (4th October, 2023)

13. 2 LAND OWNERSHIP, FARM SIZE & FARMING PRACTICES

CHARACTERISTICS	PERCENTAGE
Owned Land	90 % owned
Leased Land	10 %
Farm Size	Small (<1 hectare)(25%), Medium (1-3 hectares),(45%), Large (> 3 hectares)(30%)
Type Of Farming	Mono-cropping (20%)
Intercropping	(60%)
Use Of Technology	Traditional (55%)
Semi-mechanized	(40%)
Mechanized	(5%)
Access Of Irrigation	Rain-fed (70%)
Irrigated	(30%)
Use Of Organic Fertilizer	Yes (95%). No (5%)

13.3. INCOME AND LIVELIHOOD

CHARACTERISTICS	PERCENTAGE
Chayote Farming	95 %
Other Crops	40 %
Non Agriculture Work	20 %
Average Annual Income	Rs 240000/-
Govt. Subsidy Support/ Loans	5 %

13. 4. SOCIO ECONOMIC CHALLENGES

CHARACTERISTICS	PERCENTAGE
Socio challenges - Limited access to training and education - Labor shortages - Lack of Government support	80% 80% 70%
Economic challenges : - Fluctuating market price - High transportation costs - Lmited market access	90% 80% 90%

13.5. ENVIRONMENTAL CHALLENGES

CHARACTERISTICS	PERCENTAGE
Climate Change (Drought, Heavy Rains, Typhoons)	70%
Soil Degradation	70%
Pests And Diseases	100%
Water Scarcity	100%
Deforestation	YES 100%
Excessive use of chemicals	YES 100%

Soil sample collection at Sihphir with Joseph Lalnuntluanga, Deputy Director (INM), Dpt. of Agriculture

14 TO FIND OUT THE CAUSE OF DECLINE IN CHOW-CHOW PRODUCTION AND SUGGEST APPROPRIATE CULTIVATION PRACTICES

The objective of this study is to thoroughly investigate the underlying factors contributing to the noticeable decline in chow-chow (chayote) production, including environmental, agronomic, and socio-economic challenges faced by farmers, and to recommend scientifically sound and contextually appropriate cultivation practices that can help revitalise production, improve yield quality and quantity, and promote sustainable farming of this important vegetable crop.

15 UPGRADING SKILLS AND PROVIDING THEM APPROPRIATE TECHNOLOGY FOR TAKING UP PRODUCTION ACTIVITIES THROUGH INPUT SUPPORT

A structural approach is needed in order to improve the production of chow chow in farmers of Sihphir.

15. 1 CAPACITY BUILDING AND SKILL DEVELOPMENT

Capacity Building and Skill Development is an important part of training that is integral to the farmers like training programs which conduct workshops on modern chayote farming techniques,pest management, irrigation methods and post harvest handling. An update on farming techniques is required as well for the best practices in chow chow production.

15.2 TECHNOLOGY AND INPUT SUPPORT

Research Institution and agricultural extension services should introduce high-yield and disease-resistant chayote varieties to farmers. This will help improve crop resilience and productivity. Given the rising demand for organic produce, farmers can be encouraged to use biofertilizes, vermicompost, and natural pesticides instead of chemical pesticides. This will also help them obtain organic certification which can fetch higher prices in the market.

Stakeholder meeting with Chow Chow Farmers at Durtlang (4th October, 2023)

15.3. MARKET LINKAGE AND VALUE ADDITION

Market linkages play a crucial role in ensuring that farmers receive fair prices and a stable demand for their produce. Strengthening these linkages requires a combination of direct selling opportunities, cooperative efforts and digital solutions. Farmers in Sihphir can benefit from direct selling at local and regional markets to eliminate middlemen and get better prices. Encouraging contract farming with food processing industries and restaurant chains can ensure stable demand and pricing

Collaborations with government like Mission Integrated Development of Horticulture (MIDH) and NABARD supported market linkage schemes can provide financial and logistical support. Partnering with agribusiness start-ups and companies can help farmers access larger retail chains and processing industries

Farmers can leverage digital platforms such as Enam (Electronic National Agriculture Market), AgriBazaar and local e-commerce websites to sell their produce online. Mobile apps providing real-time price updates, buyer connections and logistic support can help farmers make informed selling decisions

Value Addition is essential to increase the profitability of chayote farming by transforming raw produced into processed products with longer shelf life and higher market demand. Introducing solar drying technology for chayote can help farmers produce dried chow chow which can be sold in off season.

Processing and packaged products such as

- Chow chow pickles and chips : Small scale processing units can be set up to produce pickles, dried chayote and chips which have longer shelf life and better market value.
- Chow-chow based flour and noodles : Processing chayote into flour or incorporating it into noodles and snackes can attract health-conscious consumers.
- Chayote Juice and Puree : Extracting chow chow juice or making puree for use in baby food and health drinks can cater to niche markets

Processed Chow Chow (Pickled, Chips, Noodles)

Branding and Packaging

Attractive and eco-friendly packaging can improve market appeal and consumer preference. Organic certification (GI) tagging for Sihphir chow chow can help farmers get premium prices in national and international markets.

Promoting agro-tourism where visitors experience chow chow farming and buy directly from farms can generate additional income. Establishing farm-to-table restaurants featuring chayote-based dishes can boost local demands.

