भाकृअनुप
ICAR

Technology Inventory for Northeast India

ICAR- Agricultural Technology Application Research Institute
Umiam, Meghalaya- 793103

ICAR - Agricultural Technology Application Research Institute, Umiam (Barapani)
Ri- Bhoi District, Meghalaya - 793103

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Title: Technology inventory for Northeast India

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Preface

Agriculture in Northeast India is by and large technology starved due to wide variations in crops, livestock and other enterprises in different Agro-eco systems. Without adequate technological interventions the region cannot enhance the productivity of various enterprises. Appropriate agricultural technologies can only address the farmers' specific problems for sustainable growth in agriculture. The KVKs of the region have been playing a significant role in transferring the technologies developed by various research institutes/ Agricultural Universities in farmers' field. Before demonstrating any agricultural technology, the Subject Matter Specialists need to conduct On Farm Trials (OFT) for evaluating the applicability of the technologies in farmers' situation. The need for a technology inventory comprising various technologies in the field of agriculture, horticulture, animal production, fisheries, integrated farming, organic agriculture etc. was discussed in various review meetings in last few months. Therefore, a decision was taken to bring out a publication with all the technologies in a format that helps the SMSs for conducting the OFTs and FLDs in various disciplines.

The present publication entitled "Technology Inventory for Northeast India" is an attempt to compile all the relevant technologies developed by Assam Agricultural University, Central Agricultural University, ICAR Research Complex for NEH Region and other Institutes of the region to assist the KVK Scientists to choose the right technologies for conducting OFTs, FLDs and training etc. so as to fulfil the need of the farmers. We sincerely acknowledge the encouragement and support received from Dr T. Mahapatra, Secretary, DARE and DG, ICAR, New Delhi and Dr. A.K. Singh, DDG (AE) for bringing out this publication.

I appreciate the initiative and effort taken by R Bordoloi, Principal Scientist (AE) and HRD nodal Officer, ICAR-ATARI, Umiam and the entire team of ICAR-ATARI for preparation of the manuscript in time. I hope this publication will help the KVK Scientists to conduct the OFT and FLDs on various disciplines in much more systematic way.

Date: 30 March, 2017

Bidyut C. Deka
Director

Acknowledgement

The editors of this publication would like to express their sincere gratitude to Dr. T. Mahapatra, Secretary, DARE & Director General ICAR and Dr. A. K. Singh, DDG(AE), ICAR New Delhi for their constant support and encouragement in preparing and bringing out this document for the greater interest of the farming community. The editors deeply acknowledge the helps rendered by all the Heads of ICAR- institutions of Northeast India, AAU, CAU and all contributing Scientists. We also acknowledge the help received from Sr. Scientist & Head Dr. C.K . Sarma and Dr. R Borgohain of KVK Bongaigaon and KVK, Jorhat, respectively for assisting us in editing the document. We are thankful to Sr. Scientist & Head Dr. M Islam, Dr. T. Samajhdar, Dr. M. Pathak of KVK Ribhoi, West Garo Hills and East Siang, respectively for helping us in collecting the information from respective host institutions. We are also thankful to Mr. Synshai Jana, Data entry operator of ICAR- ATARI for the help in compiling the information obtained from different Institutes in time. The authors also thankfully acknowledge the services rendered by all the staffs of Rumi Jumi Enterprise

ICAR-ATARI Umiam (Editors)

30 March, 2017

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Dr. A.K. Singh
Deputy Director General (Agricultural Extension)

Foreword

Agricultural Extension plays a crucial role in the application of proven technologies in the micro agro ecological conditions. Over the period, the frontline extension system of the council through its mandated activities ensures that the gap between technology generation and technology transfer is minimized. Technology assessment, demonstration and capacity development is the main mandate of KVK which help towards technology adoption, consistent with farmer's circumstances, compatible with actual farming system corresponding to farmer's goals and preferences.

I am happy to learn that ICAR-ATARI Umiam has taken a timely initiative to bring out a publication entitled "Technology inventory for North East India" compiling all the technologies generated by different ICAR Institutes and SAU/CAU of the North Eastern Region for the benefit of the KVKs. I am sure this publication will be of immense help to all the KVK experts and other stakeholders of the region.

I compliment the Director, ICAR-ATARI, Umiam and the entire team for their effort to bring out this valuable publication when the country is pursuing Doubling Farmers' Income by 2022. I wish this publication shall fulfil the long standing demand of the region.

(A. K. Singh)

Dated : 30.03.2017

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Chapter 1- Agronomy

Technology no.1

1. **Name of the Technology:** Land-use Model for Sustainable Production and Climate Resilience in Eastern Himalayas
2. **Source of the Technology:** Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of Release:** 2015
4. **Agro Climatic Zone:** High rainfall hill ecosystem
5. **Details, description about the Technology** :

- The model is suitable for sloping terraced land (< 50%) of north east India.
- Pine (*Pinuskesiya*) forest or other local natural trees (400 tree/ha) with catch pits (1'x 1'x3 ') are advocated at hill top
- Hedge rows (*Tephrosia* sp.) are adopted in contours for soil conservation and generation of green leaf for manuring.
- Micro rain water harvesting structure (Jalkund, 30000 L capacity) for life saving irrigation.
- Perennial Fodder crops viz. Broom grass (*Thysanolaena maxima*), Hybrid napier (*Pennisetumpurpureum*) and Guinea grass (*Megathyrsusmaximus*) are grown in upper terraces.
- Cover crops viz. groundnut (*Arachishypogaea*), soybean (Glycine max), frenchbean (*Phaseolus vulgaris*) and cowpea (*Vignaunguiculata*) in rainy season and rapeseed (*Brassica campestris* var. toria) in dry season are grown in next terraces.
- Intercropping of maize (*Zea mays*) with groundnut, soybean and cowpea in rainy season and frenchbean in dry season are recommended in the mid terraces.
- In lower terraces, rice (*Oryza sativa*)- lentil (*Lens cuilinaris*) system under conservation

tillage is recommended.

- Rainy season crops under minimum till and dry season crops under no-till along with residue retention are adopted.

6. **Critical inputs requires:**

- Terracing of lands and necessary facilities for terracing.
- Seeds/planting materials of crops as per requirement.
- Mechanized or manual portable Zero-till seed drill/furrow opener.
- Rain water harvesting structure jalkund in mid or upper hills.
- Fertilizer and manure as per recommendations.

7. **Observation to be recorded:** Productivity (economic & biomass), labour requirement, soil moisture in dry season crop (0-15 cm), soil loss (if possible), Soil organic carbon and bulk density after 3 years of study.

8. **Contact Address for relevant information:**

   Head, Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya.

Technology no.2

1. **Name of the Technology:** Raised and sunken bed technology for crop diversification and productivity enhancement
2. **Source of the Technology:** Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of Release:** 2012
4. **Agro Climatic Zone:** High rainfall hill ecosystem
5. **Details, description about the Technology** :

   The RSBs are made in sequence for efficient drainage and inter-plot water harvesting with a fixed width of 1 m for raised and 1.25 m for sunken beds. The length of the plots may be 5 to 8 m. The surface soil layer from each sunken bed is removed and deposited on the adjacent area marked for raised bed making a bed height of about 30 cm. All the crop residues and weed biomass are placed below the raised beds and covered with the soil from sunken beds. The width of sunken beds and the bed height may be increased depending upon the standing water and depth of waterlogged soils. Vegetable-based cropping sequences on raised beds and rice based sequences on sunken beds are recommended in comparison to rice monocropping (control) on a flat land without any land configuration. Tomato, frenchbean, carrot and potato have been identified as potential crop for raised beds during pre-kharif season (Jan to May). Okra during rainy season and frenchbean during post rainy season (Aug-Oct) are identified as potential crop for raised beds. For sunken beds, transplanted rice is the choice during rainy season. The standing water from sunken beds (rice field) is drained out during physiological maturity stage to get a dry field during rice harvest. After rice harvest, pulses like pea and lentil are grown under zero-till (no-till) condition with residual moisture.


6. **Critical inputs requires:**
   - Labour for making raised and sunken beds (about 50/ha in first year), from second year only five man-days will be sufficient.
   - Seeds/planting materials of crops as per requirement.
   - Mechanized or manual portable Zero till seed drill/furrow opener.
   - Cono-weeder for weeding in rice.
   - Fertilizers and manure as per crop need.
7. **Observation to be recorded:** Productivity (economic & biomass) and labour requirement.
8. **Contact Address for relevant information:**

   Head, Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya

Technology no.3

1. **Name of the Technology:** Modified System of Rice Intensification for higher productivity
2. **Source of the Technology:** Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of Release:** 2010.
4. **Agro Climatic Zone:** High rainfall hill ecosystem
5. **Details, description about the Technology** :

   Nursery may be raised using modified mat method for producing robust healthy seedlings. Sufficient organic manure (10 t/ha) along with 90 kg Urea (30 kg at transplanting, 30 kg at tillering and 30 kg at panicle initiation), 190 kg SSP and 35kg MOP at transplanting (50 % recommended NPK fertilizer + FYM, 10t/ha) should beapplied. The main field should be prepared uniform and leveled field for better water management. Scoop out 18-20 days old seedling (one and half leaf stage) along with soil and mother seed. A thin film of water in main field should be maintained during transplanting. Transplanting should be done with single seedling using square spacing of 20 x 20 cm. Continuous flooding should be avaoidedand field should be irrigated when hairy cracks are seen. Weeds management is done through cono-weeder and hand weeding


6. **Critical inputs requires:**
   - Cono-weeder for weeding
   - SRI Marker or a nylon rope with knots at 25 or 20 cm interval.
   - 7-10 kg rice seed/ha.
   - Fertilizers and manure as per crop need.
7. **Observation to be recorded:** Productivity (economic & biomass), 50% flowering (days from transplanting),maturity, labour requirement, soil NPK, Organic carbon at 0-15 cm depth.
8. **Contact Address for relevant information:**

   Head, Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya

Technology No. 4

1. **Name of the Technology:** Zero till production of pulses and oilseeds in rice fallow
2. **Source of the Technology:** Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of Release:** 2011.
4. **Agro Climatic Zone:** High rainfall hill ecosystem
5. **Details, description about the Technology** :

- Rice is grown using a spacing of 20-25 cm x 20 cm for lowland transplanted and 25 cm between row to row in upland direct seeded crops.
- Minimum tillage or no-till is advocated in rice cultivation for resource conservation. Integrated nutrient management involving 50% NPK through Fertilizer and 50% N through weed biomass, FYM or green manure is advocated.

- At physiological maturity of lowland rice, water is drained out in case there is saturated condition at harvest.
- Rice is harvested by leaving at least 20 cm standing stubbles in lowland and 30-40 cm in upland.
- Pea, lentil and rapeseed are sown in unploughed fields after rice.
- Weeds are managed by using a total systemic weed killer e.g., glyphosate @ 5 ml/litre water by spraying at least a week before sowing. Incase of organic production, hand weeding or mechanical weeding may be adopted.
- A narrow V-shaped slit is opened using a manual furrow opener having two or three adjustable tines in between two rice lines.
- A fertilizer dose of 20: 60: 40 kg N, P2O5 and K2o/ha for pea and lentil and 60: 60: 40 kg/ha for toria/rapeseed is applied in furrow.
- Sowing is done in furrow using appropriate spacing (8-10 cm for pea, 2-3 cm for lentil and rapeseed) in opened furrow.
- Seed is then covered with a soil : FYM mixture (2: 1) for ensuring seed soil contact.
- 2% urea or DAP (20 g in 1 litre water).
- Rest of the cultural operations are done as followed in conventional agriculture

6. **Critical inputs requires:**
   - Rice should be planted in lines (SRI is better option)
   - Zero till seed drill or furrow opener
   - Cono-weeder for weeding in rice
   - 70 kg pea, 40 kg lentil 6-7 kg rapeseed seed/ha
   - Fertilizers and manure as per crop need.
   - Lifesaving irrigation at flowering if field is dried.
7. **Observation to be recorded:** Productivity (economic & biomass), labour requirement, soil NPK, Organic carbon at 0-15 cm depth.
8. **Contact Address for relevant information:** Head, Division of Crop Production (Agronomy), ICAR Research Complex for NEH Region, Umiam, Meghalaya

Technology no.5

1. **Name of the technology:** Maize (green cobs) - black gram (*Pahenlo dal)* - buckwheat cropping system under organic crop management situations
2. **Source of technology:** ICAR – National Organic Farming Research Institute, Tadong, Gangtok
3. **Year of release:** 2015
4. **Agro Climatic zone:** North Eastern Himalayan Zone
5. **Detail description about technology:**

Maize	Black gram (*Pahenlo dal*)	Buckwheat
Package and practices- Land preparation		
One ploughing with bullock drawn plough followed by one tilling/ harrowing for maize after harvest of buckwheat.	Black gram should be sown immediately after harvesting of maize in no-till condition	Same practice should followed as for maizew
Package and practices- Organic nutrient management		
Apply dolomite @ 2 t/ha as basal application 15-20 days prior to the sowing followed by Conjoint basal application of mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ ha followed by application of vermicompost @ 2.5 t/ha should be done in two equal splits *i.e.*, half amount applied in rows at the time of sowing and the rest amount at the time of earthing up after second weeding.	FYM or mixed compost @ 5 t/ha should be applied as basal application prior to sowing followed by goat manure/ poultry manure @ 1-2 t/ha as basal dose to overcome micronutrient deficiencies.	Vermicompost should be applied @ 1.5 t/ha in two equal splits *i.e.*, ½ at the time of sowing and half 45 days after sowing in furrows.
Time of sowing		
Second fortnight of March- first week of April	Second fortnight of July	First fortnight of November
Varieties		
Vivek QPM-9, C-1415, NMH-51 Lines: RCM 1-1, RCM 1-76, RCM 1-3	PD-3, local *cv Pahenlo dal*	Local *cv Mithe*
Method of sowing:		
a. Seed rate and seed inoculation,		
20-25 kg/ha seed should be inoculated with *Azospirillum*, *Azotobacter etc*. and Phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing.	20-25 kg/ha seed should be treated with *Rhizobium* and PSB @ 200 g/kg seed.	35-40 kg/ha seed should be treated with Azophos @ 20 g/kg.
b. Spacing and depth of sowing		

Spacing of 50 cm x 25 cm on the ridge/flat bed. Sown at a depth of 3 to 5 cm.	Sown on ridge with spacing of 30 cm x 15 cm	Spacing of 30 cm to 45 cm row to row spacing and 15 cm from plant to plant with sowing depth of 3 to 5 cm.
Weed management		
Two hand weeding, first at 15-20 DAS and second at 35-40 DAS.	One hand weeding 15-20 DAS and second weeding at 40-45 DAS, if required.	Generally, no weeding is required. However, one hand weeding at 20-25 DAS in case of higher weed infestation is recommended.
Crop protection		
a. Insect pest management		
Spraying of neem formulation 1500 ppm @ 3 ml/l or Spinosad 45 SC @ 0.3 ml/l and second spray at 20 days interval is effective to control insect pests of maize.	Mechanical collection and destruction of Blister beetle, Bihar hairy caterpillar and *Helicoverpa armigera* is highly effective for management. Spraying of entomopathogenic fungi like *Beauveria bassiana* and *Metarhizium anisopliae* @ 5 g/l.	
b. Disease Management		
Turcicum leaf blight *(Helminthosporium turcicum)* ❖ Grow resistant hybrids like DHM-1. ❖ Remove plant residue from the previous crop. ❖ Plough under the infected crop residue in the field to reduce the inoculum.	**Yellow mosaic virus** ❖ Remove and destroy the infected plants. ❖ Apply neem oil @ 0.3 per cent or NSKE @ 5 per cent to control white fly. ❖ Use increased seed rate (25 kg/ha).	**Downy mildew** (*Peronospora ducometi*) ❖ Select seeds from disease-free plants. ❖ Treat the seeds using *Trichoderma viride* @ 4 g/ kg of seeds. ❖ Soil application of *Trichoderma viride* @ 2.5 kg mixed with 50 kg sand or well rotted FYM.

Maydis leaf blight (MLB) *(Bipolaris maydis)* ❖ Grow resistant varieties like Deccan, VL-42, Prabhat, KH-5901, PRO-324, PRO-339, ICI-701, F-7013, F-7012, PEMH-1, PEMH-2, PEMH-3, Paras, and Deccan 109. ❖ Remove infected crop debris.	**Urd bean leaf crinkle** (Urd bean leaf crinkle virus) ❖ Remove and destroy the infected plants. ❖ Use disease-free seeds. ❖ Use increased seed rate (25 kg/ha). ❖ Hot water treatment of the seed at 550 C for 30 minutes.	**Powdery mildew** (*Erysiphae polygoni*) ❖ Select seeds from disease-free plants ❖ Apply wettable sulphur @ 0.25 per cent.
Downy mildews: ❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11. ❖ Remove infected crop debris. ❖ Provide proper drainage to avoid water stagnation in the field.	**Rust** (*Uromyces phaseoli*) ❖ Adjust the sowing date to escape from the disease. ❖ Apply wettable sulphur @ 0.25 per cent.	
	Powdery mildew *Erysiphe polygoni*) ❖ Dust sulphur two to three times during the cropping season. ❖ Apply wettable sulphur @ 0.25 per cent. ❖ Spray NSKE @ 5 per cent or neem oil @ 3 per cent twice at 10 day interval from initial appearance of disease.	
Harvesting		
Plucking of green cobs should be done in two-three stages for obtaining proper size of cobs. After cob plucking, stalk should be removed from field and used as green fodder.	Pod picking should be done when most of the pods turn black, over maturity causes shattering of pods. Picking should be done preferably during morning or evening hours to prevent shattering losses while handling the pods.	Timely harvesting of buckwheat is essential to prevent shattering of grains. Due to its gradual formation and maturity, harvesting is done periodically and finally the crop is cut and then threshed when the rest of the seeds are fully matured.

6. **Observation to be recorded**: Yield parameters for all the crops.

7. **Contact address for relevant information:** Joint Director, ICAR – NOFRI, Tadong, Gangtok, Sikkim, **Director, ICAR RC for NEH Region, Umroi Road, Umian, Meghalaya**

Technology no. 6

1. **Name of the technology:** Maize + Beans-vegetable pea cropping system for rainfed conditions under organic management system
2. **Source of technology:** I CAR – National Organic Farming Research Institute, Tadong, Gangtok
3. **Year of release**: 2015
4. **Agro Climatic zone:** North Eastern Himalayan Zone
5. **Detail description about the technology:**

Maize+ Beans	Vegetable pea
Package and practices- Land preparation	
One ploughing with bullock drawn plough followed by one tilling/harrowing for maize after harvest of buckwheat.	Two-three ploughing for good tilth.
Organic nutrient management	
❖ Apply dolomite @ 2 t/ha as basal application 15-20 days prior to the sowing. ❖ Conjoint basal application of mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha. ❖ Application of vermicompost @ 2.5 t/ha should be done in two equal splits *i.e.*, half amount applied in rows at the time of sowing and the rest amount at the time of earthing up after second weeding.	Vermicompost @ 2.5 t/ha should be applied in two equal splits *i.e.*, half amount applied in rows opened for placing the seeds.
Time of sowing	
❖ Pre-*Kharif* sowing in the rice fields at the lower altitudes is done in mid-February to second week of March. ❖ Main season maize is sown at different altitudes from mid-February to April. Normally, sowing time is early at the lower altitudes than the mid and higher hills, where it is delayed. ❖ Post-*Kharif* maize is sown in July and first week of August along with pulses, beans and pulse-type beans.	Second fortnight of November.

Varieties		
	Composites: Vivek Sankul Makka-11, Vijay, Prabhat **Hybrids:** Vivek Hybrid-9, Vivek Hybrid-21, Vivek Hybrid-33, Vivek Hybrid-39 **Quality protein maize (QPM):** Vivek QPM-9, HQPM-1 **Lines:** RCM 1-1, RCM 1-76, RCM 1-3	VRP-5,VRP-6, TSX-10, Pant Sabzi Matar-3, Pusa Pragati
Method of sowing	❖ Line-sowing method ❖ Dibbling method	❖ Line sowing method
Seed rate and seed innoculation		
Depending upon the variety and season, 20-22 kg/ha seed of maize is required for optimum plant population. Seed should be inoculated with *Azospirillum*, *Azotobacter etc*. and Phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing		Early maturing dwarf varieties: 80-100 kg seed/ha. Late maturing and tall varieties: 75-80 kg/ha. Inoculate with *Rhizobium* inoculum @ 20 g/kg seed is sprinkled, mixed in *jaggery* solution and dried in shade.
Spacing and depth of sowing		
Spacing of 50 cm x 25 cm on the ridge/flat bed. Sown at a depth of 3 to 5 cm below the soil.		30 cm x 15 cm Depth: 3-4 cm
Weed management		
Two hand weeding, first at 15-20 DAS and second at 35-40 DAS.		Two hand-weeding at 15-20 and 35-40 DAS.
Crop protection:		
Insect pest management		
Spraying of neem formulations 1500 ppm @ 3 ml/l or Spinosad 45 SC @ 0.3 ml/l and second spray at 20 days interval is effective to control insect pests of maize.		Aphid petroleum oil-based agro spray @ 10 ml/l or neem oil (1500 ppm) @ 3 ml/l.
Disease Management		

Turcicum leaf blight (*Helminthosporium turcicum*) ❖ Grow resistant hybrids like DHM-1. ❖ Remove plant residue from the previous crop. ❖ Plough under the infected crop residue in the field to reduce the inoculum.	**Wilt** and **Root Rot** (*Fusarium oxysporum* and *Rhizoctonia solani*) ❖ Early sowing should be avoided to escape from high humidity and high temperature which are congenial for the disease. ❖ Drench soil with copper oxychloride @ 0.25 per cent. ❖ Crop rotation for at least 2-3 years with suitable non-leguminous crops should be followed.
Maydis leaf blight (MLB) (*Bipolaris maydis*) ❖ Grow resistant varieties like Deccan, VL-42, Prabhat, KH-5901, PRO-324, PRO-339, ICI-701, F-7013, F-7012, PEMH-1, PEMH-2, PEMH-3, Paras, Sartaj, and Deccan 109. ❖ Remove infected crop debris.	**Powdery mildew** (*Erysiphe polygoni*) ❖ Late planting should be avoided. ❖ Remove and destroy plants after harvest. ❖ The disease can be controlled by two to three sprays of wettable sulphur compounds like Sulfex @ 3 kg per hectare in 1000 litres of water. Give the first spray after appearance of the disease in the crop. The second spray should be done 14 days after the first spray and the third spray only if there is a need for it.
Downy mildews ❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11. ❖ Remove infected crop debris. ❖ Provide proper drainage to avoid water stagnation in the field.	**Rust** (*Uromyces fabae*) ❖ After harvest the affected plant trash should be burnt. ❖ Follow suitable crop-rotation with non-leguminous crops. ❖ Dust Sulphur @ 25 kg/ha or spray wettable sulphur. ❖ Early sowing in the month of October. Grow resistant varieties like Arka Ajit, Arka Karthik and Arka Sampoorna and moderately resistant, Arka Apoorva.

Harvesting		
	Plucking of green cobs should be done in two-three stages for obtaining proper size of cobs. After cob plucking, stalk should be removed from field and used as green fodder.	First picking 75-80 days after sowing for green pods.

6. **Observation to be recorded:** Yield parameters for all the crops.
7. **Contact address for relevant information:** Joint Director, ICAR – NOFRI, Tadong, Gangtok, Sikkim, Director, ICAR RC for NEH Region, Umroi Road, Umian, Meghalaya

Technology no. 7

1. **Name of the technology:** Maize + Beans-rajmash cropping system for rainfed conditions under organic management system
2. **Source of technology:** ICAR – National Organic Farming Research Institute, Tadong, Gangtok
3. **Year of release:** 2015
4. **Agro Climatic zone:** North Eastern Himalayan Zone
5. **Detail description about the technology:**

	Maize + Beans	**Rajmash**
Land preparation		
One ploughing with bullock drawn plough followed by one tilling/harrowing for maize after harvest of buckwheat.		A good seed bed should consist of 5 to 7 cm of fine firm soil that is free from weeds.
Organic nutrient management		
❖ Apply dolomite @ 2 t/ha as basal application 15-20 days prior to the sowing. ❖ Conjoint basal application of mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha. ❖ Application of vermicompost @ 2.5 t/ha should be done in two equal splits *i.e.*, half amount applied in rows at the time of sowing and the rest amount at the time of earthing up after second weeding.		Apply vermicompost @ 2.0 t/ha + neem cake @ 1.0 t/ha + FYM @ 5.0 t/ha in furrows open for sowing of the seeds.
Time of sowing		

❖ Pre-*Kharif* sowing in the rice fields at the lower altitude is done in mid-February to second week of March. ❖ Main season maize is sown at different altitudes from mid-February to April. Normally, sowing time is early at the lower altitudes than the mid and higher hills, where it is delayed. ❖ Post-*Kharif* maize is sown in July and first week of August along with pulses, beans and pulse-type beans.	End of September.
Varieties	
Composites: Vivek Sankul Makka-11, Vijay, Prabhat **Hybrids:** Vivek Hybrid-9, Vivek Hybrid-21, Vivek Hybrid-33, Vivek Hybrid-39 **Quality protein maize (QPM):** Vivek QPM-9, HQPM-1 **Lines:** RCM 1-1, RCM 1-76, RCM 1-3	VL Rajma-63, VL Rajma-125, IPR 98-5 (Utkarsh), HUR-15, HUR-137 and SKR-57 (Promising line)
Method of sowing	
Line-sowing method: After preparation of land and mixing of all the organic sources a line should be opened with the help of *kudal*/*deshi* plough and seed placed in the line. **Dibbling method:** This method is time taking as the seeds are placed with the help of *khurpi*/ dibbler manually at the required distance in the row. It needs less seed rate and is the best method for costly seeds. It can be practiced in small and uneven terraces.	Line-sowing
Seed rate and seed innoculation	
Depending upon the variety and season, 15-20 kg/ha seed of maize is required for optimum plant population. Seed should be inoculated with *Azospirillum*, *Azotobacter etc*. and Phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing	100-125 kg seed/ha *Rhizobium* inoculum @ 20 g/kg seed
Spacing and depth of sowing	
Spacing of 50 cm x 25 cm on the ridge/flat bed. Sown at a depth of 3 to 5 cm below the soil.	Spacing of 30 cm x 10 cm. Sowing should be done in furrows at a depth of 3-5 cm.
Weed management	
Two hand weeding, first at 15-20 DAS and second at 35-40 DAS.	Two hand weeding, first at 15-20 DAS and second at 40-45 DAS should be done to get the optimum yield.

<table>
<tr><td colspan="2">Crop protection:</td></tr>
<tr><td colspan="2">Insect pest management</td></tr>
<tr><td>❖ Spraying of neem formulations 1500 ppm @ 3 ml/l or Spinosad 45 SC @ 0.3 ml/l and second spray at 20 days interval is effective to control insect pests of maize.</td><td>❖ Blister beetle can be managed by spraying of entomopathogenic fungi like Beauveria bassiana and Metarhizium anisopliae @ 5 g/l.
❖ Spraying Spinosad 45 SC @ 0.3 ml/l and second spraying at 20 days interval is effective to control legume pod borer.</td></tr>
<tr><td colspan="2">Disease Management</td></tr>
<tr><td>Turcicum leaf blight (Helminthosporium turcicum)
❖ Grow resistant hybrids like DHM-1.
❖ Remove plant residue from the previous crop.
❖ Plough under the infected crop residue in the field to reduce the inoculum.</td><td>Powdery mildew (Erisiphe polygoni)
❖ Spray wettable Sulphur @ 0.25 per cent or dust Sulphur @ 25 kg/ha.</td></tr>
<tr><td>Maydis leaf blight (MLB) (Bipolaris maydis)
❖ Grow resistant varieties like Deccan, VL-42, Prabhat, KH-5901, PRO-324, PRO-339, ICI-701, F-7013, F-7012, PEMH-1, PEMH-2, PEMH-3, Paras, Sartaj, and Deccan 109.
❖ Remove infected crop debris.</td><td>Rust (Uromyces phaseoli)
❖ Spray wettable Sulphur @ 0.25 per cent or dust Sulphur @ 25 kg/ha.
❖ Arka Anoop is resistant to rust.</td></tr>
<tr><td>Downy mildews
❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11.
❖ Remove infected crop debris.
❖ Provide proper drainage to avoid water stagnation in the field.</td><td>Anthracnose (Colletotrichum lindemuthianum)
❖ Growing resistant varieties like Pant Anupama.
❖ Spray copper oxychloride or copper hydroxide @ 0.25 per cent.</td></tr>
<tr><td></td><td>Leaf spot (Isariopsis griseola)
❖ Spray copper oxychloride or copper hydroxide @ 0.25 per cent.
❖ Use healthy seeds.</td></tr>
</table>

		Common mosaic ❖ Remove and destroy infected plants. ❖ Use disease-free seeds for sowing. ❖ Spray neem oil @ 0.3 per cent NSKE @ 5 per cent or petroleum oil-based agro spray @ 1 per cent
Harvesting	Plucking of green cobs should be done in two-three stages for obtaining proper size of cobs. After cob plucking, stalk should be removed from field and used as green fodder.	Harvest at 90-100 days after sowing in rainfed conditions.

6. **Observation to be recorded:** Yield parameters for all the crops.
7. **Contact address for relevant information:** Joint Director, ICAR – NOFRI, Tadong, Gangtok, Sikkim Director, ICAR RC for NEH Region, Umroi Road, Umian, Meghalaya

Technology no. 8

1. **Name of the technology:** Rice – sunflower – *dhaincha* (*Sesbania* spp. for green manuring) under organic management system
2. **Source of technology:** ICAR – National Organic Farming Research Institute, Tadong, Gangtok
3. **Year of release:** 2015
4. **Agro Climatic zone:** North Eastern Himalayan Zone
5. **Detail description about the technology:**

Rice	Sunflower	Dhaincha
Land preparation		
The land should be properly prepared with two-three ploughing and uniform leveling with peripheral bund. One ploughing and puddling may be done to make the field weed-free and water retentive. Excessive tillage results in degradation of soil quality, causes soil and nutrient loss through erosion during heavy rains and finally leads to yield reduction. Organic manures like farmyard manure or composts should be applied about 15 days before transplanting and mixed with the soil during ploughing.	Soil should be thoroughly tilled to a depth of 25-30 cm and sub-surface hard pans, if any, should be broken for this purpose. After the primary tillage, the soil should be brought to fine tilth by power tilling. After harvesting rice, deep ploughing should be done for making fine seed bed for sowing sunflower.	One ploughing should be done after sunflower harvesting.
Organic nutrient management		
Application of FYM @ 10-15 t/ha and/or vermicompost @ 3-6 t/ha either alone or in combination is recommended for optimum yield of rice. Mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha should be used as basal application in maize. Application of goat manure/poultry manure @ 1-2 t/ha as basal dose helps to overcome micronutrient deficiencies.	Incorporate 5-6 tonnes of well decomposed FYM + 2 t vermicompost/ha 2-3 weeks prior to sowing and mixed well in soil before sowing of the crop. Application of goat manure/ poultry manure @ 1-2 t/ha as basal dose helps to overcome micronutrient deficiencies	
Time of sowing		

Second fortnight of June	Sunflower should be sown as *Rabi* season crop after harvesting rice.	*Sesbania* should be grown immediately after harvesting sunflower.
Varieties		
PD-10, 12, 14; Shasharang, VL Dhan-62, VL Dhan-82, KRH-2 and 4 (hybrid), Satyaranjan, Geetanjali, Rajendra Bhagawati, Pusa Sugandh-2.	Surya, Pro Sun-09, KBSH-44, KBSH-1, Jwalamukhi	
Method of sowing		
Line sowing (transplanting)	Line sowing	Broadcasting
Seed rate and seed innoculation		
40-50 kg/ha Inoculate with *Azospirillum*, *Azotobacter etc*. and phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing of the crop.	Around 4-5 kg hybrid seed/ha and 8-10 kg/ha for varieties.	40-50 kg/ha
Spacing and depth of sowing		
25 cm x 15 cm Transplant at 2 cm depth	60 cm x 30 cm between row and plants for hybrids and 50 cm x 25 cm for varieties. Sowing should be done in furrows at a depth of 4-5 cm.	
Weed management		
Two hand-weeding at 20 and 40 days after transplanting (DAT)	Two hoeing followed by one hand weeding at intervals of 15 days commencing from 15-20 DAS.	
Crop protection:		
Insect pest management		
Spray neem oil 0.15 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval. Spray *Beauveria bassiana* @ 7 g/l at the boot leaf stage to reduce Gundhi bug population.	Application of *Bacillus thuringiensis* (Bt) @ 1 kg/ha has been found effective in controlling hairy caterpillars. Green colour card board painted with sticky material should be kept in the field to attract flying jassids.	

	Spray neem oil (1500 ppm) @ 3 ml/l to protect the crop from insect damage.	
Disease Management		
Blast (*Pyricularia grisea*) Field sanitation; and burn straw and stubbles in the field. Seed treatment with *Pseudomonas flourescens* @ 6 g per kg seed. Dry seed treatment with *Pseudomonas fluorescens* talc formulation @ 10 g/kg. Use resistant/tolerant varieties.	**Sclerotium wilt** or **rot** (*Sclerotium rolfsii*) Collect and destroy plant debris and infected plants. Broadcast enriched FYM @ 2.5 kg/sq m during land preparation. *Trichoderma* spp. enriched FYM @ 2.5 kg/sq m can be applied in lines after plant emergence.	
Brown spot (*Helminthosporiun oryzae*) Hot water treatment of seed at 53-54°C for 10-12 minutes. Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease. Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.	**Alternaria blight** (*Alternaria helianthi*) Foliar spray of copper oxychloride @ 0.3 per cent or Bordeaux mixture @ 1 per cent from the initial appearance of disease.	
Sheath blight (*Rhizoctonia solani*) Apply neem cake @ 150 kg/ha as basal dose. Spray neem oil @ 3 per cent and NSKE @ 5 per cent. Foliar spray of *P. fluorescens* @ 0.2 per cent at boot leaf stage and 10 days later.	**Necrosis** (Sunflower necrosis virus) Spray neem oil @ 0.3 per cent or NSKE @ 5 per cent or petroleum oil-based agro spray @ 0.7 per cent.	
Bacterial leaf blight (BLB) (*Xanthomonas oryzae* pv. *Oryzae*) Use disease-free seeds. Hot water treatment of seed at 52-54°C for 10 minutes. Use tolerant varieties.		

Tungro virus (Rice Tungro Virus) Spray neem oil @ 0.3 per cent or NSKE @ 5 per cent 15 to 30 days after transplanting to control vector population (if one jassid is noticed in a plant and three sprays have to be given at 15 days interval).		
Harvesting		
120-125 days after planting.W	Harvest at physiological maturity which occurs at 130-145 DAS.	At 45 days after sowing green plant trampling into the soil by ploughing.

6. **Observation to be recorded:** Yield parameters for all the crops.

7. **Contact address for relevant information:** Joint Director, ICAR – NOFRI, Tadong, Gangtok, Sikkim. Director, ICAR RC for NEH Region, Umroi Road, Umian, Meghalaya

Technology no. 9

1. **Name of the technology:** Rice-fenugreek (leafy vegetable) – baby corn for irrigated condition under organic management system
2. **Source of technology:** ICAR – National Organic Farming Research Institute, Tadong, Gangtok
3. **Year of release:** 2015
4. **Agro Climatic zone:** Eastern Himalayan Zone

Rice	Fenugreek	Babycorn
Land preparation		
2-3 ploughing and one puddling should be done.	Two-three ploughing to good tilth. A good seedbed should consist of 5 to 7 cm of fine firm soil.	Two-three ploughing to good tilth. A good seedbed should consist of 5 to 7 cm of fine firm soil.
Organic nutrient management		
FYM @ 10-15 t/ha and/or vermicompost @ 3-6 t/ha either alone or in combination.	FYM @ 10 t/ ha or vermicompost @ 1 t/ha.	FYM @ 10-15t/ha should be applied 20 days before sowing.

Time of sowing		
Transplanting: 2nd fortnight of June. Nursery: 25-30 days prior to transplanting.	Second fortnight of November.	Month of February after harvest of fenugreek.
Varieties		
PD-10, 12, 14; Shasharang, VL Dhan-62, VL Dhan-82, KRH-2 and 4 (hybrid), Satyaranjan, Geetanjali, Rajendra Bhagawati, Pusa Sugandh-2	Pusa Early Bunching, Rajendra Kranti, HM-57, Champa	VL-42, VL-45, HIM-129, Baby Corn-1, HM-4
Method of sowing		
Line-sowing method Dibbling method	Line sowing method	Line sowing method
Seed rate and seed innoculation		
40-50 kg/ha Inoculated with *Azospirillum*, *Azotobacter etc*. and phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing of the crop.	25-30 kg/ha	18-20 kg/ha
Spacing and depth of sowing		
25 cm x10 cm Transplanting of rice should be done at a depth of 2 cm.	20 cm maintained between rows.	45 cm x15 cm
Weed management		
Two hand-weeding at 20 and 40 days after transplanting (DAT).	Two hand-weeding at 20 and 40 DAT.	Two hand weeding is recommended for baby corn, first at 15-20 DAS and second at 40-45 DAS
Crop protection:		
Insect pest management		
❖ Timely planting of rice. ❖ Spray neem oil 0.15 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval. ❖ Spray *Beauveria bassiana* @ 7 g/l at the boot leaf stage to reduce Gundhi bug population.	**Powdery mildew** (*Erysiphe polygoni* and *Leveillula taurica*) ❖ Dust sulphur @ 25 kg/ha or spray wettable sulphur @ 0.25 per cent.	❖ Cut worm, army worm, semi-looper, stem borer and cob borer are some major pests of maize. ❖ Spraying neem formulations 1500 ppm @ 3 ml/l or Spinosad 45 SC @ 0.3 ml/l and second spray at 20 days interval.

Disease Management		
Blast (*Pyricularia grisea*) ❖ Field sanitation. ❖ Seed treatment with *Pseudomonas flourescens* @ 6 g per kg seed. ❖ Spray *P. fluorescens* talc formulation @ 0.5% three times from 45 days after transplanting at 10 day intervals. ❖ Spray copper oxychloride @ 0.3 per cent at 7-10 day interval from the initial appearance of disease. ❖ Use of bael (*Aegle marmelos*) leaves extract @ 2.5 per cent.		**Turcicum leaf blight** (*Helminthosporium turcicum*) ❖ Grow resistant hybrids like DHM-1. ❖ Remove plant residue from the previous crop. ❖ Plough the infected crop residue to reduce the inoculum.
Brown spot (*Helminthosporiun oryzae*) ❖ Hot water treatment of seed at 53-54°C for 10-12 minutes. ❖ Sanitation and crop rotation with legumes and oil seed crops. ❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.		**Maydis leaf blight** (MLB) (*Bipolaris maydis*) ❖ Growing resistant varieties *viz.*,VL-42, Prabhat, PEMH-1, PEMH-2 and PEMH-3 ❖ Remove infected crop debris. ❖ It is important to control the disease during the period from 14 days before tasseling to 21 days after tasseling for optimal control.
Sheath blight (*Rhizoctonia solani*) ❖ Crop rotation with oil seeds and pulses. ❖ Apply neem cake @ 150 kg/ha as basal dose. ❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent. ❖ Foliar spray of *P. fluorescens* @ 0.2 per cent at boot leaf stage and 10 days later. ❖ Soil application of *P. fluorescens* @ 2.5 kg/ha mixed with 50 kg FYM after 30 days of transplanting.		**Downy mildews** 1. Sorghum downy mildew (*Perenosclerospora sorghii*): 2. Brown stripe downy mildew (*Sclerophthora rayssiae*): ❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11. ❖ Early planting is recommended for sorghum downy mildew. ❖ Provide proper drainage to avoid water stagnation in the field.

❖ Most of varieties cultivated in Sikkim are found to be resistant under organic conditions.		
Bacterial leaf blight (BLB) (*Xanthomonas oryzae* pv. *Oryzae*) ❖ Hot water treatment of seed at 52-54°C for 10 minutes. ❖ Avoid flow of water from one field to the other. ❖ Drain the field except during flowering stage. ❖ Remove and destroy previous crop residue, volunteer plants and stubbles. ❖ Spray copper oxychloride @ 0.3 per cent 35 days after and 45 days after planting. ❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.		
Tungro virus (Rice Tungro Virus) ❖ Deep summer ploughing. ❖ Apply neem cake @ 150 kg/ha as basal dose. ❖ Spray neem oil @ 0.3 per cent or NSKE @ 5 per cent 15 to 30 days after transplanting to control vector population (if one jassid is noticed in a plant and three sprays have to be given at 15 days interval). ❖ Destroy weed hosts of virus and leaf hopper. ❖ Set up light traps to monitor and destroy hoppers which transmit various RTV in rice		

Harvesting		
110-150 days after planting depending upon the varieties.	First clippings/ cuttings 55-60 DAS. Thereafter, at every 25-30 days interval two to three cutting should be done.	About 50-65 days after sowing. Harvest can be made 8-10 times over a period of 3-4 weeks. After 8 or 10 days of first harvest, second and third cobs will be ready for harvest.

