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# Farmers Guide to Mizoram Sloping Agriculture Land Technology (MiSALT)



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GREEN LANDSCAPE IMPLEMENTATION UNIT, LUNGLEI, MIZORAM

# Farmers guide to Mizoram Sloping Agriculture Land Technology (MiSALT)

## Mizoram Scenario

Mizoram is a state where majority of the population are cultivators and the state hardly has flat areas (only 2% of its total geographical area) suitable for agricultural use. The rest of the areas (98%) have rugged and steep (>33%) topography as they are interspersed with numerous hillocks and deep gorges. With many farmers still practicing jhum/shifting cultivation, the land productivity is low and unsustainable due to rapid loss of top-soil/organic matters with the water run-off during heavy monsoon. In dry season, farmers face major problems of water shortage and poor soil moisture retention.

## In Search of Alternatives

‘*Changkham*’ is an indigenous technology used by Mizo farmers where half-burned logs or any debris (non-living materials) are put along the contour to control top-soil erosion in their jhum lands.

Sloping Agriculture Land Technology (SALT) is a proven technology originated from the Philippines which emphasizes on soil health improvement using mainly soil nutrient enhancing nitrogen fixing trees as contour barrier. SALT was introduced by Baptist Church of Mizoram with few farmers, mostly in southern part of Mizoram, adopting it.

An alternative was sought by way of research collaboration between Mizoram University and FAO which led to the birth of ‘Mizoram Sloping Agriculture Land Technology’(MiSALT). MiSALT is a system resulting from improving the traditional ‘*changkham*’ and the exotic SALT putting them together in the steep jhum.

## What is MiSALT

MiSALT is an adapted approach that is specific to the steep slope of Mizoram. It is a combination of two well-tested good technologies for steep slopes which are known in Mizoram but hardly practiced together, which are - the indigenous *Changkham* or Contour Trash Bunding (CTB) and the Philippine's Sloping Agriculture Land Technology (SALT). MiSALT system resulted from improving the traditional *changkham* and the exotic SALT and putting them together in farmer's steep field. With steeply slopes and intense rainfall of Mizoram, practicing CTB or SALT alone will not be as effective and low cost as when putting them together to form MiSALT.

In order to have a successful MiSALT, first, practice improved CTB along the contour immediately after land clearance to serve as physical barrier (control erosion/water run-off) in the steep farm and then

reinforce it (CTB) with a biological material called SALT by planting valuable semi or perennial shrub-type or small tree species using VIP (Very Important Plants: for vegetables, fodder, medicine, soil



nutrient etc) at the lower side of CTB. With the accumulation/build-up of debris (plant waste is being added) and organic material with the CTB, continued availability of mulch is naturally generated while soil deposition increases as soil is trapped by the CTB, forming natural

terraces in the steep areas. Hence, the combined strengths of these two technologies which is termed MiSALT, is one of the best solutions to sustainable steep slope cultivation (if practiced properly) as it takes care of the soil health, water retention in the soil, conservation of valuable indigenous plants for food and livelihood. MiSALT is simple and practical to do and maintenance input is low.

### Why Go for MiSALT

A low-cost technology MiSALT system can address not only the immediate socio-economic needs of jhum farmers but also maintains the ecological well-being of their jhum lands on which much of their livelihood depends.

MiSALT adaptation will be a good option because:

1. The '*changkham*' at appropriate interval (contour) helps in controlling soil erosion.
2. It helps in improving soil health.
3. It helps in enhancing soil moisture retention and soil nutrient runoff.
4. The VIPs used for reinforcing the '*changkham*' can be additional sources of food, medicines, fodder, soil nutrients and also provide additional income if sold to the market.
5. Natural terraces are formed as soil is trapped by '*changkham*' and soil deposition increases.