Financial and policy support

Government subsidies and Grants

Framers in Sihphir can benefit from various government subsidy programs aimed at improving agricultural productivity and reducing costs

- Mission for integrated Development Horticulture (MIDH) : This national scheme provides financial assistance for infrastructure development, high-yield seed distribution, irrigation systems and post-harvest management

- Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) : It offers subsidies for irrigation projects like drip irrigation and rainwater harvestingensuring water availability for chow chow farming.

- National Horticulture Board (NHB) Schemes :It supports farmers by providing subsidies for setting upcold storage units, processing plants and marketing infrastructure.

15.4. AGRICULTURE LOANS AND CREDIT FACILITIES

Access to easy and affordable credit is crucial for chayote farmers to invest in modern farming techniques and post-harvest infrastructure. Key financial institutions providing credit include:

- Kisan Credit Card (KCC) : This government-backed loan facility allows farmers to borrow funds at low interest rates for purchasing seeds, fertilizes and equipment.

- NABARD's Rural Infrastructure Development Fund (RIDF) : It provides long term loans for developing storage facilities, irrigation projects and rural roads, which are essential for transporting chow chow to markets.

- State Bank of India (SBI) Agri lLoans and Mizoram Rural Bank Loans : It offered affordable financial options tailored to small and marginal farmers.

Crop Insurance Schemes

Chayote farmers in Sihphir area are often affected by unpredictable weather, pest attacks and market price fluctuations. Crop insurance can help farmers mitigate risks and secure their income. Some key insurance schmes include :

- Pradhan Mantri Fasal Bima Yojana (PMFBY): It provides compensation to farmers incase of crop failure due to natural calamities.

- Weather-Based Crop Insurance Scheme (WBCIS): It offers insurance against weather-related risks such as droughts, excessive rainfall and temperature fluctuations.

16 TO INFLUENCE FARMERS TO TAKE UP CHOW-CHOW CULTIVATION FOR UPLIFTMENT OF THEIRS AND STATE INCOME THROUGH PROMOTION OF CHOW-CHOW CULTIVATION

Agriculture plays a crucial role in the economic development of the country and introducing high value, fast growing crops chayote (commonly known as chow chow) can significantly enhance farmer's income. Agriculture remains the backbone of many economies particularly in rural areas where farmers rely on it for their livelihood. By encouraging farmers to adopt chayote cultivation, we can uplift their financial status while contributing to the economic growth of the state.

Chayote has a high market demand because of its versatility in cuisines in both domestic and international markets. It requires minimal input and thrives in diverse conditions making it suitable for regions with moderate rainfall and suitable drainage soil, a single vine can produce a large number of fruits ensuring good returns for farmers. Rich in vitamins and, fibers and antioxidants, chayote promotes health and well-being, adding to its market appeal. Chow chow vines can be grown on trellises, reducing soil erosion and making efficient use of land resources.

Sample Collection at Chow Chow Farm at Sihphir

Economic Benefits of Farmers

By adopting chayote cultivation, farmers can significantly boost their income. Since chayote is a perennial crop, it requires less replanting reducing input costs. Moreover in cn be intercropped with other vegetables or cash crops, maximizing land use and profitablility. Additionally, processing industries can use chow chow for making pickles, chips and other value-added products creating employment opportunities and enhancing and enhancing farmers earnings.

17 INPUT SUPPORT: ACTIVITIES UNDERTAKEN PROVISION OF FERTILIZERS DETAILED PROGRAM REPORT

Material distribution of chow chow (Iskut) growing on sustainable farming.
Funded by Ministry of Tribal Affairs
Implemented by Mission Foundation Movement
Chief Guest : Pu PC. Vanlalruata, Hon'bleMinister, Department of Agriculture

Material Distribution to beneficiaries by Hon'ble Agriculture Minister Pu PC. Vanlalruata at Rohrenga Hall, Sihphir

The purpose of chow chow farmers coming together for sustainable farming is to enhance productivity, to find out the reason for their decline in their crops these past years and share resources and adopt eco-friendly practices. By working collectively, farmers can exchange knowledge, reduce costs through shared resources and access better market opportunities . Sustainable farming methods, such as organic fertilization and soil conservation, help maintain long term soil health and environmental balance. Additionally, organized groups can secure financial support, government aid and technical assistance more effectively. This collaboration strengthens the farming community, improves economic stability and ensures sustainable chayote cultivation for future generations.

This function does not only incline the distribution of materials for farmers but for future purpose and collaboration enhances resource management, knowledge sharing and overall resilence. By coming together we can share knowledge and exchange techniques on soil health and improving efficiency and sustainability. Cooperatives or farmers groups can pool resources to afford better seeds, organic fertilizers and advanced irrigation systems. By working together, farmers can negotiate better prices, reduce exploitation by middlemen and create stable markets for chow chow crop. This special program is designed to support chow chow farmers which contributes to the overall sustainable growth of the crop by addressing key agricultural, economic and environmental challenges.

17.1 FUNCTION OVERVIEW

This distribution of materials was attended by beneficiaries selected from 3 region, Lungdai, Sihphir and Durltang. 60 beneficiaries were selected from these three regions and around 120 people attended the function with their family members. The distribution of Diamine phosphate (DAP) was carried out by Hon'ble Minister Pu PC Vanlalruata, Department of Agriculture, Government of Mizoram. The DAP was given to 60 beneficiaries which weight 50kgs/bag with each bag costing Rs. 2,000.