6. Observation to be recorded: Yield parameters for all the crops.

7. Contact address for relevant information: Joint Director, ICAR – NOFRI, Tadong, Gangtok, Sikkim

Director, ICAR RC for NEH Region, Umroi Road, Umian, Meghalay**a**

Technology no. 10

1. **Name of the technology:** Rice-vegetable pea-maize (green cobs) for irrigated condition under organic management system
2. **Source of technology**: ICAR – National Organic Farming Research Institute, Tadong, Gangtok
3. **Year of release:** 2015
4. **Agro Climatic zone:** Eastern Himalayan Zone
5. **Details of Technology:**

Rice	Vegetable pea	Maize (green cobs)
Land preparation		
2-3 ploughing and one puddling should be done.	Two-three ploughing to good tilth.	Two-three ploughing to good tilth.
Organic nutrient management		
FYM @ 10-15 t/ha and/or vermicompost @ 3-6 t/ha either alone or in combination.	Vermicompost @ 2.5 t/ha should be applied in two equal splits *i.e.*, half amount applied in rows opened for placing the seeds.	FYM @ 10-15t/ha should be applied 20 days before sowing.
Time of sowing		
❖ Transplanting: 2nd fortnight of June. ❖ Nursery: 25-30 days prior to transplanting.	Second fortnight of November.	Mid February to first fortnight of March.
Varieties		

PD-10, 12, 14; Shasharang, VL Dhan-62, VL Dhan-82, KRH-2 and 4 (hybrid), Satyaranjan, Geetanjali, Rajendra Bhagawati, Pusa Sugandh-2	VRP-5, VRP-6, TSX-10, Pant Sabzi Matar-3, Pusa Pragati	Composites: Vivek Sankul Makka-11, Vijay, Prabhat Hybrids: Vivek Hybrid-9, Vivek Hybrid-21, Vivek Hybrid-33, Vivek Hybrid-39 Quality Protein Maize: Vivek QPM-9, HQPM-1 Lines: RCM 1-1, RCM 1-76, RCM 1-3
Method of sowing		
❖ Line-sowing method ❖ Dibbling method	Line sowing method	Line sowing method
Seed rate and seed innoculation		
@ 40-50 kg/ha Inoculated with *Azospirillum*, *Azotobacter etc*. and phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing of the crop	Early maturing dwarf varieties: about 80-100 kg seed/ha and late maturing and tall varieties: 75-80 kg/ha.	@ 15-20 kg/ha
Spacing and depth of sowing		
25 cm x 10 cm Transplanting of rice should be done at a depth of 2 cm.	30 cm x 15 cm Depth : 3-4 cm.	50 cm x 25 cm Depth : 3-4 cm.
Weed management		
Two hand-weeding at 20 and 40 days after transplanting (DAT).	Two hand-weeding at 15-20 and 35-40 DAS.	Two hand weeding first at 15-20 DAS and second at 40-45 DAS
Crop protection:		
Insect pest management		
❖ Timely planting of rice. ❖ Spray neem oil 0.15 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval. ❖ Spray *Beauveria bassiana* @ 7 g/l at the boot leaf stage to reduce Gundhi bug population.	❖ Aphids: Petroleum oil-based agro spray @ 10 ml/l or neem oil (1500 ppm) @ 3 ml/l.	❖ Cut worm, army worm, semi-looper, stem borer and cob borer are some major pests of maize. ❖ Spraying neem formulations 1500 ppm @ 3 ml/l or Spinosad 45 SC @ 0.3 ml/l and second spray at 20days interval.

Disease Management		
Blast (*Pyricularia grisea*) ❖ Field sanitation. ❖ Seed treatment with *Pseudomonas flourescens* @ 6 g per kg seed. ❖ Spray *P. fluorescens* talc formulation @ 0.5% three times from 45 days after transplanting at 10 day intervals. ❖ Spray copper oxychloride @ 0.3 per cent at 7-10 day interval from the initial appearance of disease. ❖ Use of bael (*Aegle marmelos*) leaves extract @ 2.5 per cent.	**Wilt** and **Root Rot** (*Fusarium oxysporum* and *Rhizoctonia solani*) ❖ Early sowing. ❖ Drench soil with copper oxychloride @ 0.25 per cent. ❖ Crop rotation for at least 2-3 years with suitable non-leguminous crops should be followed.	**Turcicum leaf blight** (*Helminthosporium turcicum*) ❖ Grow resistant hybrids. ❖ Remove plant residue from the previous crop. ❖ Plough the infected crop residue to reduce the inoculum.
Brown spot (*Helminthosporium oryzae*) ❖ Hot water treatment of seed at 53-54ºC for 10-12 minutes. ❖ Sanitation and crop rotation with legumes and oil seed crops. ❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.	**Powdery mildew** (*Erysiphe* **Rust** (*Uromyces fabae*) ❖ After harvest, the affected plant trash should be burnt. ❖ Follow suitable crop-rotation with non-leguminous crops. ❖ Dust sulphur @ 25 kg/ha or spray wettable sulphur. ❖ Early sowing in the month of October. ❖ Resistant varieties *viz*., Arka Ajit, Arka Karthik and Arka Sampoorna and moderately resistant, Arka Apoorva.	**Maydis leaf blight** (MLB) (*Bipolaris maydis*) ❖ Growing resistant varieties. ❖ Remove infected crop debris. ❖ It is important to control the disease during the period from 14 days before tasseling to 21 days after tasseling for optimal control.
Sheath blight (*Rhizoctonia solani*) ❖ Crop rotation with oil seeds and pulses. ❖ Apply neem cake @ 150 kg/ha as basal dose. ❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.		**Downy mildews** Sorghum downy mildew (*Perenosclerospora sorghii*) ❖ Brown stripe downy mildew (*Sclerophthora rayssiae*)

❖ Foliar spray of *P. fluorescens* @ 0.2 per cent at boot leaf stage and 10 days later. ❖ Soil application of *P. fluorescens* @ 2.5 kg/ha mixed with 50 kg FYM after 30 days of transplanting. ❖ Most of varieties cultivated in Sikkim are found to be resistant under organic conditions.		❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11. ❖ Early planting is recommended for sorghum downy mildew. ❖ Provide proper drainage to avoid water stagnation in the field.
acterial leaf blight (BLB) (*Xanthomonas oryzae* pv. *Oryzae*) ❖ Hot water treatment of seed at 52-54°C for 10 minutes. ❖ Avoid flow of water from one field to the other. ❖ Drain the field except during flowering stage. ❖ Remove and destroy previous crop residue, volunteer plants and stubbles. ❖ Spray copper oxychloride @ 0.3 per cent 35 days after and 45 days after planting. ❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.		
BTungro virus (Rice Tungro Virus) ❖ Deep summer ploughing. ❖ Apply neem cake @ 150 kg/ha as basal dose.		

❖ Spray neem oil @ 0.3 per cent or NSKE @ 5 per cent 15 to 30 days after transplanting to control vector population (if one jassid is noticed in a plant and three sprays have to be given at 15 days interval). ❖ Destroy weed hosts of virus and leaf hopper. ❖ Set up light traps to monitor and destroy hoppers which transmit various RTV in rice.		
Harvesting		
110-150 days after planting depending upon the variet-ies.	The pod of vegetable pea should be ready for first picking 85-95 days after sowing.	Maize green cob is ready for harvest in 80-90 days after sowing.

6. **Observation to be recorded:** Yield parameters for all the crops.
7. **Contact address for relevant information:** Joint Director, ICAR – NOFRI, Tadong, Gangtok, Sikkim, Director, ICAR RC for NEH Region, Umroi Road, Umian, Meghalaya.

Technology no. 11

1. **Name of the technology:** Rice – vegetable pea (no-till) for irrigated condition under organic management system
2. **Source of technology:** ICAR – National Organic Farming Research Institute, Tadong, Gangtok
3. **Year of release:** 2015
4. **Agro Climatic zone:** Eastern Himalayan Zone
5. **Details of Technology:**

Rice-vegetable pea under no-till	
Rice	**Vegetable pea**
Package and practices - Land preparation	
Rice is grown under no-till practices, hence, only a slit has to be opened to sow the seeds which can be done with the help of local *kudal* or prototype no-till drill machines.	Vegetable pea is grown under no-till practices, hence, only a slit has to be opened to sow the seeds which can be done with the help of local *kudal* or prototype no-till drill machines.

Organic nutrient management	
❖ Mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha should be applied as basal dose in rice. ❖ Application of vermicompost @ 2.5 t/ha should be done in two equal splits *i.e.*, half amount applied 40 DAT and half 75 DAT for efficient utilization.	Apply vermicompost or neem cake @ 1.0 t/ha in furrows open for sowing of the seeds.
Time of sowing	
Second fortnight of June	Second fortnight of November immediately after harvest of rice.
Method of sowing	
Line-sowing method	Dibbling method
Seed rate	
40-50 kg/ha	Early maturing dwarf varieties (80-100 kg seed/ha) and for late maturing and tall varieties (75-80 kg/ha)
Seed inoculation	
Inoculate with *Azospirillum*, *Azotobacter etc*. and phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing of the crop.	*Rhizobium* inoculum @ 20 g/ kg seed is sprinkled, mixed in *jaggery* solution.
Spacing	
SRI technique 20 cm × 20 cm	Sowing of vegetable pea should be placed in furrows at a depth of 3-4 cm at 30 cm in row spacing.
Varieties	
PD-10, 12, 14; Pusa Sugandh-2, Shasharang, VL Dhan-62, VL Dhan-82, KRH-2 and 4 (hybrid), Satyaranjan, Geetanjali, Rajendra Bhagawati.	VRP-5, VRP-6, TSX-10, Pant Sabzi Matar-3, Pusa Pragati.
Weed management	
Two hand weeding, first 15-20 DAS and second 40-45 DAS should be done to get the optimum yield.	The critical period for crop-weed competition in vegetable pea is 15-40 days after sowing.
Crop protection:	
Insect pest management	

❖ Spray neem oil 0.15 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval. ❖ Spray *Beauveria bassiana* @ 7 g/l at boot leaf stage to reduce Gundhi bug population.	Aphids: Petroleum oil-based agro spray @ 10 ml/l or neem oil (1500 ppm) @ 3 ml/l can be sprayed for effective management.
Disease management	
Blast (*Pyricularia grisea*) ❖ Field sanitation; and burn straw and stubbles in the field. ❖ Seed treatment with *Pseudomonas flourescens* @ 6 g per kg seed. ❖ Dry seed treatment with *Pseudomonas fluorescens* talc formulation @ 10 g/kg. ❖ Use resistant tolerant varieties.	**Wilt** and **Root Rot** (*Fusarium oxysporum* and *Rhizoctonia solani*) ❖ Early sowing should be avoided to escape from high humidity and high temperature which are congenial for the disease. ❖ Drench soil with copper oxychloride @ 0.25 per cent. ❖ Crop rotation for at least 2-3 years with suitable non-leguminous crops should be followed.
Brown spot (*Helminthosporiun oryzae*) ❖ Hot water treatment of seed at 53-54°C for 10-12 minutes. ❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease. ❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.	**Powdery mildew** (*Erysiphe polygoni*) ❖ Late planting should be avoided. ❖ Remove and destroy plants after harvest. ❖ The disease can be controlled by two to three sprays of wettable sulphur compounds like Sulfex @ 3 kg per hectare in 1000 litres of water. Give the first spray after appearance of the disease in the crop. The second spray should be done 14 days after the first spray and the third spray only if there is a need for it. ❖ Spraying 10 per cent milk dilution at 10 days interval is effective modification of pH conditions.
Sheath blight (*Rhizoctonia solani*) ❖ Apply neem cake @ 150 kg/ha as basal dose. ❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent. ❖ Foliar spray of *P. fluorescens* @ 0.2 per cent at boot leaf stage and 10 days later.	**Rust** (*Uromyces fabae*) ❖ After harvest the affected plant trash should be burnt. ❖ Follow suitable crop-rotation with non-leguminous crops. ❖ Dust Sulphur @ 25 kg/ha or spray wettable sulphur. ❖ Early sowing in the month of October. ❖ Grow resistant varieties like Arka Ajit, Arka Karthik and Arka Sampoorna and moderately resistant, Arka Apoorva.

Bacterial leaf blight (BLB) (*Xanthomonas oryzae* pv. *Oryzae*) ❖ Use disease-free seeds. ❖ Hot water treatment of seed at 52-54°C for 10 minutes. ❖ Use tolerant varieties.	
Tungro virus (Rice Tungro Virus) ❖ Spray neem oil @ 0.3 per cent or NSKE @ 5 per cent 15 to 30 days after transplanting to control vector population (if one jassid is noticed in a plant and three sprays have to be given at 15 days interval).	
Harvesting	
100-140 days after planting depending upon the varieties.	The pod of vegetable pea should be ready for first picking 85-95 days after sowing.

6. **Observation to be recorded:** Yield parameters for all the crops.
7. **Contact address for relevant information:** Joint Director, ICAR – NOFRI, Tadong, Gangtok, Sikkim Director, ICAR RC for NEH Region, Umroi Road, Umian, Meghalaya

Chapter 2- Agricultural Engineering

Technology no. 1

1. **Name of technology:** Cook-stove run on powdery Biomass
2. **Source of technology:** Department of Agricultural Engineering, AAU, Jorhat
3. **Year of release:** 2010
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** This cook-stove run on powdery biomass (1.4 kg/hr) like paddy husk and rice chaff is recommended for use to supplement the household cooking energy needs and use crop residue as fuel (Thermal efficiency 11.5%). It consists of an outer container with a conical shaped hopper top made up of sheet metal, which is attached to the cylindrical shaped bottom portion of perforated sheet. In the centre, an inner cylinder of perforated sheet (holes of 3mm dia) is attached at a slightly less height. This acts as the combination chamber. The hopper and combustion chamber placed on the top of grate made of perforated sheet, is pivoted at the center of the inner cylinder. It is almost maintenance free. Only maintenance required is the removal of ash by inverting the stove. The nut and the bolt of the great need periodic tightening.

   Management practices: Fill the rice chaff or husk in the outer cylinder up to the top maintain a space of 30mm-50mm below the edge of the container.

   Use of only dry and fresh chaff or husk is recommended in the stove for burning. Take the wooden stick, wrap cotton waste at one end of it, and soak it in kerosene. Light it and insert inside the stove from the bottom port. In case of difficulty in burning the stove after lighting, checks the chaff/husk if it is dry. Keep the stove away from direct blast of air due to wind or fan as it affects the burning and gasification. The flame will rise in the cylinder of the stove. The golden colour of the flame increases as the temperature of the rice chaff or husk rises and as gasification starts. The flow of combustible gases will be visible in the form of flames coming out of the perforations. As the gases burn completely, the colour of the flame changes to blue- red. This flame indicates the proper burning of the fuel and its optimum functioning. At this stage cooking of food or boiling of water can be done by simply placing the food/water in a cooking vessel/container and putting it on the stove and covering it on top.

   The temperature or the heat can be lowered by simply removing the sticks from the bottom and hence can be adjusted as per requirement. The black colour of the chaff/husk indicates that the volatile matter has been exhausted. Therefore adding of more chaff or husk is recommended to continue burning.

   Farming situations: Rice based cropping system
6. **Critical inputs required:** Cook-stove run on powdery biomass (1.4 kg/hr) like paddy husk and rice chaff
7. **Observations to be recorded:** Type of biomass fuel in use among the villagers before intervention, Amount of powdery biomass used per month after intervention, onetary benefit by using the improved cookstoves, Acceptability - cheap fuel in use or portability of the cookstove, B: C ratio. Farmers' reaction.
8. **Additional information if any:** Cost benefit analysis

Assumption 1 - Assuming a household of 5 persons and per head consumption of firewood @1.12 kg per day. Hence for 5 member family fire wood consumed is 5.6 kg/day.

Assumption 2 – Paddy husk required for a 5 member family is 4kg/day.

Annual fuel consumption per Household	Using the traditional Cookstobve	Using the improved cookstove run on powdery biomass.	Cost of fuel (Rs) Firewood @ 2/ kg Paddy husk@1/kg
Firewood	2,044 kg	Small quantity	Rs 3475 (assuming 15% from bari & 80% bought)
Paddy husk	-	1460 kg	Rs 1460 (firewood from bari)

Cost calculation on year basis –

For the portable metallic stove

The life of the improved cookstove (costing Rs 1800/-) can be assumed as 2yrs hence depreciation @ 50% on year to year basis.

Cost of a metallic improved cookstove run on paddy husk	= Rs 900
Maintenance cost @400/year*	= Rs 400
Fuel cost	= Rs 1460
Total	= Rs 2760

For the traditional cook-stove

Cost of running a traditional cook-stove with 80% of firewood bought from the market

@ Rs 2 /Kg = Rs 3475

Benefit of running a metallic improved cook-stove = Rs 3475 - Rs2760 = Rs 715/Yr

* The maintenance cost will include the replacement of worn out perforated inner cylinder.

The life of a perforated inner cylinder is 6 months.

Partial Budget Analysis Of Portable Metallic Stove

Particulars Qty Amount (Rs)

A) ADDED COST:

1. Depreciation of stove @ 50% 900

of cost of the Stove per year (Rs 1800)*

2. Maintenance cost 400

3. Paddy husk 1460

Total = 2760

B) ADDED RETURN: Nil

C) REDUCED COST:

1. Purchase of Fuel wood (85% bought firewood

For traditional stove is 2044 kg) 3475

Total =3475

D) REDUCED RETURN: Nil

= (Added return + Reduced cost) – (Reduced return + Added cost)

=3475 – 2760

=715

Therefore, % decrease in cost = (715/3475) x 100%

= 20.57% = 21% (approx)

Technology no. 2

1. **Name of technology:** Solid State Bio-Gas Plant
2. **Source of technology:** Department of Agricultural Engineering, AAU, Jorhat
3. **Year of release:** 2009
4. **Agro-climatic zone:** Suitable for all agro climatic zones
5. **Detail description of technology:** The solid state biogas plant is recommended for use by to achieve reduction in water use while feeding (by 78%), enhanced gas production (30%) and ease in spent slurry handling (man-hr reduction by 50%). It consists of a 30cm internal diameter RCC/PVC pipe placed at an inclination of 75degree. A feed hopper is provided at the upper end of the feed pipe to facilitate feeding of plant with dung. Enlarged outlet slurry chamber is provided to accommodate total volume of the slurry displaced from the digester with an inclined smooth surface for streamlining the flow of the digested slurry. An outlet channel widening from 15- 30cm is present to facilitate self discharge of the digested slurry on to ground. The interior side of the gas dome is provided with an additional layer of 1: 1 cement sand mortar plaster of about 8mm thickness to withstand higher gas pressure.

1. **Management practices**: No or very little water is required for mixing with the dung and therefore feeding is far easier. No stirring required. Spent slurry (TS) is about 10-12%. The paste like digested slurry discharged from the plant gets dried within a week. It requires much lower space for drying and labour for handling. Relatively higher TS content makes handling of slurry easier compared to the conventional biogas plant. Biogas plant spent slurry (BSS). It is rich in N, P, K and several micronutrients. The slurry can be successfully utilized as component of integrated nutrient management (INM) practices of crop production to partially replace the inorganic fertilizer nutrients. 60 to 65 kg fresh dung/day and 11litre of water in the feedstock gives 1550-1700lit/day of combustible gas. Maintenance the solid-state plants are initially charged as usual with 1: 1 mixture of cattle dung and water (TSC of the slurry 8-10%) along with the inoculum. Fresh digested slurry (upto 10% of the total volume of the mixture) is collected from a nearby working biogas plant and fed into the new plant. After the plant operation gets stabilized, the substrate is changed from the liquid slurry to undiluted cattle dung. Fresh cattle dung (TSC 16-18%) @ more than 25 kg/ m^3 capacities is straight away poured into the inlet pipe every day. The cattle dung slowly slides into the digester under gravity and the digested slurry flows out through the outlet channel. As far as possible feeding should be done regularly. Use fresh and neat cattle dung as substrate. If TSC of the dung is more than 18%, mix water thoroughly to bring it down to around 16%. Original shape off the dung should also be deformed before feeding for better digestion in the plant. The inlet pipe and outlet pit should be kept covered. This checks moisture loss/drying and ensures smooth flow of the cattle dung from inlet pipe to digester and digested slurry from outlet pit into the outlet channel.

   Farming situations: Any cropping system coupled with

6. **Critical inputs required:** Solid state biogas plant
7. **Observations to be recorded:** Use of biogas as cooking fuel in the household. Use of spent slurry for nutrient enrichment in their crop fields. Maintenance of biogas plant particularly feeding the plant regularly without fail. B: C ratio Farmers' reaction.

8. Additional information if any:

Table : Cost and return of a Solid-state Deenbandhu Bio gas plant

Particulars	Unit	Quantity	Rate/Unit	Amount (Rs)
Size of the plant	2m3			
Initial cost	Rs			34000**
Variable cost	Rs			
Dung as manure	Kg	2000*		-
Dung as fuel	kg/day	55*		-
Labour	man-days	47	114	5358
Total variable cost				5358
Bio gas production/day	m3	1.4		
Annual production	m3	511		
1m3 bio gas =0.43 kg of LPG		219.73		
No of cylinder (1 cylinder contains 14.5 kg LPG)	No	15	924	13860
Net return				8502
B: C ratio				2.59

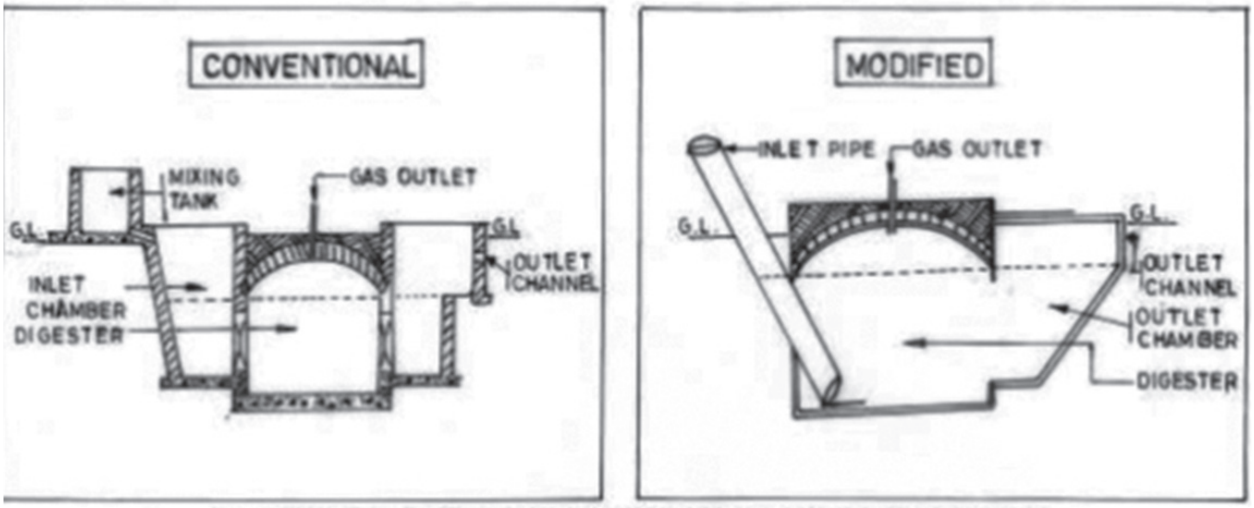


Fig. 1. Schematic diagram of conventional and solid state Janta biogas plant

Technology no. 3

1. **Name of technology:** Drip irrigation in Assam Lemon
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Plants are to be irrigated with 2 dripper of 2 LPH capacity fitted at a distance 30 cm from the trunk on either side of the plant. Irrigation frequency should be everyday during 1st week of November to 2nd week of April or initiation of pre-monsoon shower whichever is earlier.
6. **Critical inputs required:** Drip irrigation system as per specification
7. **Observations to be recorded**: Rainfall (mm), moisture status in soil, time of flowering and fruiting, yield, B: C Ratio, Farmers' reaction.

Technology no. 4

1. **Name of technology:** Fertigation through drip irrigation in Assam Lemon
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Fertigation through drip irrigation with 80% of recommended dose of N-P-K using Urea, DAP or MAP and MOP with a benefit to cost ratio of 4.04. Fertigation is to be done through 60 equal splits during 1st week of November to 2nd week of April or onset of pre monsoon rains whichever is earlier.
6. **Critical inputs required:** Drip irrigation system as per specification, Urea, DAP or MAP and MOP
7. **Observations to be recorded:** Rainfall (mm), moisture status in soil, time of flowering and fruiting, yield, B: C Ratio, Farmers' reaction, soil nutrient status.

Technology no.5

1. **Name of the Technology:** Tractor Drawn Rotavator
2. **Source of the Technology:** CAUCIAE, Bhopal
3. **Year of release:** 2003
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region
5. **Details description about the technology:** It consists of a steel frame, 3-point hitch system, a rotary shaft on which blades are mounted, power transmission system and a gearbox. The blades are of L-shape, made from medium carbon steel or alloy steel, hardened and tempered to suitable hardness. It uses the power from tractor PTO. Rotavator is used as both

primary and secondary tillage operations. A good seedbed and pulverization of the soil is achieved in a single pass of the Rotavator. It is used in both dry land and wet land conditions. It is also suitable for incorporating straw and manure in the field. The power requirement will vary depending upon the width of the Rotavator.It saves 60 percent operating time, 40 percent labour and 40 percent on cost of operation compared to conventional method of land preparation.

Fig: 1. Rotavator operation under dry land condition.

Fig: 2. Rotavator operation under wet land condition.

6. **Critical inputs:** Rotavator
7. **Observations to be recorded:**
    i. Puddling Index.
    ii. Field capacity.
    iii. Field efficiency
    iv. Fuel consumption.
    v. Depth of puddling.
    vi. Cost of operation per hectare.
8. **Contact Address for relevant information:**
    i. Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.
    ii. North Eastern Region Farm Machinery Training and Testing Institute (NERFMTTI), Biswanath Chariali, Sonitpur, Assam- 784176.

Technology no. 6

1. **Name of the Technology:** Animal drawn Paddy puddler (small size for NEH region).
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 2002
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** It is a helical blade type of puddler suitable for puddling in wetland condition and also for cutting and mixing of green manure crop. The implement consists of tow angle iron brackets carrying a bush. These blade are imparted a twist along their length to form a helix. The handle for the operation is made of wood and help in comfortable operation. It saves 30 percent labour, 40 percent operating time and 30 percent cost of operation compared to conventional method of using country plough.
6. **Critical inputs:** Peddler

Fig: 1. Animal drawn paddy puddler.

7. **Observations to be recorded:**
    i. Puddling Index.
    ii. Field capacity.
    iii. Field efficiency
    iv. Depth of puddling.
    v. Cost of operation.
8. **Contact Address for relevant information:**
    i. Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.
    ii. North Eastern Region Farm Machinery Training and Testing Institute (NERFMTTI), Biswanath Chariali, Sonitpur, Assam- 784176.

Technology no. 7

1. **Name of the Technology:** Self propelled vertical conveyor reaper.
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 2000
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region
5. **Details description about the technology:** It consists of crop row divider, star wheel, cutter bar, and a pair of lugged canvas conveyor belts and a handle fitted with clutch and brakes. This type of machines cut the crops and conveys it vertically to one end and windrows the crops on the ground uniformly. Collection of crop for making bundles is easy and it is done manually. Self-propelled walking type, self-propelled riding type and tractor mounted type vertical conveyor reaper are also available. These types of reapers are suitable for crops like wheat and rice. It can also harvest mustard, niger and other standing crops with some adjustment. In this reaper there is no shattering of the crop. It saves 90 percent labour, 60 percent operating time and operation cost compared to conventional method using sickle.
6. **Critical inputs:** Self propelled vertical conveyor reaper.
7. **Observations to be recorded:**
   i. Field capacity (ha/hr).
   ii. Field efficiency (%).
   iii. Fuel consumption (lit/hr).
   iv. Cutting width.
   v. Cutting height.
   vi. Labour requirement (man-hr/ha).
   vii. Cost of harvesting per hectare.
8. **Contact Address for relevant information:**
   i. Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.
   ii. North Eastern Region Farm Machinery Training and Testing Institute (NERFMTTI), Biswanath Chariali, Sonitpur, Assam- 784176.

Fig.1: Paddy harvesting.

Fig.2: Mustard harvesting.

Fig.3: Niger harvesting.

Technology no. 8

1. **Name of the Technology:** Multicrop Thresher.
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 1998
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** The high capacity multicrop thresher consists of a spike tooth cylinder, three-aspirators, cleaning sieves and feeding system. Three concaves made of square bars of different opening sizes are provided for threshing different crops. The cylinder, aspirators and shaker assembly receive power from PTO shaft of the tractor. The concave clearance, sieve clearance, screen slope and speeds of cylinder and blower can be adjusted according to the crop requirements. The beaters or spikes on the threshing cylinder hit the crop and the impact causes detachment of grains from the ear heads of the crop. The straw and some unthreshed grains move around the cylinder. The rubbing action between the straw, threshing drum and concave threshes the rest of grains and the straw is broken in the form of chaff. Threshed grains, chaff and other foreign matters pass through the concave openings and fall on the oscillating sieve assembly. The aspirators suck and blowout the chaff and lighter impurities through outlet. Cleaning sieves further separate the heavy straw, bigger impurities, clean grain, broken grain through oscillating motion of sieve assembly. The secondary inlet of blower does final cleaning and clean grain is obtained at the main grain outlet. It is suitable for threshing of wheat, maize, soybean, sorghum, sunflower, pigeon pea, gram, mustard and other similar crops. The output capacity of the machine is 500kg/hr to above 1000kg/hr depending on types of crops to be thresh. It saves 50 percent labour and operating time and 45 percent on cost of operation compared to manual threshing.

Fig.1. Paddy threshing.

Fig.2. Mustard threshing.

Fig.3. Niger threshing.

6. **Critical inputs:** Multicrop Thresher.
7. **Observations to be recorded:**
   i. Output capacity (kg/hr)
   ii. Labour requirement (man-h/q)
   iii. Threshing efficiency (%)
   iv. Cleaning efficiency (%).
   v. Total grain losses (%).

vi. Broken grains (%).

vii. Cost of threshing per hectare.

8. Contact Address for relevant information:

i. Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.

ii. North Eastern Region Farm Machinery Training and Testing Institute (NERFMTTI), Biswanath Chariali, Sonitpur, Assam- 784176.

Technology no. 9

1. **Name of the Technology:** Axial flow paddy thresher.
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 1990
4. **Agro Climatic Zone:** Eastern Himalayan Region /NEH Region.
5. **Details description about the technology:** It consists of a threshing cylinder, concave, cylinder casing, cleaning system and feeding chute. In axial flow concept, the crop is fed from one end, moves axially and the straw is thrown out from the other end after complete threshing of the crop. During threshing, the crop rotates three and half times around the cylinder and all the grains get detached. The threshing cylinder is of peg type. The casing of the thresher has 7 louvers for moving the crop axially. Two aspirator blowers and two sieves are provided for cleaning. It saves 70 percent labour and operating time and 20 percent on cost of operation.

Fig.1. Axial flow paddy thresher.

6. **Critical inputs:** Paddy thresher
7. **Observations to be recorded:**

    i. Output capacity (kg/hr).

    ii. Labour requirement (man-h/q).

iii. Threshing efficiency (%).

iv. Cleaning efficiency (%).

v. Total grain losses (%).

vi. Broken grains (%).

vii. Cost of threshing per hectare.

8. **Contact Address for relevant information:**

   i. Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.

   ii. North Eastern Region Farm Machinery Training and Testing Institute (NERFMTTI), Biswanath Chariali, Sonitpur, Assam- 784176.

Technology no. 10

1. **Name of the Technology:** Tractor Drawn Post Hole Digger.
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 2004
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** Posthole digger is an attachment to the three-point linkage of tractor. It consists of an auger, which is driven through bevel gears. The auger gets drive from the tractor pto through a propeller shaft and bevel gear box. The perpendicularity of digging auger is maintained with four-bar linkage formed by hitching system the tie rod provided at the top, The tip of the auger is either diamond shaped or pointed with wings to suit to different soil conditions. The diameter and depth of hole can be changed by changing the auger assembly. It is suitable for planting orchards and forests. It saves 90 percent labour, time and 50 percent operating cost over manual digging.

Fig.1. Operation of Tractor operated post hole digger for planting banana sampling.

6. **Critical inputs:** Post hole digger
7. **Observations to be recorded:**

i. Field capacity (holes/hr

ii. Operating cost (Rs./ha)

8. **Contact Address for relevant information:** Central Institute of Agricultural Engineering Nabi Bagh, Berasia Road, Bhopal - 462 038.

Technology no. 11

1. **Name of the Technology:** Twin Wheel Hoe.
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 1996
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** Twin wheel hoe consists of two wheels, frame, V-blade fixed on a Tyne, U-clamp and a handle. The cutting and uprooting of weeds in field is done through push and pull type action of the equipment. The equipment is operated at optimum soil moisture condition and preferably after 20-25 days of sowing i.e. when the weeds are small i.e. 1 to 3 cm height for better weeding performance. It is used for weeding and intercultural operation in upland row crops.

Fig.1.Twin Wheel Hoe under operation

6. **Critical inputs:** Twin Wheel Hoe.
7. **Observations to be recorded:**
   - i. Field Capacity (%).
   - ii. Weeding Efficiency (%).
   - iii. Labour requirement (man-h/ha).
   - iv. Operating cost (Rs./ha).
8. **Contact Address for relevant information:** Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.

Technology no. 12

1. **Name of the Technology:** Wheel Hoe.
2. **Source of the Technology:** ICAR, Barapani.
3. **Year of release:** 1996
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** The wheel hand hoe is a widely accepted weeding tool for doing weeding and interculture in row crops. It is a long handled tools operated by pushing and pulling action. The number of wheel varies from one to two and the diameter depends upon the design. The frame has provision to accommodated different types of soil working tools such as, straight blade, reversible blades, sweeps, V -blade, tine cultivator, pronged hoe, miniature furrower, spike harrow (rake) etc. It can be operated by a single person. It is used for weeding and intercultural operations in vegetables and other crops sown in rows.
6. **Critical inputs:** Wheel Hoe.

Fig.1. Wheel Hoe (Single tyne)

7. **Observations to be recorded:**
   i. Field Capacity (%).
   ii. Weeding Efficiency (%).
   iii. Labour requirement (man-h/ha).
   iv. Operating cost (Rs./ha).
8. **Contact Address for relevant information:**
   i. Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umian (Barapani)-793103, Meghalaya.
   ii. Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.

Technology no. 13

1. **Name of the Technology:** Hand Ridger.
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 1996.
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** A manually operated hand ridger has been developed for making ridges. It consists of ridger and pulling beam with T- type handle. Field needs to be well prepared for getting better performance of equipment for making ridges/furrows. The equipment is operated by two women workers, one for pulling and another for pushing and guiding. It is used for making ridges in field to sow vegetables on ridges. It can also be use for earthing of vegetables crops. The equipment can also be used for making furrows in field for irrigation.
6. **Critical inputs:** Hand Ridger

Fig.1. Hand Ridger

7. **Observations to be recorded:**
    i. Field Capacity
    ii. Labour requirement (man-h/ha
    iii. Operating cost (Rs./ha).
8. **Contact Address for relevant information:** Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.

Technology no. 14

1. **Name of the Technology:** Foot Sprayer**.**
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 1985
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** The foot sprayer is one of the ideal and versatile sprayers used for multipurpose spraying jobs. The sprayer consists of a pump operated by the foot lever, suction hose with strainer, delivery hose, spray lance fitted with shut off pistol valve, gooseneck bend and adjustable nozzles. The pump barrel is mounted on a steel frame, which provides it stability when placed on the ground. It has a provision of two strong springs, which retract the foot lever to its original position after each pumping stroke. The sprayer does not have inbuilt tank, therefore an additional storage device or container is required to store the spray liquid in which the strainer suction hose remains submerged. It has provision for the two discharge lines, which increases its versatility and field capacity. The plunger pump being a positive displacement pump, builds up a high pressure to throw spray liquid to larger distances with a suitable boom. For operation the inlet pipe is placed in the storage container and one person continuously operates the pump by foot lever. There is a provision for the operator to hold the sprayer at the top by V-type fixture. The other person directs the lance to the target. For spraying tall trees up to a height of 10 m, a high jet or bamboo lance. The foot sprayer is all purpose sprayers, suitable for both small and large scale spraying on field crops, in orchards, vegetable gardens, tea and coffee plantations, rubber estates, flower crops, nurseries etc.
6. **Critical inputs:** Foot Sprayer**.**
7. **Observations to be recorded:**
   - i. Field capacity (ha/day).
   - ii. Labour requirement (man-h/ha).
   - iii. Operating cost (Rs./ha).
8. **Contact Address for relevant information:**
   - i. Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road,Bhopal - 462038.
   - ii. Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umian (Barapani)-793103, Meghalaya.

Fig.1. Foot Sprayer.

Technology no. 15

1. **Name of the Technology:** Multicrop Planter.
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 2000
4. **Agro Climatic Zone:** Eastern Himalayan region/NEH Region.
5. **Details description about the technology:** In the multicrop planter, the planting attachment consists of hopper, inclined plate metering mechanism fitted in the hopper, furrow openers, ground wheel, power transmission mechanism and seed tubes. For operation, the seed is filled in the hopper, seeds are picked up by the cells of inclined plateand delivered in the opening connected to furrow opener through seed tubes. It can plant crops like maize,cotton, soybean, and sunflower etc. Seed-metering mechanism in planting attachment is ofinclined plate type with notched cells for each row. Row to row spacing and plant-to-plantspacing is adjustable. Plant to plant spacing can be varied by changing the transmission ratio.The drive to the metering mechanism is given through the ground wheel by means of chains,sprockets and bevel gears.
6. **Critical inputs:** Multicrop Planter

Fig.1. Multicrop Planter.

7. **Observations to be recorded:** i. Field Capacity (ha/hr). ii. Field Efficiency (%). iii. Number of plants (per m^2). iv. Seed rate (Kg/ha). v. Labour requirement (man-h/ha). vi. Operating cost (Rs./ha).
8. **Contact Address for relevant information:**
Central Institute of Agricultural Engineering(CIAE), Nabi Bagh, Berasia Road, Bhopal - 462 038.

Technology no. 16

1. **Name of the Technology:** Engine operated walk behind type rice transplanter (4-row).
2. **Source of the Technology:** CIAE, Bhopal.
3. **Year of release:** 2001
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** This rice transplanter consists of prime mover transmission, engine, float, lugged wheels, seedling tray, seedling tray shifter, pickup fork and pickup fork cleaner. It is a walk behind type rice transplanter using mat type nursery and it transplants the seedling uniformly without damaging them. The planting depth and hill-to-hill spacing can be adjusted. Automatic depth control helps in maintaining uniform planting depth. The overall dimension of the machine is 2450×1480×950mm with a field capacity of 0.15-0.21ha/hr
6. **Critical inputs:** Rice transplanter, mat type nursery.

Fig. 1. Engine operated walk behind type rice transplanter (4-row).

7. **Observations to be recorded:**
   i. Field Capacity (ha/hr).
   ii. Field Efficiency (%).
   iii. Hill density,hill/ m^2.
   iv. Fuel consumption lit/hr.
   v. Labour requirement (man-h/ha).
   vi. Planting efficiency, %.
   vii. Operating cost (Rs./ha).
8. **Contact Address for relevant information:** Central Institute of Agricultural Engineering(CIAE), Nabi Bagh, Berasia Road, Bhopal – 462038.

Technology no. 17

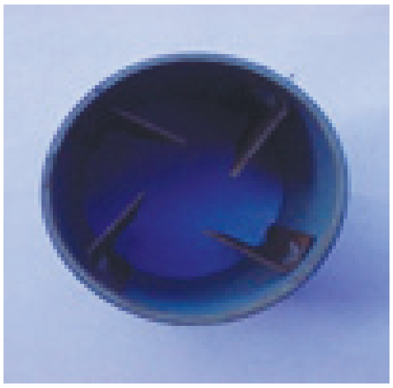
1. **Name of the Technology:** Pedal operated paddy thresher (OUAT Model).
2. **Source of the Technology:** OUAT.
3. **Year of release:** 2004
4. **Agro Climatic Zone:** Eastern Himalayan Region/NEH Region.
5. **Details description about the technology:** It consists of wire-loop type threshing cylinder, power transmitting system, mild steel body and foot pedal. The threshing cylinder consists of wire-loop U shape embedded in wooden or metallic strips joined to two discs. A shaft carries the threshing cylinder and is connected to the transmission system. The transmission system consists of meshed gears or sprocket-chain mechanism. The larger gear or sprocket is connected to foot pedal with link. The foot pedal is always in raised position. On pressing the pedal the threshing cylinder starts rotating. For continuous rotation of the cylinder the pedal is lowered and raised repeatedly. It is used for threshing of paddy crop and well suited under hiily areas.

Fig.1. Pedal operated paddy thresher.

6. **Critical inputs:** Pedal operated paddy thresher.
7. **Observations to be recorded:**
   i. Output capacity (kg/hr).
   ii. Labour requirement (man-h/q).
   iii. Threshing efficiency (%).
   iv. Cost of threshing per hectare.
8. **Contact Address for relevant information:**
   i. Orissa University of Agriculture & Technology (OUAT), Bhubaneswar- 751003, Orissa, India
   i. Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umian (Barapani)-793103, Meghalaya.

Technology no.18

1. **Name of the Technology:** Light weight and low cost Plastic Maize Sheller for drudgery reduction
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development**: 2015
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs)**: Feedback of farmers on use of iron maize sheller developed by CIAE, Bhopal encouraged to develop light weight and low cost plastic maize sheller for enhancing shelling efficiency and increase life of the equipment. It is hand held type plastic maize sheller of tubular shape used for shelling of maize cob. Diameter of maize sheller is 60 mm, length 70 mm, fitted with 4 number of fins and weight is approx 90 g. Tubular body is made of PVC pipe and tapered fins of MS sheet are riveted inside the tubular body. Shelling is done by holding the sheller in one hand and gradually inserting the cob in the tube by other hand with backward and forward twist. It is rust proof and safe for hands. Shelling capacity is 25-30 kg/h as compared with traditional shelling of 10-12 kg/h. Saves 66% labour and operating time. Cost of fabrication is Rs.67/- against GI maize sheller of Rs.85/ per piece.