## What is Contour trash bunding (CTB)

The Improved *changkham* or Contour Trash Bunding (CTB) includes all kinds of non-living materials (logs/plant debris/banana trunk/bamboos/rocks/stones etc.) that can immediately control soil erosion should be established (closed to the ground surface) along the contour before the start of rain. CTB controls Erosion, enhance soil moisture retention and improves soil nutrient through MiSALT adaptation.

## How to construct Contour trash bunding

1. Immediately after clearance of land, mark a contour line using A-Frame (Please refer to *Annexure 1*), so as to construct Improved *changkham* or CTB along the contour



2. The Improved *changkham* or CTB includes all kinds of non-living materials (logs/plant debris/banana trunk/bamboos/rocks/stones etc.) that can immediately control soil erosion should be established (closed to the ground surface) along the contour before the start of rain.

3. The CTB must be pegged alternately on both sides at a distance of 1-1.5m depending on the trash/debris being used. Based on the slope gradient, CTBs must have a maximum interval of 5 meters (as slope increases, interval of CTB decreases) to give enough area for crop cultivation.
4. Smaller CTBs with or without Very Important Plants (VIPs) can be added in irregular interval along the contour depending on the crop being cultivated.
5. Any trash (plant waste or dead weeds etc) should be added continuously to the CTB pile.
6. The decomposed materials are pushed back into the crop area to serve as mulch to increase soil moisture retention which improves crop productivity and soil health in the MiSALT system.
7. In order to support the contour trash bund in a long run, hedgerows of VIPs are planted right below the bunds, so as to replace the logs or bamboo.

### **What are Very Important Plants (VIPs) for Hedgerow**

There are 2 VIPs as below:

- VIP – Indigenous plants/shrubs
  - VIP – Nitrogen fixing tree species
1. Very important plants (VIP) are semi-perennial/perennial which are used for food, medicinal, soil fertilizer/mulch (biomass) and fodder for value addition and biodiversity conservation and improve in situ soil water retention/conservation
  2. Hedgerows of VIPs (Indigenous plant/shrubs) are planted right below the CTBs at a spacing of 1ft to 4ft to provide support to the CTBs, to prevent soil erosion and runoff and to improve soil moisture.

3. Plant VIPs (Nitrogen fixing tree species) like *Tephrosia candida*, *Flemingia macrophylla* etc in between the spaces of VIPs (Indigenous plants/shrubs) to fill up the spaces and to form a hedgerow.

The farmers choices of VIPs are *Clerodendrum colebrookianum* (Phuihnam), *Zanthoxylum rhetsa* (Chingit), *Gnetum gnemon* (Pelh), *Trevisia palmata* (Kawhtebel), *Acacia pennata* (Khanghu) etc. (**Annexure – II**)



VIP – *Clerodendrum colebrookianum*

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## How to manage VIPs

1. The VIPs (Indigenous plants/shrubs) have to be regularly pruned/trimmed to maintain a height of 1m to 2m
2. Thinning of VIPs are done in order to avoid over population.
3. The pruned/trimmed materials are placed in the CTBs, which after decomposition can be used for manures for the plants.

4. Burning of debris should be avoided as far as possible near the VIPs as it could easily catch the fire and die.
5. Manage the VIPs (Indigenous plants/shrubs) planted below the CTBs at a distance of 1-4ft. apart.
6. Plant VIPs (Nitrogen fixing tree species) like *Tephrosia candida*, *Flemingia macrophylla* etc in between the spaces of VIPs (Indigenous plants/shrubs) which were planted at a spacing of 1-4 ft to fill up the spaces and to form a hedgerow.
7. The VIPs (NFTs) have to be regularly pruned/trimmed to maintain a height of 1m to 1.5m



VIP – *Tephrosia candida*, *Acacia pennata*

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**Basic steps of a successful MiSALT:**