Distribution of materials to Chow Chow Beneficiaries

18 FINDINGS

18.1 SOIL TESTING RESULT

Sl no	Name	Address	pH	EC	SOC	N	P	K
1.	Laltanpuia Pachuau I	Sihphir	5.68	57.42	4.8	0.2	12	100
2.	Laltanpuia Pachuau II	Sihphir	4.38	34.17	5.3	0.2	12	110
3.	Laltanpuia Pachuau I	Sihphir	5.77	66.02	4.9	0.3	13	100
4.	Laltanpuia Pachuau II	Sihphir	5.98	33.95	3	0.2	12	110
5.	Lalchungnunga I	Sihphir	5.72	244.2	2.0	0.3	13	92
6.	Lalchungnunga II	Sihphir	5.56	144.8	2.8	0.3	13	95
7.	Rodinga I	Sihphir	3.95	202.6	3.3	0.3	13	90
8.	Rodinga II	Sihphir	3.75	166.6	2.9	0.4	12	95
9.	H. Kaptluanga	Durtlang	5.96	69.06	3.2	0.4	14	88
10.	H. Kaptluanga	Durtlang	6.28	74.62	2.7	0.3	14	100
11.	Pu Lalnuntluanga I	Durtlang	5.96	129.5	2.8	0.4	13	90
12.	Pu Lalnuntluanga II	Durtlang	5.82	88.91	3.0	0.3	13	95
13.	Pu Remthanga 1	Lungdai	3.67	129.6	2.9	0.2	12	110
14.	Pu Remthanga II	Lungdai	3.56	123.7	2.7	0.3	12	120
15.	Pu Remthanga I	Lungdai	4.46	28.00	2.8	0.4	12	110
16.	Pu Remthanga II	Lungdai	5.11	21.26	2.7	0.4	12	110

18.2 DETAILED RESULTS OF SOIL SAMPLE

1. pH : Soil pH indicates how acidic or alkaline the soil is, measured on the scale from 0-14.

2. EC: Electrical Conductivity (µS/cm) – It measures the ability of soil or water to conduct electricity, which is directly related to the amount of soluble salts (salinity) present. It's a key indicator of soil health and fertility.

3. SOC: Soil Organic Carbon (%) – It is a key indicator of soil health and fertility. It represents the amount of carbon stored in organic matter (like decomposed plant and animal residues) in the soil.

4. N, P, K: Primary nutrients – Nitrogen (%), Phosphorus (ppm), Potassium (ppm)

18.3. IMPORTANCE OF SOIL PH IN CHAYOTE CULTIVATION

Soil pH is a critical determinant of soil fertility. It influences the availability of essential nutrients, microbial activity, and overall crop productivity. For chayote, which prefers moderately acidic soils, maintaining an optimal pH range ensures healthy growth, good crop development, and reduced incidence of nutrient deficiency.

Categorization of Soils Based on pH

Optimal Range (5.0 – 6.5)

Below pH 5.0, availability of phosphorus, calcium, and magnesium decreases, while toxic elements like aluminum and manganese may increase, harming plant roots.

Fields in this range are generally well-suited for chayote cultivation. Nutrient uptake is efficient, and plant growth is not significantly restricted by pH.

Farmers/Fields

- Laltanpuia Pachuau I & II (Sihphir)
- Lalchungnunga I & II (Sihphir)
- H. Kaptluanga (Durtlang)
- Pu Lalnuntluanga I & II (Durtlang)
- Pu Remthanga II (Lungdai)

Moderately to Strongly Acidic (<5.0)

These soils require intervention to improve pH and crop response. High acidity can reduce root growth, suppress microbial activity, and lock up key nutrients like phosphorus and potassium.

Farmers/Fields

- Laltanpuia Pachuau II (4.38)
- Rodinga I (3.95), Rodinga II (3.75)
- Pu Remthanga I (3.67, 4.46)
- Pu Remthanga II (3.56)

Implications of Low pH on Chow chow

Sl. No	Issue Caused by Low pH	Effect on Chow chow
1	Phosphorus lock up	Poor root development
2	Aluminium & magnesium lock up	Root injury & leaf yellowing
3	Microbial inhibition	Reduced organic matter breakdown
4	Poor nutrient uptake	Stunted growth & low yield

Recommendations for Soil pH Correction

To improve soil pH and ensure optimum conditions for chayote:

Sl No	Practice	Purpose
1	Apply agriculture lime ($CaCO_3$) Dose: 1–2 tons/ha (based on pH & soil type)	Neutralizes soil acidity Adjust according to lab results
2	Incorporate organic matter (FYM, compost)	Enhances soil buffering and fertility
3	Avoid acid-forming fertilizers (e.g., ammonium sulfate)	Prevents further acidification
4	Regular soil testing (every 6–12 months)	Track and reapply if needed

18.4. ELECTRICAL CONDUCTIVITY (EC)

Electrical Conductivity (EC) is a measure of salts (soluble ions) in the soil solution. It is a critical indicator of:

- Nutrient availability
- Salinity stress
- Soil fertility
- Fertilizer build-up or leaching

For chow chow, a moderately salt-sensitive crop, EC levels must be maintained within a safe range to avoid yield loss due to salt stress or nutrient imbalance.

EC Interpretation Table

Sl No	EC Range (µS/cm)	Salinity Level	Effect on Chayote
1	0–100	Low	May indicate poor nutrient availability
2	100–250	Optimal	Suitable for chayote, good fertility
3	250–500	Moderately high	May affect sensitive varieties
4	>500	High	Likely to cause salt stress

Chayote prefers EC values between 100–250 µS/cm. Too low can signal nutrient deficiency; too high can lead to salt toxicity.