6. **Critical inputs required**: Matured maize cob
7. **Observations to be recorded**: Duration of operation, quantity of maize grain shelled, quantity of broken grains.
8. **Contact Address for relevant information:** The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103
   Phone: 0364-2570257, Fax: 0364-570213

Technology no.19

1. **Name of the Technology:** Beehive Briquette Mould developed for small scale entrepreneurship by land less farmers.
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2016
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** This equipment is used for making briquettes from charcoal powder. Overall Dimension of the equipment is 250 mm × 100 mm. It consists of three parts a) cylinder, b) base plate with 21 rods and c) cover plate. Base plate has total 21 rods of 12 mm diameter and 95 mm height which are welded on it. Cover plate has same number of holes of diameter 13 mm so that it can move through the rods on base plate easily. After putting cover plate and cylinder on base plate, the mixture prepared with charcoal powder, clay and water is put into the cylinder and the whole unit is beaten on a wooden plank to increase the compaction of the mixture. Then the cylinder and cover plate are pulled out of the base plate along with the briquette. It is placed upside down on ground and pressed to release the briquette. Thus the dimension of each briquette is 146 mm in diameter and 85 mm in height which perfectly fits in a charcoal/ wood stove available in the market. It was found that targeting to produce 6000 briquettes per month a profit of Rs.24, 000 can be earned. The input cost per briquette was found as Rs.6.5. if the charcoal produced in-house then the cost could be much lower.

6. **Critical inputs required:** Charcoal powder, clay soil, water
7. **Observations to be recorded**: Number of briquettes made per day, time required to make each briquette, life of briquette mould, marketing price of briquette.
8. **Contact Address for relevant information:** The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

   Phone: 0364-2570257, Fax: 0364-570213

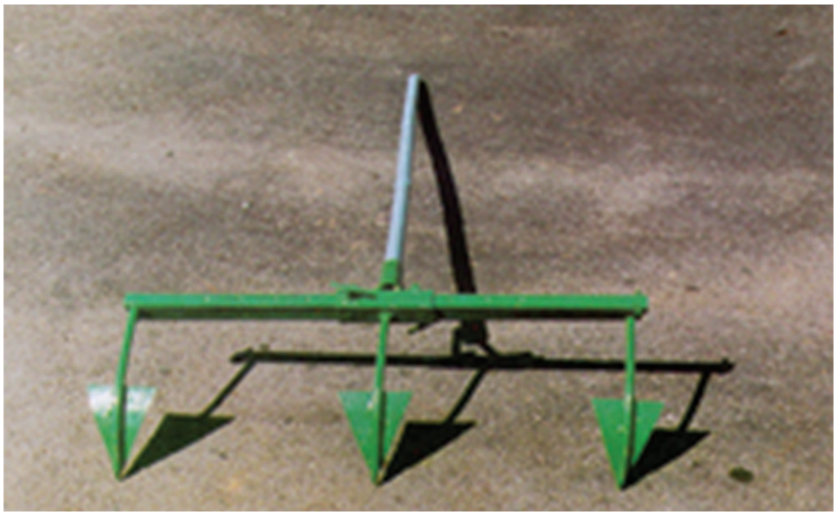
Technology no.20

1. **Name of the Technology**: Modified Cono weeder
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development**: 2008
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** It is manually operated equipment for weeding in low land paddy in the presence of water. Overall dimension is 1740x200x940 mm and weight approx 7.0 kg. It mainly consists of two rotors, float, frame and handle. Rotors are cone frustum with serrated strips, mounted in tandem with opposite orientation. It is operated by pushing action and pulling action and suitable for weeding in low land paddy, when water is present in the field. - One person is required to operate the equipment without bending the posture thus reducing drudgery of work, 60% saving in cost as compared to manual weeding.

6. **Critical inputs required:** Labour to operate the equipment
7. **Observations to be recorded:** Width of operation, depth of water present in the field, weeding efficiency, field capacity, labour requirement per unit area
8. **Contact Address for relevant information:** The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103
Phone: 0364-2570257, Fax: 0364-570213

Technology no.21

1. **Name of the Technology:** Adjustable Row Marker
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 1998
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology:** It is manually operated equipment suitable for marking rows on seed bed for maintaining row to row spacing while using single row seeding device. Overall dimension of the equipment is 240x120x60 cm and weight is 2 kg. Three number of rows can be marked at a time and row to Row spacing can be adjusted from 20 to 60 cm. Field capacity of 0.2 ha/h at 60 cm spacing and 0.06 ha/h at 20 cm spacing can be achieved using this equipment. Marking of rows in the field is faster as compared with traditional method of using rope and peg.
6. **Critical inputs required:** Man –power,



7. **Observations to be recorded**: Row spacing, depth of furrow made, field capacity, labour requirement per unit area
8. **Contact Address for relevant information:** The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

   Phone: 0364-2570257, Fax: 0364-570213

Technology no.22

1. **Name of the Technology:** Metallic tip dibbler
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 1994
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs) :** Metallic tip dibbler is having a cone shape point for making hole and fitted with wooden handle. It is used for dibbling maize and other bold seeds on steep slopes manually. It helps in getting better output per unit time as compared with local dibbling stick. Seeds can be sown up to 7 cm depth as compared to 3-4 cm with wooden stick. Its field capacity is about 0.10 ha/day at 40 cm row-to-row spacing.

6. **Critical inputs required:** Seed to be sown, labour for operating the equipment
7. **Observations to be recorded:** Depth of sowing, plant to plant spacing, area covered, field capacity, labour requirement per unit area
8. **Contact Address for relevant information:** The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

   Phone: 0364-2570257, Fax: 0364-570213

Technology no.23

1. **Name of the Technology:** Long handle weeders
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 1994
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** Five designs of long handle weeders namely Multipurpose "U" blade weeder, Garden rake, V-blade weeder, Hand grass slasher and Hand fork are suitable for performing weeding operation manually without bending thus reducing drudgery of the operator with increased output. These weeders are suitable for weeding in vegetable fields. The uprooted weeds can be collected using garden rake. With these hand tools labour saving to the extent of 60-65% can be achieved over traditional method.
6. **Critical inputs required:** Labour for operating the hand tools

7. **Observations to be recorded:** Type of crop, width and depth of cut, field capacity, weeding efficiency, labour requirement.
8. **Contact Address for relevant information:**

The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

Phone: 0364-2570276, Fax: 0364-2570213

Technology no.24

1. **Name of the Technology:** Adjustable Zero Till Furrow Opener
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2013
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** It is manually operated equipment for making furrow under zero till condition. Two persons are required to operate the equipment. There are two numbers of furrow openers fitted on it which can open furrow of 2-3 cm width and 3-4 cm depth. The furrow opener is of narrow tine type with rake angle of 30° fitted with two small boards to overturn the soil. Row spacing can be adjustable between 20-60 cm. It has a long pulling handle and a guiding handle. It is suitable for making furrow for sowing mustard, pea and lentil after harvesting paddy. Field capacity vary from 0.06 to 0.2 ha/h depending on row width.
6. **Critical inputs required**: Seed to be sown, two labourers

7. **Observations to be recorded:** Row spacing, depth of furrow made, field capacity, labour requirement
8. **Contact Address for relevant information:** The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

   Phone: 0364-2570257, Fax: 0364-570213

Technology no.25

1. **Name of the Technology:** Fruit harvesters
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2001
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** Two different types of fruit harvesters designed are a) Hold and cut type and b) Hold and twist type. Fruits such as orange and guava can be harvested while standing on the ground. After picking 5-7 fruits at a time the holder bag are emptied. With the use of this harvester damage to the fruits can be minimized which will increase shelf life of fruits. These light weight fruit harvesters are simple and easy to operate.

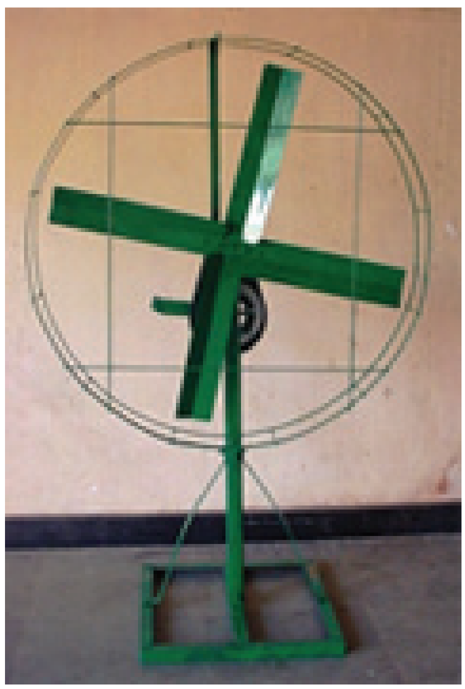

6. **Critical inputs required:** Fruits ready for harvesting
7. **Observations to be recorded:** Type of fruit harvested, number of fruits harvested per unit time, fruit damage percentage, ease of operation
8. **Contact Address for relevant information:**

The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

Phone: 0364-2570257, Fax: 0364-570213

Technology no.26

1. **Name of the Technology:** Modified Hand operated Winnower
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2008
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** It is a manually operated hand winnower used for cleaning threshed paddy grains and separation of straw, husk, dust and other light weight foreign material from paddy crop. One person is required for the operation of this equipment while another person release grains from height so as to separate the husk or other unwanted light material from the grain by air flow of the winnower. Overall dimension of the equipment is 1.16x1.16x1.77 m and weight is 29 kg.
6. **Critical inputs required:** Grain to be cleaned, basket for dropping the grains in front of winnower, two labours



7. **Observations to be recorded:** Quantity of grain cleaned per unit time, cleaning efficiency, labour requirement
8. **Contact Address for relevant information:**

The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

Phone: 0364-2570257, Fax: 0364-570213

Technology no.27

1. **Name of the Technology**: Pedal Paddy Thresher
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:**
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** It is manually operated equipment for threshing harvested paddy. Pedal thresher consists of threshing cylinder, pedal and grain shield. Threshing cylinder fitted with wire loops perform threshing operation by combing action. The overall dimension of the equipment is 1.25x0.65x0.63 m. The output capacity is 40-50 kg grain/hr with threshing efficiency of 98%.
6. **Critical inputs required:** Harvested paddy crop, two labours

7. **Observations to be recorded:** Quantity of grain cleaned per unit time, cleaning efficiency, labour requirement
8. **Contact Address for relevant information:**

   The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

   Phone: 0364-2570257, Fax: 0364-570213

Technology no.28

1. **Name of the Technology:** Power paddy Thresher
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2009
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** It is an improvement over pedal type paddy thresher. It consists of threshing cylinder, blower, prime mover (1 HP motor) and grain shield. Its capacity is four times higher than that of pedal type. Blower fitted with the machine helps to throw the broken chaff at some distance away from grain. The machine can be operated either with 1.0 hp electric motor or 2 hp engine. Threshing cylinder and prime mover can easily be detached (if required) from the frame to enable easy transportation of thresher in hilly area. There is saving of about 80% labour requirement and 74% on cost of operation against pedal type paddy thresher. Dimension is 0.85x0.75x0.75 m and weight approx 50 kg. The output capacity of the equipment is 150-200 kg/h with 98% threshing efficiency.
6. **Critical inputs required:** Harvested paddy crop, single phase AC supply, two laboures

7. **Observations to be recorded:** Quantity of grain threshed, threshing efficiency, cleaning efficiency, labour requirement
8. **Contact Address for relevant information:**

   The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

   Phone: 0364-2570257, Fax: 0364-570213

Technology no.29

1. **Name of the Technology:** Power Tiller operated Inclined Plate Planter
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2013
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** It is a Power tiller operated 3 row inclined plate planter for sowing maize, soybean and pea in terraces and valley lands. Chain and sprocket mechanism is used for getting drive from ground wheel to seed metering shaft. Bevel gears are used for operating the seed plates. There is provision for sowing different crops by selecting appropriate seed plates for different crops and by changing the transmission ratios. The overall dimension of the planter is 900 x 990 x 610 mm (lxwxh) having row spacing range of 130-280 mm. The equipment is fitted with shoe type furrow opener and inclined plate with edge cells type seed metering mechanism.
6. **Critical inputs required:** Seed to be sown, conventional power tiller (12 HP)

7. **Observations to be recorded:** Row spacing, average depth of sowing, area covered, field capacity
8. **Contact Address for relevant information:**

The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103
Phone: 0364-2570257, Fax: 0364-570213

Technology no.30

1. **Name of the Technology:** Bio-terracing techniques for slow conversion of hill slopes into terraced land
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2014
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** Bio-terracing technology provides an option for conversion of hilly slope into bench terrace on hill slopes. The hedgerows are established by planting of fast-growing and deep rooted leguminous trees or shrubs such, as *Leucaena leucocephala, Gliricidia sepium, Erythrinasp*. etc. along the contours on a hill slope. The spacing (vertical interval) of the hedgerows may be designed as per the land slope. However, in NEH region vertical interval between the hedgerows has been recommended as 1.0–1.5 m. Crops are planted between hedgerows. Accumulation of organic matters through leaf litter of hedgerow species improves the water holding capacity and improves other physical properties of the soils. *Cajanus cajan, Crotalaria tetragona, Desmodium rensonii, Flemingia macrophylla* and *Indigofera tincotoria* are some of the hedgerow species of the region. Regular pruning of nitrogen fixing hedgerow species added 20–80, 3–14 and 8–38 kg ha^{-1} yr^{-1} of nitrogen, phosphorous and potassium, respectively. The hedgerow helps in progressive development of terraces through accumulation of up slope hedgerow and stabilization of risers against rain storms by stems and roots. Among perennial grasses legumes–*Stylosanthus guyamensis, Shameta, thin nappier* and *Seteria sphaculata* with yield potential of 19.7, 19.0, 65.05 and 80.86 t ha^{-1} of green fodder may be planted on bunds and terrace risers.
6. **Critical inputs required: Leguminous grasses or hardy hedge row grasses**

7. **Observations to be recorded:** Spacing of staggered ows, plant to plant and row to row distance
8. **Contact Address for relevant information:**

The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103
Phone: 0364-2570257, Fax: 0364-570213

Technology no.31

1. **Name of the Technology:** Agrifilm Lining of Water Harvesting Pond on Hillslopes using Plastic
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2016
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** The pond is dug as per the design. Pond bed and sides are made weed and stone free. Steps at 50 cm vertical interval are made on sides of the pond to hold the agrifilm at its place. On top of the sides, continuous trench of 50x50 cm is dug for the purpose of anchoring the agrifilm to prevent it from sliding down. Pre-emergence weedicide is also sprayed on sides and bed to arrest the weed growth. After the sides and bed are dressed properly, 10cm thick layer of sieved sand is spread uniformly on bed and sides to provide cushion to the agrifilm. Perforated plastic pipes are laid in trenches. Pipes are wrapped with coir rope to prevent choking of the perforations in the pipe. Then pipes are covered with sand. After that, agrifim is laid properly in the pond. LDPE agrifilm of 250 μ is used for lining. Utmost care is taken in joining the agrifilm to suit the shape and size of the pond. For joining, bitumen of 85/25 and 80/100 grade in the ratio of 2: 1 is used. Over agrifilm, soil cover of 30 cm is provided. Then stone pitching is done on sides only to safeguard the sides of the pond against erosion and any other external forces. Safety mechanism included a well-designed drainage system with perforated plastic pipe laid on the bottom of pond to drain out seepage water.

   Cost of construction: Rs 1, 75,000/- for a 260 m^3 of pond having life of 15 years

   Benefit: Seepage loss reduced from 55 (unlined) to 2.9 $L/m^2/day$ i.e. by 94.7%.

   Small agrifilm lined water harvesting ponds of capacity 15 – 20 m^3 are successfully constructed in the farmer's filed at upper reaches of the hill slope to utilize the harvested rainwater for irrigating homestead gardens by gravity flow and to meet the water requirement for poultry, pig or cattle in the dry season.

   More advanced and durable plastic materials like silpaulin, HDPE or nylon also can be used for the lining of water harvesting tanks using the same technology.
6. **Critical inputs required:** Availability of terrace width, LDPE/HDPE
7. **Observations to be recorded:** Wetting front, labour requirement, evaporation
8. **Contact Address for relevant information:**

   The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103

Technology no.32

1. **Name of the Technology:** Low cost bamboo frame polyhouse technology for terraced beds on hill slopes
2. **Source of the Technology:** Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya
3. **Year of release/ development:** 2013
4. **Agro Climatic Zone:** Eastern Himalayan Region
5. **Detail description about the technology (with suitable photographs):** Hill cultivation is affected by low temperature, insect and pests. Cultivation of cash crops and high value off season vegetables protected cultivation under poly house condition has been recommended. Initial cost of construction using iron frame is high. A technology was developed and evaluated replacing iron frame by locally available bamboo frame. The cost of construction has reduced drastically to 1/3rd of the iron framed poly house in which resource poor farming community can afford. A rectangular terraced portion of 20m x 5m land is selected and bamboo posts painted with bitumen at 5m intervals (lengthwise & 2.5m (widthwise) making longitudinally arc shape. Splitted bamboo post are used to provide supports. 200 μ thick UV stabilized transparent LDPE film is cladded over the frame fixed with nails to make the house. Most profitable cropping sequence of the capsicum-tomato-lettuce with assured income of Rs. 197.90 m^{-2} of land per year has been recommended from cost of construction of Rs. 240 per m^2 of floor area (at 2014 cost index).

6. **Critical inputs required:** Bamboo, UV stabilized LDPE film, bitumen, rope, nails
7. **Observations to be recorded:** Crop growth parameters, yield, insects and pest infestation
8. **Contact Address for relevant information:**

The Head, Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya – 793 103
Phone: 0364-2570257, Fax: 0364-570213

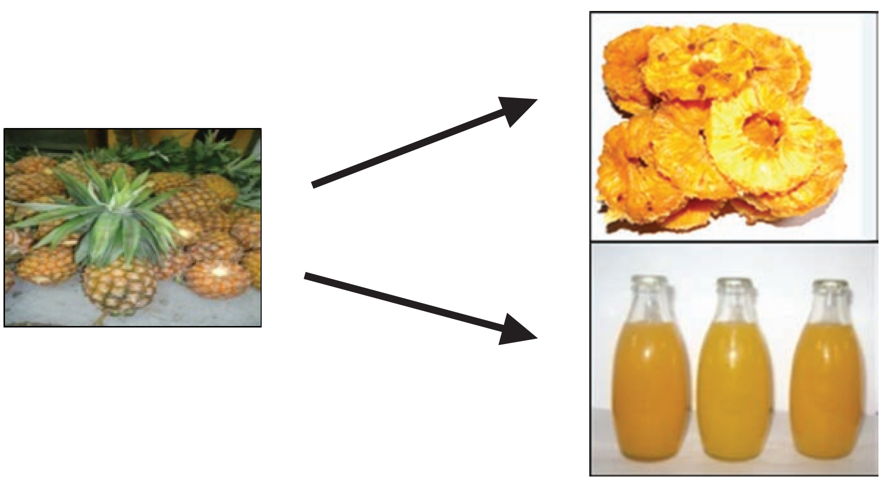
Process and Food Engineering

Technology no. 33

1. **Name of the Technology:** Processing and value addition of pineapple for production of osmo dehydrated slices, juices, titbits etc.
2. **Source of the Technology:** College of Agricultural Engineering and PHT, CAU, Ranipool - 737135, Sikkim
3. **Year of release:** 2010
4. **Agro Climatic Zone:** All agro-climatic zones of NEH, India
5. **Detail description about Technology**

   Juices
   - Sorting, washing, peeling and cutting of pineapple slices
   - Extraction of juice using juice extractor
   - Processing of juice with additives
   - Bottling/packaging of juices

   Osmo-air dried slices
   - Sorting, washing, peeling and cutting of pineapple slices
   - Osmotic dehydration using sugar syrup
   - Tray drying of osmo-dried slices
   - Packaging of osmo-air dried slices



6. **Critical input required:** Pineapple, Sugar syrup, Additives, Washer, Cutter, Corer, Slicer, Juice extractor, Tray drier, Hand sealers, Bottling machine, and Crown corking machine.
7. **Observations to be recorded:** Total soluble solids content, Acidity, Processing temperature and time, Slice thickness, Drying air temperature and time, Packaging weight.
8. **Contact Address for relevant information:**
   - ➢ Director of research, CAU, Imphal
   - ➢ Dean, CAEPHT, Ranipool, Gangtok

Technology no.34

1. **Name of the Technology:** Blended RTS beverages using passion fruit, orange and ginger
2. **Source of the Technology:** College of Agricultural Engineering and PHT, CAU, Ranipool - 737135, Sikkim
3. **Year of release:** 2010
4. **Agro Climatic Zone:** All agro-climatic zones of NEH, India
5. **Detail description about Technology**
    - Sorting, washing and peeling of fruits and spices
    - Extraction of passion fruit, orange and ginger juice using juice extractor
    - Blending of juices in different proportions
    - Addition of sugar and KMS as per RTS formulae
    - Pasteurization of blended beverages
    - Bottling of blended beverages

6. **Critical input required**: Passion fruit, Orange, Ginger, Sugar, KMS, Sugar syrup, Washer, Juice extractor, Bottling machine
7. **Observations to be recorded:** Total soluble solids content, Acidity, Pasteurization temperature and time, Packaging volume
8. **Contact Address for relevant information**
    - ➢ Director of research, CAU, Imphal
    - ➢ Dean, CAEPHT, Ranipool, Gangtok

Technology no.35

1. **Name of the Technology:** Value addition of high value cut flowers
2. **Source of the Technology:** College of Agricultural Engineering and PHT, CAU, Ranipool - 737135, Sikkim
3. **Year of release:** 2009
4. **Agro Climatic Zone:** All agro-climatic zones of NEH, India
5. **Detail description about Technology**
    - Sorting of cut flowers
    - Cutting to suitable length
    - Packaging in suitable packaging films using hand sealer
    - Shrink packaging of cut flowers
6. **Critical input required:** Orchids, Cartons, Packaging film, Hand sealer, Shrink packaging machine.

7. **Observations to be recorded:** Length of cut flowers, Shrink packaging temperature.
8. **Contact Address for relevant information**
    - ➢ Director of research, CAU, Imphal
    - ➢ Dean, CAEPHT, Ranipool, Gangtok

Technology no.36

1. **Name of the Technology:** Essential oil extraction from Lemongrass and Java Citronella
2. **Source of the Technology:** College of Agricultural Engineering and PHT, CAU, Ranipool - 737135, Sikkim
3. **Year of release:** 2013
4. **Agro Climatic Zone:** All agro-climatic zones of NEH, India
5. **Detail description about Technology**
   - Field drying of Lemongrass and Java Citronella for 12-16 h after harvesting
   - Steam distillation using steam distillation plant
   - Collection of oil
   - Packaging of oil in consumer pack or in bulk for marketing to dealers of aromatic oils
6. **Critical input required:** Lemongrass, Java citronella, Steam distillation plant, Packaging containers

7. **Observations to be recorded:** Temperature of condenser, Water flow rate in steam distillation plant, volume of oil for packaging
8. **Contact Address for relevant information**
   - Director of research, CAU, Imphal
   - Dean, CAEPHT, Ranipool, Gangtok

Technology no.37

1. **Name of Technology:** Development of portable manual mulch laying machine for hill terraces
2. **Source of Technology:** All India Coordinated Research Project on Plasticulture Engineering and Technologies (PET)
3. **Year of Release:** 2014-16
4. **Agro Climatic Zone:** Humid
5. **Detail description about the technology:**

   The portable manual mulch laying machine was fabricated at the AICRP-PET's CAEPHT, Ranipool Centre in 2014. The two furrow openers made up of MS flat were attached to the machine for soil inversion on plastic mulch sheet from two ends along its length. A plastic sheet roll carrier and a handle for manual pulling of the machine are other important machine attachments.

Manual mulch laying machine fabricated at AICRP-PET's CAEPHT, Ranipool

Manual mulch laying machine after satisfactory operation

6. **Critical input required:**

   Specifications of the Machine :

   Size/ Dimensions of the machine : Length: 1.75 m, Width: 1.4 m

   Width of mulch sheet : 1.2 m

   Material of Make : Iron (MS) frame

   No. of furrow openers : Two

   Operation : Manual pulling

   Machine cost : 2,500/-

7. **Observations to be recorded:** In its testing inside the poly-house, it was observed that the soil inversion was satisfactory. Sufficient soil was turned on to the plastic mulch sheet,

besides a very good unrolling and laying of the plastic mulch sheet.

8. **Contact address for relevant information**

   The Project In-charge, All India Coordinated Research Project on PET, Department of Soil and Water Engineering, CAEPHT, Ranipool

Technology no.38

1. **Name of Technology: Gravity fed micro irrigation system**
2. **Source of Technology:** College of Agril Engineering & PHT, CAU
3. **Year of Release:** 2011
4. **Agro Climatic Zone:** Humid
5. **Detail description about the technology:**

   The rain water falling on a roof is collected through suitable channel. The water is collected in a tank. The tank is placed at a height of more than 18 m height to provide suitable pressure. The water under when routed to micro sprinkler it provides a rainfall patter with uniformity of distribution.
6. **Critical input required:** Roof size, rainfall pattern and probable use
7. **Observations to be recorded:**
   i. Head (pressure difference between sprinklers and collecting tank): Most of the sprinklers operate at optimal efficiency at a pressure of 1.8 Kg/cm^2 or 18 m.
   ii. Leakage of piping system
   iii. Time of operation
8. **Contact address for relevant information:** Department of Soil and Water Engineering, College of Agricultural Engineering and PHT, Ranipool; (E) Sikkim- 737135

Renewable Energy Engineering

Technology no.39

1. **Name of the technology:** Drying of freshly harvested large cardamom using fuel wood/ briquettes.
2. **Source of the Technology:** Department of Farm Power and Machinery, College of Agricultural Engineering and Post Harvest Technology, CAU, Ranipool, Gangtok, Sikkim
3. **Year of release:** 2012
4. **Agro Climatic Zone:** Any Where
5. **Detail description about the technology**

   Smokeless stove operated hot air drier is suitable for drying of freshly harvested large

cardamom using wood/briquettes fuel, comparatively in smaller quantity than the conventional biomass combustion based drying. Freshly harvested large cardamom can be dried in 6–8 h of its continuous operation.

6. **Critical inputs required:** Nil
7. **Observations to be recorded**

   Initial moisture content, %

   Final moisture content, %

   Weight of product, kg

   Ambient air temperature, °C

   Dryer air temperature, °C

   Solar insolation, W/m^2
8. **Contact address for relevant information:** Department of Soil and Water Engineering, College of Agricultural Engineering and PHT, Ranipool; (E) Sikkim- 737135

Technology no.40

1. **Name of the technology:** Portable Side Feed Smokeless Cook Stove
2. **Source of the Technology:** Department of Farm Power and Machinery, College of Agricultural Engineering and Post Harvest Technology, CAU, Ranipool, Gangtok, Sikkim
3. **Year of release:** 2012
4. **Agro Climatic Zone:** Any Where
5. **Detail description about the technology**

   This is a portable and light weight insulated metallic biomass cook stove, which uses long size fuel wood sticks for continuous operation. The equipment is well suitable for indoor & outdoor cooking of food without production of smoke during combustion.
6. **Critical inputs required:** Nil
7. **Observations to be recorded**

   Moisture content of biomass, %

   Weight of biomass, kg

   Initial water temperature, °C

Flame Temperature, ^{o}C

Time taken for cooking measured quantity, h

Quantity of biomass consumed in cooking, kg

8. **Contact address for relevant information:** Department of Soil and Water Engineering, College of Agricultural Engineering and PHT, Ranipool; (E) Sikkim- 737135

Technology no.41

1. **Name of the technology:** Mixed Mode Photovoltaic Powered Forced Convection Solar Dryer
2. **Source of the Technology:** Department of Farm Power and Machinery, College of Agricultural Engineering and Post Harvest Technology, CAU, Ranipool, Gangtok, Sikkim
3. **Year of release:** 2015
4. **Agro Climatic Zone:** Any Where
5. **Detail description about the technology**

   It is combination of direct and indirect solar dryers. Product may dry with both direct exposure to solar radiation and hot air supplier on it. The dryer had capacity to dry10 kg of drying product. The solar dryer has total collector area of 0.9902 m^2 including 0.5002 m^2 of solar air collector area, 0.49 m^2 of drying area. The air can be circulated within dryer with the help of 12 V DC fan operated on 37 Wp solar PV module. It is recommended that the developed mixed mode photovoltaic powered forced convection solar dryer can be used for drying of agricultural and horticultural products, which reduces quality degradation over an extended storage period. The developed solar dryer can be provided a promising option for drying various agricultural and horticultural products in NEH region. The developed solar dryer can be used to heat air up to the range 55-75^{o}C temperature needed for drying of most of the agricultural and horticultural products, efficiently and economically without compromising in quality of final product.
6. **Critical inputs required:** Nil
7. **Observations to be recorded**

   i. Initial moisture content, %

   ii. Final moisture content, %

   iii. Weight of product, kg

   iv. Ambient air temperature, ^{o}C

   v. Dryer air temperature, ^{o}C

   vi. Solar insolation, W/m^2

8. **Contact address for relevant information:** Department of Soil and Water Engineering, College of Agricultural Engineering and PHT, Ranipool; (E) Sikkim- 737135

Technology no.42

1. **Name of Technology:** Portable Pv Powered Forced Convection Solar Dryer
2. **Source of Technology:** College of Agricultural Engineering and Post Harvest Technology, Central Agricultural University, Ranipool, Gangtok, Sikkim
3. **Year of release:** 2014
4. **Agro climatic Zone:** All states.
5. **Brief description**

This dryer has four main components viz. flat plate collector, drying trays, exhaust fan and solar PV module. The drying chamber is made up of M.S. angle, G.I. sheet and glazing material with the frame of size of (700×700) mm^2, opposite wall size of (700×700) mm^2 and front side size of (890×700) mm^2 with the inclination of 45°. The two drying trays are contained inside the drying chamber which is made up of aluminum angle, aluminum strip and steel wire mess. The lower and upper tray are fitted at the height of 150 mm and 350 mm from the base of the dryer. The size of lower and upper tray are (680×490) mm^2 and (680×270) mm^2 respectively. Air inlet is provided in the one fourth area of the base with the diameter of 600 mm.

Specification

Type and model	Forced convection
Area of the flat plate, m^2	0.49
Loading capacity, kg/batch	5
Glazing materials	Glass
Air circulation mode	PV powered forced convection
Power of PV Module, Wp	5
No. of trays	02
Unit Price, Rs.	5,000/-

Performance

Average air temperature attained in the solar dryer is about 40 °C higher than the ambient temperature. The chilly is dried within 32 hour of solar radiation from initial moisture content 80 % to the final moisture content about 10% (w.b). The thermal efficiency of the dryer is 30%.

Benefits

The dryer has high efficiency, uniform drying of products, suitability for NEH region, drying temperature in desirable range, light weight and easy to handle.

6. **Contact address for relevant information:** Department of Soil and Water Engineering, College of Agricultural Engineering and PHT, Ranipool; (E) Sikkim- 737135

Technology no.43

1. **Name of Technology:** Modified Double Pot Improved Biomass Cook Stove
2. **Source of Technology:** College of Agricultural Engineering and Post Harvest Technology, Central Agricultural University, Ranipool – 737135, Gangtok, Sikkim.
3. **Agro climatic zone:** All state of NEH region
4. **Year of release:** 2013
5. **Brief description of Technology:**

   The modified double pot improved biomass cook stove having two pot holding places is designed to meet the cooking requirement of the hilly region. This stove is sufficient to cook the meal of one family of 10–12 persons and is of permanent nature. The special feature of the improved biomass cook stove is bigger size of fire box, which is suitable for big size firewood and light agro waste type of fuel. The cook stove is suitable for firewood, agro waste and dung cakes. Bigger sized wood may also be used at the fuel burning rate of 1.00 kg/h. The thermal efficiency is 26 %. The passage between the firebox chamber and the inlet of the chimney pipe is horizontal, which flows smoky gases outside the kitchen. A mixture of cement and sand is used to fix up the bricks and to enhance the life of the structure.

Specification

Type and model	Modified double pot improved biomass cook stove
Body (L×B×H), mm	790 × 360 × 250
First pot diameter, mm	200
Second pot diameter, mm	180
Fire box opening (D × L), mm	200 × 160
Chimney (D × L), mm	76 × 3000
Average thermal Efficiency, %	27
Unit price, Rs.	1,000/-

Performance

The thermal efficiency of traditional biomass cook stove and modified double pot improved biomass cook stove are respectively 10–11% and 26-28%.

Benefits

The modified improved biomass cook stove saves 70% fuel (2.67 kg of wood saved by one improved biomass cook stove) and 64.28% saving in cooking time. Smokeless environment of kitchen is achieved by modified double pot improved biomass cook stove. Pollutant emission in the kitchen is lower than the traditional biomass cook stove.

6. **Contact address for relevant information:** Department of Soil and Water Engineering, College of Agricultural Engineering and PHT, Ranipool; (E) Sikkim- 737135

Technology no.44

1. **Nameof the technology:** Wing Plough
2. **Source of the Technology:** Department of Farm Power and Machinery College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim) .
3. **Year of release:** 2011
4. **Agro Climatic Zone:** Suitable for hill farming 11l all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill /.one, Sub-tropical plain zone, Mild-tropical hill /one, and Mild-tropical plain Zone.

5. **Detail description about the technology:** The plough is suitable for both friable and wct condition in place of traditional wooden plough. Thc higher work rate is due to reduced drudgery to the animal and operator and time lost in turning and removing clogging. the required draft is also reduced from 45 kg in case of case of conventional plough to 40 kg making it suitable for local breed of bullock. The clod size formed is smaller requiring less energy requirement for secondary tillage. Working width: 200 mm, Weight: 5.5 kg, Work rate: 300 sqm/h, Cost, Rs 1000.00, operation cost: Rs 2500.00/ha, saving over tradition plough: 35% .
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Soil moisture content(d.b)%	
2.	Area covered per unit time, ha	
3.	Time taken to cover 01 ha, h	
4.	Working width, mm	
5.	Depth of operation, mm	
6.	Speed of operation, km/h	
7.	Draft of the implement, kg	
8.	Time lost, h	
9.	Field capacity, ha/h	
10.	Field efficiency, %	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.45

1. **Nameof the technology:** Animal drawn improved wedge plough
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on UAE CentreCollege of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2013
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** It is used for primary tillage for seed bed preparation in wet and and dry conditions. The CAEPHT designed animal drawn improved sedge plough consisting of handle, shoe, share and beam(overall dimension: handle height 800 mm, shoe length with share 600 mm, width 2010 mm Weight: 12 kg, unit Price Rs. 1200/-) The Average work rate of wedge plough is 0.025 hectare (250 sq. meters) per hour at average draft of plough is 45 kg corresponding to depth of operation of 110 mm. The cost of operation has been estimated as Rs. 2100/- per hectare using improved wedge plough. This equipment is an improved version of traditional plough made of mild steel which provided more working width(210 mm) as compared to traditional plough (local wooden plough) having (100 mm width, work rate 0.012 hectare per hour at average draft of 48 kg with a depth of operation of 100 mm). The improved wedge plough was operated in 250 sq.m area. The net saving in cost of operation by improved CAEPHT design plough is estimated as Rs. 400/- per hector over traditional plough (Rs. 2500/ha). It showed that the available area may be better managed by adoption of animal drawn improved wedge plough which would reduce the drudgery and cover more area in a season for cultivation.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Soil moisture content(d.b)%	
2.	Area covered per unit time, ha	
3.	Time taken to cover 01 ha, h	
4.	Working width, mm	
5.	Depth of operation, mm	

6.	Speed of operation, km/h	
7.	Draft of the implement, kg	
8.	Time lost, h	
9.	Field capacity, ha/h	
10.	Field efficiency, %	
11.	Cost of operation, Rs./ha	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.46

1. **Name of the technology:** Animal drawn multi purpose Tool frame with attachments
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on UAE Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2013
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** Performing different unit operations viz. ploughing, ridge making, sowing, potato digging and intercultural operations by using same unit by fitting appropriate attachments. It is multi-purpose equipment consisting of ground wheel, main frame, handle, hitch, beam & two hollow square sections for depth adjustment. The attachments of light weight are fitted to it. The main frame is of round section of galvanized pipe. The mould board plough(150 mm size), two ridgers (170 mm size each), single row potato digger (200 mm size), and sowing of maize in two rows can be attached on multi-purpose tool frame. The draft of all attachment varies 25-40 kg.
6. **Critical inputs required:** Nil

Attachments:

i) Improved Mould Board Plough

Brief description

Mould plough (one of the attachments of multipurpose tool frame) weight 10 kg, width 150 mm, and unit price Rs. 1000/-. The work rate of plough is 0.021 ha/h. The average draft of plough is 38 kg corresponding depth of operation is 100 mm. The cost of operation of the mould board plough is 1760 Rs./ha. The net saving in cost of operation by improved

CAEPHT mould board plough is estimated as Rs. 1548/- per hector over traditional plough (Rs. 3308/ha).

Observations to be recorded:

Sl. No.	Parameters to be recoded	Average Values
1.	Soil moisture content(d.b)%	
2.	Area covered per unit time, ha	
3.	Time taken to cover 01 ha, h	
4.	Working width, mm	
5.	Depth of operation, mm	
6.	Speed of operation, km/h	
7.	Draft of the implement, kg	
8.	Time lost, h	
9.	Field capacity, ha/h	
10.	Field efficiency, %	
11.	Cost of operation, Rs./ha	

ii) Ridger Plough

Brief description – Ridger plough (one of the attachments of multipurpose tool frame) weight 12 kg, width 512 mm, and unit price Rs. 1500/-. The work rate of ridger is 0.05 ha/h. The average draft of plough is 40 kg corresponding depth of operation is 80 mm. The cost of operation of the ridger plough is 470 Rs./ha.

Observations to be recorded:

Sl. No.	Parameters to be recoded	Average Values
1.	Soil moisture content(d.b)%	
2.	Area covered per unit time, ha	
3.	Time taken to cover 01 ha, h	
4.	Working width, mm	
5.	Depth of operation, mm	
6.	Speed of operation, km/h	
7.	Draft of the implement, kg	
8.	Time lost, h	
9.	Field capacity, ha/h	
10.	Field efficiency, %	
11.	Cost of operation, Rs./ha	

iii) Animal Drawn Improved Maize Planter

Brief Description – The maize planter (one of the attachments of multipurpose tool frame) overall dimensions are 730 x 700 x 960 mm and its weight with seeding attachment is 19.8 kg. The work rate of Maize planter is 700 sq. m/h. The average draft of machine is 25 kg with

45 mm the depth of sowing. The cost of operation for sowing of maize is Rs. 630/ha.

Observations to be recorded:

Sl. No.	Parameters to be recoded	Average Values
1.	Soil moisture content(d.b)%	
2.	Area covered per unit time, ha	
3.	Time taken to cover 01 ha, h	
4.	Working width, mm	
5.	Depth of operation, mm	
6.	Row spacing, mm	
7.	Plant to plant spacing, mma	
8.	Plant population, No./sqm	
9.	Yield, kg/ha	
10.	Cost of operation, Rs./ha	
11.	Economic comparison	

iv) Animal drawn single row improved potato digger

Brief description – It consists of mild steel plate, shank, L Shape clamps (02 no.), main frame, clevis, beam and handle, The light weight digger can work up to 100 mm depth. The working width of digger is 200 mm and its required draught of 35 kg.

Observations to be recorded:

Sl. No.	Parameters to be recoded	Average Values
1.	Soil moisture content(d.b)%	
2.	Area covered per unit time, ha	
3.	Time taken to cover 01 ha, h	
4.	Working width, mm	
5.	Depth of operation, mm	
6.	Speed of operation, km/h	
7.	Draft of the implement, kg	
8.	Time lost, h	
9.	Field capacity, ha/h	
10.	Field efficiency, %	
11.	Cost of operation, Rs./ha	

7. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.47

1. **Nameof the technology:** Animal drawn improved rolling Peg type puddler
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on UAE Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2014
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** It is use for the seed bed preparations of field for transplanting of paddy. The developed Light weight improved rolling peg type puddler (weight: 12 kg, Size: 700 mm, Unit price: Rs. 3500/-) consisted of 200 mm size rotor made from 25 x 25 x 5 mm size 04 no. of mild steel angle. Each row was welded with 04 pegs (10 x 10 mm size, square bar) of 50 mm length. The work rate of puddler is 0.105 ha/h and average draft is 35 kg.