1. Decide the crop and VIP to grow/manage
2. Clear the land and gather CTB materials (keep them aside)
3. Mark a contour line by using A-Frame
4. Establish Improved CTB (start CTB from the highest slope in the farm and pegged them)
5. Arrange any farm debris across the slope (do not leave them lying along the slope)
6. Prepare land for crop production in between the CTBs
7. Practice contour-line planting for all crops (not along the slope)
8. Grow your crops (Do Intercropping, Crop Rotation with legumes and also do weeding)
9. Establish and manage SALT/VIPs planted below CTB at a distance of 1-4 feet apart; trim/prune the VIP regularly
10. Manage soil moisture by mulching with weeds, other plant materials and pruned leaves and branches of VIPs
11. Manage soil health (Compost; Manure from Biomass and animals; Mulch)
12. Maintain on site water harvesting facility

## Calendar for MiSALT

Sl. No.	Particulars	Month
1.	Land preparation and gathering of CTB materials	March - April
2.	Contour line marking	April
3.	Laying of improved CTB	April
4.	Land preparation for main crop	April - May
5.	Sowing of main crop	April - June
6.	Sowing/planting of VIPs (Indigenous plants and NFTs)	May - June
7.	Pruning/trimming of VIP (Indigenous shrubs/plant)	As soon as it shades the main crop in between the CTBs or it grows above 1 to 2m height. (All year round)
8.	Pruning/trimming of VIP (NFTs)	To be maintained at a height of 1 to 1.5m all year round

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MiSALT Research Terminal Report – MiSALT research Team, Mizoram University, Aizawl, Mizoram

MiSALT IEC Brochure-2 – Facilitator’s companion to Mizo Sloping Agriculture Land Technology (MiSALT)

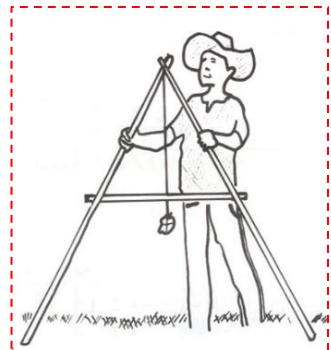
## *Annexure - I*

### **How to make A-Frame for marking contour lines:**

1. Take 3 wooden or bamboo pole and cut the 2 poles into 1.5m length to serve as a leg of the A-frame. Cut the third piece at least 1m long to be used as cross bar of the frame.
2. To assemble the A-frame, tie together the upper ends of the longer poles. Let the lower ends of the legs stand on the level ground. Spread the legs about one meter apart to form a perfect angle. Brace horizontally the shorter pole to become a crossbar between the two legs.
3. Tie a rope on top of the A-frame to hang a Plum bob or stone, so that the Plum bob or the stone hangs just below the cross bar.

### **How to calibrate A-Frame:**

1. Keep the A - frame on a level ground.
2. Hold the A-frame upright and mark exactly where the poles touch the ground. With a pencil, mark where the string crosses the cross bar. Turn the A-frame around, placing the poles in the marked positions. Again, mark where the string crosses the cross bar.
3. Mark the 'level mark' on the cross bar – exactly half way between the previous marks. If the first two marks happen to be in the same place, this is the level mark.

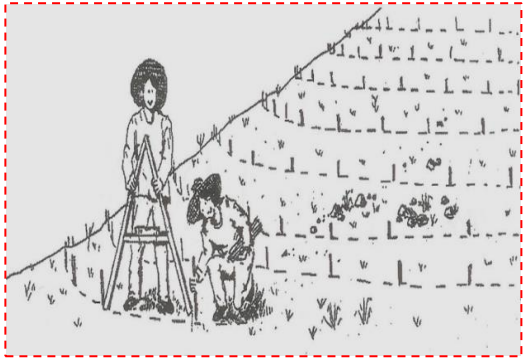


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<https://www.semanticscholar.org/paper/Agricultural-technologies-for-marginal-farming-in-Malla/3cc06acac256fead84f97bec3e4ee2f575c9dc10>

### How to mark contour lines:

1. Before using the A-frame, collect a number of sticks about 30cm long.
2. Begin at one side of the land where the first contour line is wanted. Hold one pole firmly on the ground. Move the other pole until the string touches the level mark.