Soil Sample collection at Sihphir

Field Categorization by EC Range

Low EC (<100 µS/cm)

These fields may be nutrient-deficient and require organic matter or fertilization to boost fertility.

- Laltanpuia Pachuau I & II (Sihphir) – 57.42, 66.02, 34.17, 33.95
- Pu Remthanga I & II (Lungdai) – 28.00, 21.26
- H. Kaptluanga (Durtlang) – 69.06, 74.62

Recommendation: Apply compost, farmyard manure (FYM) or balanced fertilizer (based on NPK analysis).

Optimal EC (100–250 µS/cm)

These are in the ideal range for chayote cultivation.

- Lalchungnunga II – 144.80
- Pu Lalnuntluanga I & II – 129.5, 88.91
- Pu Remthanga I & II (Lungdai) – 123.7, 129.6
- Rodinga I & II – 202.6, 166.6

Recommendation: Maintain current fertility; monitor EC annually.

Moderately High EC (>250 µS/cm)

None of the tested fields exceed this threshold. This indicates no immediate salinity hazard, which is a positive finding.

Sl No	Issue	Suggested Action
1	Low EC (<100 µS/cm)	Apply FYM, vermicompost, or NPK fertilizer
2	Sudden EC increase	Check for over-fertilization or poor drainage
3	Maintain optimal EC	Practice crop rotation & organic inputs
4	Monitor regularly	Retest soil every 6–12 months

Conclusion

• Most fields are within or near the optimal EC range for chayote production.

• Some soils show low EC, indicating the need for nutrient enrichment through organic or inorganic amendments.

• No signs of salt toxicity were observed, which is favorable for long-term cultivation.
Maintaining a balanced EC, together with proper pH and NPK levels, will significantly improve the productivity and sustainability of chayote farming in Sihphir, Durtlang, and Lungdai.

18.5. SOIL ORGANIC CARBON (SOC)

It is the carbon component of organic matter in the soil. It is a vital indicator of soil fertility, ***structure, microbial health, and water retention—all essential for healthy chow chow growth.***

SOC Enhances:

- Nutrient holding capacity (especially nitrogen and phosphorus)
- Water retention in sloping/hilly soils
- Soil structure and aeration
- Biological activity and beneficial microorganisms
- Resistance to erosion and compaction

Ideal SOC levels for upland/hilly vegetable cultivation like chayote: 1.5% – 3.0% or higher

SOC Rating Scale for Interpretation

Sl No	SOC (%)	Soil Health Rating	Implication for Chayote
1	< 0.5%	Very low	Severe fertility problems
2	0.5 – 1.5%	Low	Poor productivity
3	1.5 – 2.5%	Medium	Moderate fertility
4	2.5 – 3.5%	High	Good fertility, balanced soil
5	> 3.5%	Very high	Excellent fertility and structure

Categorization of Fields Based on SOC Levels

Very High SOC (>3.5%)

• Laltanpuia Pachuau I & II – 4.8, 4.9, 5.3%

Interpretation: These soils are exceptionally fertile and well-structured. Focus on maintaining organic matter through minimal tillage and balanced NPK.

High SOC (2.5% – 3.5%)

• Most of the remaining fields (Lalchungnunga II, Rodinga I & II, H. Kaptluanga, Pu Lalnuntluanga, Pu Remthanga)

Interpretation: Soils are in good condition. Fertility is sufficient, but attention should be given to maintaining pH, avoiding nutrient leaching, and continued composting.

Medium SOC (2.0% – 2.5%)

• Lalchungnunga I – 2.0%

Interpretation: Moderate fertility. Consider increasing organic inputs such as vermicompost, cover crops, or mulching to raise SOC.

No fields fell below 2.0%, which is a very positive result.

Recommendations for Farmers

Sl No	Practice	Purpose
1	Apply compost, FYM, or green manure	Boosts SOC and microbial activity
2	Retain crop residues	Prevents organic matter loss
3	Avoid burning organic waste	Preserves carbon in the soil
4	Use cover crops (e.g., legumes)	Adds biomass and prevents erosion
5	Avoid over-tillage	Prevents SOC oxidation and loss

Conclusion

The SOC status across the surveyed fields in Sihphir, Durtlang, and Lungdai is generally excellent, with most samples registering in the high to very high range. This reflects good organic matter management and offers a strong base for sustainable chayote production.

To maintain and enhance this advantage:
- Continue organic practices
- Avoid practices that degrade carbon (Jhum cultivation, over-tillage)
- Monitor nutrient levels to ensure balanced fertility

18.6. NPK (NITROGEN, PHOSPHORUS, POTASSIUM) RESULTS

Nitrogen (N%)

Role of Nitrogen in Chayote Cultivation

Nitrogen (N) is a vital macronutrient required for:
- Leaf and stem growth
- Photosynthesis (via chlorophyll production)
- Overall plant vigor and yield potential

Chayote is a leafy vine crop that requires moderate nitrogen input, especially during the early vegetative stage.

Interpretation of Nitrogen Levels

Sl No	N (%)	Rating	Implication for Chayote
1	< 0.2%	Very Low	Severe deficiency; poor leaf growth
2	0.2 – 0.3%	Low	May limit yield; needs supplementation
3	0.3 – 0.5%	Moderate	Adequate for chayote with good SOC
4	> 0.5%	High	Rare; may risk excessive vegetative growth

Field Categorization Based on N Levels

Low Nitrogen (0.2 – 0.3%)

These soils may limit chayote vegetative growth and yield unless amended.