6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Area, ha	
2.	Time taken to cover the area, h	
3.	Work rate, ha/h	
4.	Puddling index	
5.	Depth of water on soil surface, mm	
6.	Operating cost Rs/h Rs/ha	
7.	Economic comparison with traditional method	
8.	Saving in cost, Rs/ha	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.48

1. **Nameof the technology:** Cultivator matching to light weight (65 kg) power tiller
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on FIM Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2012
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** All manufacturers of power till provide only rotary tillage attached with it. It restrict the use of power tiller for single operation that results limited annual use of power tiller thus it becomes un-economical. Different attachments have been developed so that power tiller can be used not only for secondary tiller but for all the agricultural operations. One of them is cultivator. This cultivator is consisted of a frame on which hitching attachment and three tynes are fitted. At the end of tyne, a shovel type blade for soil cutting and manipulation is attached. The cultivator was tested in the field and performance was satisfactory. The function is similar to tractor drawn cultivators used in the plain areas.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Width of coverage, mm	
2.	Speed of operation	
3.	Area covered, ha	
4.	Time taken to cover the area, h	
5.	Work rate, ha/h	
6.	Average size of clod, mm	

7.	Fuel consumed, lit/h lit/ha	
8.	Operation cost, Rs./h Rs./ha	
9.	Economic comparison with traditional method	
10.	% saving in cost	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.49

1. **Name of the technology:** Light weight power tiller operated cage wheel
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on FIM Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2013
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** Puddling is one of the most energy and time consuming process in traditional method. Keeping in view of details given earlier and aiming to reduce the drudgery, a cage wheel was developed which can be attached to the power tiller. This cage wheel in combination with rotary tiller has been found suitable for puddling purpose. A flap cover over rotary tiller has been provided to protect the operator and also helps in churning of soil.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Area, ha	
2.	Time taken to cover the area, h	
3.	Work rate, ha/h	
4.	Puddling index	

5.	Depth of water on soil surface, mm	
6.	Fuel consumption lit/h lit/ha	
7.	Operating cost Rs/h Rs./ha	
8.	Economic comparison with traditional method	
9.	Saving in cost, Rs/ha	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Techynology no.50

1. **Nameof the technology:** Animal drawn Peg planker
2. **Source of the Technology:** Department of Farm Power and Machinery, College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2012
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** The equipment is used for secondary tillage operation. Its working width is 800 mm and made of mild steel sheet similar to local harrow was developed to suite the topographical conditions of the North Eastern Hill Region as a substitute to the local wooden peg type harrow. The average large size clod after operation was 112.55 x 81.25 mm in case of control plot and 71.82 x 54.70 mm in case of developed equipment. The work rate of 0.035 and 0.047 ha h^{-1} and draft requirement 52 kg and 48 kg for local and improved equipment respectively was observed. These values suggested that the soil was finer, well and uniformly graded by use of improved developed peg planker as compared to local harrow. The total energy input was 2077.8961 MJ ha^{-1} and 1546.9671 MJ ha^{-1} for local and improved equipment respectively. The saving in energy input by use of improved equipment was 25.55%.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Area, ha	
2.	Time taken to cover the area, h	
3.	Work rate, ha/h	
4.	Average clod size before, Before operation After operation	
5.	Depth of water on soil surface, mm	
6.	Operating cost Rs/h Rs./ha	
7.	Saving in cost, Rs/ha	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.51

1. **Nameof the technology:** Two row manual sprouted rice seeder
2. **Source of the Technology:** Department of Farm Power and Machinery ,College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2010
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** The equipment is used for sowing of sprouted rice seeds in puddle soil of narrow terraces in place of transplanting rice cultivation. The advantage are: saving of cost, time involved in nursery raising, establishment is 15-20 days advanced than the transplanting rice resulting and possibility of growing second crop under rainfed condition. The tapered(diverging towards the end) container facilitate easy flow of seed towards the holes. Telescopic markers with wedge shape openers provided ahead of the metering rows helps to accommodate dropped seeds on the surface of the soil in rows for early establishment of crop. The working with is 500 mm, cost is about Rs. 1000.00, the work rate is about 600 sqm/h. The top surface of the field after puddling should be smooth, flat and free from crop/weed residues.

6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Depth of water on soil surface, mm	
2.	Area covered, ha/h	
3.	Seed rate, kg/ha	
4.	Seed to seed spacing (in case of planting), mm	
5.	Row spacing	
6.	Cost of sowing, Rs./ha	
7.	Plant population (20 days after sowing), No./sqm	
8.	Yield, kg/ha	
9.	Economic comparison with traditional method	
10.	% saving	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.52

1. **Nameof the technology:** Two row manual rice transplanter
2. **Source of the Technology:** Department of Farm Power and Machinery,College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2010
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** The equipment is used for transplanting two rows at a time in narrow terraces where other 4 or 8 row developed manual transplanter is not suitable due to narrow width of terraces. The transplanting is done in rows therefore subsequent weeding by cono-weeder is possible. The working width is 200 mm, work rate is about 100 sqm/h. Two persons are required to smooth working of the machine. The top surface of the field after puddling should be smooth, flat and free from crop/wee residues.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Puddling index	
2.	Depth of water on soil surface, mm	
3.	Area covered, ha/h	
4.	Depth of planting, mm	
5.	Missing hills	
6.	Floating hills	
7.	Seed rate, kg/ha	
8.	Plant to plant spacing, mm	
9.	Row spacing, mm	
10.	Cost of planting, Rs./ha	
11.	Plant population (20 days after planting), No/sqm	
12.	Yield, kg/ha	
13	Economic comparison with traditional method	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.53

1. **Nameof the technology:** Light weight mulcher-cum-zero-till multi crop planter
2. **Source of the Technology:** Department of Farm Power and Machinery,College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2015
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** Although, efforts have been made in developing and promoting machinery for seeding wheat in zero till/flat/FIRB systems, successful adoption of CA practices would be useful for developing, standardizing and promoting quality machinery aimed at a range of crops and cropping sequences, permanent bed and furrow planting systems, harvesting operations to manage the crop residues and others specially in terrace cultivation under rain-fed conditions. For hilly tracts of NEH region, mechanically powered knapsack type hand tools, animal drawn implements and light

weight power tiller operated equipment may have greater relevance for adoption of CA practices. Keeping in view of above, a self-propelled light weight walk behind type mulcher cum multi-crop planter was designed and developed. The planter was powered by a 1.6 kW gasoline engine, rotary blade for furrow opening, cell type seed plate for seed metering and chain and sprocket for power transmission. The actual field capacity was 0.043 ha h^{-1} at 1.21 km h^{-1} average operating speed with 89% field efficiency.

6. **Critical inputs required:** Nil

7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Quantity of crop residue, t/ha	
2.	Area covered, ha/h	
3.	Depth of sowing, mm	
4.	Seed rate, kg/ha	
5.	Seed to seed spacing, mm	
6.	Row spacing, mm	
7.	Moisture content of soil, %(db)	
8.	Cost of sowing, Rs./ha	
9.	Plant population (20 days after planting), No/ sqm	
10.	Yield, kg/ha	
11	Economic comparison with traditional method	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.54

1. **Nameof the technology:** Power till operated multicrop seed drill cum planter
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on FIM Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2015
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** The seed drill is suitable for sowing wheat and maize in narrow terraces on small area. For sowing of maize, vertical rotor cell fill type seed metering mechanism is used. For maize sowing by seed drill, the time and labour requirement were 20.8 h/ha and 42 man-h/ha respectively as compared to 50 h/ha and 100 man-h/ha respectively by traditional method.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Quantity of crop residue, t/ha	
2.	Area covered, ha/h	
3.	Depth of sowing, mm	
4.	Seed rate, kg/ha	
5.	Seed to seed spacing, mm	
6.	Row spacing, mm	
7.	Moisture content of soil, %(db)	
8.	Fuel consumption, lit/h and lit/ha	
9.	Cost of sowing, Rs./ha	
10.	Plant population (20 days after planting), No/sqm	
11.	Yield, kg/ha	
12.	Economic comparison with traditional method	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.55

1. **Nameof the technology:** Manually operated seeder cum planter
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on ESA Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2013
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** The equipment is suitable for sowing/planting of all crops in small area. It is pulled by human power. It is fitted with seed plate that rotate in vertical plane, carry the seed and drop in seed tube. By changing the seed plate, different type of seeds can be planted. It is very much suitable for maize planting.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Area covered, ha/h	
2.	Depth of sowing, mm	
3.	Seed rate, kg/ha	
4.	Seed to seed spacing, mm	
5.	Row spacing, mm	
6.	Moisture content of soil, %(db)	
7.	Cost of sowing, Rs./ha	
8.	Plant population (20 days after planting), No/sqm	
9.	Yield, kg/ha	
10.	Economic comparison with traditional method	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.56

1. **Nameof the technology:** Animal drawn single row zero till drill
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on UAE Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2011
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** For sowing of rabi crops, traditionally two ploughing with indigenous plough and two planking for land preparation and sowing behind plough is practiced. The animal drawn single row zero-till drill is suitable for the purpose. It consists of seed box, main frame, two ground wheels, handle and clevis for fitting beam, chain sprocket arrangements for transmitting power to seed feed shaft. The effective field capacity 0.03 ha/h, saving in time 65% and saving in cost is about 70%.

6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Area covered, ha/h	
2.	Depth of sowing, mm	
3.	Seed rate, kg/ha	
4.	Seed to seed spacing(in case of planting), mm	
5.	Row spacing, mm	
6.	Moisture content of soil, %(db)	
7.	Cost of sowing, Rs./ha	
8.	Plant population (20 days after planting), No/sqm	

9.	Yield, kg/ha	
10.	Economic comparison with traditional method	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.57

1. **Nameof the technology:** Animal drawn two row zero till seed drill
2. **Source of the Technology:** Department of Farm Power and Machinery under AICRP on UAE Centre College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool. Gangtok (Sikkim)
3. **Year of release:** 2012
4. **Agro Climatic Zone:** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** It may be used for sowing of seeds (small and medium size) in row rows with single pass operation. The animal drawn seed drill consists of seed box fitted with fluted roller for seed metering, inverted-T furrow openers(02 no.) for making narrow opening, main frame, two ground wheels, handle, plastic rubes for seed dropping and power transmission system for transmitting power to seed feed shaft through chain and sprocket arrangement from one of the ground drive wheels. The effective field capacity of the machine is 0.07 ha/ha, cost of operation 715.00 Rs./ha, saving in time and cost are about 15 %.
6. **Critical inputs required:** Nil
7. **Observations to be recorded:**

Sl. No.	Parameters to be recoded	Average Values
1.	Area covered, ha/h	
2.	Depth of sowing, mm	
3.	Seed rate, kg/ha	
4.	Seed to seed spacing(in case of planting), mm	
5.	Row spacing, mm	
6.	Moisture content of soil, %(db)	
7.	Cost of sowing, Rs./ha	
8.	Plant population (20 days after planting), No/sqm	
9.	Yield, kg/ha	
10.	Economic comparison with traditional method	

8. **Contact address for relevant information:** Dean, College of Agricultural Engineering and Post Harvest Technology(Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.58

1. **Name of the Technology:** Improved large cardamom harvesting knife
2. **Source of the technology:** College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)
3. **Year of release:** 2012
4. **Agro-climatic zone :** Suitable for hill farming in all the six agro-climatic zones of NEH region i.e. Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild-tropical hill zone, and Mild-tropical plain Zone.
5. **Detail description about the technology:** The equipment is a hand held improved design of large cardamom harvesting knife. Various parameters of knife have been presented below.

Specification				
Knife parameter	**1**	**2**	**3**	**4**
Total length, mm	320	320	240	340
Length of handle, mm	150	150	110	180
Length of blade, mm	170	170	130	160
Length of blade from lower end, mm	35–40	35–40	30–35	35–40
Size of blade from upper end, mm	40–45	40–45	35–40	45–50
Curvature of cutting edge, 0	110–115 115–120	110–115 115–120	110–115 115–120	110–120 115–120
Material of construction	Spring steel (En–3)	Spring steel (En–3)	Spring steel (En–3)	Spring steel (En–3)
Weight, g	140–200	140–200	140–170	150–200

Performance

Efficient harvesting of large cardamom capsules with reduced drudgery and more output compared to the conventional harvesting knife.

6. **Critical inputs required:** Nil
7. **Observations to be recorded: Nil.**
8. **Contact address for relevant information** : Dean, College of Agricultural Engineering and Post Harvest Technology (Central Agricultural University, Imphal) Ranipool, Gangtok (Sikkim)-737135, e-mail: dean.caepht@gmaillcom, Ph: 03592-251389

Technology no.59

1. **Name of the Technology:** Pineapple Harvester
2. **Source of the technology:** Directorate of Research, CAU, Imphal
3. **Year of release:** Not yet
4. **Agro-climatic zone:** -
5. **Detail description about the technology:** A manually operated pineapple harvester is fabricated with mild steel rod of 30 mm diameter and 1500 mm length. A sharp cutting blade of 125 mm diameter made of mild steel is attached at the end of the main frame which is used to cut the stalk of the pineapple. Rotation of the cutting blade (125mm) is obtained through a transmission from a 1.5 hp petrol engine through a spiral rotating shaft. When the operator pulls the lever of the cranking wheel of engine mounted at the back of the operator which is connected to the cutting blade, the blade starts rotating and cuts the stalk just beneath the pineapple. The cut pineapple is held with the finger provide just above the cutting blade. The detached/cut pineapple will be shifted to a basket kept on the ground. A single operator is required for cutting the pineapple and putting it in the basket as well. The total weight of the machine is 9 kgs. The cutting blade can be sharpened or replaced when damaged.
6. **Critical inputs required :**

a. Overall dimension (L×B×H mm) :	1500(L) x 130 (B)
b. Weight :	9 kgs.
c. Prime mover :	Petrol engine
d. Power (hp) :	1.5 hp
e. Man power :	Single operator
f. Land :	Hilly terrains/terrace land of NEH
g. Investment :	Rs.10,000/-

7. **Observations to be recorded:** NA
8. **Contact Address for relevant information:** Directorate of Research, Central Agricultural University, Imphal-795004

Chapter 3- Soil Science

Technology no.1

1. **Name of technology:** Zinc management in low land Rice-Rice cropping system
2. **Source of technology:** RARS, Titabor, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** UBVZ and BVZ of Assam
5. **Detail description of technology:** Application of zinc sulphate @ 25 kg/ha

   Management Practices:

   Seed treatment: Mancozeb @ 2.5 g/ kg or Captan @ 2.5 g/ kg

   Land preparation: Thoroughly Puddled

   Manuring: FYM @ 2 ton/ ha

   Fertilization: Basal application of 25 kg $ZnSO_4$/ha (3 kg $ZnSO_4$/bigha) in every three years interval in addition to recommended dose of fertilizers along with 2 t FYM/ha for Sali rice.
6. **Critical inputs required:** Zinc Sulphate
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no. 2

1. **Name of technology:** INM in utera cropping of Lathyrus in Rice
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All agroclimatic zones of Assam
5. **Detail description of technology:**

   ❖ **Without rhizobium and PSP inoculation**:

   i. Application of 7.5 kg N and 17.5 kg P_2O_5/ha at the time of sowing before rice harvest

   ii. Application of second dose @ 7.5 - 17.5 - 15 kg N, P_2O_5, K_2O/ ha at the time of rice harvest. [The fertilizers are to be incubated for 48 hours with compost/ moist soil in 1: 10 ratio before applying]

   iii. Apply two foliar sprays of 2% urea at branching and pod initiation stages

   ❖ **With rhizobium and PSB inoculation (50 g/kg):**

   i. Apply 5.0 kg N and 13.0 kg P_2O_5/ha at the time of sowing before rice harvest

ii. Apply second dose @ 5 - 13 - 15 kg N, P2O5, K2O/ ha at the time of rice harvest. [The fertilizers are to be incubated for 48 hours with compost/ moist soil in 1 : 10 ratio before applying]

iii. Apply two foliar sprays of 2% urea at branching and pod initiation stages

Variety: Ratan/Nirmal/Madhuri (JL-1)

Management Practice:

Seed rate: 50 kg/ha

Sowing time: Mid-October to mid-November when soil is at saturation

Duration: 120-125 days

6. **Critical inputs required:** Biofertilizers, fertilizers, organic manure, and variety.
7. **Observations to be recorded:** Initial and final nutrient status in soil, Soil moisture,Nutrient uptake, Plant height (cm), plant stand, pod/plant, seed/pod and seed yield (q/ha), Rainfall and temperature throughout the crop growing period, B: C ratio, Farmers'reaction.

Technology no. 3

1. **Name of technology:** Phosphorous management in Rice-Linseed sequence
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** All agro-climatic zones of Assam
5. **Detail description of technology:**

Crop: Linseed

Variety: Rice- Ranjit (June 1st week sown), Linseed- T-397 (Mid Oct. to Mid Nov.)

Treatment: In rice 75% of RD of P2O5 + PSB (50 g/kg seed)

In Linseed 75% of RD of P2O5

Management Practice:

Seed rate: 20 kg/ha

Fertilizer: dose Rice: 40: 20: 40 kg of N: P2O5: K2O/ ha

Linseed: 40: 20: 10 kg of N: P2O5: K2O/ ha

Spacing: 25 cm x 10 cm

6. **Critical inputs required:** Variety, Phosphorus, PSB
7. **Observations to be recorded:** Initial fertility status of the soil, Date of sowing and harvest, Incidence of pest and diseases, Yield and yield attributing characters, B: C ratio, Farmers' reaction

Technology no. 4

1. **Name of technology:** INM in irrigated wheat
2. **Source of technology:** RARS, Shillongoni, Nagaon
3. **Year of release:** 2017
4. **Agro-climatic zone:** All zones except Barak valley zone
5. **Detail description of technology:**

   Treatment:

   T1: 75% Recommended fertilizer + Azotobacter and PSB (50 g each/ kg seed)

   T2: 100% Recommended fertilizer (Control)

   Management Practice:

   Variety: Any recommended variety or released variety for NEPZ

   Seed rate: 100 kg/ha

   Spacing: 20 cm row to row

   Sowing time: Nov.5th to 20th (NBP Zone), 5th Nov. to 15th Dec. (CBV & LBV Zone)

   Fertilizer: dose as per recommended fertilizer doses for different Agril.

   Sub-division
6. **Critical inputs required:** Fertilizers, biofertilizers
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C ratio, Farmers' reaction, Soil status.

Technology no. 5

1. **Name of technology:** INM in Chilli
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Treatment: Biofertilizer (Azotobacter + PSB) @ 2kg + vermicompost 1 t/ha incubated for 15 days and N: P: K @ 60: 30: 30 kg/ha mixture applied as circular band placement at 10 and 30 days after planting (DAP).
6. **Critical inputs required:** Fertilizers, biofertilizers, vermicompost
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Plant height (cm), No. Of fruits/plant, Pest infestation, Disease infestation, Grain yield (q/ha), B: C ratio, Farmers' reaction, Soil status.

Technology no. 6

1. **Name of technology:** Performance of Biofertilizers in *kharif* blackgram and greengram
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Technology Seed inoculation with Rhizobium and PSB each @ 50 g/kg seed (seeds are to be moistened carefully with water so as to avoid excessive wetting. Rhizobium and PSB culture is to be mixed with seeds @ 50 g each culture per kg of seed so that a thin layer of inoculums I deposited over the seed coat. Treated seeds are to be dried under shade. Inoculated seed should not be exposed to sun)

   Management Practice

   Seed rate: Blackgram: 22.5 kg/ha; Greengram: 20 kg/ha

   Spacing: 30 X 10 cm

   Sowing time: Mid-August to mid September

   Fertilizer: dose 15 : 35 : 15 N: P2O5: K2O kg/ha

   Land preparation: 3-4 ploughings followed by laddering
6. **Critical inputs required:** Rhizobium and PSB
7. **Observations to be recorded:** Initial and final nutrient status in soil, Nutrient uptake,Date of sowing and harvest, Plant height, plant stand, pod/plant, seed/pod and seed yield (q/ha), Rainfall (mm), and temperature(0C), throughout the crop growing period, Farmers' reaction.

Technology no. 7

1. **Name of technology:** Performance of Biofertilizers in *kharif* blackgram andgreengram.
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Technology Seed inoculation with Rhizobium and PSB each @ 50 g/kg seed (seeds are to be moistened carefully with water so as to avoid excessive wetting. Rhizobium and PSB culture is to be mixed with seeds @ 50 g each culture per kg of seed so that a thin layer of inoculums I deposited over the seed coat. Treated seeds are to be dried under shade. Inoculated seed should not be exposed to sun).

   Management Practice

   Seed rate: Blackgram : 22.5 kg/ha; Greengram : 20 kg/ha

Spacing: 30 X 10 cm

Sowing time: Mid-August to mid September

Fertilizer: dose 15 : 35 : 15 N: P2O5: K2O kg/ha

Land preparation: 3-4 ploughings followed by laddering

6. **Critical inputs required:** Rhizobium and PSB
7. **Observations to be recorded:** Initial and final nutrient status in soil, Nutrient uptake,Date of sowing and harvest, Plant height, plant stand,pod/plant, seed/pod and seed yield(q/ha), Rainfall(mm), and temperature(0C), throughout the crop growing period, Farmers' reaction.

Technology no. 8

1. **Name of technology:** INM in lentil along with Biofertilizer component
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Application of 10: 20 : 15 N: P2O5: K2O kg/ha along with vermicompost 1 t/ha or FYM 2 t/ha as basal and seed inoculation with Rhizobium and PSB each @ 50 g/kg of seed (seeds are to be moistened carefully with water so as to avoid excessive wetting. Rhizobium and PSB culture is to be mixed with seeds @ 50 g each culture per kg of seed so that a thin layer of inoculums I deposited over the seed coat. Treated seeds are to be dried under shade. Inoculated seed should not be exposed to sun)

   Management Practice

   Seed rate: 30 kg/ha

   Spacing: 25 cm between rows

   Duration: 115-120 days

   Sowing time: Mid-October to mid-November

   Fertilizer dose: 10 : 20 : 15 N: P2O5: K2O kg/ha

   Land preparation: 3-4 ploughings followed by laddering

6. **Critical inputs required:** N, P, K, vermicompost/FYM, Rhizobium, PSB
7. **Observations to be recorded:** Initial and final nutrient status in soil, Nutrient uptake, Plant height (cm), plant stand, pod/plant, seed/pod and seed yield (q/ha), Rainfall(mm) and temperature(0C), throughout the crop growing period, B: C ratio, Farmers' reaction, Soil status.

Technology no. 9

1. **Name of technology:** INM in lentil with Foliar spray of Nitrogen
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Technology: T1 Application of 75% of RD along with vermicompost@ 0.5 t/ha and 2 sprays of 2% urea at branching and pod initiation stages.

   T2: Application of 50% of RD along with vermicompost 1 t/ha as basal and 2 sprays of 2% urea at branching and pod initiation stage

   Management Practice

Variety:	HUL 57/PL 406
Seed rate:	30 kg/ha
Spacing:	25 cm between rows
Duration:	115-120 days
Sowing time:	Mid-October to mid-November
Fertilizer dose:	15 : 35 : 15 kg N: P2O5: K2O /ha
Land preparation:	3-4 ploughings followed by laddering

6. **Critical inputs required:** N, P, K, Vermicompost, Urea,
7. **Observations to be recorded:** Initial and final nutrient status in soil, Nutrient uptake, Plant height (cm), plant stand, pod/plant, seed/pod and seed yield (q/ha), Rainfall(mm) and temperature(0C), throughout the crop growing period, B: C ratio, Farmers' reaction, Soil status.

Technology no. 10

1. **Name of technology:** INM in Rajmah
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone**: All zones of Assam
5. **Detail description of technology:**

   Technology: Application of 60 : 45 : 40 : kg N: P2O5: K2O /ha along with seed inoculation with PSB @ 50 g/kg of seed and three sprays of 2% urea at pre-flowering (45 DAS), 25% pod initiation (60 DAS) and pod development (70 DAS) stages (nitrogen in two equal splits as basal and top dressing at 30 DAS

Management Practice:

Variety:	HUR 301/HUR 203
Seed rate:	75 kg/ha
Spacing:	30 X 10 cm
Duration:	95-105 days
Sowing time:	November 20-30
Fertilizer dose:	60 : 45 : 40 (N: P2O5: K2O) kg/ha
Land preparation:	3-4 ploughings followed by laddering

Bio – fertilizer: PSB 50 g/kg seed Irrigation One each at pre-flowering and pod Initiation stage

6. **Critical inputs required:** N, P, K, PSB, Urea
7. **Observations to be recorded:** (including cost benefit ration) Initial and final nutrient status in soil, Nutrient uptake, Plant height, plant stand, pod/plant, seed/pod and seed yield (q/ha), Rainfall and temperature (0^{C}), throughout the crop growing period, B: C ratio, Farmers' reaction, Soil status.

Technology no. 11

1. **Name of technology:** Integrated nutrient management in Toria
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Technology: Integrated nutrient management Application of 75% of recommended dose of N and P and 100 % RD of K when seeds are inoculated with Azotobacter @ 40 g/kg seed and PSB @ 40 g/kg seed for toria.

   Management Practice:

Seed rate:	10 kg/ha
Spacing:	30 cm between rows and 5-7 cm between plants
Duration:	90-95 days
Sowing time:	Mid October to end of November

6. **Critical inputs required:** N, P, K, Azotobacter, and PSB
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Siliqua/plant, Grain/siliqua, Pest infestation, Disease infestation, Grain yield (q/ha.), B: C ratio, Farmers' reaction, Soil status.

Technology no. 12

1. **Name of technology:** INM in Olitorious Jute
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Seed inoculation with biofertilizers *i.e.* Azotobacter @ 50 g/kg seed and PSB @ 50 g/kg seed and application of 50% N + 50% P2O5 + 100% K2O of RD of fertilizer (i.e. 15-12.5-30 N- P2O5-K2O kg/ha) as basal.
6. **Critical inputs required:** Fertilizers, biofertlizers
7. **Observations to be recorded:** Rainfall (mm), yield attributes, yield (q/ha), fibre length, B: C Ratio, Farmers' reaction, soil nutrient status.

Technology no. 13

1. **Name of technology:** Nutrient management in Rapeseed and Mustard
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Two foliar applications of 1% urea at flowering and pod filling stages along with basal application of recommended fertilizer dose, *i.e*. 60 kg N, 30 kg P2O5 and 30 kg K2O/ha for rapeseed and mustard.
6. **Critical inputs required:** Fertilizers (urea)
7. **Observations to be recorded:** Rainfall (mm), yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction, soil nutrient status.

Technology no. 14

1. **Name of technology:** Nutrient management in Sali Rice under low input condition
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Application of vermicompost (1t/ha) along with FYM (2.5 t/ha) under low input (N: P2O5: K2O @ 20: 10: 10 kg/ha) medium land situation.
6. **Critical inputs required:** Vermicompost, FYM, N, P, K
7. **Observations to be recorded:** Rainfall (mm), yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction, soil nutrient status.

Technology no. 15

1. **Name of technology:** Low cost Vermicomposting technology
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Low cost vermicompost unit fabricated using high quality polyethylene sheet supported with a bamboo structure with 2.5 m (L) × 0.91 m (B) × 0.91 m (D)

- ❖ Drainage hole is to be provided at the base of the structure for drainage of excess water from the unit.
- ❖ The vermicomposting unit should be filled with partially decomposed waste material and cowdung in 60: 40 ratio followed by subsequent release of 750 gm earthworms.
- ❖ A temporary shed made of bamboo and polyethylene sheet has to be provided for protection of units from adverse climatic condition.
- ❖ A drain surrounding the vermicposting unit needs to be laid out and kept filled with water as a preventive measure against attack of ants.

6. **Critical inputs required:** Polythene sheet, bamboo, waste materials, cow dung, earthworm,
7. **Observations to be recorded:** Rainfall (mm), B: C Ratio, Farmers' reaction, nutrient content.

Technology no. 16

1. **Name of the technology:** Root-dipping in SSP-MC Slurry Method of P Management
2. **Source of the technology:** Central Agricultural University (Imphal**)**
3. **Year of release:** Have to be released
4. **Agro-climatic zon**Suitable to transplanted rice grown in acidicsoils
5. **Detail description about the technology:**

   Rationale of the technology: The deficiency of phosphorus (P) is widespread especially in acidic soils of the world. In NE India, production of rice is mainly constrained by aluminum (Al) and iron (Fe) induced phosphorous (P) deficiencies. More than 81% soils of North East India suffer from this cause. The use efficiency of water soluble inorganic P fertilizer *viz.* single super phosphate exhibits hardly 15-20% of the applied quantity in a crop season. So, the application of higher quantity of inorganic P fertilizer is mere a wastage of poor farmers' money and can also pose a cause to environmental pollution. As an alternative to conventional way of P management in acid soil, the rhizosphere-based P management approach seems to be pertinent in acid soils for enhancing P-use efficiency and yield of crops because: (a) *There are no substitutes for P in agriculture* and (b) a *potential Global P* *crisis* in near future. The strategies for the aforementioned technology are 3 folds: (1) To increase tissue P content at the seedling stage for better root growth, (ii) to synchronize the rates of P mineralization in soil and P uptake in rice throughout the crop growing period and (iii) To minimize P fixation and mineralization as Fe- and Al-phosphates in the rhizosphere.

Methodological description:

Step-I: Root dipping in soil-water slurry amended with SSP:

A mud slurry bed (45 sq.m.) is prepared in one corner of the main field (area 1 ha). An amount of 7.0 kg SSP is to be mixed thoroughly with mud. Roots of uprooted rice seedling bundles need to be washed free of adhered mud and then roots are to be dipped in the SSP amended mud slurry bed for over-night (optimum duration is 10h). The optimum dose of P applied in the mud slurry bed is 112.5 mg per kg mud slurry.This treatment is usually carried out in the evening hour and seedlings get ready for microbial consortium treatment in the next morning. See Fig.1.

Step-II: Root-dipping in soil-water slurry amended with MC:

Similar to SSP root-dip treatment, a mud slurry bed (45 sq.m.) is to be prepared in one corner of the main field. Approximate 5 kg finely grounded dry compost/FYM along with either 4.0 kg MC biofertilizer (if solid carrier based formulation) or 500 ml liquid MC biofertilizer are to be mixed thoroughly with mud in the slurry bed. Addition of finely grounded dry compost/ FYM increase stickiness of mud. The SSP slurry treated roots of rice seedling bundles are to be dipped in to MC amended mud slurry bed and incubated for 2 h. After this treatment, seedlings are ready for transplanting in the main field. See Fig.1.

Step-III: Prior to transplantation of the SSP-MC treated rice seedlings, RP needs to be broadcasted on the main field @125 kg ha^{-1} along with 50% of the recommended dose of Urea (133 kg ha^{-1}) and MOP (66 kg ha^{-1}).

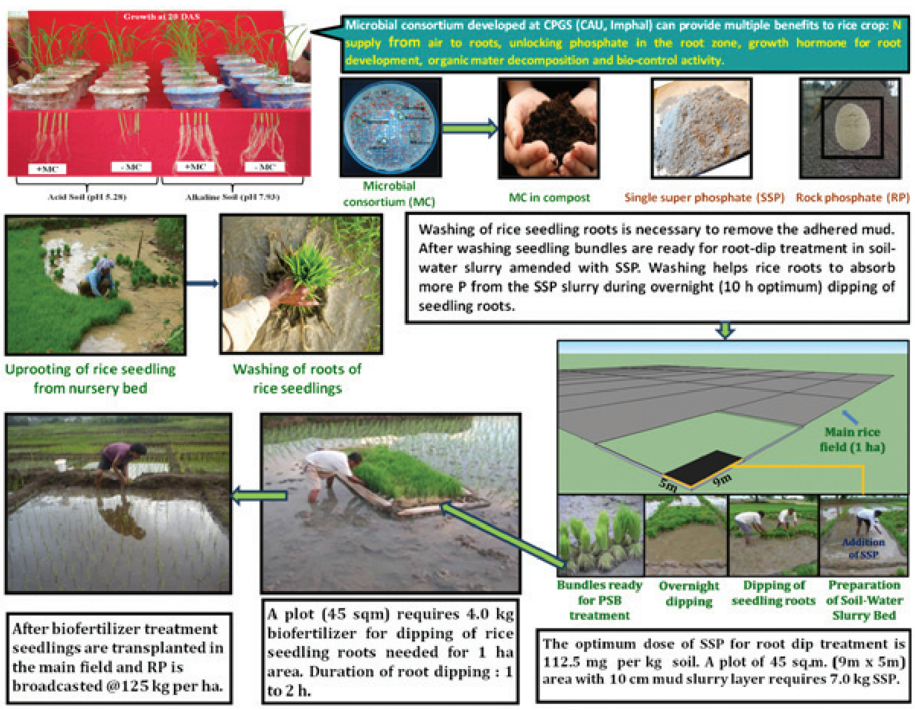


Fig.1: Depiction of Root-Dipping in SSP-MC Slurry Method of P management in acid soil.

6. **Observations to be recorded**
   i. Root growth parameter at 40 to 45 DAT
   ii. Number of effective tillers per hill
   iii. Nos. of grains per panicle
   iv. Grain yield and Biological yield
   v. Harvest Index
   vi. P and Zn concentration in shoot at 45DAT and in edible portion of grain (optional)
7. **Contact address for relevant information**

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Phone No-0364-2570030; e-mail: deancpgs@gmail.com

Technology no.17

1. **Name of the Technology**: Root-dipping in SSP-MC Slurry Method of P Management
2. **Source of the technology**: College of Post Graduate Studies, CAU, Umiam
3. **Year of release**: 2016
4. **Agro-climatic zone**: Suitable to transplanted rice grown in acidic soils
5. **Detail description about the technology** (with suitable photograph)

Rationale of the technology: The deficiency of phosphorus (P) is widespread especially in acidic soils of the world. In NE India, production of rice is mainly constrained by aluminum (Al) and iron (Fe) induced phosphorous (P) deficiencies. More than 81% soils of North East India suffer from this cause. The use efficiency of water soluble inorganic P fertilizer *viz.* single super phosphate exhibits hardly 15-20% of the applied quantity in a crop season. So, the application of higher quantity of inorganic P fertilizer is mere a wastage of poor farmers' money and can also pose a cause to environmental pollution. As an alternative to conventional way of P management in acid soil, the rhizosphere-based P management approach seems to be pertinent in acid soils for enhancing P-use efficiency and yield of crops because: (a) *There are no substitutes for P in agriculture* and (b) a *potential Global P crisis* in near future. The strategies for the aforementioned technology are 3 folds: (1) To increase tissue P content at the seedling stage for better root growth, (ii) to synchronize the rates of P mineralization in soil and P uptake in rice throughout the crop growing period and (iii) To minimize P fixation and mineralization as Fe- and Al-phosphates in the rhizosphere.

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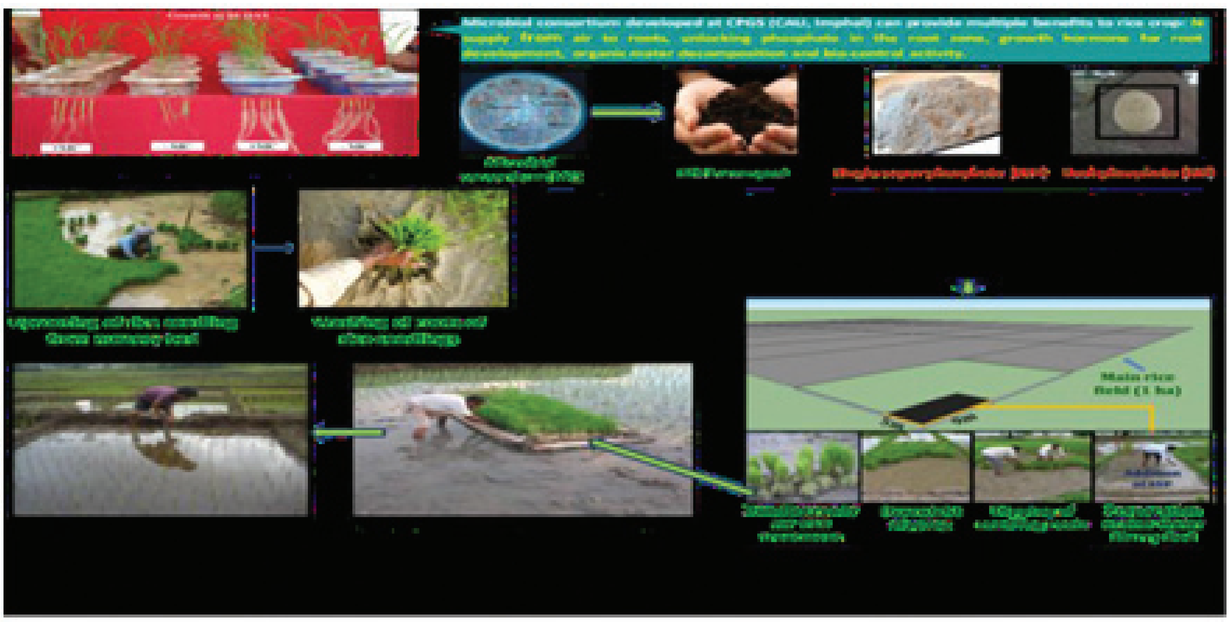

Fig.1. Depiction of Root-Dipping in SSP-MC Slurry Method of P management in acid soil

6. Observations to be recorded

i. Root growth parameter at 40 to 45 DAT

ii. Number of effective tillers per hill

iii. Nos. of grains per panicle

iv. Grain yield and Biological yield

v. Harvest Index

vi. P and Zn concentration in shoot at 45DAT and in edible portion of grain (optional)

7. **Contact address for relevant information**

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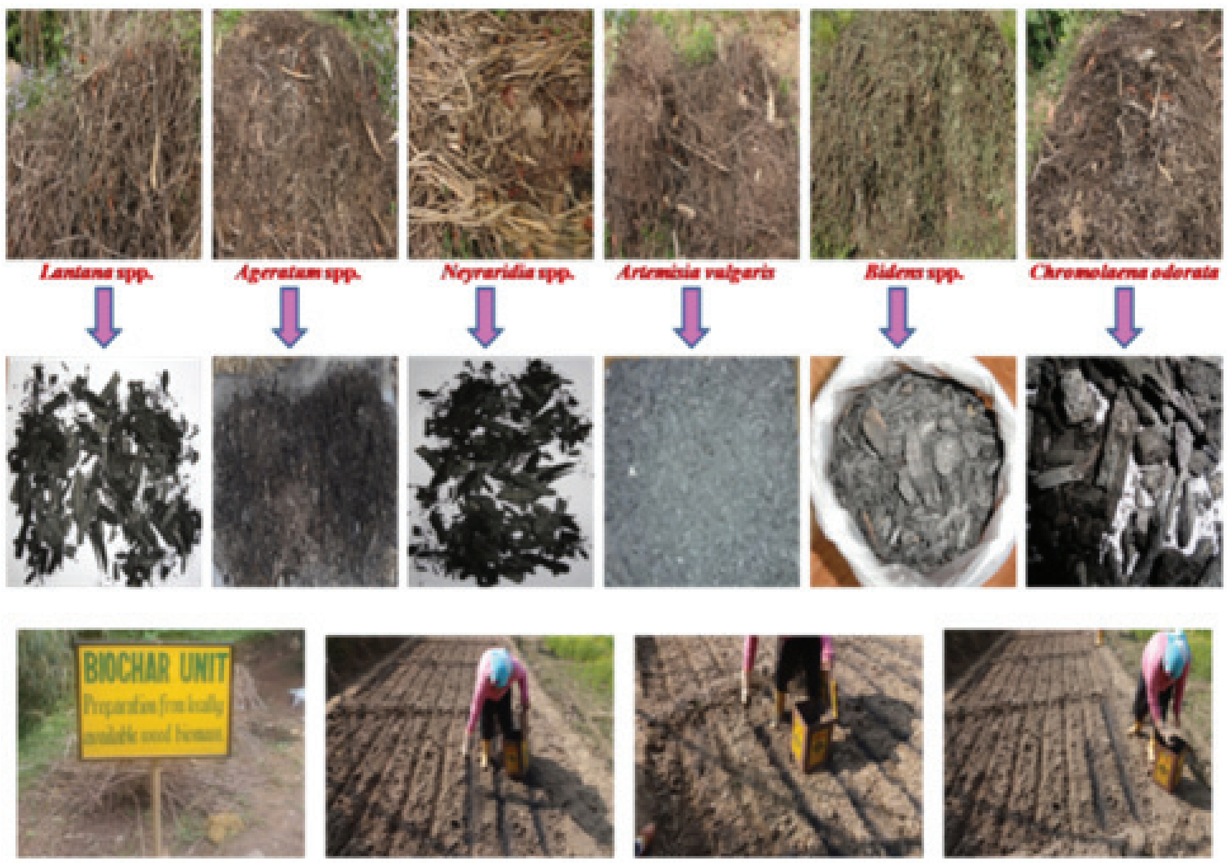
Technology no. 18

1. **Name of the technology:** Biochar technology from locally available weed biomass for acid soil management.
2. **Source of Technology:** ICAR Complex, Sikkim Centre
3. **Year of release:** 2016
4. **Agro-climatic zone:** North East Region with special reference to Sikkim
5. **Details description about the technology (with suitable photograph):**

Biochar is simply carbon rich charcoal-like substance which is created by heating biomass (organic matter) in limited oxygen condition, through a process known as pyrolysis. If we prepare biochar from locally available weed biomass then it is possible to reduce the weed population in the agricultural field which is a serious problem in organic agriculture. Biochar application increase soil pH, decrease leaching losses of nutrients, enhance nutrient availability and water holding capacity, sequesters huge carbon into soil, decrease N_2O and CH_4 emission into environment, increased nitrogen fixation, root nodule number and nitrogenase activity, remove heavy metals from soil, increase water holding capacity. Biochar should be applied along with other inputs like compost or manure at the same rate every year to realize the actual benefits. Application rates of these organic inputs can be reduced as biochar also contains some nutrients. During conversion of organic residues into biochar, farmers can also obtain an energy yield by capturing energy given off during biochar production process. Biochar is alkaline in nature (pH > 7.0). It can react similarly as dolomite does (by increasing soil pH) and provides an unique opportunity to improve soil fertility for longer period of time. It was found that rates between 5-10 t/ha (0.5-1 kg sqm) have beneficial effect on soil properties and crop yield. Application of higher amounts of biochar to the soil increases the carbon credit benefit to the farmers. During conversion of organic residues into biochar, farmers also obtain an energy yield by capturing energy given off during biochar production process. Biochar increases/improves soil moisture retention upto 20%, nutrient use efficiency upto 15%, CEC upto 35% and crop productivity upto 30%. Biochar increases grain yields (15%) by decreasing leaf SPAD value at sites with low P availability in upland rice.

ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok has utilized six different locally available weed biomass *viz.*, *Ageratum* spp., *Lantana* spp., *Artemisiavulgaris*, *Chromolaena odorata*, *Bidens* spp., *Neyraridia* spp. which were used to prepare biochar. Charring was carried out in a pit (2×2×3 ft^3) to keep the process simple, quick and low cost having production efficiency 13.2, 23.2, 15.1, 16.4, 14.6 and 19.6%, respectively. The biochar prepared from weeds biomass and dolomite were applied at three rates (0, 2.5, and 5.0 t/ha). Amendment type, application rate, and their interaction had significant effects on soil pH ($p<0.05$). Application of *Lantana* spp. biochar had shown a relatively larger increase in soil pH followed by *Ageratum* spp., *Neyraridia* spp., *Artemisia vulgaris*, *Bidens* spp., *Chromolaena odorata*. These weed spp. can be effectively used as potential source of biochar preparation.