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3. Place a stick into the soil by each pole. Move the A-frame along the field, alternately moving each pole (pivoting).
4. This will result in a line of small sticks. Smooth out any sharp bends in the line and use this line as the guide for building bunds and contour mounds.
5. To find the position of the next contour line, stand with one arm stretched out. Walk backwards down the slope until an identified contour line can be seen in line with your arm. Make the next contour line where you are now standing.
6. The distance between two contour lines should not be more than 5m and not less than 3.5m.

## Summary of VIPs

### A. VIP – Indigenous shrubs/plants/trees

1. **Botanical name:** *Acacia pennata* syn. *Senegalia pennata*

**Local name:** Khanghu

**Description:** It is a shrub or small tropical tree which grows up to 5 metres (16 ft) in height.

**Uses:** The tender leaves are locally used as an ingredient in indigenous cuisine as fried and boiled vegetables. The edible shoots are used before they become tough and thorny. It is sold in local market all over Mizoram.

**Method of propagation:** It is mainly propagated through seeds and stem cuttings.



2. **Botanical name:** *Amomum dealbatum*

**Local name:** Aidu

**Description:** *Amomum dealbatum* is a robust perennial herb, growing up to 3 metres tall, with a thick rhizome.

**Uses:** Young shoots, young inflorescences and young fruits are eaten as vegetables cooked with rice. It is sold in local market all over Mizoram.

**Method of propagation:** Through seeds and cuttings of the root-bearing tips of the rhizome.



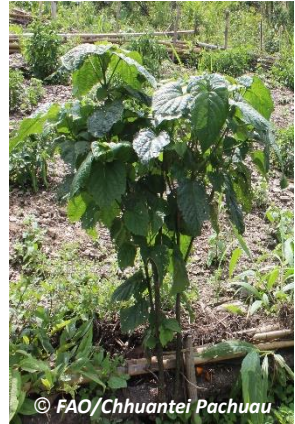
**3. Botanical name:** *Clerodendrum colebrookianum*

**Local name:** Phuihnam

**Description:** It is a perennial shrub and grows up to 4 - 8 ft. height. It is a medicinal food plant widely used in the North East India.

**Uses:** The leaves are used as vegetable as well as medicine to control high blood pressure by boiling it with water.

**Method of propagation:** Propagated through seeds and stem cuttings.



**4. Botanical name:** *Dysoxylum gobara*

**Local name:** Thingthupui

**Description:** It is an evergreen plant, ranging in size from a shrub to a fairly large tree up to 35 metres tall. It supplies food and medicines for the local people. *Dysoxylum* species are well-known in the Philippines for their medicinal properties; an infusion of the bark is widely used as an emetic.

**Uses:** The tender fruits are eaten as vegetables locally by boiling and frying. It is sold in market in Mizoram.

**Method of propagation:** It is propagated by seeds only.



**5. Botanical name:** *Gnetum gnemon*

**Local name:** Pelh

**Description:** It is a small to medium-size tree, growing to 15–22 m tall.

**Uses:** *Gnetum* nuts are eaten boiled, roasted, fried in Mizoram. The young leaves, flowers, and the outer flesh of the fruits are also edible when cooked. It is found growing in southern parts of Mizoram.

**Method of propagation:** It is propagated by seeds and stem cuttings.



**6. Botanical name:** *Parkia roxburghii* syn. *Parkia timoriana*

**Local name:** Zawngtah

**Description:** *Parkia* spp. is a briefly deciduous tree growing up to 50 metres tall. The bole can be 81cm in diameter. It is a large tree, therefore, it is to be planted on the edge of the farm, so as to avoid shading of main crops.

**Uses:** The pods are edible, and are considered a delicacy in Mizoram. Pods are also used in bleeding piles; bark extract is given in diarrhoea and dysentery.