- Sihphir: Laltanpuia Pachuau I & II, Lalchungnunga I & II, Rodinga I
- Lungdai: Pu Remthanga I & II
- Durtlang: H. Kaptluanga (one sample), Pu Lalnuntluanga II

Recommendation: Apply FYM, compost, or urea/DAP as a basal or split dose. Use leguminous cover crops to improve N naturally.

Moderate Nitrogen (0.4%)

Sufficient for chayote production, especially when supported by good SOC levels.

- Rodinga II (Sihphir)
- H. Kaptluanga (Durtlang)
- Pu Lalnuntluanga I (Durtlang)
- Pu Remthanga I & II (Lungdai)

Recommendation: Maintain N through organic topdressing, avoid over-fertilization which may raise EC or harm fruit set.

Recommendations for Nitrogen Management

Sl No	Practice	Benefit
1	Apply FYM/compost regularly	Builds long-term N supply & SOC
2	Use urea or ammonium sulfate as needed	Boosts rapid N for early growth
3	Grow legumes or cover crops	Fixes atmospheric nitrogen naturally
4	Use split fertilizer applications	Reduces loss, increases efficiency
5	Avoid excessive N	Prevents soft growth & pest problems

Conclusion

Most fields across Sihphir, Durtlang, and Lungdai fall into the low to moderate nitrogen category, with no extremely deficient fields. However, nitrogen supplementation is essential, particularly in Sihphir and Lungdai, to ensure strong vegetative growth and high-quality chayote (chow chow) yields.

With high SOC levels already present in most plots, nitrogen amendments are likely to be effective and well-utilized. A balanced fertilization plan and organic matter maintenance are key to long-term soil health and productivity.

Phosphorus (P)

Importance of Phosphorus in Chayote Cultivation

Phosphorus is a key macronutrient essential for:
• Root development and early plant establishment
• Energy transfer and flower initiation
• Fruit set and seed formation
In chayote cultivation, adequate phosphorus is particularly important during the early stages to support vine establishment and throughout flowering and fruiting for improved yield quality.

Farm visitation (Durtlang)

Interpretation of Phosphorus Levels in Soil

Sl No	Phosphorus (ppm)	Rating	Implications for chayote
1	< 15 ppm	Low (Deficient)	Limits root growth, flowering, and fruit set
2	15 – 30 ppm	Adequate	Supports optimal growth and yield
3	> 30 ppm	High	Uncommon; risk of nutrient imbalance or environmental loss

Field Categorization Based on Phosphorus Levels

Low Phosphorus (< 15 ppm)

All tested fields fall below the critical phosphorus threshold for chayote, indicating widespread deficiency.

Locations Identified

- Sihphir: Laltanpuia Pachuau I & II, Lalchungnunga I & II, Rodinga I & II
- Durtlang: H. Kaptluanga (both samples), Pu Lalnuntluanga I & II
- Lungdai: Pu Remthanga I & II (all samples)

Range of Values: 12–14 ppm

Status: Deficient in all samples tested

Implications

- Poor early root development
- Weak vine establishment
- Reduced flowering and fruit production

Recommendation

- Apply Single Super Phosphate (SSP) at 150–250 kg/ha during land preparation.
- Alternatively, apply DAP (if N is also low) at 80–100 kg/ha.
- Use rock phosphate for longer-term improvement, especially in acidic soils.
- Enhance uptake with Phosphate Solubilizing Bacteria (PSB).

Best Practices for Phosphorus Management

Sl No	Practice	Benefits
1	Use of SSP or DAP	Immediate phosphorus availability for early crop stages
2	Enrichment of compost with rock phosphate	Improves long-term phosphorus reserves in soil
3	Application of PSB biofertilizers	Solubilizes unavailable forms of phosphorus in acidic soils
4	Incorporate organic matter regularly	Enhances microbial activity and phosphorus use efficiency
5	Avoid phosphorus leaching	Especially on slopes and during heavy rainfall

Conclusion

All tested chayote fields across Sihphir, Durtlang, and Lungdai show deficient phosphorus levels (below 15 ppm). This deficiency poses a direct threat to:

- Root and shoot development
- Vine strength and growth duration
- Flower and fruit production

Timely phosphorus application—combined with organic inputs and microbial support—will play a critical role in enhancing crop performance. These recommendations are particularly crucial for farmers practicing monsoon-dependent, rainfed cultivation on sloping terrain, where nutrient loss is common.

Sustained soil fertility improvement through balanced fertilization, organic matter enrichment, and biofertilizer use will ensure long-term productivity of chayote in these regions.

Potassium (K)

Importance of Potassium in Chayote Cultivation
Potassium plays a key role in:

- Water regulation and nutrient transport
- Fruit development and quality (size, firmness, shelf life)
- Stress and disease resistance
- Enzyme activation and photosynthesis efficiency

Chayote, being a vine and fruiting crop, has a moderate to high demand for potassium, especially during flowering and fruit enlargement stages.

Interpretation of Potassium Levels in Soil

Sl No	Potassium (ppm)	Rating	Implications for Chayote
1	< 100 ppm	Low (Deficient)	Limits fruit development, quality, and disease resistance
2	100–250 ppm	Adequate	Supports healthy growth, flowering, and fruiting
3	> 250 ppm	High	Rare; may cause imbalance with other nutrients

Field Categorization Based on Potassium Levels

Low Potassium (< 100 ppm)

Fields below 100 ppm require supplementation to avoid limitations in yield and quality.