6. **Observation to be recorded:** Initial soil properties before sowing of crops and final soil properties after harvest of crops (pH, SOC, N, P, K, micronutrients, BD and available moisture)

7. **Contact address for relevant information:** Joint Director, ICAR-NOFRI, Tadong, Gangtok, Sikkim,

   The Director, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya.

Technology no. 19

1. **Name of technology:** Furrow application of lime for improving crop productivity on acid soils
2. **Source of Technology:** Soil Science Section (Division of NRM), ICAR RC NEHR, Umiam
3. **Year of release:** Technology developed over a period of time through various field experiments in trials in farmers' field.
4. **Agro climatic Zone :** Suitable for all acid soils of NEH Region
5. **Detailed Description about the technologywith suitable photographs:**

   Soil acidity is a major constraint to crop productivity in northeastern hill regions of India. About 21 million ha area in the region is affected by soil acidity, of which 16 million ha area is afflicted by high levels of soil acidity (pH <5.5). Many essential nutrients (such as P, Ca, Mg etc) are highly deficient on these soils, while many others present in toxic concentrations (viz. Al, Fe & Mn). These nutritional imbalances severely affect the crop productivity on these soils. Liming is usually recommended to get rid of these nutritional deficiency and toxicity problems. However, the lime requirement for broadcasting and the cost associated therewith are prohibitively very high, which makes this practice unaffordable by the farmers. Keeping this in view, an alternate method of lime application (furrow application of lime @2-4 q/ha) has been found to be more cost effective and easily affordable by the farmers. In this method, lime is applied only in furrow (for furrow grown crops) for every crops,unlike broadcast application which is done usually once in four years.

Furrow application of lime in farmers' field (by a potato growing farmer)

In a series of field trials with different crops including cereals, oilseed, pulses, tuber crops etc. furrow application of lime @ 2-4 q/ha has been found to increase the crop yields by 14-50 percent over farmers' practice. Yield improvement can be further enhanced by applying lime along with NPK fertilizers. The yields with 50% recommended NPK + lime are usually equal or slightly higher than the yields with 100% NPK. Liming can therefore save chemical fertilizers by 50 percent.

Yield under farmers' practice (No lime)Yield under farmers' practice + liming

6. **Critical input requires:** Agricultural lime or lime sludge
7. **Observation to be recorded**
   - i. Crop growth and yield parameters (plant height, root length and mass, leaf greenness, crop yield)
   - ii. Soil pH, Al toxicity, P availability etc
8. **Contact address of relevant information**

   Division of NRM (Soil Science), ICAR Research Complex for NEH Region, Umiam

Technology no. 20

1. **Name of technology:** Enriched compost (Made from locally available biomass**)**
2. **Source of the technology:** ICAR Research Complex for NEH Region, Umiam
3. **Year of release:** 2014
4. **Agro climatic zones:** Suitable to all type of soils
5. **Details description about the technology with suitable photographs:**

   For preparation of enriched compost, locally available substrates like crop residues (paddy straw, maize stalk etc.), weed biomass (local abundant weed) are converted in to compost with the help of locally available organic nutrient sources as well as judicious use of mineral additives. In the preparation of desired compost, following steps have to be followed.

   - i. The dry and hardy substrates (weed biomass & crop residues) are chopped in small size (2.5 to 10 cm, depending on resources) using sharp knife to increase the surface area of biomass for faster decomposition.
   - ii. The naturally dry crop residues and weed biomass are mixed with green and succulent ones in roughly equal proportions to maintain the C: N ratio at desired levels to fasten the decomposition.

iii. Pits of 3m (L) x 2m (B) x 1m (D) (or different size, according to convenient) dimensions were dug in a location of the farm which is free from water stagnation. This dimension, can accommodate approximately 3 quintals of mixed substrate.

iv. The sides and the bottom of the pit should be made free from cracks and crevices to avoid the seepage and leaching.

v. Before filling the pit with substrates, the inner sides and bottom of the pit are plastered using the slurry. The slurry consisted of cow dung/poultry excreta/pig dung, soil and well rottencompost in the ratio of 1: 1: 0.5. Slurry prepared from 100 l of water containing 35 kg offresh cowdung/poultry excreta (one month old) /pig dung (one month old), 35 kg dry soiland 17 kg of well rotten compost is enough for a single pit of 3m (L) x 2m (B) x 1 m (D)dimension. Before making slurry, poultry excreta and pig dung are dried under shade, debrisremoved and lumps broken. Slurry is used as microbial inoculum and for supplementingnutrients to the compost.

vi. Plastering with slurry creates a nearly impervious layer that checks seepage loss of nutrients and prevents entry of water from outside. The slurry at the pit bottom also provides an ideal seat for microbial activity.

vii. The most critical part of the whole composting process is proper filling of the pit with layers of substrate, slurry and mineral additives.

viii. Approximately 20cm thick layer of the substrate is placed uniformly on the pit bottom. Care should be taken to avoid too much compaction of the substrate while putting in layers.

ix. After placing each layer of the substrate, the slurry (composition given above) is sprinkled over each of the layers in sufficient quantity to ensure a coating of the whole substrate with slurry, which acts as a sticker that helps the mineral additives to adhere on the substrate.

x. Immediately after sprinkling of slurry, mineral additives are applied to the substrate layer. In general, nitrogen (N) was applied @ 0.5% as urea; phosphorus (P) @ 1.5% as Mussoorie rock phosphate and sulphur (S) @ 0.5% as elemental sulphur are used.

xi. After adding mineral additives, another new layer of substrate is placed in the similar fashion and steps are repeated till the pit gets filled up with substrate and reaches a height of 1ft above the ground level.

xii. The materials inside the pit are moistened with water sufficiently (70% moisture content). After filling the pit, a dome shape is given to the substrates remaining above the ground level.

xiii. The pit top is plastered with a thick layer of the slurry (as above) and care should be taken to maintain proper consistency of the slurry so that cracks do not develop on drying.

xiv. After plastering the pit top, the compost pit is kept as such for 20 days. After 20 days the materials inside the pit is turned manually. The moisture content of the partially decomposed substrate inside the pit is to be checked and water is added, if necessary, to maintain moisture level of nearly 70%. The pit top should be covered again with slurry.

xv. Same process to be repeated at an interval of 20 days till the completion of composting (till 100-105 days).

xvi. Frequent turning of substrate is considered vital for rapid composting process to succeed.

xvii. Turning is very important which ensures uniform distribution of temperature throughout the compost pile, facilitating production of a homogenous end product, maintain moisture uniformly, and facilitates proper aeration and uninterrupted faster decomposition.

xviii. The completion of the composting process is marked by a number of indicators-both physical and chemical. As it is not possible for the farmers to evaluate the chemical indices, they have to rely on the physical indicators only. Usually, when the temperature inside the compost heap is similar as that of ambient temperature, the composting process appears to be complete.

xix. Once composting process is complete, the compost is collected from the pit and care should be taken to avoid scraping of the pit-bottom-soil along with compost which deteriorates the quality of the compost.

xx. After collection from the pit, compost is spread under a shade to remove excess moisture and unwanted materials like, stone, pebbles, plastics, metals etc. (If any)

xxi. The final product should contain 35-50% moisture (Optimum) and sieved using 1 inch mesh to obtain a uniform size.

xxii. The processed compost is then stored in a cool dry place for future use.

Figure: Preparation and filling of compost pit

6. Critical input requires

i. Crop residue viz., paddy straw, maize Stover, groundnut and soybean stalks.

ii. Weed biomass viz., *Ambrossiaartimisifolia*, *Eupatorium* spp., *Ageratum conyzoides*, *Lantana camara etc.*

iii. Slurry (Slurry consisted of cow dung/ poultry excreta/pig dung, soil and well rotten compost in the ratio of 1: 1: 0.5)

iv. Mineral additive (external addition of nutrients such as N, P and S to the substrate for hastens the process of composting and improves the quality of compost. Urea, rock phosphate and elemental sulphur are added as mineral additive)

7. **Observation to be recorded**

i. There should no more reduction in volume of compost.

ii. Conversion of the substrate to a dark brown to black colored mass.

iii. Absence of the pleasant smell

iv. Little or no presence of original substrate.

v. Complete cooling down of the compost pile and no more heating upon wetting.

vi. Production of a mass- friable and brittle when dry.

vii. Almost dry and friable

8. **Contact address of relevant information:** Division of NRM (Soil Science), ICAR Research Complex for NEH Region, Umiam.

Technology no. 21

1. **Name of technology:** Seed priming for improving crop productivity and nutrient efficiency in acid soils
2. **Source of Technology:** Soil Science (Division of NRM), ICAR RC NEHR, Umiam
3. **Year of release:** 2015
4. **Agro climatic Zone :** Technology tested in Subtropical Meghalaya
5. **Detailed Description about the technology with suitable photographs:**

Crop productivity in northeastern hill regions of India is constrained by a range of edapho-climatic limitations. Among the soil-related factors, nutrient deficiencies and low use efficiency of applied nutrients are the major constraints. Phosphorus and zinc are respectively the most deficient major and micro nutrient in acidic soils of NEH Region. Thus, if crop productivity has to improve in the region, deficiency of these essential nutrients must be addressed. Presently, external application of these nutrients through mineral fertilizers is extremely low, mainly due to associated high cost and some other logistical limitations. Whatever little fertilizer is applied, their use efficiency is extremely low (particularly of phosphorus), due mainly to higher P fixation capacity of the soils and low uptake efficiency of plant roots growing in acid soil environment. Moisture deficiency in *Rabi* season is also a constraint which limits germination, seedling establishment and overall productivity of the crop in NEH region. Therefore, a cost effective technology is required which could simultaneously aim at reducing the doses of applied nutrient, improving their use efficiency, and overcoming the nutritional and moisture stress to crops, at least during the initial phases of crop growth. Seed priming has been testedand established as one such technology which addresses all these issues simultaneously.

It's a very simple, easily adoptable and enormously cost effective technology where crop seeds are soaked overnight in either simple water or nutrients solutions (1% $ZnSO4.7H_2O$, 1% KH_2PO_4). After overnight soaking, the seeds are sown in field or air dried if storing for a brief period is required. This practice helps in fast germination, better seedling establishment, better initial root growth and thereby more efficient uptake of moisture and nutrients, leading ultimately to improved yield and nutrient use efficiency.

Seed priming with water is particularly effective in improving germination and seedling establishment in moisture stress condition. Priming with Zn and P solution also offers this advantage with some additional advantages as well. On an average, Zn and P priming improves crop yield by 14-15%. They reduces the fertilizer requirement by 30 kg P_2O_5/ha and 5 kg Zn/ha (soil applied) respectively. Foliar application of Zn can also be combined with Zn seed priming for better results. Agronomic P use efficiency increases by nearly 10 kg kg^{-1} $P_2O_5$by seed priming with P solution, while agronomic efficiency of soil- and foliar-applied Zn could almost be doubled by seed priming with $ZnSO_4$ solution.

6. **Critical input requires: -**10 g of $ZnSO_4$or KH_2PO_4per litre of water
7. **Observation to be recorded:** Germination percentage, days to 50% germination, plant height, days to flowering/maturity and crop yield.
8. **Contact address of relevant information-** Division of NRM (Soil Science), ICAR Research Complex for NEH Region, Umiam

Technology no.22

1. **Name of the Technology:** Production of Vermicompost
2. **Source of the Technology:** College of Horticulture & Forestry, CAU, Pasighat
3. **Year of release:** 2013-14
4. **Agro Climatic Zone:** NEH Region/Eastern Himalayan Region
5. **Detail description about the technology**
6. **Vermicomposting**

Vermicomposting is the process of recycling organic matter into nutrient rich compost using earth worms. It is very important for the all the north east state It is carried out generally under aerobic condition for production of organic manure in a lesser time and to get rid of the bad odor of the degrading organic wastes. Vermicompost is stable organic manure produced as vermicast by earthworm feeding on biological waste materials. It is an efficient recycling process of animal, agriculture and industrial waste. Vermicompost is a mixture of warm cast, humus, live earthworms and their cocoons and other organisms like insect, mold and micro organisms. The major constituents are essential macro and micro nutrients, immobilized enzymes, vitamins, antibiotics, humic acid and growth hormones.

The species most commonly used for vermi-composting is *Eisenia foetida.* It can thrive well under wide range of temperature 4-30^{0}C and moisture of about 30-60 % and can live in organic waste in a p^H range from 6-8. It is ideal natural manure that improves the physical, chemical and biological characteristics of the soil.

Farm waste for vermicomposting

- Two weeks old farm yard manure
- Fruits and vegetables waste
- Crop residue and weed etc.

Some common species of earthworms used for vermicomposting are:

- *Eisenia foetida* (Red worm)
- *Eudrilus eugeninae* (African night crawler)
- *Perionyx excavates* (Blue worm)

In this region, most common one is Red worm (***Eisenia foetida***) which is clearly recognized by their alternating red and buff stripes. The worm has a wide range of temperature tolerance but prefers 20-25^{0}C for fast growth and double its population within 2-3 months.

Why vermi-composting?

- An important source of organic manure.
- Helps in recycling any organic wastes into a useful bio-fertilizer and leaves no chance of environmental pollution.
- An eco-friendly, non-toxic product, consumes low energy input
- A preferred balanced nutrient source.
- Improves physical, chemical and biological properties of soil without any residual toxicity.
- Reduces the incidences of pests and diseases in crop production.
- Improves quality of agricultural produce.

Fig. 1. Red worm (Eisenia foetida)

Production Technology

Prepare a bed as per space availability in shade and keep the following layers as follows:

Vermicompost in pit: -

- Selection of Earthworms: Earthworms which are native of the locality may be used for vermicomposting.
- Size of pit: The pit of convenient size such as 2m X 1 m X 1 m may be prepared with bamboo or cemented permanent structure.
- Preparation of vermin-bed: A 6 inch thick layer of dry fodder or good loamy soil spread in the bottom of pit and above it a 6 inch ripen FYM or fresh cattle dung is spread and leave up to 48h after watering.
- Inoculation of Earth worms: About 100 earthworms/square feet are uniformly incubated to maintain an optimum inoculating density of about 2mXlmXlm compost pit.
- Organic layering: The compost pit is then layered to about 6 inch with dry leaves or hay. Moisture content of the pit is maintained through addition of water without flooding.
- Mixing of vermicompost layers: Mixing of vermicompost layers done after one month without disturbing the vermin bed ensures proper vermin-composting and wet it till the vermicompost is mature within 60-65 days after inoculation.
- Harvesting of vermin-compost: At maturation the moisture contents is brought down by stopping the addition of water for 3-4 days. This ensures drying of compost and migration of worms into the vermin-beds, the mature compost and a fine loose granular mass is dug out from the pit, sieved, cleaned and packed.

Precaution: bed should be located in a shady place at a higher plane and free from water stagnation.

Advantages of Vermicompost

1. In comparison to other fertilizers and organic manures, vermicomposting is very simple, prepared in lesser time, environmentally safe, and useful in increasing yield and making productive soils.
2. Vermicompost has microbes of various types, micronutrients, minerals (calcium, potassium, and nitrogen), vitamins, enzymes and bacteria in sample quantities, which

Fig. 2. Constructed newly vermicompost unit

essential for plants and to maintain the environment.

3. Provides proper environment to soil, water and microbes and conserve them.
4. There is no need of fertilizers, and soil fertility is regenerated by regular use of vermicompost.
5. The plants remain healthy yield more and regenerate resistance against insects and diseases.
6. Vermicomposting is a simple, cheap and profitable enterprise which attracts youth for employment generation.

Recommended dose of application of vermicompost is as follows:

1. **Seeds Beds, Domestic lawn and flower plots** - Apply vermi-compost @100-200g/sq feet area in seed beds or lawn.
2. **Horticulture Crops:** in fruit plants 5-10kg/plants vermicompost along with equal quantity of FYM may be applied depending upon the age and size of the plants. Mature vermicompost is recommended @ 5tones/ha
3. **Vegetables:** For vegetable@ 5tones/ha vermicompost is recommended. It gives best result when mixed with equal amount of FYM.
4. **Agricultural Crops:** In field crops like soybean, maize, bajra, kharif pulses, wheat, barley, mustard, gram *etc.,* vermicompost may be applied @ 2-3 tones/ha along with FYM.

Constituents of Vermicompost

Organic Carbon	19.89%
Nitrogen (N)	1.54 to 1.60%
Phosphorus (P_2O_2)	1.29 to 1.33%
POTASH (K_2O)	0.86 to 0.95%
Mineral content at 46% moisture	
Ca	1.70%
Mg	0.80%
S	0.35%
Zn	158 ppm
Cu	28 ppm
Fe	7497 ppm
Mn	257 ppm

Ready-reckoners for soil test based fertilizer recommendations for wheat.

The fertilizer recommendations based on targeted yield approach are not only balanced but also remove the arbitrariness in fertilizer recommendations and ensure the yield that could be achieved. It provides the basis where fertilizer recommendations can be tailored to the need, management and input investment capacity of the farmers. Ready reckoners were prepared from the fertilizer adjustment equations, for different soil test values, which will provide a working basis for soil testing laboratories for making fertilizer recommendations based on targeted yield. This recommendation is applicable for Delhi and adjoining areas having similar soil agro- climatic conditions. The requirement of fertilizers is decrease with the increase in soil values.

Soil test based fertilizer adjustment equations

Wheat

FN = 5.31t-0.51 SN

FP_2O_5 = 3.45T-5.55 SP

FK_2O = 2.75T-0.32 SK

Where FN, FP2O2 and FK2O= fertilizer dose (kg/ha), SN, SP and SK= soil test values (kg/ha), T stand for targeted yield of the crop in q/ha and amount of N added through DAP will be adjusted.

Cost benefit ratio of vermin compost

Raw materials required for preparation of one tones of nutrient enriched compost

S. No.	Material	Amount (in kg)	Estimated cost (₹)
1	Crop residue	2000	Nil
2	Poultry droppings/Cow dung	200	600
3	Rock phosphate	50	500
4	Compost inoculants	0.50	200
5	Earth worm	1000/pit	1000
6	Total cost (Rs)		2,300

S. No.	Market price of vermin compost	Amount (₹)
1	Market price of 1000 kg compost @ Rs 10/kg	10,000
2	Input Cost	2,300
3	Profit	7,700

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Chapter 4- Plant Pathology

Technology no. 1

1. **Name of technology:** Control of False Smut disease of Rice
2. **Source of technology:** RARS, Titabor, AAU
3. **Year of release:** 2013
4. **Agro-climatic zone:** All Agro-climatic Zones of Assam
5. **Detail description of technology:**

   Application:

   Treatment: Spraying of Propiconazole 25 EC once at 50% panicleemergence stage.

   Method of One need based application (based on the disease history of the location) in the evening hours only (after 1 pm)
6. **Critical inputs required:** Fungicide (Propiconazole 25 EC**)**
7. **Observations to be recorded:** Disease incidence,- % of infected panicle, Disease Severity, % of spikeletes/ panicle, Time of occurrence,Formation of sclerotia, if any, Yield loss, Soil status, B.C. Ratio, Farmers' reaction.

Technology no. 2

1. **Name of technology:** Management of Stem rot disease of *Sali* Rice
2. **Source of technology:** RARS, Titabor, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** All agro-climatic zones of Assam
5. **Detail description of technology:** Spraying of Contaf 2 ml/l (Hexaconazol) at the appearance of disease at 5% disease severity (lesion with sclerotia) followed by 2nd and 3rd spray at an interval of 10 to 15 days.
6. **Critical inputs required:** Fungicide (Hexaconazol)
7. **Observations to be recorded:** No. of infected plants at 10-15 days interval with infected lesion and sclerotia, At least 3 observations are to be recorded, Yield record, B: C ratio, Farmers' reaction.

Technology no. 3

1. **Name of technology:** Management of rust disease in Pea
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All agro-climatic zones of Assam
5. **Detail description of technology:** Rhizome treatment with Copper oxychloride (COC) @ 3g/Lit + streptomycin (0.2g/Lit) for 45 minutes followed by shade drying and planting and two soil drenching with COC @ 3g/Lit at 60 and 90 days after planting against rhizome rot of ginger and alternatively rhizome treatment with Biofor-pf + 2 soil drenching with Copper oxychloride (3g/Lit) at 60 and 90 days after planting and also for organic management, rhizome treatment with Biofor- pf followed by spraying with Biozine @100ml /clump at 60, 90 and 120 days after planting against rhizome rot of ginger
6. **Critical inputs required:** Copper oxychloride, streptomycin, Biofor-pf, Biozine
7. **Observations to be recorded:** No. of infected plants at least 3 observations are to be recorded, Yield record, B: C ratio, Farmers' reaction.

Technology no. 4

1. **Name of technology:** Management of rhizome rot disease in Ginger
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All agro-climatic zones of Assam
5. **Detail description of technology:**

   Rhizome treatment with Copper oxychloride (COC) @ 3g/Lit + streptomycin (0.2g/Lit) for 45 minutes followed by shade drying and planting and two soil drenching with COC @ 3g/Lit at 60 and 90 days after planting against rhizome rot of ginger and alternatively rhizome treatment with Biofor-pf + 2 soil drenching with Copper oxychloride (3g/Lit) at 60 and 90 days after planting and also for organic management, rhizome treatment with Biofor- pf followed by spraying with Biozine @100ml /clump at 60, 90 and 120 days after planting against rhizome rot of ginger
6. **Critical inputs required:** Copper oxychloride, streptomycin, Biofor-pf, Biozine
7. **Observations to be recorded:** No. of infected plants at least 3 observations are to be recorded, Yield record, B: C ratio, Farmers' reaction.

Technology no. 5

1. **Name of technology:** Management of late blight disease in Potato
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All agro-climatic zones of Assam
5. **Detail description of technology:**

   One spraying of Mancozeb 75% (Indofil M 45 / Dithane M 45) @ 0.25% (2.5 g/Lit) at canopy closure (35-40 days after planting) and second spraying of Cymoxanil 8% + Mancozeb 64% (Curzet M / Moximate) @ 0.25% (2.5 g/Lit) at first appearance of the disease (if disease appear) and third spraying of Mancozeb 75% (Indofil M 45 / Dithane M 45) @ 0.25% (2.5 g/Lit) after 10 days of second spraying and fourth spraying of Cymoxanil 8% + Mancozeb 64% (Curzet M / Moximate) @ 0.25% (2.5 g/Lit) after 10 days of third spraying against late blight of potato
6. **Critical inputs required:** Mancozeb 75%, Cymoxanil 8%
7. **Observations to be recorded**: No. of infected plants at least 3 observations are to be recorded, Yield record, B: C ratio, Farmers' reaction.

Technology no. 6

1. **Name of technology:** Biological suppression of sugarcane pests
2. **Source of technology:** NBAII, Bangalore
3. **Year of release:** 2011
4. **Agro-climatic zone:** UBVZ
5. **Detail description of technology:**

   Technology: T1: Release of *Trichogramma chilonis* on 45th day after crop germination @ 50,000/ha at 10 days interval. Total of 8-12 releases to be made depending pest severity.

   T2: Chemical control plot

   T3: Untreated control

   Management practices:

Variety:	Any recommended variety
Characteristics:	Drought tolerant, Good for autumn planting
Duration:	360-540 days
Cane Characters:	Straight, Medium thick cane
Sowing time/planting time:	March- April
Harvesting time:	December -March
Sett rate:	45000 – 52000/ ha

Spacing: 75-90 cm row to row

6. **Critical inputs required:** *Trichogramma chilonis, insecticides*
7. **Observations to be recorded:** All observations to be recorded in Bio-control plots as well as plots with farmers' practice for making comparison, Incidence of pests/diseases, Time of occurrence: 45-50 DAP to before harvest, Percent damage/ percent survival, Percent infested cane and healthy canes before and after treatment, Pre and post parasitisation record by releasing tricho card, Yield &yield attributes, Soil status, B: C ratio, Farmers' reaction.

Technology no.7

1. **Name of technology:** Fiber quality improvement in Jute through microbial retting
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** CBVZ, LBVZ, NBPZ
5. **Detail description of technology:**

   Method of application to be applied at the time of retting in between jute bundles in retting tanks

   Variety: Tarun, Apeswaree

   Rate/quantity: 4 kg of bacterial formulation per 70 quintal of green sticks

   Duration of retting: 15-20 days during July-August
6. **Critical inputs required:** Microbial culture
7. **Observations to be recorded:** Crop age, Date of sowing and harvesting, Soil characterises, Date of application of bacterial formulation, Date of fibre extraction, Depth of water of retting tank and its area, Water temperature during retting, Colour of jute fibre, B: C ratio, Farmers' reaction.

Technology no. 8

1. **Name of the Technology:** Management of Bacterial Wilt of Binjal, Chilli and Tomato in North East Region
2. **Source of the Technology:** Department of Plant Protection, College of Horticulture & Forestry, CAU, Pasighat -791 102, Arunachal Pradesh.
3. **Year of release:** 2012-13
4. **Agro Climatic Zone:** NEH Region/Hot Humid Region
5. **Detail description about the technology:**

   Wilt diseases of brinjal, chilli and tomato can be caused by fungal and bacterial pathogens (both are soil borne), as well as by abiotic factors. Bacterial wilt is predominant in North Eastern Region of India followed by Fusarium and Verticillium wilt. Determining which agent is responsible for causing disease can be vital for prescribing the proper management strategies. The external and internal symptoms produced on the host by each pathogen; provides information on the disease life cycle and environmental conditions that favor disease development; and also provides basis for diagnostic techniques that can be used in the field diagnosis of each disease described.

Bacterial Wilt

Causal organism: *Pseudomonas solanacearum* or *Ralstoniasolanacearum* (soil-borne bacterium)

Symptom:

A characteristic of this disease, which sets it apart from other wilt diseases, is that plants wilt and die rapidly without the presence of yellowing or spotting of the foliage. The disease can occur in newly cleared land as well as in areas where susceptible crops have not been grown previously. The bacterium often enters a field on infested transplants, equipment, or through drainage water. The pathogen can overwinter in soil.

Entry of the bacterium:

Bacteria infect plants through the roots or stem, most often where tissue has been injured by cultivating, or by some other physical means such as nematodes. Bacteria invade the vascular tissue, apparently causing wilt by a gradual blocking of the water conducting vessels.

Epidemiology:

The disease is most commonly found in low, wet areas of fields and is most active at temperatures above 20-25^{0}C.

Identification of the bacterium:

To identify bacterial wilt pathogen, cut and peal back a section of the epidermis and cortical tissue (bark) just above the soil line. The center of the stem (pith) will, in early stages, appear water soaked; later, the pith will turn brown and sometimes become hollow. The discoloration of the pith distinguishes this disease from Fusarium and Verticillium wilt. Another relatively easy diagnostic technique is to cut a portion of the affected stem and place it in a clear glass container filled with water. The appearance of white, milky ooze streaming out of the cut end of the discolored vascular tissue is diagnostic for this disease.

Host range:

Bacterial wilt attacks members of the Solanaceous plant family, which includes peppers, potatoes, and egg plant etc.

Control measures:

i. Before sowing the seeds should be dipped in a solution of Streptocycline (1 g/ 40 litres of water) for 30 minutes.

ii. Roguing of wilted plants and the soil surrounding their roots can reduce spread of the disease and may be a viable control alternative in home garden situations.

iii. Soil fumigation should be considered in heavily infested fields.

iv. Soil solarization is another alternative for control of bacterial wilt.

v. Crop rotation is an effective method of control.

vi. Growing susceptible crops in the same area not more than once every 4 years will reduce inoculum in the soil.

Fig. 1. Wilt infected Tomato crop.

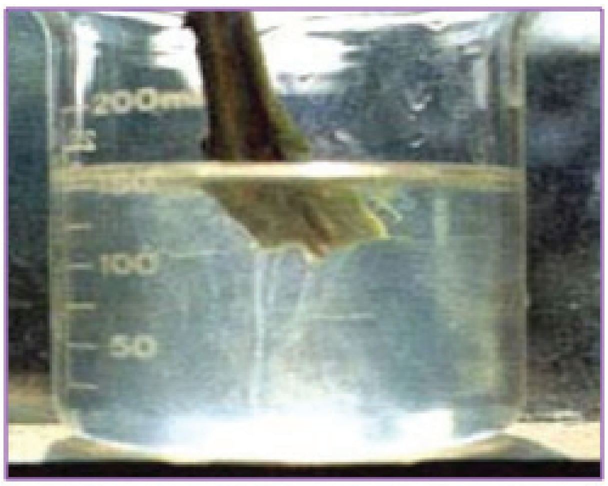

Fig. 2. White milky ooze of bacterial wilt

Fig. 3. Healthy tomato crop.

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Technology no. 9

1. **Name of the technology:** Citrus Rejuvenation
2. **Source of the technology:** Department of Plant Protection, College of Horticulture & Forestry and Krishi Vigyan Kendra East Siang Pasighat -791 102, CAU, Arunachal Pradesh
3. **Year of release:** 2011-12
4. **Agro Climatic Zone:** NEH Region/Hot Humid Region
5. **Detail description about the technology:**

   Management and Rejuvenation of Citrus Orchard in Different Location of North East Region of India

   Citrus is the second most important fruit crop of the world in terms of area, production and utility. India with the production of 6 million tons occupies sixth position in the world. There are four distinct citrus growing regions in the country *viz.* North east region comprising of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, North western region comprising of Himanchal Pradesh, Punjab, Haryana and Rajasthan, Central region including Gujarat, Maharashtra & Madhya Pradesh and Southern region comprising of Andhra Pradesh, Karnataka and Tamilnadu. North east region of India is considered to be the natural home of citrus for many species. Mandarins (*Citrus reticalata*), sweet orange (*C. sinensis*), acid lime (*C. aurantifolia*) and lime (*C. limon*) are the major cultivated species of the region. Citrus crop are widely grown fruit crop in north east region of India but the productivity is very low with 4.54 tons /ha as against the national productivity of 8.42 tons /ha. One of the main reasons of low productivity is due to losses caused by diseases *i.e.* Fungal, bacterial, viral and phanerogamic plant parasites and Insect-pest. The grower do not adopt the proper management practices in terms of plant protection, manuring, irrigation, mulching, pruning etc. and the orchard become sick.

   Rejuvenation strategies:

- Provide technical knowhow including plant health coverage and nutritional management programme.
- Re-planting of old / uneconomically orchards.
- Gap filling by provide disease free quality seedlings.
- The development agencies may prepare comprehensive orchards management programme provide all the necessary inputs like plant nutrients, plant protection horticultural equipment and periodically trainings.
- Training is an important component, which improves overall efficiency and knowledge and skill of field functionaries.
- Complete technological information for the management of decline orchard may be packed and same may be disseminated by farm’ fields.

Months	Management Practices
January	❖ Cleaning of orchard followed by pruning of dead, diseased and overlapping branches immediately after harvest. ❖ Treatment of pruned ends with 1% Bordeaux paste (1 kg lime dissolved in 5 liter of water in the bucket do not use plastic & Iron, dissolve 1 kg copper sulphate $CuSo_4.5H_2o$ is another 5 liter of water, mixed the solution well.) ❖ Clean the lichen /mosses growth with a piece of gunny bag.
February	❖ Locate trunk borer and plug the holes with mud after plugging cotton soaked in petrol/kerosene or carbon disulphide. ❖ Cut the wither parts and destroy them. ❖ Loranthus infected branches should be cut well below the last haustorium. The parasitic plant should be eradicated before the maturity of berry. ❖ Orchard phytosanitation and basin preparation by light working of the soil without root injury.
March	❖ Apply 25 kg FYM/tree around the tree trunk and after 15 days apply Urea (800g), Single Super Phosphate (400g), and Murate of Potash (800) / tree. ❖ Swapping of tree trunk with 1% of Carbaryl up to 2 meter from base. ❖ Spray endosulphan 0.07% to kill the adult trunk before feeding the foliage. ❖ Shaking of tree to kill the adult trunk borer manually.
April	❖ Apply Bromocil 6 kg/ha to control weeds ❖ Spray micronutrients mixture (Zinc sulphate 60g, Manganese sulphate 40g, borax 20g and lime 180g dissolve in 20 litres of water) or spray agromin @ 15g in 10 litres of water. ❖ Spray of Quinolphos 1.5ml./litre to control foliage feeder.
May	❖ Swapping of the base of the trunk with 1% Carbaryl and 1% of Bordeaux paste. ❖ Install light trap to catch trunk borer adults or hands picks. ❖ Apply 200g of urea in the soil around the tree basin.
June	❖ Sow intercrops like French bean, Chilli or any leguminous crops. ❖ If fruit drop problem occurs, apply light irrigation in orchard. ❖ Clean the weeds in the entire orchard area manually.
July	❖ Spray Roger or Monocrotophos @ 1.5 ml/liter of water if leaf minor damage appears. ❖ Spray of Bordeaux mixture 1% (dissolve 1kg lime in 50 liter water in plastic bucket + dissolve Copper sulphate 1 kg in 50 liter water separately. Mixed two the solution and use within a day).
August	❖ Kill the grubs of trunk borer by hooking by spike. ❖ Under severe infestation of trunk borer inject 5 ml Monocrotophos or Carbon disulphide / hole and plug with mud. ❖ Cut and burn dried parts of the plants as they harbor grubs and pupae. ❖ Apply 200g of Urea /plant in soil application.

September	❖ Apply Glyphosate 5 liter / ha to weed control ❖ Harvest the Intercrop. ❖ Use poison bait prepared by mixing 20g Malathion 50wp + 200g Jaggery or molaess in 2 liter water. Place in small plastic containers and hang 2-3 / tree for control of fruit sucking moths. ❖ Generate smoke in the orchard @ 2-4 / acre for 2-3 hours after night fall to control fruit piercing moth. ❖ Dispose fallen fruits which attract the moth.
October	❖ Follow control methods (as September) to control fruit sucking moth. ❖ Dispose fallen fruits which attract the moth. ❖ Control of trunk borer may be repeated. ❖ If pre-matured fruit drop problem occurs, spray 10 ppm 2,4 –D or 15-20 ppm Naphthalene acetic acid (NAA).
November	❖ Harvest the mature fruit without damaging the plant. ❖ Cut the dried branches, if any and apply 1% Bordeaux paste at the cut ends.
December	❖ Harvest of matured fruits continued. ❖ Harvest the fruits using secateurs, cutter or clipper avoid hand plucking. ❖ Grade the fruit into too small, too big, rotten, damage, hard green, over ripe. ❖ Wash the fruit at the packing shade with chlorine water and then rinse with fresh water. ❖ Washed fruit should be treated with Benomyl or Bavistin @ 0.25% mix with wax. ❖ Pack 50 fruits in one box or basket. Use chopped rise straw or dry grass for packing.

Rejuvenation Practices:

- Pruning of dried branches, after the harvest fruit immediately followed by application of Carbendazim (Bavistin) spraying @ 1g / liter of water.
- Control of bark eating caterpillar (Inderbela) by application of Dichlorovas @ 0.1% (3-5 ml) in each larval tunnel or inserting tunnel cotton swap soaked with insecticides.
- Scrapping of oozing out gum and application of Metalaxyl paste on the wound.
- Spraying of Ridomil MZ 72 WP @ 2.5g /liter for the control of Phytophthora.
- Irrigation by double ring method / drip and provide proper drainage.
- Application of recommended dose of fertilizer and micro-nutrients.
- Spraying of Imidacloprid (0.3 ml) or Monocrotophos @ (0.5 ml) / liter of water for the control of citrus psylla.
- Spraying of Dicofol @ 1.5 ml / liter for the control of mites.
- Application of Bordeaux paste on the tree trunk twice a year before monsoon and after

monsoon.

6. **Critical input required:**

- Pruning knife (Dao sterilized with fire)
- Foot sprayer
- Bordeaux paste
- Bucket
- Brush

Fig.1. Citrus Rejuvenation in Arunachal Pradesh

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Technology no. 10

1. **Name of the technology:** Eco-friendly management of turcicum leaf blight of Maize
2. **Source of the technology:** Department of Plant Protection, College of Horticulture and Forestry, Central Agricultural University, Pasighat - 791 102, Arunachal Pradesh
3. **Year of release:** 2012-13
4. **Agro Climatic Zone:** NEH Region/Hot Humid Region
5. **Detail description about the technology**

   Maize (*Zea mays* L.) belongs to the family Graminaceae (Poaceae) is one of the most important crops in World agricultural economy used both as food for man and feed for animals. It has yield potential far higher than any other cereal and that's why it is sometimes referred to as the miracle crop or the 'Queen of Cereals'. In India as well as north eastern region with the growth in demand of poultry feed the demand for maize is also going up. Whereas, Human Consumption 35%, Poultry Feed 25%, Cattle Feed 25%, Food processing (corn flakes, popcorns, etc.15%) andother Industries (mainly starch, dextrose, corn syrup, corn oil, etc). A number of diseases are attack during its growth stages. Among the various diseases damaging the maize crop, the turcicum leaf blight is one of the most important diseases in maize growing areas. Earlier the disease was considered as minor, although at the present it has assumed the status of major disease in the World. In this article we will discussed about eco-friendly management of leaf blight of maize.

   Symptoms

   The disease is characterized by long elliptical grayish green or tan lesions on the leaves measuring 2.5 to 25 cm in length and upto 4 cm in width. The fungus affect the maize plant at young stage. Small yellowish round to oval spots are seen on the leaves. The spots gradually increase in area into bigger elliptical spots and are straw to grayish brown color in the centre with dark brown margins. The spots coalesce to form bigger spots and gives blighted appearance. The surface is covered with olive green velvety masses of conidia and conidiophores. Under high humidity the whole leaf area becomes necrotic and plant appears as dead. Lesions may be extended to husk.

   Causal organism: *Helminthosporium turcicum* (Syn: *Helminthosporium maydis*)

   Etiology

   The conidiophores of pathogen are in group, geniculate, mid dark brown, pale near the apex and smooth. Conidia are distinctly curved, fusiform and pale to golden brown with 5-11 pseudosepta.

   Disease cycle

   Fungus survives in plant debris, seed and collateral hosts. The fungus is externally seed borne. It also infects Sudan grass, Johnson grass, sorghum, wheat, barley, oats, sugarcane and spores of the fungus are also found to associate with seeds of green gram, black gram and cowpea. Secondary spread is through wind borne conidia.

   Favourable Conditions

   Optimum temperature for the germination of conidia is 18 - 27^{0}C provided with free water on the leaf. Infection takes place early in the wet season.

Eco- friendly disease management

- Removal and destruction of infected plant debris.
- Always use deep summer ploughing and stubbles burn it.
- Clean cultivation is to check the disease.
- Use of crop rotation with non host crops.
- Grow resistant hybrids like DHM-1, DHM-103,
- It can also be managed by seed treatment and soil application with *Trichoderma spp.* formulations @ 2% and 5% respectively.
- Foliar application of Nimbicidin @ 3%.

Figure 1. Maize crop infected by leaf blight

Figure 2. Elliptical symptom on maize leaf

Figure 3. Golden brown conidia of fungus

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Technology no. 11

1. **Name of the technology:** Mushroom Cultivation in Arunachal Pradesh
2. **Source of the technology:** College of Horticulture & Forestry, CAU, Pasighat -791102**,** Arunachal Pradesh
3. **Year of release:** 2010-11
4. **Agro Climatic Zone:** NEH Region/Hot Humid Region
5. **Detail descriptions about the technology:**

Commercial cultivation of mushroom started in north estern region was very late because of the lacking of the knowledge. Now a days according to climatic conditions various mushrooms are cultivated in different places. However, in Pasighat condition of Arunachal Pradesh are suitable for cultivation of Oyster (Dhingri) *Pleurotus* spp. round the year.

Production technology:

Period: January to December - Oyster mushroom

Mushroom house: It can be constructed with bamboo frames. Air vents on the upper walls and side walls are provided for ventilation. The walls may be covered with gunny cloth to increase the relative humidity to 80-85% in the production house. The sides are covered with tokkopatta (palm) plants. The floor of the shed is filled with sand to a uniform height of 10 cm.

Mushroom House

Spawn running room: Spawn running room is one where the beds are kept for running of spawn under dark condition but ventilation is required. Temperature in the spawn running room should be maintained between, 25-28 ^{0}C.



Cropping room: Cropping room is the one where the opened mushroom beds are to be kept after completion of spawn running. Fruiting requires a temperature range of 20-28 ^{0}C, cross ventilation (2-3 hour daily by opening doors and window) and light (2-4 hours per 24 hours from fluorescent tube), moisture and humidity range of 80-95%.


Substrate for mushroom cultivation: *Pleurotus* spp. can be grown on the tropical wastes like rice straw, wheat straw, corn Cobbs, dried water hyacinth, sugarcane bagasse, banana leaves, cotton waste or sawdust are used for cultivation. Paddy straw is cheap, easily available and used as a substrate in Pasighat conditions of Arunachal Pradesh. Hand thrashed and fresh paddy straw is cut into 3 to 5 cm length were used for pasteurization.


Pasteurization of substrate (Hot water treatment)

Soak the chopped 3-5cm paddy straw in cold water for 4 hr in a drum (Plastic/Teen/

Iron). Drain out the water and add fresh water with cover the drum with gunny sac. Boil the contents over the flame for 45-60 minutes. After boiling, take out the straw and drain the excess water by keeping them in wire baskets. Spread the straw as thin layer on a hessian cloth, spread on a raised platform. Shade dry the straw to get 60-65 % moisture capacity.