**Method of propagation:** It is propagated by seeds.



**7. Botanical name:** *Trevisia palmata*

**Local name:** Kawhtebel

**Description:** An evergreen tree 15-20 feet tall with few or no side branches and topped with a crown of long stalked 1-2-foot-wide leaves, the shoots are with brownish or rusty coloured hair and numerous prickles. It grows wild all over Mizoram.

**Uses:** Young flower buds of the tree is a food items for Mizo's as vegetable, it is eaten boiled or fried. It is sold in local market.

**Method of propagation:** Propagation is possible by means of hardwood cutting.



**8. Botanical name:** *Zanthoxylum rhetsa*

**Local name:** Chingit

**Description:** It is a deciduous tree with a spreading crown growing up to 35 metres tall. The tree has a rather long bole that can be up to 75cm in diameter. It is commonly cultivated in *jhumlands* of Mizoram.

**Uses:** The tender and young leaves are eaten cooked.

**Method of propagation:** It is mainly propagated by seeds naturally in *jhumland* of Mizoram. The seeds have a very hard seed coat and it is best sown as soon as it is ripe. The stored seeds when sown needs different kind of treatment.

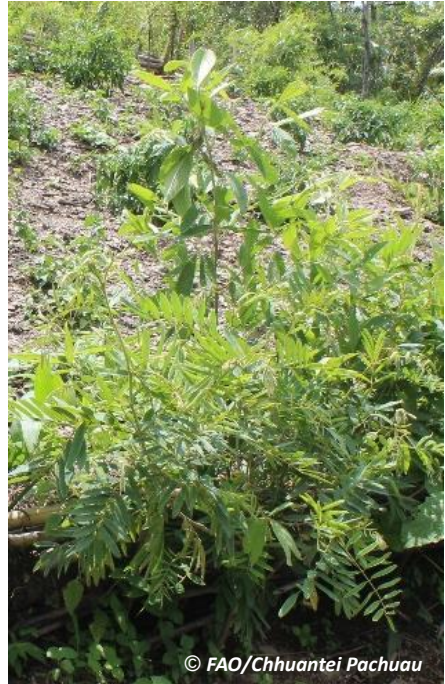




## B. VIP – Nitrogen fixing tree species

### 1. Botanical name: *Tephrosia candida*

**Description:** It is a fast-growing nitrogen fixing shrub species and commonly growing in tropical and sub-tropical regions, it is native to the foothills of the Indian Himalayas. It is introduced in Mizoram in the year 2004 with the introduction of Sloping Agriculture Land Technology (SALT) by the Baptist Church. It is found growing in the southern parts of Mizoram.



**Uses:** It has been widely grown in degraded land and shifting cultivation sites to enhance soil fertility and check soil erosion in Mizoram. The species helps in restoring degraded lands, fixing atmospheric nitrogen, controlling soil erosion and increasing the level of soil nutrients. Pruning is used as mulch.

**Method of propagation:** It is propagated by seeds. Soak the seed for 4 - 5 hours in warm water prior to sowing. It should be sown just before or during the rainy season.

## 2. **Botanical name:** *Flemingia macrophylla*

**Description:** It is a perennial, deep-rooting, leafy shrub, 0.5–2.5m high. Produces flowers and seed within 6–7 months from planting, although first year seed yields are low. Vigorous, leafy growth after cutting. It is adapted to acidic, infertile soils. It is also introduced to Mizoram in the year 2004 by the Baptist church.



**Uses:** It is most commonly used in contour hedgerows for erosion control. Pruning is used for mulch. It also helps in fixing atmospheric nitrogen to increase the level of soil nutrients.

**Method of propagation:** It is propagated by seeds. It has a hard seedcoat and may benefit from scarification before sowing in order to speed up and improve germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them) and then soaking them for 12 - 24 hours in warm water. Excellent coppicing and regrowth capacity after cutting, producing numerous shoots from buds near the base of the stem.



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