Locations Identified

- Sihphir: Lalchungnunga I & II, Rodinga I & II
- Durtlang: H. Kaptluanga (Sample 1), Pu Lalnuntluanga I & II

Range of Values: 88–95 ppm
Status: Deficient

Implications

- Potential for poor fruit size and firmness
- Increased susceptibility to wilt and mildew
- Poor water regulation in plants under heat or moisture stress

Recommendation

- Apply Muriate of Potash (MOP) at 40–60 kg/ha
- Use wood ash as an organic alternative (rich in K)
- Incorporate K-mobilizing biofertilizers to improve availability

Adequate Potassium (100–120 ppm)

These fields are within the sufficient range for chayote growth.

Locations Identified

- Sihphir: Laltanpuia Pachuau I & II (both samples)
- Durtlang: H. Kaptluanga (Sample 2)
- Lungdai: Pu Remthanga I & II (all samples)

***Range of Values*:** 100–120 ppm

Status: Adequate

Recommendation

- Maintain levels through balanced fertilization
- Avoid overuse of potassium which may interfere with magnesium and calcium uptake
- Monitor crop response and soil test every 2–3 seasons

Best Practices for Potassium Management

Sl No	Practice	Benefit
1	Apply MOP or SOP as needed	Ensures availability during peak fruiting stages
2	Use compost/wood ash	Organic and sustainable source of potassium
3	Employ K-mobilizing biofertilizers	Enhances use efficiency of native and added potassium
4	Avoid nutrient imbalance	Prevents antagonism with calcium and magnesium
5	Use mulch and moisture conservation	Enhances K uptake under rainfed conditions

Conclusion

The potassium status across Sihphir, Durtlang, and Lungdai shows a mix of low and adequate levels:

• Sihphir and Durtlang: Several fields show marginal to low potassium (88–95 ppm) and need immediate correction.

• Lungdai: All tested fields are within adequate range, suggesting stable potassium management.

To ensure strong vine growth, robust fruiting, and resistance to stress, potassium levels must be maintained through balanced nutrient application and organic matter integration.

Regular soil testing and use of integrated nutrient management (INM) practices will sustain long-term soil health and high productivity in chayote farming systems.

Chow Chow Farm (Durtlang)

19 DISEASES AND PESTS IN CHOW CHOW

19.1 INFECTION OF CHOW CHOW

Leaf curling in chow chow indicates virus infection

Observed Symptoms

A visual examination revealed the following consistent symptoms:

- Upward curling and wrinkling of leaves
- Thickened and puckered leaf surface
- Slight mosaic mottling or vein clearing in some cases
- Reduced leaf size and distorted morphology
- General stunting of the plant canopy in severe cases

(Refer to Fig – Photo of affected leaf)

Diagnosis and Probable Cause

Based on symptomatology and regional pest profiles, the leaf curling disorder is most likely due to:

Primary Cause: Viral Infection

- Most probable agent: Chayote Leaf Curl Virus (CLCV) or a related mosaic virus
- Transmission: Through sap-sucking insect vectors, primarily:
- Whiteflies (Bemisia tabaci)
- Aphids (Aphis spp.)
- Such viral infections are often exacerbated by monoculture practices and the use of infected planting materials.

Secondary Factors:

- Micronutrient imbalances (e.g., Zn or B deficiency) can aggravate the symptoms
- However, based on existing soil data, this is less likely the primary cause

Role of Insect Vectors

The presence of whiteflies and aphids in several affected fields suggests active transmission. These vectors are known to thrive in warm and humid conditions, particularly where weed hosts are abundant and sanitary crop management is lacking.

Management Recommendations

Immediate Control Measures

Sl No	Intervention	Details
1	Rogueing of infected plants	Remove and destroy severely affected plants to prevent further spread
2	Installation of yellow sticky traps	To monitor and reduce whitefly/aphid populations
3	Spray of neem-based biopesticides	Neem oil @ 3–5 ml/L – safe and effective against soft-bodied insects
4	Insecticide application	If pest population is high, use Imidacloprid or Thiamethoxam (rotate with other modes of action to avoid resistance)

Nutritional support

• Apply foliar sprays of micronutrients (Zinc, Boron) where minor deficiencies are suspected
• Maintain soil fertility through compost, FYM, and pH correction as previously recommended

Long-Term Preventive Strategies

Sl No	Strategy	Rationale
1	Use virus-free planting material	Prevents initial introduction of infection
2	Crop rotation	Avoid continuous cultivation of chow chow in the same plot
3	Biological control promotion	Encourage natural enemies (e.g., lady beetles, lacewings)
4	Intercropping with pest-repellent species	e.g., marigold, basil – to deter vectors
5	Regular scouting and monitoring	Helps in early detection and timely management

Conclusion

The leaf curling disorder observed in chayote fields of Durtlang, Sihphir, and Lungdai is most likely the result of virus infection transmitted by insect vectors, particularly whiteflies and aphids. Given the economic importance of chow chow in the region, it is imperative to adopt integrated disease and vector management practices, along with improved planting material selection and soil health monitoring.

Ongoing surveillance, farmer training, and implementation of Integrated Pest and Disease Management (IPDM) are strongly recommended to prevent further crop losses and sustain chayote productivity in the region.