Precautions to be observed:

The straw should not be dried on a floor. The hessian cloth should be disinfected with dettol or any disinfectant before use. The 60 % moisture content in the straw can be judged by taking a handful of straw and squeeze it tightly.

Preparation of mushroom bed:

For preparation of bed (spawning) use 60x30 cm polythene bags of 80 gauge. Wash hands thoroughly with antiseptic lotion or dettol liquid/soap. Take the polythene cover and tie the bottom end with a thread and turn it inwards, put two holes of 1 cm dia in the middle to ensure aeration. Mix the dried straw thoroughly to get a uniform moisture level in all areas, put the processed straw in the bottom of the bag to height of 7.5cm, sprinkle 25g of spawn. Fill the second layer of the straw to a height of 12.5cm and spawn it as above. Repeat the process to get four layers of spawn and 5 layers of straw. The last layer of straw is of 5 cm height. Tie the mouth with twine (rubber band). Arrange the beds inside the thatched shed, (Spawn running room) following rack system or hanging system. Maintain the temperature of 22-25^{0}C and relative humidity of 85-90 % inside the shed. Observe the beds daily for contamination, if any. The contaminated beds should be removed and destroyed after 15-20 days of spawn running period, cut and remove the polythene bag and transfer the beds to cropping room. Maintain cropping conditions. Keep the beds moist by periodical spraying with water.

Precautions to be observed:

Keep the spawn running room dark so that spawn running will be faster. Periodically place Rat-baiting to kill rats as they are attracted by the spawn. Periodically sprinkle water on sand layer to maintain the required conditions. Never spray any insecticides on the mushroom beds.

Harvest and yield:

Mushroom pin heads appear on 3rd or 4th day of opening of beds. Matured mushrooms can be seen 3-4 days after pin head formation. Harvest matured mushrooms before spraying water. To harvest the mushrooms, they are grasped by the stalk and gently twisted and pulled. A knife should not be used. The mushrooms remain fresh for up to 3-6 days in a refrigerator/cool place. Second and third harvest can be obtained after scraping the surface of beds to 1-2 cm deep after first or second harvest. The entire cropping will be over in 40- 45 days.

Storage and packaging:

- At ambient temperature mushroom can be kept up to 48 hours and in cold storage conditions it can be stored up to 4-7 days.
- After harvesting wash in running tap water and immediately store at 5^0C.
- Packaging of mushroom in 200 g or 500g in polythene bags with the help of shrink wrap machine can be done.



Cost and Profit in Mushroom cultivation

Production: Average production 5kg/day (Mid June to Mid December)

S. No.	Cost and profit	Amount (₹)
1	Non recurring and fixed capital	30,000
2	Fixed cost	4,000
3	Recurring cost (paddy straw, polythene bags, labour, spawn etc.)	25,000
4	Total cost of the mushroom production (2+3)	29,000
5	Total income (400kg @ 200)	80,000
6	Net Profit (5-4)	51,000
7	Cost: benefit ratio	

6. **Contact address for relevant information:**

   Dr. R.C. Shakywar

   Assistant Professor (Plant Pathology & Microbiology)

   P I of AICRP on Mushroom

Technology no. 12

1. **Name of the Technology:** Mass production of *Trichoderma viride* a bio-control agent
2. **Source of technology:** Funded by DBT, New Delhi
3. **Year of release:** 2009-10
4. **Agro climatic Zone:** North East Region/Hot Humid Region
5. **Detail description about the technology:**

   The bio-control agent *Trichoderma* spp. was isolated from Arunachal Pradesh tested for their efficacy against soil borne pathogen *in vitro* and *in vivo* condition. The promised *Trichoderma* bio-control *Trichoderma virid*e was mass multiplied and given the name CAU GREEN GOLD. It is the best bio-control agent to manage of soil born diseases

   Procedure

   - Prepare potato dextrose broth media (Potato 200g, Dextrose 20g, Distilled water 1000ml) in culture flasks and sterilize at 1.1kg/cm^2 for 20 min.
   - Inoculate 10 days old *Trichoderma viride* culture into conical flasks and incubate it 22^0C for 10 days.
   - Mix well grown fungal biomass with talk powder at the ratio of 1: 1.
   - Air dry the mixture and mix it with carboxymethyl cellulose @5g/kg of product.
   - Count the fungal population and pack in polythene bag.

❖ The fresh product should contain not less than 10^9CFU/g.

Recommendation:

- Seed treatment with BCA 2g/l water for 30 minutes + Soil application of BCA (5%) is effective.
- Two training was given to ginger growers in Lower Subansri district villages and totally 65 farmers are benefitted. *Trichoderma* bio-formulation was tested in tomato, brinjal, cabbage and cauliflower crops against soil borne pathogens.
- It was observed that bio-control treated plot has shown significant yield than untreated plot.

6. Critical Inputs required:

Mass Multiplication of *Trichoderma viride*

Molasses yeast medium

Molasses	:	30.0 g
Yeast	:	5.0 g
Distilled water	:	1000ml

Molasses yeast medium is prepared in culture flasks and sterilized at 1.1 kg/cm^2 for 20 minutes. *Trichoderma* culture is inoculated by taking a fungal disc from 10 day old culture and incubated for 10 days. The fungal biomass and broth are mixed with talc powder at 1: 2 ratio. The mixture is air dried and mixed with Carboxy Methyl Cellulose (CMC) @ 5g / kg of the product. It is packed in Polythene covers. Fresh product should contain not less than 9 X 10^9CfU / g

7. **Observation to be recorded**
   a. Quality of the medium
   b. Microbial population at the end product
   c. Viability of the bio-control agent
8. **Contact Information for relevant information:**

Dr. P. RAJA, Assistant Professor (Plant Pathology)

Department of Plant Protection,

College of Horticulture and Forestry, Central Agricultural University,

Pasighat-791102, East Siang District, Arunachal Pradesh, India.

Mobile 09436447356, Office: 03682-224887, Fax: 03682-225066

Email: prajachf@gmail.com

Technology no. 13

1. **Name of the Technology:** Mass production of Plant growth promoting rhizobacteria agent for management of seed and soil borne disease of tomato, chilli, cabbage cauliflower and citrus.
2. **Source of technology:** CAU, Pasighat
3. **Year of release:** 2014
4. **Agro climatic Zone:** NEH Region/Hot Humid Region
5. **Detail description about the technology:**

   PGPR isolates were collated from Arunachal Pradesh their potentially was checked *in vitro* and *in vivo* isolate Chf 2011 32a and TRB found to be the best one for seed and soil borne diseases of tomato, chilli, cabbage , cauliflower and citrus. Bacterial bio-control agent *Psedomonas putida* was mass multiplied and released as PASIPUSA to manage soil borne pathogenic bacteria and citrus canker.
6. **Critical input required:**

   Production procedure Mass multiplication of PGPR bio-formaulation.

   PGPR isolates *P. fluorescens* is mass multiplied in sterilized king's B broth for 48 hours.

   KING'S B Broth Preparation

   - Peptone: 20.00
   - Heptahydrated Magnesium Sulfate: 1.50
   - Di Potassium Hydrogen Phosphate: 1.50
   - Final pH 7.2± 0.2 at 25°C

     The above chemicals are mixed in one liter of distilled water. Added 10 ml of glycerol and dissolved by heating with frequent agitation. Boiled for one minute until complete dissolution. Dispense into conical flask, and sterilized in autoclave at 121ºC for 15 minutes. The color is amber, slightly opalescent. A loopful of bacterium was inoculated in to the Kings B broth culture under aseptic condition. The bacterial culture is mixed with sterilized talcum powder (pH is adjusted to 7 by adding calcium carbonate @ 150 g/kg). The substrate is then sterilized at 1.1kg/cm^2 pressure for 30 min for two successive days. Four hundred ml of 48 h old culture suspension of *P. fluorescens* was added to 1 kg of substrate containing 5 g of carboxymethyl cellulose (CMC) and mixed well. The formulation was packed in polythene bags and can be stored in room temperature.

Releasing of PGPR as PASI PUSA in Agri Horti Expo, 2014

Sparying of PGPR in College Orchard

Awareness training about Citrus Management at Renging Village

7. **Observation to be recorded:**
    a. Quality of the medium
    b. Microbial population at the end product
    c. Viability of the PGPR
8. **Contact Information for relevant information:**

Dr P.RAJA, Assistant Professor (Plant Pathology)
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Technology no. 14

1. **Name of the Technology:** Storage of Planting Material for Effective Management of Rhizome Rot of Ginger
2. **Source of technology:** CAU, Pasighat
3. **Year of release:** 2009
4. **Agro climatic Zone:** NEH Region/Hot Humid Region
5. **Detail description about the technology:**
    - Make a pit of 1 x 2 m^2 size under shade
    - Spread a 5cm uniform layer of sand at the bottom of pit
    - Treat the ginger planting materials with CAU Green Gold (*Trichoderma* Bio-control Agent) 5g/lit of water for 30 min
    - Treated rhizomes keep under shade for 24 hours
    - Keep the dried rhizomes in pit and cover with fine sand
6. **Critical input required:**
    1. Trichoderma
    2. Ginger
    3. sand
7. **Observation to be recorded:**

a. Viability of ginger

b. Diseased ginger

c. Germination percentage

8. Contact Information for relevant information

Dr P.RAJA, Assistant Professor (Plant Pathology)
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College of Horticulture and Forestry,
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Technology no. 15

1. **Name of the technology:** Organic management of late blight in tomato
2. **Source of technology:** ICAR- National Organic Farming Research Institute
3. **Year of release:** 2014
4. **Agro-climatic zone:** North Eastern Himalayan Zone
5. **Details description about the technology:**

S. No	Particulars	Description
1.	Introduciton	Tomato (*Solanum lycopersicum*) is one of the important vegetables belonging to the family solanaceae. Among the pests and diseases Associated with tomato production in Sikkim, late blight caused by *Phytophthora infestans* (Mont) de Bary is one of the most significant constraints for its tomato production. The disease is more severe in humid and high rainfall areas.
2	Management	❖ Application of Copper oxychloride(COC) @0.25% (25 g in 10 l of water). ❖ Planting in suitable areas and climate. ❖ Practicing rain shelter cultivation in the areas of high rainfall.
3.	Interval of application	COC can be applied immediately after the onset of disease after removing the infected leaves on tomato and should be continued at 7-10 days interval until the disease become less severe.
4.	Observations to be recorded	Disease severity will be determined using a 1-6 severity scale (Gwary and Nahunnaro1998) where scale 1= trace to 20% leaf infection, 2=21-40% leaf infection, 3= 41-60% infection, 4= 61-80 infection, 5= 81-99% infection, 6= 100% leaf infection or the entire plant defoliation and the Per cent Disease Index (PDI) was calculated using standard formula. At physiological maturity, tomato fruits from each plot will be harvested and weighed separately to determine fruit yield. Benefit: cost ratio will calculated from the average yield.
5.	Precautions to be followed	❖ Normally copper and sulphur fungicides are not systemic fungicides. ❖ They should be applied before the arrival or when the disease incidence is very less or just started. ❖ Three to four applications or until the disease become less severe. ❖ They should not be sprayed on the plants which are sensitive. ❖ Copper is more toxic to crop plants under acidic conditions whereas it is more effective under higher pH conditions. ❖ The rate of application of copper fungicides should not exceed 8kg per hectare per year.

6.	Contact address for relevant information	Joint Director, ICAR-NOFRI, Tadong, Gangtok, Sikkim or Dr. R. Gopi, Scientist (Plant Pathology), ICAR-NOFRI, Tadong, Gangtok, Sikkim.

$$\text{PDI} = \frac{\text{Sum of individual rating}}{\text{Number of plants examined x Maximum disease grade in the scale}} \times 100$$

Technology no.16

1. **Name of the technology:** Organic oyster mushroom production
2. **Source of technology:** ICAR- National Organic Farming Research Institute
3. **Year of release:** 2013
4. **Agro-climatic zone:** North Eastern Himalayan Zone
5. **Details description about the technology**

Particulars	Description
Mushroom bed preparation	Cultivation of oyster mushroom is usually carried out in transparent polythene covers. The size of the cover should be 60 cm x 40-45 cm with a thickness of 80 gsm. ❖ Collect good quality paddy straw(golden yellow in colour without blemishes or spots) and chop 2 kg dry straw with a hand chopper(about 5 cm long) for one polythene bag. ❖ Soak the straw overnight(6-8 hrs) in cold water; the 2 kg Dry straw becomes 4.5 kg/ 5 kg in weight. ❖ Boil the soaked straw for 30 mins. ❖ Remove the straw from boiled water and allow cooling by spreading on a clean floor. Squeeze or drain out the excess water. ❖ The poly bags are perforated by making holes with a punch machine or similar toll at a distance of about 10 cm between the holes. The closed end of the poly bag is then tied with a piece of jute thread. ❖ The bag is then filled with a little compact layer of the straw(4-5 cm). On a tray, the spawn packet of 200 gm is first divided into parts of 25 gm each. The straw layer is spawned with 25 gm of the spawn. ❖ Likewise with a total of five straw layers and four layers of spawn in between fill up the poly bag. Once the bag is filled, the open end of the bag is now tied up with a piece of jute thread. The mushroom bag is then placed in a cool and dark place, for spawn run whic is completed within 15-20 days with a white mycelia mat covering the entire straw. ❖ Maintain 22-25°C temperature and 85-90 per cent relative humidity inside the shed.

Mushroom bed preparation	❖ Observe the beds daily for contamination, if any. The contaminated beds should be removed and destroyed. ❖ Remove the polythene bag after completion of spawn run to allow space for fruiting. Open the mouth of the bag; hold the bag upside down with right hand and place the other hand on the open end below, remove the poly bag with slight thrust. ❖ The fully spawn run beds can be shifted to cropping room for initiation of buttons. (Completion of spawn run is indicated by the growth of white to creamy coloured mycelium mat covering the entire straw). ❖ Place the mushroom bed on racks or hang it like pots in the mushroom house. ❖ Allow the bed to dry for one day and start watering from second day onwards on the basis of requirement with the touch of the hand. ❖ Periodically observe the beds and remove the contaminated beds, if any. ❖ Mushroom fruit bodies (pinheads) starts appear from 5-7 days after opening. The pinheads develop into fully mature mushroom after 3-5 days of the appearance.
Harvesting	Harvesting is done by gentle twisting of stalk in the early hours of morning before attaining over maturity (curling of margin of pileus either upward or downward indicates over maturity). The left over part of stipe is scooped out to prevent contamination of saprophytic fungi or bacteria. Trimming the stalk or stipe should be done to remove the adhering straw particles. The fruit bodies should be neatly packed in perforated polythene cover @ 200 g or 500 g per bag as per requirement. *Note*: It is reported that addition of 5 per cent steamed neem cake or 2 per cent deoiled soybean meal or 4 per cent rice bran or 2-5 per cent wheat bran enhanced the yield of oyster mushroom.
Yield	Yield range from 100-200 per cent of dry weight of the substrate depending upon the substrate combination and the manner in which the substrate has been managed during the growing season.
Observations to be recorded	❖ Days taken for spawn run. ❖ Days taken for pinhead formation. ❖ Yield data (number and weight up to 4 weeks). ❖ Time taken for I, II and III flush
Contact address for relevant information	Joint Director, ICAR-NOFRI, Tadong, Gangtok, Sikkim or Dr. R. Gopi, Scientist (Plant Pathology), ICAR-NOFRI, Tadong, Gangtok, Sikkim.

Technology no. 17

1. **Name of the technology:** Organic large cardamom production
2. **Source of technology:** ICAR- National Organic Farming Research Institute
3. **Year of release:** 2015
4. **Agro-climatic zone:** North Eastern Himalayan Zone
5. **Details description about the technology**

S. No	Particulars	Description
1.	Land preparation/ Method of planting	Pits of size of 30 cm x 30 cm x 30 cm are prepared at a spacing of 1.5 m x 1.5 m. Wider spacing of 1.8 m x 1.8 m is recommended for robust cultivars like Ramla, Ramsey, Sawney, Varlangey *etc*. While closer spacing 1.45 m x 1.45 m is advised for non-robust cultivators like Dzongu Golsey, Seremna *etc*. Suckers are treated using *Pseudomonas fluorescence* @ 0.5%.
2.	Organic nutrient management	FYM application 2 Kg per plant in the months of October-November and April to June along with *Trichoderma viride* @ 2.5 kg for one hectare is recommended. Mulching is done with locally available biomass. Mulching is done with locally available biomass.
3.	Time of planting	Planting is done in June-July.
4.	Cutivars/varieties	1. Ramsey: It is well-suited to high altitudes (1515 m amsl) and can be cultivated even on steep slopes. 2. Ramla: Cultivation is restricted to few high altitude areas in North Sikkim. 3. Sawney: It is a widely adapted cultivar, which is most suited to medium (975-1515 m amsl) and high (> 1515 m amsl) altitude areas. 4. Varlangey: It is found to grow in mid and high altitude (> 1515 m amsl) areas. 5. Seremna: The cultivar is grown in a small pocket of the Hee-Gaon, 6. Dzongu Golsey: It is suitable to areas below 975 m amsl and is very specific in Dzongu area of North Sikkim. 7. ICRI Sikkim 1: Medium(1500 m amsl) to high (1650 m amsl) altitudes. 8. ICRI Sikkim 2: Medium (1500 m amsl) altitude
5.	Pest and disease management	Application of Copper oxychloride @ 0.25% during rainy season 15- 20 days interval to manage capsule rot if any. For management of insect pests spray neem oil (1500 ppm) @ 3 ml/l at 20 days intervals (minimum four sprays).

6.	Shade management	Shade management using locally available trees like *Alnus nepalensis*, *Schima wallichii etc.*
7.	Observations to be recorded	No. of tillers, no. of spike, no. of capsules on the spike and total yield of capsules and damaged capsules.
8.	Contact address for relevant information	Joint Director, ICAR-NOFRI, Tadong, Gangtok, Sikkim or Dr. R. Gopi, Scientist (Plant Pathology), ICAR-NOFRI, Tadong, Gangtok, Sikkim.

Technology no. 18

1. **Name of the technology:** Soft rot management in ginger
2. **Source of technology:** ICAR- National Organic Farming Research Institute
3. **Year of release:** 2013
4. **Agro-climatic zone:** North Eastern Himalayan Zone
5. **Details description about the technology:**

S. No	Particulars	Description
1.	Introduciton	Soft rot is one of the most important diseases of ginger. soft rot of ginger caused by *Pythium* sps. is a major bottleneck, causing huge crop losses up to 70% in a cropping season The disease symptoms appear as yellowing, drooping, withering and drying of leaves and brown discoloration in rhizome and collar region.
2.	Management	Hot water treatement @ 47°C for 30 mins+ *Trichoderma harzianum*+ drenching of COC @ 0.3 %. ❖ Crop rotation for 4-5 years ❖ Provision of good drainage. ❖ Use of disease free healthy rhizomes for planting.
3.	Interval of application	The COC drenching can be done immediately after the onset of disease after removing the infected plants and should be continued at 7-10 days interval until the disease become less severe.
4.	Observations to be recorded	No. of tillers, per cent disease incidence and total yield of ginger.
5.	Precautions to be followed	❖ Normally copper and sulphur fungicides are not systemic fungicides ❖ They should be applied before the arrival or when the disease incidence is very less or just started ❖ Three to four applications or until the disease become less severe ❖ They should not be sprayed on the plants which are sensitive

	Precautions to be followed	❖ Copper is more toxic to crop plants under acidic conditions whereas it is more effective under higher pH conditions. ❖ The rate of application of copper fungicides should not exceed 8kg per hectare.
6.	Contact address for relevant information	Joint Director, ICAR-NOFRI, Tadong, Gangtok, Sikkim or Dr. R. Gopi, Scientist (Plant Pathology), ICAR-NOFRI, Tadong, Gangtok, Sikkim.

6. Observations to be recorded:

$$\text{Per cent disease incidence} = \frac{\text{Total no. of infected plants}}{\text{Total no of plants}}$$

Technology no. 19

1. **Name of the technology:** Blast disease management in ric**e**
2. **Source of technology:** ICAR- National Organic Farming Research Institute
3. **Year of release:** 2016
4. **Agro-climatic zone:** North Eastern Himalayan Zone
5. **Details description about the technology:**

S. No	Particulars	Description
1.	Introduciton	Rice is affected by many diseases among them blast, caused by Magnaporthe oryzae (T.T. Hebert) Barr (anamorph = Pyricularia grisea (Cooke) Sacc.), is the most important disease of rice and it appears at all the stages of plant growth. It affects stem nodes (nodal blast), leaf (leaf blast) neck (neck blast) and also grains of paddy. Blast disease occurs both in nursery and main field. The disease results in yield loss as high as 70–80%
2.	Management	❖ Field sanitation. ❖ Seed treatment with *Pseudomonas flourescens* at the rate of 10 g per kg of seeds. ❖ Copper oxycholoride @ 0.25% or copper hydroxide @ 0.25%.
3.	Interval of application	The COC application can be done immediately after the onset of disease and should be continued at 7-10 days interval until the disease become less severe.
4.	Observations to be recorded	No. of tillers, per cent disease index and per cent neck blast infection total yield.

5.	Precautions to be followed	❖ Normally copper and sulphur fungicides are not systemic fungicides ❖ They should be applied before the arrival or when the disease incidence is very less or just started ❖ Three to four applications or until the disease become less severe ❖ They should not be sprayed on the plants which are sensitive ❖ Copper is more toxic to crop plants under acidic conditions whereas it is more effective under higher pH conditions. ❖ The rate of application of copper fungicides should not exceed 8kg per hectare.
6.	Contact address for relevant information	Joint Director, ICAR-NOFRI, Tadong, Gangtok, Sikkim or Dr. R. Gopi, Scientist (Plant Pathology), ICAR-NOFRI, Tadong, Gangtok, Sikkim.

Technology no. 20

1. **Name of technology:** Bio- control of stem borer and leaf folder in rice
2. **Source of technology:** NBAII, Bangalore
3. **Year of release:** 2011
4. **Agro-climatic zone:** UBVZ of Assam
5. **Detail description of technology:**

   Treatment T1: BIPM package consists of

   a. Seed treatment with *Pseudomonas fluorescence* @ 8g/kg of seeds or Seedling root dip treatment with 2% suspension of *P. fluorescence*
   b. Spray of *Beauveria bassiana* @1013 spore/ha against sucking pests.
   c. Three release of *Trichogramma japonicum*@ 1,00,000/ha from 30 days after transplanting against stem borer and leaf folder
   d. Spray of *Pseudomonas fluorescence* @2% against foliar diseases
   e. Application of botanicals (Neem oil/pestoneem @ 3ml/li) at the time of pest occurrence
   f. Erection of Bird perches @ 15/ha and to be removed before crop maturity

   T2: Chemical control plot (Farmers' practice)
6. **Critical inputs required:** *Pseudomonas fluorescence, Beauveria bassiana,Trichogramma japonicum,* botanicals.
7. **Observations to be recorded:** All observations to be recorded in BIPM plots as well as plots with farmers' practice for making comparison, Incidence of pests/diseases: Per cent Dead heart /white ear head damage from 20 randomly selected hills before treatment and after treatment at 7, 10 and 15 days interval starting from imposition of treatment, per

cent damage of leaf folder, and case worm larvae from 20 randomly selected hills before treatment and after treatment at 7, 10 and 15 days interval starting from imposition of treatment, Number of sucking pests before and 7 days after each spray of B. bassiana from 20 randomly selected hills, Record Per cent disease incidence, Time of occurrence: Dead heart 25 DAT to 65 DAT, White ear head: Before penicle initiation or at before harvest stage, Leaf folder: 30DAT to flowering stage, Caseworm: 25 DAT to maximum tillering stage, Per cent damage/ per cent survival, Yield &yield attributes, Soil status, B: C ratio, Farmers' reaction.

Technology no. 21

1. **Name of technology:** Management of white grub in Potato
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Agro-Climatic Zones of Assam
5. **Detail description of technology:** Treatment Soil application of Quinalphos 25EC @ 400 g a.i./ha (1.5 lit./ha or 2 ml/lit of water) against white grub and other soil insects in potato.
6. **Critical inputs required:** Quinalphos 25EC
7. **Observations to be recorded:** Per cent damage, Yield &yield attributes, Soil status, B: C ratio, Farmers' reaction.

Technology no.22

1. **Name of technology:** Integrated pest and disease management module for *olitorius* jute
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Agro-Climatic Zones of Assam
5. **Detail description of technology:** Treatment - Application of *Trichogramma viride* @ 2.5 Kg /ha (mixed with 150 Kg FYM, covered with moist gunny bag and incubated for 48 hours in shade) in soil at the time of sowing and incorporated with soil.
    - Manual weeding at 3-4 weeks after sowing
    - Hand picking and destruction of egg masses and
    - larvae of Bihar hairy caterpillar
    - Erection of bamboo perches @ 40 Nos./ha
    - Two sprays of neem oil @ 4 ml/lit of water at 2nd
    - week of June and 1st week of July.
    - One spray of recommended insecticide (ifnecessary).

6. **Critical inputs required:** *Trichogramma viride,* FYM, Bamboo perches, Neem oil, Insecticide
7. **Observations to be recorded:** Per cent damage, percent insect pest and disease incidence, yield &yield attributes, B: C ratio, Farmers' reaction.

Technology no. 23

1. **Name of technology:** Protection of wheat seeds from insect pests during storage
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Agro-Climatic Zones of Assam
5. **Detail description of technology:** Treatment -Dry the wheat seeds to reduce moisture content up to 11-12%
    - ❖ Mix black peeper seed powder @ 6 g / kg seed thoroughly
    - ❖ Store in gunny bags impregnated with polyethene in dry places
6. **Critical inputs required:** Black peeper seed powder, gunny bags, polyethene
7. **Observations to be recorded:** Per cent damage, B: C ratio, Farmers' reaction

Technology no. 24

1. **Name of technology:** Management of papaya mealy bug (Paracoccus marginatus)
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Agro-Climatic Zones of Assam
5. **Detail description of technology:** Treatment - **Mechanical:** Removal and burning of infestedparts/plants

- ❖ **Cultural:** Removal of weeds/ alternate hosts like *Hibiscus sp.* and application of sticky bands or alkathene sheet on main stem of the plant to prevent upward movement of crawlers.
- ❖ **Chemical:** Dusting of chlorpyriphos 1.5% dust or malathion 5% dust around the healthy plants to check the movement of crawlers; spot spraying of Neem oil (1 to 2%), NSKE (5%), profenophos 50 EC (2 ml/l), chlorpyriphos 20 EC (2 ml/l), dimethoate 30 EC (2 ml/l), thiomethoxam 25WG (0.6 g/l) and imidacloprid 17.8 SL (0.6 g/l); destruction of ant colonies with drenching of chlorpyriphos 20 EC @ 2 ml/l

6. **Critical inputs required:** Insecticides, sticky bands or alkathene sheet
7. **Observations to be recorded:** Per cent damage, B: C ratio, Farmers' reaction

Technology no. 25

1. **Name of technology:** Beneficial birds in suppression of insect and rodent pests
2. **Source of technology:** AINP on Agricultural Ornithology(ICAR)
3. **Year of release**: 2011
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Technology: Barn owl (*Lakhi Fesa),* Nest box (Made of country wood/ Ply wood) Floor = 35cm X 35cm Height= 45cm with an entrance hole of 15cmX15cm at a height of 15cm on the front cover of the box with a 15 cm floor at bottom of the box and a roof cover(lid) with provision of 2 hinges at the top of the back cover for hanging or fixing on substrate. Spotted owlet *(Futuki Fesa)* nest box(Country wood/ Apple box/ shop box) Floor = 25cmX25cm.

   Method of application: Height= 30cm with an entrance hole of 10cmX10cm at a height of 15cm on the front cover of the box with a 15 cm floor at bottom of the box.

6. **Critical inputs required:** Barn owl (*Lakhi Fesa),* Nest box (Made of country wood/ Ply wood) Spotted owlet *(Futuki Fesa)* nest box(Country wood/ Apple box/ shop box)
7. **Observations to be recorded:** Owl species occupied the nest box, Time of occupation, No. of Live burrow of rodents in the crop field, Pests infestation records both in control and trcated plots, percent damage/ yield loss, Farmers' reaction.

Technology no.26

1. **Name of Technology:** Biorational management of insect pests in Sikkim mandarin
2. **Source of Technology:** ICAR-NOFRI, Tadong-737102, Sikkim (*formerly ICAR Research Complex for NEH Region, Sikkim Centre, Tadong-737102*)
3. **Year of release:** 2012
4. **Agro Climatic Zone**: Mid hills of Sikkim
5. **Detail description about the technology:**

Management of insect pests

- ❖ Cleaning and pruning of the orchard after harvest.
- ❖ Smearing of Bordeaux paste at the base of the trunk up to 1 m height in April.
- ❖ Frequent monitoring of the orchard.
- ❖ Two sprays of petroleum-oil based spray @ 10 ml/l during April-May for control of aphids and leaf miner and one spray of *Bacillus thuringiensis* @ 2 g or 2 ml/l when infestation of lemon butterfly is observed.
- ❖ Cleaning of trunk borer and bark eating caterpillar infested plants and insertion of iron wire to kill the larvae June onwards and insertion of cotton soaked in petrol or kerosene

in to the holes and plastered with soil and cow dung mixture.

- Installation of methyl eugenol based para pheromone trap September onwards to manage fruit fly @ 20 traps/ha.
- The dropped infested fruits should be collected on community basis and buried under the soil or destroyed by keeping in hot water to reduce the infestation of fruit fly.
- During August-September also spray of petroleum-based oil spray @ 10 ml/l should be done in case of occurrence of aphids and leaf miner and one spray of *Bacillus thuringiensis* @ 2 g or 2 ml/l when the infestation of lemon butterfly is observed.
- Yellow colour trap can be installed in the field throughout the year to trap the population of aphids, leaf miner and psylla.

6. **Critical inputs required:** Biopesticdes (Bordeaux paste, petroleum oil based agro-spray, *Bacillus thuringiensis*), methyl eugenol based para pheromone traps, yellow colour sticky traps etc.
7. **Observation to be recorded:** % of incidence of Trunk borer and bark eating caterpillar from randomly selected 20 plants, for leaf miner, lemon butterfly, aphids, mealy bug and scale insects observations from randomly selected 50 shoots; for fruit fly randomly selected 100 fruits from each treatment.
8. **Contact Address for relevant information:** Joint Director, ICAR- National Organic Farming Research Institute, Tadong, Sikkim

Technology no. 27

1. **Name of Technology:** Eco-friendly management of insect pests in organic rice cultivation
2. **Source of Technology:** ICAR-NOFRI, Tadong-737102, Sikkim (*formerly ICAR Research Complex for NEH Region, Sikkim Centre, Tadong-737102*)
3. **Year of release:** 2011
4. **Agro Climatic Zone:** Mid hills of Sikkim
5. **Detail description about the technology:**

Management of insect pests

The insect pests of rice can be managed by adopting the practices in an integrated approach.

- Planting should be done in time according to the crop duration.
- Clipping of leaf tips to prevent pest infestation from nursery to main field. Field sanitation is important to prevent multiplication of the pests.
- Spraying of neem oil 0.03 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval.
- Regular monitoring, collection and destruction of egg, larvae, pupae and adults of different insects.
- Installation of pheromone traps @ 16-20 traps/ha in a triangular pattern at 60 m distance

for trapping the adult male of yellow stem borer.

- ❖ Release of *Trichogramma japonicum* or *T. chilonis* @ 50,000 per hectare at weekly interval for 7-8 times starting from 30 days after transplanting
- ❖ At the beginning of Gundhi bug infestation, a few first batch population of Gundhi bug should be collected and after preparing the aqueous extract from them it should be sprayed in the field to repel subsequent population.
- ❖ One spray of *Beauveria bassiana* @ 7 g/l at the boot leaf stage to reduce Gundhi bug population.

6. **Critical inputs required:** Biopesticdes (Neem oil, *Beauveria bassiana*), sex pheromone traps, Tricho cards, Sherman traps for rodent *etc*.
7. **Observation to be recorded:** Dead heart % for stem borer, damaged leaves per 10 hills for leaf folder, case worm, whorl maggot and for gundhi bug no. of insects per 10 hills.
8. **Contact Address for relevant information:** Joint Director, ICAR- National Organic Farming Research Institute, Tadong, Sikkim

Technology no. 28

1. **Name of Technology:** Organic management of insect pests in mustard
2. **Source of Technology:** ICAR-NOFRI, Tadong-737102, Sikkim (*formerly ICAR Research Complex for NEH Region, Sikkim Centre, Tadong-737102*)
3. **Year of release:** 2014
4. **Agro Climatic Zone:** Mid hills of Sikkim
5. **Detail description about the technology:**

Pre-sowing

- ❖ Proper planning of cropping pattern for avoiding pest like painted bug.
- ❖ Summer ploughing should be done to kill the residual population of the pests.
- ❖ Remove the residue of previous crops from preventing the painted bug.

Sowing

- ❖ Planting should be done during first fortnight of October to reduce major pest like aphid and saw fly.

Seedling and vegetative stage

- ❖ Periodical weeding helps in reducing building up of painted bug population.
- ❖ Irrigate the crop in the 4th week after sowing.
- ❖ Collection and destruction of the saw fly larvae during the early morning time.
- ❖ Need based and judicious application of *Bacillus thuringiensis* @ 2 g or ml/l or botanical insecticides like neem oil 0.15 EC (1500 ppm) @ 3 ml/l.

Flowering stage

- ❖ Removal of the aphid infested twigs at the initial level of the pest attack at community level to stop the further spread of the pest.
- ❖ Conservation of natural enemies like Syrphid fly, *Coccinella septempunctata*, *Menochilus sexmaculata etc*.
- ❖ If population reaches ETL one spray of neem formulation @ 3 ml/l or petroleum oil-based spray @ 10 ml/l and second spraying followed by 20 days interval. Spraying should be done in the afternoon to save pollinators.

Pod formation stage

- ❖ For painted bug, threshing of harvested crop should be done quickly.

6. **Critical inputs required:** Biopesticdes (Neem oil, petroleum oil-based spray, *Bacillus thuringiensis*), *etc*.
7. **Observation to be recorded:** Aphids/10 cm central shoot, sawfly larvae per plant, painted bug per plant (10 observations from each treatment)
8. **Contact Address for relevant information:**

   Joint Director, ICAR- National Organic Farming Research Institute, Tadong, Sikkim

   Director, ICAR RC for NEHR, Umiam, Meghalaya

Technology no. 29

1. **Name of Technology:** Organic management of insect pests in tomato
2. **Source of Technology:** ICAR-NOFRI, Tadong-737102, Sikkim (*formerly ICAR Research Complex for NEH Region, Sikkim Centre, Tadong-737102*)
3. **Year of release:** 2014
4. **Agro Climatic Zone:** Mid hills of Sikkim
5. **Detail description about the technology**

Management

- ❖ Transplant two rows of marigold for every 16 rows of tomato, as a trap crop, as the female of fruit borer will be attracted to marigold flowers and lay eggs.
- ❖ Regular monitoring and collection and destruction of fruit borer larvae, infested shoots of aphids and whitefly.
- ❖ Spraying Spinosad 45 SC @ 0.3 ml/l and second spray at 20 days interval is effective to control of tomato fruit borer.
- ❖ Installation of sex pheromone trap for mass trapping of adult of fruit borers is highly effective.
- ❖ Use petroleum-oil based spray @ 10 ml/l and second spray at 20 days interval can easily control aphids in tomato for aphids and whitefly.

6. **Critical inputs required:**

   Petroleum oil-based spray , Spinosad 45 SC, sex pheromone trap of fruit borer *etc.*

7. **Observation to be recorded:**

   Aphids and white flies/leaf, no. of fruits and infested fruits (10 observations from each treatment)

8. **Contact Address for relevant information:**

   Joint Director, ICAR- National Organic Farming Research Institute, Tadong, Sikkim

   Director, ICAR RC for NEHR, Umiam, Meghalaya

Technology no. 30

1. **Name of Technology:** Enriched vermicompost production technology
2. **Source of Technology:** ICAR-NOFRI, Tadong-737102, Sikkim (*formerly ICAR Research Complex for NEH Region, Sikkim Centre, Tadong-737102*)
3. **Year of release:** 2010
4. **Agro Climatic Zone:** Mid hills of Sikkim
5. **Detail description about the technology**
   - ❖ Bed of cow dung and legume leaves (3: 1)
   - ❖ Addition of bio-fertilizers; Azospirilium + PSB + PMB @ 100 g each/quintal of raw material.
   - ❖ Mixed culture of earthworms (*Eudrilus euginea* + *Eisenia foetida*) should be added @ 1000/q
   - ❖ Turning of bed after 25-30 days and vermicompost gets ready between 60-70 days.
   - ❖ Regular monitoring and spraying of water to be done as required maintaining moisture (75-90%).
6. **Critical inputs required:**

   Cow dung, legume leaves, Azospirilium, PSB, PMB, *Eudrilus euginea* and *Eisenia foetida etc*.

7. **Observation to be recorded:**

   N, P, K, OC to be recorded.

8. **Contact Address for relevant information:**

   Joint Director, ICAR- National Organic Farming Research Institute, Tadong, Sikkim

   Director, ICAR RC for NEHR, Umiam, Meghalaya

Technology no. 31

1. **Name of technology:** Management of rice root knot nematode *Meloidogyne graminicola*
2. **Source of technology:** Department of Nematology, AAU, Jorhat
3. **Year of release:** 2012
4. **Agro-climatic zone:** In all zones of Assam where rice root knot nematode is a problem.
5. **Detail description oftechnology**:

1. Treatment: Application of *Pseudomonas fluorescens*(Bioforpf) cfu-2x108 @20g/m2
2. Methods of application: Direct seeded *ahu* rice: 20 kg of Bioforpf should be mixedwith180kg well dried FYM and kept for 10-15 days covered with gunny bag. To keep it moistened, a little water should be added in to the mixture. After 10-15 days, the FYM will be enriched and bacterial colony will be observed, which will be whitish in colour. Then the mixture should be mixed thoroughly and applied in the field before sowing of seeds. Transplanted *Sali* rice: Bioforpf should be applied in the nursery bed @20g/m2 before sowing of seeds.

6. **Critical inputs required:** Bioforpf, FYM
7. **Observations to be recorded:** Incidence of pest: Nematode population at the start of the experiment and at harvest, Per cent survival: Per cent decrease of pests at harvest, Yield and yield attributes: Plant height in treated and untreated, Yield in treated and untreated, Per cent increase in yield, ICBR/B: C ratio, Farmers' reaction.

Technology no.32

1. **Name of technology:** Management of root knot nematode *Meloidogyne incognita, Ralstonia solanacearum*andm, *Macrophomina phaseolina* complex in jute
2. **Source of technology:** Department of Nematology, AAU, Jorhat
3. **Year of release:** 2012
4. **Agro-climatic zone:** Lower Brahmaputra Valley Zone
5. **Detail description of technology:**

1. Technology: Application of carbofuran @1kg a.i/ha +*Pseudomonas fluorescens*(Bioforpf) cfu-2x108 @20g/m^2 withvermicompost at 1: 10 ratio
2. Methods of application: 20 kg of Bioforpf should be mixed with 180kg well dried FYM and kept for 10-15 days covered with gunny bag. To keep it moistened, a little water should be added in to the mixture. After 10-15 days, the FYM will be enriched and bacterial colony will be observed, which will be whitish in colour. Then 2 tons vermicompost should be mixed thoroughly with this and applied in the field before sowing of seeds.

6. **Critical inputs required:** Carbofuran, *Pseudomonas fluorescens,* vermicompost
7. **Observations to be recorded:** Nematode population at the start of the experiment and at harvest, Bacterial and fungal population at harvest, Incidence of pest: Per cent decrease of

pest at harvest, Per cent survival: Plant height in treated and untreated Yield in treated and untreated, Per cent increase in yield, Yield and yield attributes: ICBR/B: C ratio, Farmers' reaction.

Technology no.33

1. **Name of technology:** Management of rice root-knot nematode, *Meloidogyne graminicola in direct seeded Rice*
2. **Source of technology:** Department of Nematology, AAU, Jorhat
3. **Year of release:** 2015
4. **Agro-climatic zone:** -
5. **Detail description of technology:**
   Technology: Application of *Pseudomonas fluorescens* @ 20 g/m2 at sowing time of direct seeded upland rice for management of rice root-knot nematode, *Meloidogynegraminicola.*
6. **Critical inputs required:** *Pseudomonas fluorescens*
7. **Observations to be recorded:** Nematode population at the start of the experiment and at harvest, Bacterial and fungal population at harvest, Incidence of pest: Per cent decrease of pest at harvest, Per cent survival: Plant height in treated and untreated Yield in treated and untreated, Per cent increase in yield, Yield and yield attributes: ICBR/B: C ratio, Farmers' reaction.

Technology no. 34

1. **Name of technology:** Management of root-knot nematode *Meloidogyneincognita in* Green gram
2. **Source of technology:** Department of Nematology, AAU, Jorhat
3. **Year of release:** 2015
4. **Agro-climatic zone**: -
5. **Detail description of technology:**

Treatment of seed with NSKP @ 5 g/kg and *T. viride* @ 5 g/kg separately for the management of root-knot Nematode, *Meloid ogyne incognita*

6. **Critical inputs required:** NSKP, *T. viride*
7. **Observations to be recorded:** Nematode population at the start of the experiment and at harvest, Bacterial and fungal population at harvest,Incidence of pest: Per cent decrease of pest at harvest,Per cent survival: Plant height in treated and untreated Yield in treated and untreated, Per cent increase in yield, Yield and yield attributes: ICBR/B: C ratio, Farmers' reaction.