19.2. DISEASE OF CHOW CHOW

Yellowing and burnt leaves in chayote fruit

Observed Symptoms

- Yellowing of leaf margins and interveinal areas
- Scorched, burnt appearance (necrosis) at leaf tips and edges
- Progression from yellow to brown and black tissue
- Lower (older) leaves more affected than younger ones

(Refer to Fig – Photo of symptomatic leaf)

Probable Diagnosis: Nutrient Stress Combined with Fungal Infection

The symptom pattern suggests a combined disorder, primarily:

Potassium Deficiency

• Marginal chlorosis (yellowing along leaf edges) followed by necrosis (leaf burn)
• Common in fruiting crops when potassium demand is high
• Likely in soils with acidic pH or leaching-prone slopes, as reported in Sihphir and Lungdai

Secondary Fungal Infection (e.g., Downy Mildew or Anthracnose)

• Irregular necrotic patches, especially in humid conditions
• Possible presence of gray or dark lesions suggests downy mildew (Pseudoperonospora cubensis) or anthracnose (Colletotrichum spp.)

Contributing Soil Conditions

According to earlier soil reports:

• Low potassium (K) levels likely – low potassium as well as acidic pH and high EC can affect uptake
• High soil organic carbon (SOC) – supports fungal growth in moist environments
• Possible poor drainage or microclimate humidity from thick canopy or low-lying field sections

Management Recommendations

Nutritional Correction

Sl No	Recommendation	Purpose
1	Apply Muriate of Potash (MOP) @ 25–30 kg/ha	Correct potassium deficiency
2	Use wood ash (if organic approach preferred)	Contains K and raises soil pH
3	Apply balanced NPK fertilizer	Prevents nutrient imbalance

Fungal Disease Management

Sl No	Control Measure	Timing and Details
1	Spray with Copper oxychloride (3 g/L) or Mancozeb (2 g/L)	Every 10–14 days in wet/humid weather
2	Ensure proper spacing and air flow	Reduces humidity around foliage
3	Remove and destroy infected leaves	Prevents spread of spores
4	Alternate fungicides to avoid resistance	Use systemic + contact fungicides in rotation

Preventive Measures

- Conduct soil K testing for accurate recommendation
- Improve drainage in sloped areas to avoid waterlogging
- Use resistant chow chow varieties if available
- Maintain regular mulching to reduce moisture stress

Conclusion

The yellowing and scorching symptoms observed in chayote (chow chow) across Durtlang, Sihphir, and Lungdai appear to result from potassium deficiency compounded by fungal infection, most likely downy mildew. Immediate nutritional correction and protective fungicide application, along with improved field hygiene and drainage, will help mitigate the problem and restore crop health.

19.3 PEST OF CHOW CHOW

chayote (chow chow) fruit (Sechium edule) infested with mealybugs.

Pest Identified: Mealybug

(Family: Pseudococcidae)

Visual Symptoms (From Fig.)

• Soft-bodied, white cottony insects clustered on the fruit surface

• Presence of sooty mold (black fungus) may develop due to honeydew secretion

• Malformed, underdeveloped or discolored fruits

• Associated ant activity (seen in the image), which protects mealybugs and helps spread them

Pest Biology and Impact

Sl No	Parameter	Details
1	Scientific Group	Pseudococcus spp., Planococcus spp.
2	Feeding Behavior	Piercing-sucking – sap removal from fruit and stems
3	Reproduction	Rapid – multiple generations per season
4	Mode of Spread	Through infected planting materials, ants, wind, or tools
5	Favorable Conditions	Warm, humid, and shaded environments

Impact on Chayote Production

- Reduces fruits quality and marketability
- Causes fruit drop and drying
- Promotes secondary fungal infections
- In severe cases, leads to yield loss up to 50%

Integrated Management Strategy (IPM)

Cultural Control

Sl No	Practice	Benefit
1	Remove and destroy infested fruits	Prevents further spread
2	Prune overcrowded vines	Improves sunlight and air flow
3	Avoid excessive nitrogen fertilizer	Prevents soft, pest-attracting tissue growth

Biological Control

Sl No	Agent	Application
1	Predatory beetles (Cryptolaemus montrouzieri)	Releases in affected fields at 10–15 beetles/tree
2	Parasitic wasps (Anagyrus spp.)	Biological suppression of mealybugs
3	Avoid excessive nitrogen fertilizer	Prevents soft, pest-attracting tissue growth

Mechanical Control

- Wash affected fruits with soap solution (1 tsp/litre) and soft brush
- Use sticky bands or glue traps to block ant movement on vines

Chemical Control

Sl No	Chemical Name	Dose & Notes
1	Imidacloprid 17.8% SL	0.3 ml/L – systemic action
2	Buprofezin 25% SC	1 ml/L – insect growth regulator
3	Neem oil (Azadirachtin 300 ppm)	5 ml/L – organic, safe for beneficial insects

Note : Always rotate insecticides to prevent resistance, and follow a pre-harvest interval (PHI) of at least 7 days.

Monitoring & Prevention

- Regular visual inspection of vines and fruits, especially during fruiting stage
- Install yellow sticky traps to monitor sap-sucking pests
- Avoid replanting using infected suckers or shoots

Conclusion

The observed infestation on chayote fruits in Durtlang, Sihphir, and Lungdai is attributed to mealybug attack, which can significantly reduce fruit quality and yield. A combination of sanitation, pruning, biological agents, and safe insecticide use under an Integrated Pest Management (IPM) framework is strongly recommended.

Timely intervention is crucial to prevent spread to unaffected plots and to ensure a healthy and marketable crop.