Chapter 5- Horticulture

Technology no.1

1. **Name of technology:** Mulching in Tube rose
2. **Source of technology:** Department of Horticulture, AAU, Jorhat
3. **Year of release:** 2012
4. **Agro-climatic zone:** UBVZ & LBVZ of Assam
5. **Detail description of technology:** Black polyethylene mulch of 50 micron

   Method of application of mulch: The polyethylene should be laid on well prepared beds of 1.2/1.8 m breadth and of convenient length. Holes are made at a spacing of 30 cm x 20 cm and proper sized bulbs of tube rose are planted.

   Management practices:

   Variety: Suvasini

   Characteristics: It is a summer commercial cut flower. Flowers are white having aroma

   Duration: One to three years.

   Planting time: February—March/ March--April

   Harvesting time: 60--65 days after planting

   Seed rate: (bulbs/ha) 1,42,500 no. of bulbs

   Spacing: 30 cm x 20 cm

   Seed Treatment: Bulbs should be treated with captaf or bavistin @ 1.5 g/l water for 30 min.

   Land preparation: The land is thoroughly ploughed, harrowed and leveled. Beds are raised by 25--30 cm.

   Manuring: Well rotten cowdung @ 5 kg/m2

   Fertilizer: NPK@ 40: 20: 20g/m^2 (88 g urea, 125g SSP and 66 g MOP/m^2)
6. **Critical inputs required:** Black polyethylene mulch of 50 micron
7. **Observations to be recorded:** Temperature, Rainfall, Date of sowing , Date of germination, Date of planting, date of weeding, Days to 50 % flowering, Plant height, Number of flower/ m2, Florate per spike, Pest infestation, Disease infestation, Farmers reaction, Soil test data (initial & final), B: C ratio.

Technology no. 2

1. **Name of technology:** Gerbera cultivars identified for Assam
2. **Source of technology:** Department of Horticulture, Assam Agricultural University, Jorhat.
3. **Year of release:** 2013
4. **Agro-climatic zone:** UBVZ & LBVZ of Assam
5. **Detail description of technology:** Gerbera is a perennial crop which flowers during winter. The crop duration is 8 months. Varieties are: RedGem, Orange Gleam, Pink Melody, Classic Beauty,Pride of Sikkim, Pride of India and Indukumari. Flower Character: Red Gem- Red colour flowers with both ray and trans florets of red colour. The stalk colour is brick red, involucre colour is dark green.

   Pink Melody: The colour of flowers is light pink with both ray and trans florets having light pink colour but the disc florets are black or brown in colour.. The colourof the stalk and involucre is dark green.

   Classic Beauty: Light orange colour flowers with ray florets of light orange and trans floret are of yellow colour. Disc florets are light yellow or green in colour. The colour of the stalk is light green and involucres colour is dark green.

   Pride of Sikkim: White colour flowers with both ray and Trans florets of white colour. Disc florets are white or green in colour. The colour of the stalk and involucre is dark green.

   Pride of India: The colour of flowers is light orange with both ray and trans florets having light orange colour but the disc florets are light green or yellow in colour.. The colour of the stalk and involucre is dark green.

   Indukumari: The colour of flowers is mezenta with both ray and trans florets having mezenta colour but the disc florets are light yellow in colour. The ray florets are bilipped. The colour of the stalk is dark green and involucre colour is green.

   Planting time: September--October

   Harvesting time: Starting from 2 months after planting for a period of 6 months

   Requirement of suckers/ha: 85,000 nos.

   Spacing: 30 cm x 30 cm

   Management practices:

   Sucker Treatment: Healthy, disease free suckers having at least one growing point are selected. The roots and leaves should be trimmed leaving 5-6 cm and treated with captaf or bavistin @ 1.5 g/l water for 30 min

Land preparation: Thoroughly ploughed, harrowed and levelled. Beds are raised by 25--30 cm.

Manuring: Well rotten cow dung @ 5 kg/m2

Fertilizer: NPK@ 30: 10: 20g/m^2 (66 g urea, 62 g SSP and 33 g MOP)

Pest management: Malathion 50 E.C. @ 1 per cent is sprayed at 15 days interval to control the insects attack. Endosulfan is also applied @ 2 ml/l to control the caterpillars at the later stages.

Disease management: Bavistin @ 5 per cent is sprayed on the foliage to control the bacterial blight in the initial stage of the crop. Later on, this mixture is sprayed as a prophylactic measure against bacterial blight at an interval of one month.

6. **Critical inputs required:** Varieties-Red Gem, Orange Gleam, Pink Melody, Classic Beauty, Pride of Sikkim, Pride of India and Indukumari.
7. **Observations to be recorded:** Temperature, Rainfall, Date of sowing, Date of germination, Date of planting, date of weeding, Days to 50 % flowering, Plant height, Number of flower/ m2, Pest infestation, Disease infestation, Yield/ m2, Farmers reaction, B: C ratio.

Technology no.3

1. **Name of technology:** Cut flower production of Gerbera using organic sources of nutrient
2. **Source of technology:** Department of Horticulture, Assam Agricultural University, Jorhat
3. **Year of release:** 2013
4. **Agro-climatic zone:** UBVZ & LBVZ of Assam
5. **Detail description of technology:**

Microbes: Biofertilizer (Azospirillum and PSB)

Manure: Well rotten cow dung @ 5 kg/m2

Dose of bio – fertilizer: Enrich compost @10t/ha + Biofertilizer (Azospirillum and PSB) @3.5 g/ha.

Method of application: Enrich compost as soil application one day before planting and biofertilizer as root treatment on the same day of planting.

Management practices:

Crop: Gerbera Cv .Red Gem

Sucker Treatment: Biofertilizer as root treatment on the same day of planting

Land preparation: The land is thoroughly ploughed, harrowed and levelled. Beds are raised by 25--30 cm.

Manuring: Well rotten cow dung @ 5 kg/m2

6. **Critical inputs required:** Biofertilizer (Azospirillum and PSB), enriched compost

7. **Observations to be recorded:** Temperature, Rainfall, Date of planting of sucker, Date of weeding, Days to 50 % flowering, Plant height, Number of flower/ m2, Pest infestation, Disease infestation, Flower yield/m2, Farmers reaction, Soil test data (initial & final), B: C ratio.

Technology no.4

1. **Name of technology:** NPK requirement for yield and cut flower production of chrysanthemum
2. **Source of technology:** Department of Horticulture, Assam Agricultural University, Jorhat
3. **Year of release:** 2013
4. **Agro-climatic zone:** UBVZ & LBVZ of Assam
5. **Detail description of technology:**

Fertilizer dose: NPK@ 30: 20: 20 g/m^2 (66 g urea, 125 g SSP and 33 g MOP/ m2)

Manure: Well rotten cow dung @ 5 kg/m2

Method of application: Half dose of urea and full dose of SSP and MOP are applied as basal dose. After one month of planting the rest of the fertilizers are applied in two equal doses at 15 days interval in ring method.

Management practices:

Varieties: Chrysanthemum, Cv.Carnival Pride

Planting materials Treatment: 5-7 cm long Terminal cutting are taken dipped in 1.5 g/lit captaf or Dithane M-45 solution for 20 min and then planted in nursery bed or pot after applying growth hormone (Rootex 1). The bed is also treated with the same fungicide up to a depth of 15-20 cm.

Land preparation: The land is thoroughly ploughed, harrowed and leveled. Beds are raised by 25--30 cm. Planted spacing - 30 cm x 30 cm

Pest management: Malathion 50 EC is sprayed @ 2% in every 30 days interval for the entire crop season to keep the crop pest free

Disease management: To control leaf spot disease after flowering i.e. stock plant maintenance application of Bavistin @ 1.5 gm/lit or Caftaf @ 1.5 gm / lit in one month interval.

Farming situation: High land

6. **Critical inputs required:** N, P, K, organic manure
7. **Observations to be recorded:** Temperature, Rainfall, Date of planting, Days to 50 % flowering, Plant height, Number of flower/ m2, Pest infestation, Disease infestation, Yield / m2, Farmers reaction, Soil test data (initial & final), B: C ratio.

Technology no. 5

1. **Name of technology:** Growth regulators for flowering & planting material production of gladiolus
2. **Source of technology:** Department of Horticulture, Assam Agricultural University, Jorhat.
3. **Year of release:** 2013
4. **Agro-climatic zone:** UBVZ of Assam
5. **Detail description of technology:** Application of GA3 100 ppm and Ethrel 250 ppm Method of application: The corms of gladiolus were soaked overnight in the different solutions of growth regulators before planting

   Management practices:

   Crop: Gladiolus, Cv. Red Candiman

   Manure: Well rotten cow dung @ 5 kg/m2

   Planting materials Treatment: Healthy, disease free corms having a diameter more than 2.5 cm. Dry scales should be removed, treated with 2% Bavistin or Captaf for 30 min and then dried in shade

   Land preparation: The land is thoroughly ploughed, harrowed and levelled. Beds are raised by 30 cm.

   Manuring: Well rotten cow dung @ 5 kg/m2

Fertilizer: 25 g urea, 140 g SSP and 50 g MOP/ m^2

6. **Critical inputs required:** GA3 and Ethrel

7. **Observations to be recorded:** Temperature, Rainfall, Date of sowing, Date of germination, Date of weeding, Days to 50 % flowering, Plant height, Number of flower/ m2, Florae per spike, Pest infestation, Disease infestation, Farmers reaction, Soil test data (initial & final), B: C ratio: 4.5.

Technology no. 6

1. **Name of technology:** Summer Marigold technology

2. **Source of technology:** Department of Horticulture, Assam Agricultural University, Jorhat.

3. **Year of release:** 2017

4. **Detail description of technology:**

   Variety: Seracole

   Characteristics: It is a day neutral plant.

   Duration: 4 months

   Flower Character: Orange in colour and flower petals are compact in nature

   Planting time: Every month from February to September cuttings are prepared and rooted cuttings planted in each months in raised beds for getting flower continuously through out the summer months.

   Harvesting time: 75 days after planting of rooted cuttings

   Requirement of cutting/ha: 47500 nos.

   Spacing: 45 cm x 45 cm

   Management practices:

   Planting material Treatment: Healthy,disease free. 5-7 cm long terminal cuttings are taken, treated with Dithane M-45 or captaf @ 1.5 g/lit for 20 min and then planted in nursery bed or pot after applying growth hormone. The bed is also treated with the same fungicide up to a depth of 15-20 cm.

   Land preparation: The land is thoroughly ploughed, harrowed and levelled. Beds are raised by 30 cm.

   Manuring: Well rotten cow dung @ 5 kg/m2

Fertilizer: NPK@10: 10: 10 g/m^2 (21 g urea, 62 g SSP and 16.5 g MOP/ m^2)

Pest management: For mite infestation, Omite @ 1.5 per cent is sprayed at 7 days interval. Endosulfan @ 2 ml/l to control the caterpillars at the later stages

Disease management: For leaf spot infestation, Bavistin or Diethane M-45 @ 1.5 per cent is sprayed at 7 days interval.

5. **Critical inputs required:** Variety 'Seracole', fungicide, growth hormone, organic manure, N, P, K, insecticides.
6. **Observations to be recorded:** Temperature, Rainfall, Date of planting of rooted cuttings, Date of weeding, Days to 50 % flowering, Plant height, Number of flower, Pest infestation, Disease infestation, Flower yield/ m2, Farmers reaction, B: C ratio.

Technology no.7

1. **Name of technology:** Cultivation of Okra by using organic sources of nutrien
2. **Source of technology:** Deptt. of Horticulture, AAU, Jorhat
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Treatment of seeds with biofertilizers AZB and PSB @ 7.5g each per 100 g of seeds and application of Rock Phosphate @ 313 kg/ha, FYM @ 5 t/ha and Vermicompost @ 1 t/ha during final land preparation has been recommended.

Microbes: *Azotobacter* and *Phosphorus Solubilizing* Bacteria

Dose of biofertilizer: *Azotobacter* and *Phosphorus Solubilizing* Bacteria @ 7.5g each per 100g of seeds.

Manuring: Farm Yard Manure @ 5t/ha+ Vermi Compost @1t/ha along with Rock.Phosphate 313 kg/ha

Method of application: Manure application is to be done at the time of final land preparation.

Management practices:

Crop: Okra

Spacing: 50 cm X 45 cm

Seed rate: 10 kg/ha

Seed treatment: Seed treatment with biofertilizer slurry for at least 1 hour beforesowing of seeds

Land preparation: Minimum tillage operation is done.

Pest management:

- Installation of pheromone traps for monitoring *Earias vitella.*
- Yellow sticky traps should be set up for monitoring whitefly, thrips etc. @ 10 traps/ha. Locally available empty tins can be painted yellow colour, coated with vaseline/ castor oil on outer surface may also be used as yellow sticky traps.
- Five release of *Trichogramma chilonis* @ 1lakh/ha starting from 35DAS at weekly interval.
- Neem bases insecticides @ 20ml/10 lt to be applied for conservation of natural enemies at an interval of 15 days whenever necessary.
- Three sprays of 5% NSKE for hopper, white fly and mites starting at 28DAS
- Erection of bird perches for facilitating predation of borer larvae.

Disease management: Sowing of Yellow Vein Mosaic resistant variety. Destruction of crop residues after harvest and phyto sanitation measures is to be adopted.

Any other: Use of black mulch (50 micron) between the rows control weeds and also conserves soil moisture.

6. **Critical inputs required :** *Azotobacter, Phosphorus Solubilizing* Bacteria, FYM, vermicompost, Rockphosphate.
7. **Observations to be recorded:** Rainfall, Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height, Number of fruits/ m2, Fruit character, Pest infestation, Disease infestation, Yield, Soil test data (initial & final), Benefit Cost Ratio : 3.45.

Technology no. 8

1. **Name of technology:** Cultivation of Cabbage by using organic sources of nutrient
2. **Source of technology:** Deptt. of Horticulture, AAU, Jorhat
3. **Year of release:** 2012
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Microbes: *Azotobacter* and *Phosphorus Solubilizing* Bacteria

   Dose of biofertilizer: Azotobacter and Phosphorus Solubilizing Bacteria @ 7.5g each per 100g of seeds

   Manuring: Vermicompost @5 t/ha + Rock Phosphate@375kg/ha Rock phosphate 375kg/ha (as per SSP dose)

   Method of application: Manure application is to be done at the time of final land preparation.

   Management practices:

   Crop: Cabbage

   Spacing: 45 cm X 45 cm

   Seed rate: 800g/ha for early; 10 g of seed should be sown/m2

   Seed treatment: Seed treatment with biofertilizer slurry for at least 1 hour before sowing of seeds

   Land preparation: Minimum tillage operation.

   Pest management: i) 1% Lemon juice as a foliar spray for controlling Diamond

   Black Moth is found effective.

   ii) Erect bird perches @ 50 nos./ha helps to come and eat the insect larvae.

   iii) Use of trap crop: Bold seeded mustard is more suited for using as trap crop in cabbage cultivation. Mustard is sown twice; first is at 15 days prior to cabbage transplanting, while the second one is at 25 days after transplanting. However, there may be some incidence at later stages. For this apply 5% NSKE.

   iv) Release of *T. chilonis* @ 50,000/ha 4-5 times with interval of 5-7 days helps in controlling DBM and other *lepidopteran* pests.

   Disease management:

i) Soak the seeds in 122-degree water for about 25 minutes to killany lingering bacteria.

ii) Avoid cruciferous crops in the in the infected location.

iii) Use clean cultivation

iv) Use copper fungicide

Any other: Use of black mulch (50 micron) between the rows control weeds and also conserves soil moisture. Earthing up can be done at about 30 days after planting.

6. **Critical inputs required:** *Azotobacter, Phosphorus Solubilizing* Bacteria, vermicompost,rockphosphate

7. **Observations to be recorded:** Temperature, Rainfall, Date of sowing, Date of germination, Date of planting, Date of weeding, Pest infestation, Disease infestation, Yield, Soil test data (initial & final), B: C ratio

Technology no.9

1. **Name of technology:** Cultivation of Carrot by using organic sources of nutrient
2. **Source of technology:** Deptt. of Horticulture, AAU, Jorhat
3. **Year of release:** 2012
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Microbes:	*Azotobacter* and *PSB*
Manure:	Enriched compost @5 t/ha or Cowdung @ 10t/ha
Dose of biofertilizer:	Azotobacter and PSB @ 7.5g each per 100g of seeds
Manuring:	Enriched compost @5 t/ha or Cowdung @ 10t/ha+Rock Phosphate188kg/ha
Rock phosphate:	188kg/ha (as per SSP dose)
Method of application:	Manure application is to be done at the time of final land preparation.
Management practices:	
Crop:	Carrot

Spacing: Seeds should be sown at a depth of 1.5 cm in lines spaced at 30 cm on flat bed and seedlings are to be thinned out to 10 cm within rows at 10-15 days after emergence.

Seed rate: 7.0 kg/ha

Seed treatment: Seed treatment with biofertilizer slurry for at least 1 hour.

Land preparation: Land is prepared to fine tilth

Pest management/Disease management:

i) Destruction of crop residues after harvest and phytosanitation measures is to be adopted.

ii) Use of repellant: 4% garlic juice is sprayed whenever required.

iii) Neem bases insecticides @ 2ml/lt is applied against any leaf cutting insects whenever required.

iv) Neem cake enriched with *Pseudomonas fluorescens* applied at 10g/m2 increases the root colonization andsignificant increase in the yield of carrot.

Any other: Earthing up is done at about one month after sowing.

6. **Critical inputs required:** *Azotobacter* and *PSB, enriched compost/cowdung,* Rock Phosphate
7. **Observations to be recorded:** Rainfall, Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Yield Soil test data (initial & final), B: C ratio: 6.12

Technology no.10

1. **Name of technology:** Stage wise requirement of N and K in banana
2. **Source of technology:** Department of Horticulture, Assam Agricultural University,Jorhat.
3. **Year of release:** 2017
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Manures and fertilizers: Pits of 45cmx45cmx45cm size are dug and each pits filled withthe top soil mixed with 200g lime and 12kg FYM one monthbefore planting. Nitrogeneous and potassic fertilisers @ 110g Nand 330g K2O per plant in the form of Urea and Murriate ofPotash respectively are applied in splits in different stages as

Nitrogenous fertilizer :

- 60% of N at planting to five month stage
- 20% of N at shooting
- 20% of N at last hand opening to one month before harvestPotassium fertilizer:
- 40% of K at shooting to last hand opening
- 60% of K at last hand opening to one month before harvest stage

Phosphatic fertilizer: The phosphate fertilizers @ 33g P2O5 per plant are applied in third month after planting.

Management practices:

Variety: Barjahaji

Characteristics: It is high yielder, has no persistent male bract, fingers are long and green, even at ripening, flesh is soft and smooth.

Duration: 13-16 months

Planting materials: 4-6 months old sword suckers

Requirement of suckers: 3086 nos

Planting time: March to May

Planting material treatment: Healthy uniform sword suckers weighing about 2kg of uniform age are selected. Before planting, the top portion of selected suckers is removed at 30cm from the corm. The weighed suckers are pared and pralinaged by dipping them in a clay slurry with carbofuran 3G @ 20g per sucker.

Land preparation: Thoroughly ploughed, harrowed and levelled

Spacing: 1.8mx1.8m

Harvesting time: June/July

Farming situation: High land

6. **Critical inputs required:** N & K
7. **Observations to be recorded:** Bunch weight, Yield, Hands per bunch, Fingers per handWeight of finger, Farmers' reaction, B: C ratio.

Technology no.11

1. **Name of technology:** Off season cultivation of cucumber under polyhouse
2. **Source of technology:** Department of Horticulture, AAU, Jorhat-13
3. **Year of release:** 2017
4. **Agro-climatic zone:** All zones of Assam

Detail description of technology:

Variety:	Alisha F-1
Sowing time:	Mid of Oct to Jan
Spacing:	30cm (Plant to plant) X 60 cm (Row to row)
Seed rate:	20 g/ 100 m2
Land Preparation:	The width per bed is 75 cm and distance between bed is 40 cm.
Manure & fertilizers:	90: 270: 120 kg NPK/ha + FYM @ 15 t /ha
Seed treatment:	Potassium nitrate @ 0.2%
Plant population:	506 plants/ 100m2
Plant protection:	techniques Powdery mildew: Sulfex @ 0.2%

Downy mildew : Indofil M-45 @ 0.2%

Interculture: Irrigation and weeding are done as and when required.

Special cultural practices: Four bamboo poles are put at two ends of each bed and Coconut ropes are tied horizontally in the poles at a distance of1.5 feet. Upto 1.5 feet from ground level no fruits are allowed to develop. Only one stem is allowed to trail and after 2m of height tip is removed and allowed the plant to trail downwards as umbrella system.

Crop duration:	Three and half months
Harvesting time:	Harvesting starts about one and half months after sowing
Yield:	8-12q /100m2
Farming situation:	High land, under protected condition

5. **Critical inputs required:** Variety 'Alisha F-1', Potassium nitrate, polyhouse
6. **Observations to be recorded:** (including cost benefit ration)

Days to first female and male flower, Nod no at which firstfemale and male flower appear, Fruits/ plant, Weight, Girth,Volume, length per fruit, Yield/ plant (kg), Vine length (m), B: C Ratio.

Technology no.12

1. **Name of technology:** Integrated Nutrient Management in Colocasia
2. **Source of technology:** Department of Horticulture, Assam Agricultural University,Jorhat.
3. **Year of release:** 2017
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Treatment : Vermicompost 1t/ha + FYM 10t/ha + 75% RD(80: 60: 80kg/ha) of NPK. The entire quantity of vermicompost, FYM, P_2O_5, K_2O and half quantity of the N is applied as basal.Remaining quantity of N splited in to two parts, one applied atfirst earthing up (one month after planting) and 2nd is appliedat the time of second earthing up(two months after planting).

   Management Practices:

   Variety: Jorhat *Ahina*

   Characteristics: It is a high yielder, easily palatable and consumer preference

   Duration: 8 months

   Planting materials: Cormel (25 g)

   Requirement of Cormel: 60-80 q/ha

   Planting time: April-May

   Planting material treatment: The cormels are treated with 2% Bevistin and shade dried for one day before planting

   Land preparation: One time deep ploughing and two times harrowing followed by levelling

   Spacing: 60cm x 45cm

   Harvesting time: At 6-7 months(September-October)

   Farming situation: Upland

6. **Critical inputs required:** Vermicompost, FYM, N, P, K
7. **Observations to be recorded:** Yield, No. of corms, No. of cormels, Farmers' reaction, B: Cratio, soil status.

Tehnology no. 13

1. **Name of technology:** Use of organic and biofertilizers for cut flower production of gerbera cv. Red Gem
2. **Source of technology:** Department of Horticulture, Assam Agricultural University, Jorhat.
3. **Year of release:** 2013
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Organic and Biofertilizer: Enrich compost @10t/ha + Biofertilizer (Azospirillum and

   PSB) @3.5 g/ha.

   Method of application: Enrich compost as soil application one day before planting andbiofertilizer as root treatment on the same day of planting.

   Management Practices:

   Variety: Red Gem

   Characteristics: Gerbera is a perennial crop which flowers during winter. Enrich compost is an organic fertilizer which is fortified with rock phosphate.

   Duration: 8 months

   Planting materials: Healthy, disease free suckers having at least one growing point.

   Requirement of suckers/ha: 85,000

   Planting time: September--October

   Planting material treatment: The roots and leaves should be trimmed leaving 5-6 cm and treated with captaf or bavistin @ 1.5 g/l water for 30 min.

   Land preparation: The land is thoroughly ploughed, harrowed and levelled. Beds are raised by 25--30 cm.

   Spacing: 30 cm x 30 cm

   Manures and fertilizers: Well rotten cow dung @ 5 kg/m^2, NPK@ 30: 10: 20 (66 g urea, 62 g SSP and 33 g MOP/ m^2)

   Crop duration: Perennial

   Harvesting time: Starting from 2 months after planting for a period of 6 months.

   Farming situation: High land

6. **Critical inputs required:** Enrich compost, Azospirillum, PSB
7. **Observations to be recorded:** Plant height, No. of leaves/ plant, No. of flowers/ plant, Flower size, No. of suckers/ plant, B: C ratio.

Technology no. 14

1. **Name of technology:** NPK requirement for yield and cut flower production of chrysanthemum
2. **Source of technology:** Department of Horticulture, Assam Agricultural University,Jorhat.
3. **Year of release:** 2013
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

   Manures and fertilizers: Well rotten cow dung @ 5 kg/m^2,NPK@ 30: 20: 20 (66 g urea, 125 g SSP and 33 g MOP/ m^2)

   Method of application of fertilizer: Half dose of urea and full dose of SSP and MOP are applied as basal dose. After one month of planting the rest of the fertilizers are applied in two equal doses at 15 days interval in ring method.

   Management Practices:

   Variety: Carnival Pride

   Characteristics: It is a short day crop

   Duration: 5 months

   Planting materials: Healthy, disease free 5-7 cm long cuttings having four leaves.

   Requirement of cuttings/ha: 85,000

   Cutting time: July to September

   Planting time: August - September

   Planting material treatment: 5-7 cm long tips are taken, dipped in 1.5 g/lit captaf or Dithane M- 45 for 20 min and then planted in nursery bed or pot after applying growth hormone (Rootex 1). The bed is also treated with the same fungicide up to a depth of 15-20 cm.

   Land preparation: The land is thoroughly ploughed, harrowed and levelled. Beds are raised by 25--30 cm.

Spacing: 30 cm x 30 cm

Crop duration: One year

Harvesting time: 3-3 1/2 months after planting.

Farming situation: High land

6. **Critical inputs required:** Cow dung, N, P, K

7. **Observations to be recorded:** Plant height, No. of leaves/ plant, No. of flowers/ plant, Flower size, No. Of suckers/ plant, Flower duration, Vase life, B: C ratio.

Technology no.15

1. **Name of technology:** Growth regulators for flowering & planting material production of gladiolus.

2. **Source of technology:** Department of Horticulture, Assam Agricultural University, Jorhat.

3. **Year of release:** 2013

4. **Agro-climatic zone:** All zones of Assam

5. **Detail description of technology:**

Growth Regulator: Application of GA3 100 ppm and Ethrel 250 ppm

Method of application ofgrowth regulators: The corms of gladiolus were soaked overnight in the different Solutions of growth regulators before planting.

Management Practices:

Variety: Red Candiman

Characteristics: Winter crop

Duration: 6 months

Planting materials: Healthy, disease free corms having a diameter more than 2.5 cm.

Requirement of corms/ha: 85,000 corms

Planting time: Mid October- mid November

Planting material treatment: Dry scales should be removed, treated with 2% Bavistin or Captaf for 30 min and then dried in shade.

Land preparation: Thoroughly ploughed, harrowed and levelled. Beds are raised by 30 cm.

Spacing: 30 cm x 30 cm

Manures and fertilizers: Well rotten cow dung @ 5 kg/m2, 25 g urea, 140 g SSP and 50gMOP/m2

Crop duration: Six months

Harvesting time: Three months after planting

Farming situation: High land

6. **Critical inputs required:** Growth regulators (GA3, Ethrel)
7. **Observations to be recorded:** Plant height, Days to corm sprouting, Spike length, No. of florets/ spike, Flower duration, Vase life, Corm weight, Corm diameter, No. Of cormel/ corm, B: C ratio.

Technology no.16

1. **Name of technology:** Integrated weed management in Tuberose
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:** Application of Metribuzin @ 500 g/ha or Oxadiargyl@ 150 g/ha as pre-emergence followed by garden hoeing 3 times at 60, 90 and 120 days after planting.
6. **Critical inputs required:** Herbicide, garden hoe
7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.17

1. **Name of technology:** Integrated weed management in Brinjal
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:** Application of pre-emergence herbicide (0-3 days after planting) Pendimethalin @ 1.5 kg/ha followed by hand weeding at 35 days after planting.
6. **Critical inputs required:** Herbicide

7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no. 18

1. **Name of technology:** Integrated weed management in Marigold
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones
5. **Detail description of technology:** Pre-emergence application of herbicide (0-3 days after planting) Butachlor @ 1.0 kg/ha followed by grubber at 35 days after planting and alternatively, garden hoeing at 20 and 40 days after planting.
6. **Critical inputs required:** Herbicide, grubber/garden hoe
7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.19

1. **Name of technology:** Irrigation management in coriander, chilli and tomato
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:** Application of 4 cm irrigation at 18-20 days interval by surface flooding.
6. **Critical inputs required:** Irrigation water (4 cm)
7. **Observations to be recorded:** Rainfall (mm), moisture status in soil, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.20

1. **Name of technology:** Irrigation management in Brinjal
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:** Application of 4 cm irrigation at 15-18 days interval by surface flooding.
6. **Critical inputs required:** Irrigation water (4 cm)
7. **Observations to be recorded:** Rainfall (mm), moisture status in soil, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.21

1. **Name of technology:** Irrigation management in Gladiolus
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Three irrigations of 4 cm depth at plant emergence, 4 leaves and spike initiation stage in gladiolus
6. **Critical inputs required:** Irrigation water
7. **Observations to be recorded:** Rainfall (mm), soil moisture status, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.22

1. **Name of technology:** Gerbera varieties for green house cultivation
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Black centered gerbera varieties like Antibes (red), Batavia (orange), Shimmer (white with pink trans floret), Faith (yellow), Prianha (purplish

pink), Winter Queen (white), Cross Road (yellow with red trans floret) and Dream (pink).

6. **Critical inputs required:** Planting materials
7. **Observations to be recorded:** Rainfall (mm), flower yield, B: C Ratio, Farmers' reaction, soil nutrient status.

Technology no.23

1. **Name of technology:** Fertility management in Tuberose
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone**: All zones of Assam
5. **Detail description of technology:** Application of NPK @ 30: 20: 20 g/m2 with half of N and full doses of P2O5 and K2O to be applied at the time of land preparation and the remaining N to be top-dressed in 2 split doses at 35 and 55 days after planting of cutting.
6. **Critical inputs required:** N, P, K
7. **Observations to be recorded:** Rainfall (mm), flower yield, B: C Ratio, Farmers' reaction, soil nutrient status.

Technology no.24

1. **Name of technology:** Chemical treatment for increased vase life of the spathe of Anthurium
2. **Source of technology**: Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones
5. **Detail description of technology:** Application of 50 ppm Sodium hypochlorite + 5% sucrose or 300 ppm of Aluminium Sulphate + 5% sucrose as holding solution for increased vase life of the spathe of Anthurium.
6. **Critical inputs required:** Sodium hypochlorite or Aluminium Sulphate, Sucrose
7. **Observations to be recorded:** Rainfall (mm), vase life of the spathe of Anthurium , B: C Ratio, Farmers' reaction, soil nutrient status.

Technology no.25

1. **Name of Technology:** Drying Technology of Orchids
2. **Source of Technology:** ICAR-NRCO (Value addition in orchids)
3. **Year Release:** 2015-16
4. **Ago climatic Zones:** Any states especially for city dwellers
5. **Brief Description Of Product/Technology**

Sl.No.	Species / varieties of orchids	Recommendations
1.	*Vanda teres*, *Dendrobiummoschatum, Arundinagraminifolia, Den.* 'Madam Pink', *Den.* 'Lervia', *Den*. 'Abraham', Phal. 'Casa Blanca', Phal. 'Detroit' and Oncidium 'Sweet Sugar'	Embedded drying with borax at 50°C in oven
2.	*Epidendrum* spp., *Cattleyabowringiana* and *Cattleya* hybrids, Phal. 'Ox Plum Rose x Black Jack' and Den. 'Big White', *Vanda coerulea*	Embedded drying with borax at 60°C in oven
3.	*Coelogyneflaccida*, *Coelogynecristata, Dendrobiumnobile, Dendrobiumwilliamsonii, Dendrobiumaphyllum*, Den, 'Erika', Den. 'Big White 4N', Den. 'Bangkok Blue', Phal.'Nagasaki' and Cym. 'Sungold'.	Embedded drying with borax and silica gel at 55°C in oven
4.	Dendrobium, Phalaenopsis, Cattleya, Cymbidium, Aranda, Mokara hybrids	Perlite, Perlite + borax and Perlite + Silica gel under room condition (24-25°C and 75-79%RH)
5.	Cattleya 'Guanmian City', Dendrobium 'Lervia, Phalanopsis 'Vienna ', Vanda tessellata, Oncidium 'Taka Yellow', Phalanopsis 'TaidaS.Red'	Embedded drying with sand at 50°C in oven

Photographs




Dry orchids in batches

6. **Critical inputs:** Fresh flowers, hot woven, sand, borax, silica gel, perlite
7. **Observations to be recorded:** Name of species, stage of harvest (bud, half opened bud/ full bloom, single flower/spray, thickness of petal (thick, medium, thin), colour (as per RHS colour chart), duration, brittleness
8. **Address of the institute:** ICAR-NRC for Orchids, Pakyong, Sikkim, Email address: nrcorchids@rediffmail.com0

Technology no. 26

1. **Name of Technology**: DUS Test Guidelines of Commercial Orchids
2. **Source of Technology**: Preparation for Plant Varieties Protection and DUS Testing through ICAR-SAU System
3. **Year of release:**

Sl.No.	Genera	Publication in Plant Variety Journal of India	Gazette Notification No.
	Cymbidium	Vol. 05, No. 10, October 03, 2011	S.O. 617 (E), 27/03/2012
	Dendrobium	Vol. 05, No. 10, October 03, 2011	S.O. 617(E) 27/03/2012
	Vanda	Vol. 05, No. 10, October 03, 2011	S.O. 617(E) 27/03/2012
	Phalaenopsis	Vol. 06, No. 11, November 01, 2012	S.O. 1093(E), 15/04/2014
	Cattleya	Vol. 06, No. 11, November 01, 2012	S.O. 1093(E), 15/04/2014
	Oncidium	Vol. 08, No. 04, April 01, 2014	S.O. 2664 (E), 16/10/2014
	Paphiopedilum	Vol. 09, No. 08, August 03, 2015	19/4/2016

4. **Agro-climatic Zones**: Western Himalaya, NEH Region, Deccan Plateau

5. **Details description about the Technology**

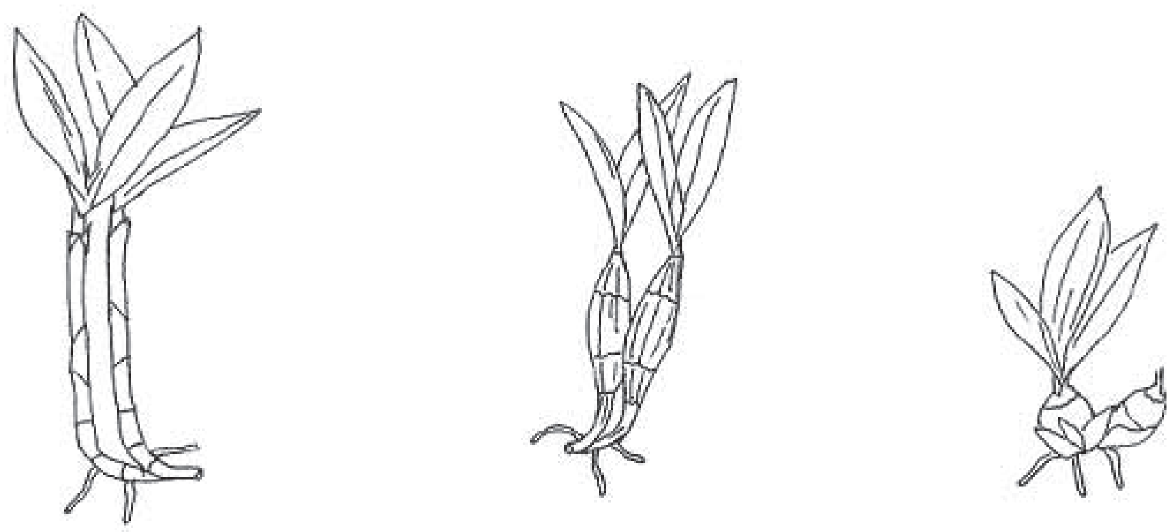
Sl.No.	Genera	No. of hybrids	Total No. of morphological descriptors	Grouping characteristics
1.	*Cymbidium*	41	66	Pseudobulb shape & size , Inflorescence length, number of flowers/ inflorescence, Flower width, Flower duration, Flower predominant color, Lip ornamentation , Blooming time
2.	*Dendrobium*	14	60	Plant height, Internode length, Inflorescence length, Flower width, Lip colour, Lip ornamentation, Flowering time
3.	*Vanda*	11	66	Plant type , Internode length , Leaf type, Spike length, Flower number, Inflorescence colour, Sepal & petal ornamentation, Lip: shape, colour, ornamentation, Spur length , Flowering time
4.	*Cattleya*	9	53	Plant: height, Leaf: number/ pseudobulb, Flower width in front view, Petal: predominant colour, Lip predominant colour , Lip colour pattern
5.	*Phalaenopsis*	50	58	Plant size , Flower width in front view, Petal predominant colour, Petal colour pattern, Lip predominant colour, Lip Predominant colour of apical lobe, Lip colour pattern of apical lobe
6	*Oncidium*	40	60	Plant type, Number of basal leaves/ pseudobulb, Flower width in front view, Petal main colour, Petal colour pattern, Lip main colour, Lip colour pattern
7	*Paphiopedilum*	10	77	Floral bract shape, Flower width in front view, Dorsal sepal colour pattern, Synsepal width, Synsepal main colour, Petal orientation, Lip colour pattern, Column staminode size

Photographs

Fig 1. Nature of stem in *Dendrobium*

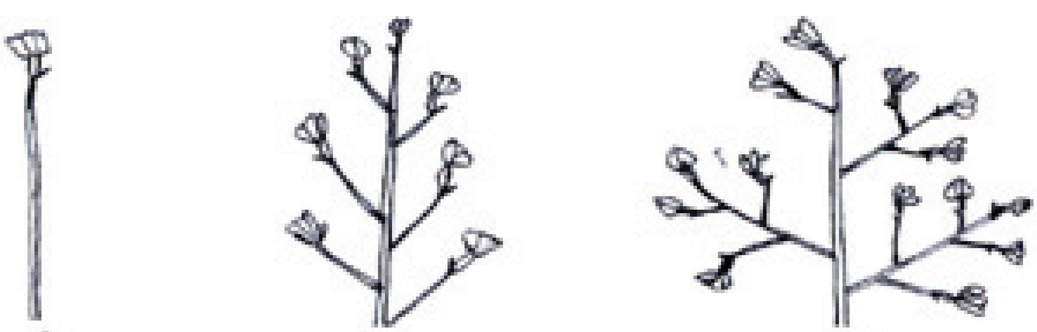
1 Cane (woody) — 3 Cane cylindric (fleshy) — 5 Cane clavate fleshy — 7 Bulbous (round)

Fig 2. Nature of pseudobulb in *Cattleya*



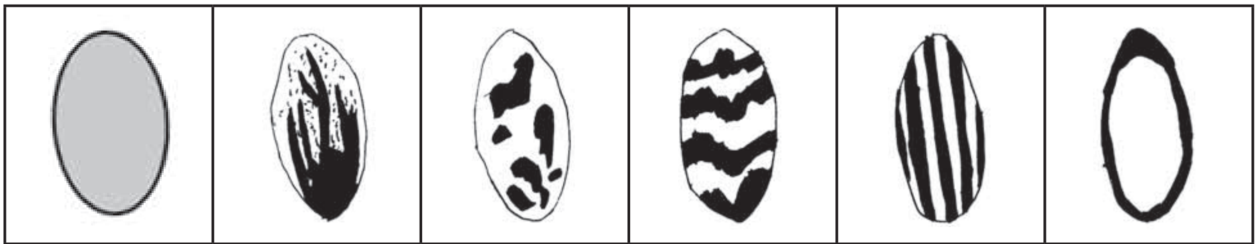
Cylindric — 3 Clavate — 5 Globular/Ovoid

Fig 3.Inflorescence type in *Phalaenopsis*



1 Solitary — 3 Raceme — 5 Panicle

Fig 4.Lip colour pattern in *Oncidium*



uniform	shaded	blotched	brindled	striped	edged
(1)	(2)	(3)	(4)	(5)	(6)

6. **Critical inputs requires:** Fully grown plants, protected structures, pots, potting mixtures, Thermohygrometer, RHS colour chart.

7. **Observations to be recorded**:

   a. Observations shall be made on the longest leaf of flowering plant.

   b. Observations on the inflorescence shall be made at the time when 50% of the flowers on the inflorescence have opened. Observations on the flowers should be made on the most recently fully opened flower before the color starts to fade.

   c. Observations on the length and width of the flower and parts of the flower shall be made on the spread out positions.

   d. Observations on the color of the sepal, the petal and the lip shall be made on inner side at apex, mid and base portion.

   e. Observations on the colour of column shall be made on inner side at apex, mid and basal region.