20 STRATEGIC RECOMMENDATION REPORT FOR SUSTAINABLE CHOW CHOW (SECHIUM EDULE) CULTIVATION

The following report synthesizes key findings and proposes comprehensive future strategies to enhance productivity, soil sustainability, and pest resilience in the region.

Workshop on "Understanding the Decline of Chow Chow Farming in Sihphir." This programme was part of the initiative titled "Chow Chow Growing for Sustainable Development." at Sihphir with Mizoram Iskut Growers Association. (3rd July, 2025)

The following report synthesizes key findings and proposes comprehensive future strategies to enhance productivity, soil sustainability, and pest resilience in the region.

20.1 KEY FINDINGS SUMMARY

Soil Health Observations

Sl No	Parameter	Observation Summary	Impact
1	Soil pH	Ranged from 3.56 to 6.28; ~30% of samples <5.0	Soils are strongly acidic in Lungdai and parts of Sihphir -> nutrient lockup
2	Electrical Conductivity (EC)	Mostly within safe limits (21–244 µS/cm), but a few samples showed low EC (<100 µS/cm)	Indicates low soluble nutrient levels, particularly in Sihphir
3	Soil Organic Carbon (SOC)	All fields showed medium to very high SOC (2.0% – 5.3%)	Very good organic matter levels – a strong foundation for sustainability
4	Nitrogen (N)	Mostly low to moderate (0.2% – 0.4%)	Indicates potential N deficiency, especially during peak vegetative growth
5	Phosphorus (P)	Mostly low (< 15 ppm)	Indicates potential P deficiency
6	Potassium (K)	Mostly low to moderate (< 80-110 ppm)	Indicates a potential K deficiency

Disease and Pest Incidence

Sl No	Issue	Observation	Probable Cause
1	Leaf Curling	Curling, puckering, stunted growth	Likely due to viral infection, transmitted by aphids and whiteflies
2	Leaf Yellowing & Burn	Yellow margins, necrosis, leaf drying	Likely a result of potassium deficiency and secondary fungal infection (downy mildew or anthracnose)
3	Mealybug Infestation	Cottony insects on fruit surface, fruit deformation	Spread facilitated by ant activity, poor pruning, and high humidity

21 FUTURE STRATEGIC RECOMMENDATIONS

Capacity Building and Farmer Training

- Seasonal Farmer Training Programs

Organize structured training sessions during the pre-monsoon and post-monsoon periods on:
- Soil health and nutrient management (lime application, composting, NPK balance)
- Integrated Pest and Disease Management (IPDM)
- Safe use of agro-inputs and organic alternatives
- Hands-On Demonstrations

Conduct on-field demonstrations of:
- Soil amendment techniques using lime and organic inputs
- Installation of traps, pruning practices, and disease scouting
- Biopesticide preparation and application

Establishment of Farmer Field Schools (FFS)

- Create village-based Farmer Field Schools in Durtlang, Sihphir, and Lungdai to promote peer learning and participatory experimentation.
- FFS can serve as platforms for testing new pest control methods, fertilizer trials, and organic cultivation techniques under real field conditions.

Soil Health Monitoring and Advisory Support

- Distribute Soil Health Cards to each participating farmer, updated annually based on soil test results.

Promoting Organic and Sustainable Practices

- Encourage gradual reduction in chemical inputs through the introduction of biofertilizers, botanical pesticides, and intercropping systems.
- Train farmers on composting, vermiculture, and the use of green manures to build soil health.

Discussion of results with stake holders, Sihphir (3rd July, 2025)

22 FUTURE GOALS

The ultimate goal is to build a self-reliant, well-informed, and technically capable farming community that can sustainably produce high-quality chow chow while maintaining ecological balance and improving rural livelihoods.

By implementing these forward-looking initiatives, we can ensure that the benefits of this research and assessment are not just documented, but delivered—directly to the hands of those who need it most: our farmers.

Conclusion

The findings indicate that while the region has rich organic matter content, challenges related to soil acidity, nutrient imbalances, and emerging pest/disease threats require immediate and sustained interventions.

Adopting an Integrated Soil Fertility and Pest Management (ISFPM) strategy, supported by capacity building and regular monitoring, will enhance the sustainability and profitability of chayote cultivation in Durtlang, Sihphir, and Lungdai.

The proposed recommendations are practical, scalable, and aligned with agroecological principles suited to the hill farming systems of Mizoram.

Call to Action

In view of the challenges and opportunities identified through these detailed assessments, it is strongly recommended that this report be formally submitted to relevant agricultural authorities, research institutions, and extension agencies. By recognizing and acting upon the findings outlined herein, we can provide timely and science-based interventions that directly support the needs of chayote farmers in Durtlang, Sihphir, and Lungdai.

These reports are not just documents—they are tools of empowerment. Their implementation will help bridge the gap between diagnostics and action, ensuring improved soil health, better pest management, and ultimately, more resilient and productive farming communities. Let us move forward with commitment and collaboration to ensure that the efforts invested in these findings translate into tangible benefits for our farmers.

ProjectTeam

HL Rinawma
B.A. MDiv
Project Coordinator

Lalmuanpuii
M.Sc. Horticulture
Technical Specialist

Dr. Vanlalsanga
Ph.D. in Botany
Technical Team

Jacob Lalrinawma
MJMC
Technical Team

Esther Lalthachawii
M.Sc. Psychology
Technical Team

Mission Foundation Movement
Bawngkawn, Aizawl - 796014
Mizoram, India

www.mfm.org.in