8. **Contact address:** ICAR-NRC for Orchids, Pakyong, Sikkim, Email address: nrcorchids@rediffmail.com

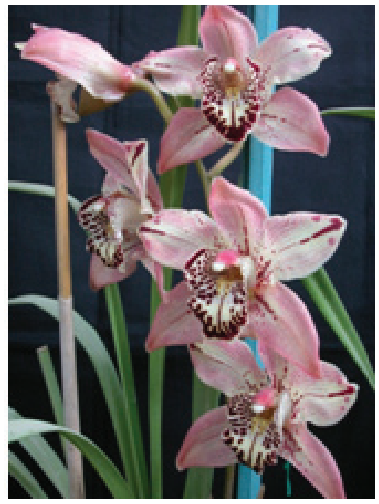
Technology no.27

1. **Name of Technology :** Post-harvest Technology of Cymbidium orchids
2. **Source of Technology:** Post-harvest technology of Orchids
3. **Year of Release:** 2013-14
4. **Agroclimatic Zones:** Western and North Eastern Himalayan region
5. **BRIEF DESCRIPTION OF TECHNOLOGY**

Sl.No.	Particulars	Recommendations
	Evaluation of elite hybrids for vase life	Bob Marlin Lucky (57 days), Fire Strom Blaze (53 days), Hazel Fay Tangerine (50 days), Everett StockstillBullai (48 days), Caripepper Peachy Keen (43 days), Hana Akari (41 days), Fire Storm Ruby (36 days)
2.	Spike length and vase life of different classes of Cymbidium	Miniature (30-60cm): 30-34 days Intermediate (60-75cm): 35-37 days Standard (> 75cm): 55-59 days
3.	Optimal stages of harvest of Cymbidium 'PCMV' for maximum vase life	Two buds opened stage (66.8 days)
4.	Best impregnation treatment of Cymbidium 'PCMV' for maximum vase life	$CoCl_2$ (1000ppm) for 15 minutes (46 days)
5.	Best pulsing treatment of Cymbidium for maximum vase life	5% sucrose for 8 hours (56 days)
6.	Best pre-harvest spray of Cymbidium for maximum growth and vase life	GA_3 (50 ppm) + BA (200 ppm)
7.	Best chemical treatment for opening of tight buds of Cymbidium cutflowers	Sucrose 4% + Salicylic acid 200 ppm with 75% opening and vase life of 45 days
8.	Best holding solution for improved vase life of Cymbidium	2% sucrose + 200 ppm 8-HQS with vase life of 76.6 days
9.	Best packaging material of Cymbidium spikes and florets for improved vase life	Cellophane (56 days)

10.	Best harvesting stage of Cymbidium florets for improved vase life	Fully opened florets with vase life of 48 days.

1. **Photographs**

		
Cym, 'Bob Marlin Lucky'	Cym. 'Fire Storm Blaze'	Cym. ''Everett StockstillBullai'

Cymbidium hybrids for cut flowers

Chemicals for opening of tight buds of Cymbidium cutflowers

6. **Critical inputs requires:** Cut flowers of Cymbidium, chemicals, packaging materials, glasswares

7. **Observations to be recorded:** Days to first floret opening, longevity of first floret (days), , diameter of first floret (cm), , water uptake (ml), changes in fresh weight (g), per cent of half opened buds, per cent of fully opened buds, vase life (days)

8. **Address of the institute: I**CAR-NRC for Orchids, Pakyong, Sikkim, Email address: nrcorchids@rediffmail.com

Technology no. 28

1. **Name of Technology:** Potting Mixtures of Commercial orchids
2. **Source of Technology:** ICAR-NRCO (Production Management of Tropical and Subtropical Orchids)
3. **Year of release:** 2013-2014
4. **Agro climatic Zones:** NEH Region and Deccan Plateau
5. **Brief Description Of Technology**

Sl. No.	Commercial orchids	Recommended varieties/hybrids	Potting mixtures
1.	*Cymbidium*	Cym. Red Beauty Evening Star, Cym. Bob Marlin Lucky, Cym. Fire Storm Ruby, Rocky Greek Pebbles, Cym. Hazel Fay Tangerine, Cym. Fire Storm Blaze, Cym.Sunny Moon, Cym. 'Samurai HeeSagun', Cym. 'Winter Beach See Green', Cym. 'PCMV', Cym. 'Ensikhan', Cym. Everett StockstillBullai, Cym. Valley Legend Steff, Cym. Caripepper Peachy Keen, Cym. Soul Hunt	Cocochips + Cocopeat + Brick pieces + Slow release fertilizer (Osmocot) (1: 1: 1: 5g)/dry leaf fern
2.	*Dendrobium*	Big White 4N, Bangkok Blue, Dang Saard, Big White Jumbo, Erika, Madam Pompadour, Ear Sakul, Thongchai Gold, Madam Pink, Triple Pink, Emma White, Julie, Kating Dang	Coco peat / cocochips + brick pieces + tree bark (1: 1: 1)
3.	*Vanda*	Prao Sky Blue, Pures Wax, RBSD Black, Pat Delight, Sansai Blue, Roberts Delight Blue, Motes Indigo Blue, V. Sirilak x Thonghchai Gold, Pakchong Blue, RBSD Pink, RBV-10 x Fusch's Delight, RBSD Blue, RBV-10 x Dr. Anek, Ratch Blue Stars	Cocochips + brick pieces + leaf fern (1: 1: 1)
4.	*Phalaenopsis*	Taida S.Red, Kaleidoscope,Strawberry,Maki Watanabe, Hsin-Ying Fortune,Shu Shu Long First Love,Memoria Francis Hunter,Ox Prince Thunder,Chian Xen Magpie, Ox Plum Rose x Ox Black Jack, Detroit, Vienna, Manchester	Cocochips + brick pieces + leaf moulds + green moss (1: 1: 1: 1)

5.	***Cattleya***	Blc. Guanmiau City, Blc. Chinese Beauty Orchid Queen, Lc. Purple Cascade 'Fragrant Beauty', C.Queen Sirikhit, Blc. Hsin ying Catherine, Lc. Ahmad Shiekhi, Blc.Mem Ann Balmores 'Conves', Blc 'Chia Lin New City', Blc.Ablaze Medal 'U Emperor'	Cocochips + brick piece + leaf mould/ leaf fern (1: 1: 1)
6.	***Oncidium***	Colm. Wildcat Bobcat, Colm. Wildcat Carmera, Colm. Pixie Ruth, Sweet Sugar, Gower Ramsay, Sharry Baby Sweet Fragrance, Taka Yellow, Popki Red, Jairak Rainbow Pink Spot, J.R. Orange Red, J.R. Yellow Brown, J.R. Orange Spot	Cocochips + brick pieces + leaf moulds (1: 1: 1)

6. **Critical inputs requires:** Protected structures, pots, cocochips, cocopeat, leaf moulds, brick pieces, green moss, leaf fern, tree bark, slow release fertilizers.

7. **Observations to be recorded:**

Sl.No.	Genera	Main observations
1.	*Cymbidium*	Pseudobulb shape & size , Inflorescence length, number of flowers/ inflorescence, Flower width, Flower duration, Flower predominant color, Lip ornamentation , Blooming time
2.	*Dendrobium*	Plant height, Internode length, Inflorescence length, Flower width, Lip colour, Lip ornamentation, Flowering time
3.	*Vanda*	Plant type , Internode length , Leaf type, Spike length, Flower number, Inflorescence colour, Sepal & petal ornamentation, Lip: shape, colour, ornamentation, Spur length , Flowering time
4.	*Cattleya*	Plant: height, Leaf: number/ pseudobulb, Flower width in front view, Petal: predominant colour, Lip predominant colour , Lip colour pattern
5.	*Phalaenopsis*	Plant size , Flower width in front view, Petal predominant colour, Petal colour pattern, Lip predominant colour, Lip Predominant colour of apical lobe, Lip colour pattern of apical lobe
6	*Oncidium*	Plant type, Number of basal leaves/pseudobulb, Flower width in front view, Petal main colour, Petal colour pattern, Lip main colour, Lip colour pattern

8. **Address of the institute:** ICAR-NRC for Orchids, Pakyong, Sikkim, Email address: nrcorchids@ rediffmail.com

Technology no.29

1. **Name of the Technology:** Low Cost Plastic Shelters for High Value Organic Vegetable Production in North Eastern Hill Regions

2. **Source of the Technology:** ICAR-National Organic Farming Research Institute, Tadong-737102, Gangtok, Sikkim

3. **Year of Release:** 2016

4. **Agro Climatic Zone:** High Rainfall Mid Hills of North Eastern Hill Regions

5. **Detail Description of the Technology:** Production of vegetables under low cost shelters provides the best way to get better return per unit area especially during rainy season. At ICAR-National Organic Farming Research Institute (Formerly ICAR RC for NEH Region, Sikkim Centre), Tadong, Gangtok we have tried determinate and indeterminate tomato varieties, capsicum, cherry pepper, bitter gourd, bottle gourd, sponge gourd, ridge gourd, cucumber *etc.* under low cost plastic shelters during summer and rainy season. It was observed that all the vegetables can be grown successfully under low cost plastic shelters and have shown significant increase in earliness with higher production and productivity. Low cost plastic shelters provide crop diversification opportunities and supports production of high quality and clean organic produce. It gives protection against wind, rain and hail storm during rainy season andmaintains optimum temperature for plant growth, and protects crop from frost during winter season.

   Low cost plastic rain shelters are very simple structures, covering plants along the row. These are about 7 ft. high at one end and 6 ft. high at other end to give slanting roof. Crossed bamboo sticks are placed on the roof for supporting the plastic sheets. The width of these shelters can be 6-8 ft. The plastic rain shelters are erected with bamboo or wooden poles of about 1-2 inch diameter. A transparent UV stabilized plastic sheet of 35 or 45 GSM is placed on the bamboo structure to cover the roof. The plastic films are properly tied on bamboo structures with wire. The plastic sheet simply protects the plants from adverse climatic conditions for *e.g.,*high rainfall, hail storm and frost during winter.

Preliminary Requirements

- Potential stresses caused by heavy wind, hail or heavy rains and orientation of structure must be considered while constructing the low cost plastic shelters.
- Prior to start high value organic vegetable farming in low cost plastic shelters, the farmer must have practical knowledge about vegetable farming.
- Soil and water quality should be tested before starting the farming.

- Recommended seed should be used.
- Farmer must have the updated market information to earn high profit.

6. Critical Inputs Required

Space Requirement

Minimum area should be 100 m^2; however, length of plastic shelterscan be made as per the availability of land. Slopy land should not be used for the construction of plastic shelters.

Plan Set up Cost

Construction cost of plastic shelter per 100 m^2 area is approximately Rs.9,550.00.

Raw Materials Required

UV stabilized plastic sheets (35 or 45 GSM) or Non UV stabilized plastic sheets (120 GSM), bamboo, binding wire *etc*.

Photographs of the Technology

Low Cost Plastic Shelters for High Value Organic Vegetable Production

7. Observations to be Recorded

- Compartive vegetable crops yield between open conditions and under low cost plastic shelters.
- Compartive vegetable crops duration between open conditions and under low cost plastic shelters.

- B: C Ratio should be calculated as per the region and crop season.
- Cropping sequences can be modified and adopted as per the location specific requirement.

Benefits of the Technology

- Vegetables can be produced year round regardless of the season.
- It gives better return per unit area especially during rainy season.
- Provides crop diversification opportunities and supports production of high quality and clean products.
- Maintains optimum micro climate for good plant growth.
- Protection against wind, rain, hails, frost and to some extent disease and pests.

8. Contact Address for Relevant Information

The Joint Director,

ICAR-National Organic Farming Research Institute, Tadong, Gangtok, Sikkim.

E-mail: jdsikkim.icar@gmail.com

Technology no.30

1. **Name of the Technology:** Low Cost Plastic Tunnels for Year Round Organic Vegetable Production in North Eastern Hill Regions
2. **Source of the Technology:** ICAR-National Organic Farming Research Institute, Tadong-737102, Gangtok, Sikkim
3. **Year of Release:** 2016
4. **Agro Climatic Zone:** High Rainfall Mid Hills of North Eastern Hill Regions
5. **Detail Description of the Technology:** Production of vegetables under low cost tunnels provides the best way to increase the productivity and quality of vegetables, especially during rainy season and severe winter season. At ICAR-National Organic Farming Research Institute (Formerly ICAR RC for NEH Region, Sikkim Centre), Tadong, Gangtok we have tried several high value vegetables *viz.* cabbage, cauliflower, broccoli, coriander, fenugreek, spinach, rayo sag, lettuce, pakchoi, garlic, beetroot, carrot, pea and radish under low cost plastic tunnels and observed that all the vegetables can be grown successfully under low cost plastic tunnels and have shown significant increase in earliness with higher production

and productivity.

Low cost plastic tunnels or open tunnels are greenhouse-like structures, covering the plants along the row. These tunnels are about 1.0 m high and 1.5 m wide at the base and are erected with bamboo sticks or wooden poles of about 1 inch diameter. A UV stabilized transparent plastic sheet (35 or 45 GSM) is placed on the bamboo structure to allow sunlight during the day passes through the plastic sheet, and is absorbed by the soil. This raises the temperature to desired levels. The plastic sheet serves two purposes: first it traps heat and reduces water loss and second it protects plants from adverse climatic conditions. Transparent plastic films are stretched over low (about 0.5 m or so) as a flexible wall on both sides of tunnels. The plastic films are properly tied up on bamboo structures with wire.

Photographs of the Technology

Preliminary Requirements

- ❖ Potential stresses caused by heavy wind, hail or heavy rains and orientation of structure must be considered while constructing the low cost plastic tunnels.
- ❖ Prior to start off-season vegetable farming in low cost plastic tunnels, the farmer must have practical knowledge about vegetable farming.
- ❖ Soil and water quality should be tested before starting the farming.
- ❖ Self-pollinated plant should be grown.
- ❖ Recommended seed should be used.
- ❖ Farmer must have the updated market information to earn high profit.

6. Critical Inputs Required

Space Requirement

Minimum area should be 100 m^2; however, length of plastic tunnelscan be made as per the availability of land. Slopy land should not be used for the construction of plastic tunnels.

Plan Set up Cost

Construction cost of plastic tunnels of size 15 x 1.5 x 1.0 m (Length x Width x Height) = Appx. Rs. 2015.00 and Per 100 m^2 area is approximately Rs.8,950.00.

Raw Materials Required

UV stabilized plastic sheets (35 or 45 GSM) or Non UV stabilized plastic sheets (120 GSM), bamboo, binding wire *etc*.

7. Observations to be Recorded

❖ Compartive vegetable crops yield between open conditions and under low cost plastic tunnels.

❖ Compartive vegetable crops duration between open conditions and under low cost plastic tunnels.

❖ B: C Ratio should be calculated as per the region and crop season.

❖ Cropping sequences can be modified and adopted as per the location specific requirement.

Benefits of the Technology

- ❖ Vegetables can be produced year round regardless of the season to get better return.
- ❖ Provides crop diversification opportunities and supports production of high quality and clean products.
- ❖ Used for raising healthy and early nursery.
- ❖ Maintains optimum micro climate for good plant growth.
- ❖ Protection against wind, rain, frost, and snow at higher hills.
- ❖ Makes cultivation of vegetables possible in areas where it can't grow in open conditions viz. high altitudes.

8. Contact Address for Relevant Information

The Joint Director,

ICAR-National Organic Farming Research Institute, Tadong, Gangtok, Sikkim.

E-mail: jdsikkim.icar@gmail.com

The Director, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya.

Technology no.31

1. **Name of the Technology:** Farmer Friendly Low Cost Structure for Organic Kiwifruit Multiplication through Cuttings
2. **Source of the Technology:** ICAR-National Organic Farming Research Institute, Tadong-737102, Gangtok, Sikkim
3. **Year of Release:** 2015
4. **Agro Climatic Zone:** Mid Hills Regions of India
5. **Detail Description of the Technology:** The kiwifruit can be multiplied through seed and vegetative means of propagation. Propagation by softwood cuttings is the commercial method to produce rapid and quality plants. Sterilized growing medium, free from pathogenic organism should be selected. Organic kiwifruit plant multiplication by semi-hardwood cuttings under low cost farmer friendly structure has been standardized at ICAR-National Organic Farming Research Institute (Formerly ICAR Research Complex for N.E.H. Region, Sikkim Centre), Tadong, Gangtok. Sterilized growing medium composed of perlite, vermiculite, cocopeat and vermicompost (1: 1: 1: 1 ratio) is being used for propagation through semi-hardwood cuttings under jute bag made low cost tunnels. Cuttings were taken from semi-mature growth of the current season. Base of cuttings wounded and dipped in 400 ppm IAA for 24 hr and then planted in growing media and in moist soil under greenhouse. Relative Humidity (70-80%) was maintained by regular spraying of water on jute bags after shoot emergence to prevent desiccation. Cuttings of 0.5-1.0 cm thickness with relatively short internodes and about 15-20 cm in length were most ideal and showed 70% rooting under low cost structure. Jute bags should be removed after 90 days planting of cuttings.






6. **Critical Inputs Required:** Jute bags, bamboo, nails, binding wire *etc.*

7. **Observations to be Recorded:** Comparative kiwifruit cutting rooting percentage under low cost farmer friendly structure and open conditions.

8. **Contact Address for Relevant Information**

   The Joint Director,

   ICAR-National Organic Farming Research Institute, Tadong, Gangtok, Sikkim.

   E-mail: jdsikkim.icar@gmail.com

   The Director,

   ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya.

Technology no. 32

1. **Name of the Technology:** Partial Protection of Kiwifruit for Organic Production in North Eastern Hill Regions

2. **Source of the Technology:** ICAR-National Organic Farming Research Institute, Tadong-737102, Gangtok, Sikkim

3. **Year of Release:** 2016

4. **Agro Climatic Zone:** High Rainfall Mid Hills of North Eastern Hill Regions

5. **Detail Description of the Technology:**

   Prolonged wet seasons with high rainfall intensities along with frequent hails in North Eastern Hill Regions causes several biotic and abiotic stress conditions under open cultivation and have a serious negative effect on kiwifruit yield and quality. Kiwifruit flowers are extremely susceptible to damage by heavy rainfall and hail storm. Provision of adequate shelter is essential to protect kiwifruit flowers from heavy rainfall and hails and for the successful production of kiwifruit in Sikkim. Heavy rainfall and hails coincides with the time of kiwifruit flowering, which causes major physical damage to both flowers and new vegetative growth, however, adoption of 50% agro-shade net protects the kiwifruit from adverse weather conditions. At ICAR NOFRI, we mount agro-shade net on kiwifruit vines at the end of March for about sixty days and remove the shade net at the end of May, which results in better fruit set (80-90%) and initial fruit growth. Final fruit size and yield depends upon the hand pollination and initial fruit set percentage. The adoption of partial protection and hand pollination techniques resulted in 70-80% production of 'A' grade kiwifruit (*i.e.*>100 g/fruit).

Photographs of the Technology:

Partial Protection of Kiwifruit for Organic Production

- Provide a suitable microclimate for vegetative growth, flowers, initial fruit set and fruit development. Compared with plants grown under unsheltered conditions, kiwifruit vines that are provided with adequate shelter grow more rapidly, have better fruit set, and produce larger fruit, also their fruit reach maturity earlier. Pollination is improved under shelter, because bees work better in sheltered conditions.

- Reduce physical damage to vines and fruit. The new shoots of kiwifruit plants, and especially the young growing tips, are very soft and tender and are easily damaged by high rainfall and hails. Flowering shoots are easily broken, reducing the current season's crop. However, more serious damage can be caused by breakage of the replacement shoots which will carry the following season's crop. These shoots usually grow almost vertically, and are subject to breakage at the junction of the shoot and the main permanent leader of the vine. This result in the loss not only of the shoot itself but also of the basal axillary buds which normally provide the shoots of future years.

- Any leaf damage implies a reduced photosynthetic area, which would lead to reduced flowering in the following season. Young plants are particularly prone to this type of damage, at a stage when the canopy can provide only limited self – shelter. Additional benefits of providing shelter include the improved efficiency of orchard spraying, and more pleasant working conditions.

6. Critical Inputs Required:

Agro-shade net (50%) or hail net, bamboo, nails, binding wire *etc*.

7. **Observations to be Recorded:**

   ❖ Comparative kiwifruit fruit set percentage, fruit growth and yield between open conditions and under partial shade conditions.

   ❖ B: C Ratio should be calculated as per the region.

8. **Contact Address for Relevant Information:**

   The Joint Director,

   ICAR-National Organic Farming Research Institute, Tadong, Gangtok, Sikkim.

   E-mail: jdsikkim.icar@gmail.com

   The Director,

   ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya.

   The Director, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya.

Technology 33

1. **Name of the Technology:** TRC BADAMA (ELEPHANT FOOT YAM).

2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

3. **Year of Release:** 2014

4. **Agro Climatic Zone:** Tripura. Also suitable for entire North eastern region

5. **Details description about the Technology:**

   ■ Tripura Yam Batema received very good farmers acceptance, particularly among tribal farmers due to very high yield and low disease incidences.

   ■ Yellowish white flesh is preferred taste wise over the other popular varieties with white flesh.

- Produces more number of corms, which are suitable for easier multiplication.
- Yield: 45-55 t/ha.

6. **Critical inputs requires:** Planted in pits of 60cm x 60cm x 45 cm at a spacing of 90 cm x 90 cm or 75 cm x 75 cm. Fill each pit with 4-5 kg FYM and a basal dose of 40: 60: 50 (NPK /ha). Ideal planting time is March-April. 750-1000 g size corm pieces are required in each pit for good harvest.
7. **B: C ratio:** 2.5-2.7
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:** The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura


Tripura Yam Bate


Tripura Yam Batema


Tripura Yam Batema

Technology 34

1. **Name of the Technology:** BRINJAL- TRC BHOLANATH
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2012
4. **Agro Climatic Zone:** Tripura. Also promising in other North eastern states
5. **Details description about the Technology:**

- Resistant to bacterial wilt
- Plant height 95-100 cm, fruit length 16.5-18 cm, fruit breadth 19.5-21 cm and fruit weight 160-190g.
- Requires 92 days for flowering and 130 days for first harvest in Tripura condition.
- It has wide adaptability in all brinjal growing areas due to its resistance to bacterial wilt disease which is major problem for brinjal Most preferred brinjal variety for fry purpose

in Tripura

- Yield: 400 -450 q/ha

6. **Critical inputs requires:** Seed rate 300-400g/ha. Nursery to be raised in March and planting by April – May or nursery in July-August for September Planting. Fertilizer @ 120: 60: 60 (NPK) for good growth. Regular irrigation for good growth.
7. **B: C ratio:** 3.2-3.5
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:**
    - The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

TRC BHOLANATH

Technology 35

1. **Name of the Technology:** TRC GREATER YAM
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also suitable for entire North eastern region
5. **Details description about the Technology:**
   - High yielding disease resistant variety of greater yam.
   - Highly vigorous creeper with dark green foliage and indeterminate climbing nature.
   - Produces more number of corms (10-11), which is helpful in faster multiplication.
   - Flesh colour is yellowish white, preferred over the white flesh.
   - Yield: 45-50 t/ha.
6. **Critical inputs requires:**

   Planted in pits of 60cm x 60cm x 45 cm at a spacing of 90 cm x 90 cm or 75 cm x 75 cm. Fill each pit with 4-5 kg FYM and a basal dose of 40: 60: 50 (NPK /ha). Ideal planting time is March-April. 750-1000 g size corm pieces are required in each pit for good harvest.
7. **B: C ratio:** 2.4-2.6
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:**
   - The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Tha

Tripura Tha

Technology 36

1. **Name of the Technology: BRINJAL-TRC SINGHNATH**
2. **Source of the Technology** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2012
4. **Agro Climatic Zone:** Tripura. Also performed very well in all North eastern states
5. **Details description about the Technology:**
   - Resistant to bacterial wilt.
   - Plant height 125-130 cm, fruit length 23-27 cm and fruit breadth 10-13 cm and fruit weight 85-100g.
   - It has wide adaptability in all brinjal growing areas of the state due to its resistance to bacterial wilt disease which is major problem for brinjal .
   - Requires 94 days for flowering and 128 days for first harvest. Fruiting throughout the year and suitable for multi year ratooning.
   - Yield: 400 -450 q/ha.
6. **Critical inputs requires:**

   Seed rate 300-400g/ha. Nursery to be raised in March and planting by April – May or nursery in July-August for September Planting. Fertilizer @ 120: 60: 60 (NPK) for good growth. Regular irrigation for good growth.
7. **B: C ratio** 3.2-3.6
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:**
   The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

TRC Singnath

TRC Singnath

Technology 37

1. **Name of the Technology: TRIPURA PAPITA**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also suitable for entire North eastern region
5. **Details description about the Technology:**

- RCTP1 produced much higher average fruit yield per plant (63.25 kg/ plant) in comparison to 2nd highest yielder – Pusa Delicious (52.65 kg/plant).
- It has remarkably higher fruiting zone of 214.68 cm on an average. Average fruit size is 2.05 kg.
- Tolerant to Papaya Ring Spot Virus
- Average Yield: 63.25 kg/plant

Critical inputs requires:

B: C ratio 3.1-3.2

Observation to be recorded: Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

Contact Address for relevant information:

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Papita

Tripura Papita

Technology no. 38

1. **Name of the Technology**: Megha Turmeric-1
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2006
4. **Agro Climatic Zone:** Suitable for plain as well as hilly region of North eastern states
5. **Details description about the Technology:** Maturity: 300-315 days, Average yield: 27-30 t/ha, Tolerant to leaf blotch and leaf spot. Suitable for processing into dried rhizome, powder as well as extraction of oleoresin. Recommended as stable variety for high yield and curcumin content.
6. **Critical inputs requires:** Seed rate: 18-20 q/ ha, FYM: 20 q/ ha, NPK @ 120: 90: 90 kg/ ha
7. **Observation to be recorded:** Maturity, Average yield/ plant, Average yield/ ha, % powder recover
8. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 39

1. **Name of the Technology**: Megha Tomato-3
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2010
4. **Agro Climatic Zone:** Suitable for rainfed as well as irrigated conditions
5. **Details description about the Technology:** Developed by hybridization and selection of Pusa Sheetal x Lima. Fruit is medium sized, round, smooth attractive at maturity; tolerant to low temperature and bacterial wilt. Suitable for rainfed as well as irrigated conditions. Indeterminate in growth habit, good for protected cultivation; Locules 4, TSS 5.9%, fleshy, good in colour development; Cultivar is uniform in ripening and suitable for processing; with high ascorbic acid content (19.20 mg/100g) and high lycopene (36.59 mg/100 g) with good shelf life. Yield potential : 500-550 q/ha.
6. **Critical inputs requires:** Spacing: 60x 45 cm, FYM: 25t/ ha, NPK @120: 80: 60 kg/ ha
   Observation to be recorded: yield, shelf life
7. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 40

1. **Name of the Technology**: Megha Guava - 1 (RCGH-1)
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2015
4. **Agro Climatic Zone:** mid hill condition
5. **Details description about the Technology:** It is a progeny of cross Sour Type x Red Fleshed. Plant growth was upright, erect with dark green broad leaves. Yield potential was 17-19 t/ha under mid hill condition. Fruits were medium size, fruit shape was globose, greenish yellow in colour with red dots at ripening. Pulp was creamy white, soft seeded, rich in vitamin C (230.66-246 mg/100g), pectin (1.26-1.37%) and dietary fibres (3.41-3.52%). Fruits matured 8-12 days earlier than other varieties under mid hill conditions and is suitable for table and processing purpose.
6. **Critical inputs requires:** Spacing: 5x 5 m, FYM: 25 kg/ bearing plant, NPK @ 1.4, 1.25 and 0.5kg Urea, SSP and MOP / bearing plant
   Observation to be recorded: plant, growth, yield, fruit size, shelf life
7. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 41

1. **Name of the Technology**: **Megha Saw Priam (RCGH-4)**-
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2015
4. **Agro Climatic Zone:** mid hill condition
5. **Details description about the Technology:**

   It is a progeny of cross Red Fleshed X Allahabad Safeda, was bred to develop coloured high yielding guava variety. It has semi-spreading growth habit with yield potential of 11-14 t/ha under mid hill condition. Fruits are medium to big in size; fruit shape is elliptical to ovate with greenish yellow colour at maturity. Pulp is red coloured and products viz., jam, jelly, juice; RTS can be prepared.
6. **Critical inputs requires:** Spacing: 5x 5 m, FYM: 25 kg/ bearing plant, NPK @ 1.4, 1.25 and 0.5kg Urea, SSP and MOP / bearing plant
   Observation to be recorded: fruit size, fruit shape, yield
7. **Contact Address for relevant information: :** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 42

1. **Name of the Technology**: Megha Khongpheram Paudiik (RCGH-7)
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2015
4. **Agro Climatic Zone:** suitable for high density planting with yield potential of 12-15 t/ha under mid hills
5. **Details description about the Technology:** It is a progeny of cross Lucknow-49 X Pear Shaped guava. Variety has drooping growth habit suitable for high density planting with yield potential of 12-15 t/ha under mid hills. Fruits are medium size, light green in colour at maturity. Pulp is creamy white with less and soft seeded (107-119 seeds/100g fruit weight), high in sugar (7.96-8.39%), pectin (1.29-1.40%) and phenol content (358.14 - 369 mg GAE/100g) suitable for table and processing purpose.
6. **Critical inputs requires:** Spacing: 5x 5 m, FYM: 25 kg/ bearing plant, NPK @ 1.4, 1.25 and 0.5kg Urea, SSP and MOP / bearing plant

   Observation to be recorded: maturity, size
7. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 43

1. **Name of the Technology**: Megha Priam Thiang (RCG-11)
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2015
4. **Agro Climatic Zone:** mid hills
5. **Details description about the Technology:** It a seedling progeny selection from Meghalaya, selected for low seed content. Plant growth is semi spreading type with yield potential of 11-13 t/ha under mid hills. Fruits are sweet (TSS: 11.88-12.50 0B) with low seed content (42-55 seeds/100 g fruit wt), rich in pectin (1.28-1.32%), phenol content (330.65-340.11 mg GAE/100 g) and vitamin C (207-215.33 mg/100g) suitable for table and processing.
6. **Critical inputs requires:** Spacing: 5x 5 m, FYM: 25 kg/ bearing plant, NPK @ 1.4, 1.25 and 0.5kg Urea, SSP and MOP / bearing plant/ year

   Observation to be recorded: fruit size, fruit shape, yield
7. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 44

1. **Name of the Technology**: Rejuvenation of old/senile peach trees
2. **Source of the Technology:** Horticulture Division,, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2011
4. **Agro Climatic Zone:** Mid hills
5. **Details description about the Technology**

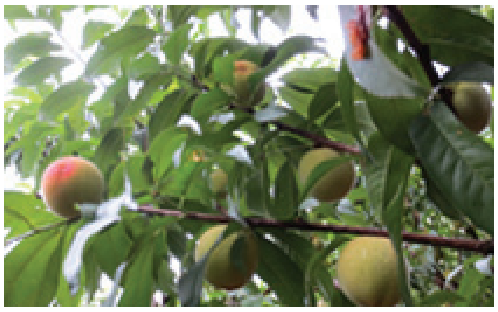
   Following steps have been standardized for rejuvenation of old/senile peach trees

   - Select old/senile peach trees of more than 20 years old.
   - Heading back of primary branches leaving 50 cm on main trunk during November-December.
   - Pasting of cut portion with copper oxychloride and main trunk with Bordeaux paste, mixing 25 kg FYM and fertilizer, mulching of basin area with black polythene
   - The 10-15 new shoots will emerge 30-45 days after heading back
   - The 2-3 new shoot/branch should be selected and remaining will be removed during March-April.
   - Terminal pruning of selected shoot up to 50% of its length should be done.
   - Retention of desirable fruiting shoots.
   - Reproductive pruning of the shoots in October-November.
6. **Critical inputs require:** FYM: 15-20 kg/ plant, Urea, SSP and MOP @ 100, 300 and 100 g/ bearing plant/year
   Observation to be recorded: Fruit yield and quality
7. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Rejuvenated peach plants

Technology no. 45

1. **Name of the Technology**: Thinning time and fruit spacing for early maturity and quality fruit production in peach cv. Flordasun:
2. **Source of the Technology:** Horticulture Division ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2010
4. **Agro Climatic Zone:** Mid hills
5. **Details description about the Technology:** Among the low chilling peaches cv. Partap and Flordasun are recommended for mid hills of NE India. But profuse bearing of peach cv. Flordasun, resulted in to excessive crop load of undersized fruits with impaired fruit quality and limb breakage. Further ripening of this cultivar coincides with rains in late April hampering fruit quality and marketability. To get rid of these problem fruit/ fruitlets of cv. Flordasun should be thinned on 20 days after full bloom (DAFB) with spacing of fruits at 10 to 15 cm on shoot on whole tree canopy. This advanced the fruit maturity by 12-14 days with an average fruit yield of 28.10 kg/tree.



Fruits thinned at 20 DAFB and spaced at 10 to 15 cm on shoot

6. **Critical inputs require:** FYM: 15-20 kg/ plant, Urea, SSP and MOP @ 100, 300 and 100 g/ bearing plant/year

   Observation to be recorded: Fruit yield and quality
7. **Contact Address for relevant information:** Horticulture Division ICAR Research Complex for NEH Region, Umiam

Technology no. 46

1. **Name of the Technology**: Technology to increase the production of grafted/budded plants of *Khasi* Mandarin:
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2008
4. **Agro Climatic Zone:** Mid hills
5. **Details description about the Technology:** Looking towards the advantage of rootstocks in citrus production system, T-budding is suggested in *Khasi* mandarin during February in which practically less than one month is available for actual budding operation. Further, around 50-60% budding success is recorded in *Khasi* Mandarin. To increase the production of budded/grafted plants, Division of Horticulture ICAR, Umiam, Meghalaya has standardized the wedge grafting technique, which is done in July-August on 6 to 7 month old rootstock for the production of grafted plants with more than 80-85% plant survival. Thus it is suggested to do wedge grafting during July-August on 6-7 months old rootstock. Rootstock left after

grafting can be utilized for T-budding during February to extend the grafting/budding period up to 3 months with the use of available resources.

6. **Critical inputs require:** FYM: 15-20 kg/ plant, Urea, SSP and MOP @ 350, 600 and 300 g/ bearing plant/year

   Observation to be recorded: Plant canopy, Fruit yield

7. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 47

1. **Name of the Technology**: **:** Off-season production of Strawberry under low tunnels
2. **Source of the Technology:** Horticulture Division ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2009
4. **Agro Climatic Zone:** Mid hills
5. **Details description about the Technology:** Strawberry was planted at monthly intervals from July to November under low tunnels of plastic and shade net (Fig 8). The size of tunnels was 4.0m x 0.90m x 0.75cm. Maximum plant growth in terms of survival, plant height and number of leaves/plant was recorded in low tunnels of shade net 50 % in the month of August and September whereas in the month of November it was highest in low tunnels of UVS polythene. It was observed that strawberry can be produced 30-35 days earlier than normal period, when planted in low tunnels of 50% shade net in the month of July or August and the period of fruit availability may be extended to 47 days from normal when planted in the month of November under UVS polythene tunnels. Normal fruiting period under open condition was 2nd fortnight of January to 2nd fortnight of March.

Off-season production of strawberry

6. **Critical inputs requires:** FYM: 15-20 kg/ plant, Urea, SSP and MOP @ 100, 300 and 100 g/ bearing plant/year
7. **Observation to be recorded:**
8. **Contact Address for relevant information:** Horticulture Division ICAR Research Complex for NEH Region, Umiam

Technology no. 48

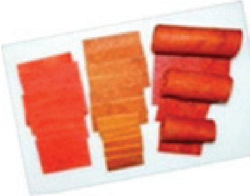
1. **Name of the Technology**: **Instant ginger candy**
2. **Source of the Technology:** Horticulture Division ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2010
4. **Agro Climatic Zone:** Entire Northeast India
5. **Details description about the Technology:** Low cost technology suitable for ginger growing areas. It is very simple process which does not require much technical skills. Rhizomes were washed and air dried at room temperature (22±2 °C; 70±5% RH) for 2–3 h for removal of surface moisture. Dried rhizomes were peeled manually and slices were made with the help of stainless steel knife. The rhizome were sliced (slice thickness: 5.0–25.0 mm) and blanched (BT, 10–30 min). Blanched slices were dipped in 40°brix and 75°brix sugar solutions containing 2.0% citric acid for 1 and 2 h at 95 °C, respectively. As soon as the retention time reached the predetermined level, the materials were taken out from the syrup and kept in laboratory tray drier at 60 °C for 1 h. Dried materials were cooled at room temperature before being packed in air tight containers.
6. **Critical inputs requires:** Sugar and citric acid
7. **Observation to be recorded:** Candy recovery/ kg ginger, Quality, B: C ratio
8. **Contact Address for relevant information:** Horticulture Division ICAR Research Complex for NEH Region, Umiam

Technology no. 49

1. **Name of the Technology**: **Guava leather, nectar, spread and cheese**
2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Entire Northeast India
5. **Details description about the Technology:** Value added products such as nectar, spread and cheese are prepared from guava fruits. In guava nectar, 20% guava fruit pulp is adjusted to 15 °B. In case of guava spread preparation, firm ripe fruits pulp was adjusted to 70° B and

Guava Nectar

Guava Cheese



Guava leather

cooked to smooth and creamy consistency. For guava cheese preparation, every kilogram of mature fruits was cooked to a thick paste with sugar (1.25-1.5 kg), acid (3 g) and butter (56 g). Hot cheese is spread on tray to set overnight and cut in to desired shapes and sizes.

6. **Critical inputs requires:**
   Sugar, Citric acid, packaging materials
   Observation to be recorded: Recovery % of finished products, quality, B: C ratio

7. **Contact Address for relevant information:** Horticulture Division ICAR Research Complex for NEH Region, Umiam

Technology no. 50

1. **Name of the Technology**: Sohiong RTS, jam and nectar

2. **Source of the Technology:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

3. **Year of Release:** 2010

4. **Agro Climatic Zone:** Entire hill zones

5. **Details description about the Technology:** Various pulp percentage and syrup strength was considered for developing optimum products. Total protocols have been developed for RTS, nectar and jam were prepared from freshly harvested ripen Sohiong**.** The Sohiong fruits of 225 days of maturity are selected for preparation of RTS beverage. The total soluble sugar and acidity of 10% juice are adjusted to 15°brix and 0.5% acidity respectively. The ingredients mentioned in the Table 5 are mixed in calculated quantity of water. The RTS is filled in sterilized bottle immediately. It was then pasteurized at 80°C for 20 minutes.
   Table. Different ingredient and amounts for preparation of RTS Sohiong beverage

Sohiong jam

Sohiong RTS beverage

Ingredients	Amount
Sohiong	1 L
Sugar	1.4 kg
Citric acid	17 g
Water	7.6 L

6. **Critical inputs requires:**
   Sugar, citric acid

Observation to be recorded:
Recovery % of products, quality and B: C ratio

7. **Contact Address for relevant information:** Horticulture Division ICAR Research Complex for NEH Region, Umiam

Technology no. 51

1. **Name of the Technology**: **Ready-to-cook green jackfruits (Minimally processed)**
2. **Source of the Technology:** Horticulture Division ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2010
4. **Agro Climatic Zone:**
5. **Details description about the Technology:** Mature fruits (45-60 days after fruit set) were harvested and peeled. Slicing into pieces are done which was followed by blanching for 10 minutes. The pieces are filled in sterilized bottles and brine solution (8% salt + 0.2% KMS) is poured into it. The bottle is sealed and kept in cool dry place.

Ready-to-cook green jackfruits

6. **Critical inputs requires:**

   Raw materials, salt, chemicals etc

   Observation to be recorded:

   % recovery of finished product, Quality and B: C ratio

7. **Contact Address for relevant information:** Horticulture Division, ICAR Research Complex for NEH Region, Umiam

Technology no. 52

1. **Name of the Technology Chow chow tooty fruity and shreads**
2. **Source of the Technology:** Horticulture Division ICAR Research Complex for NEH Region, Umiam
3. **Year of Release:** 2010 and 2014
4. **Agro Climatic Zone:** Entire Northeast India
5. **Details description about the Technology:**

   A process for producing a natural cho-cho (*Sechium edule*) tooty fruity was prepared from matured chow-chow vegetable. In this method, peeled vegetables were sliced into pieces of (10-15) x (10-12) x 5 mm followed by blanching in boiling water for 5-10 minutes. Blanched vegetables were dipped in sugar syrup of 30-40% for 1-2 hours and 72-75% for another 2-3 hours with slow heating. Syrup was mixed with 15-20% Sohiong juice and 10-15% fresh ginger juice as a natural colouring, acidulant and flavouring agent. Drained slices were dried in tray drier for 15-30 minutes at 60°C. The chow-chow tuity fruity thus prepared had 70 -73% total soluble solid (TSS) and the product is ready for packing in packaging materials. This product could be used as a confectionery, bakery and pan masala purposes. Mature chow-chow fruits are collected for making dehydrated shreds. The fruits are peeled manually, core removed and cut into slices. The slice thickness and length are kept at 0.5 cm and 6 cm, respectively. The slices are dehydrated on trays in cabinet drier oven at 55±5° C.

6. **Critical inputs requires:**

Tooty fruity

Dehydrated shreds

   Sugar and other ingredants
   Observation to be recorded:
   % recovery of finished products, Quality, B: C ratio

7. **Contact Address for relevant information:** Horticulture Division ICAR Research Complex for NEH Region, Umiam

Chapter 6 - Plant Breeding

Technology no.1

1. **Name of the Technology**: High yielding paddy variety CAU-R1
2. **Source of the technology**: Central Agricultural University, Imphal
3. **Year of release**: 2009
4. **Agro-climatic zone**: Sub tropical plain zone and sub tropical hill zone (upto1200 m MSL) in North East India
5. **Detail description about the technology**

Variety	CAU-R1 (Tamphaphou)
Parentage	Leimaphou x BR-1
Year of release	1999
Year of Notification	2009
Duration	125-130 days
Plant Height	100 cm
Area of Adaptation	Rainfed, wetland paddy fields of Manipur valley as main Kharif (Rainy season) transplanted and broadcast sown paddy crop
Maturity group	Medium (Under Manipur valley conditions)
Resistance to lodging	Non Lodging
Shattering/Threshing	Non Shattering/and non threshability
Seed Rate	a.) Direct seeding in puddled soil-60 kg/ha b.) Transplanted-50 kg/ha c.) SRI-5 kg/ha d.) ICM-16 kg/ha
Levels of fertilizer Application	High Performance under low applied fertilizer level of 60: 40: 40 kg/ha
Spacing	50 hills/sq.m (20 cm row to row and 10 cm plant to plant)
Brown rice recovery	High brown rice recovery-72%
Tolerance to	Rice blast, BLB, etc. under field condition and moderately susceptible in rice blast & BLB under controlled conditions
Submergence up to	7 days
Late Sowing	Up to July end
Reaction to	**(Under field conditions):** Tolerance to rice gall midge **(Under controlled conditions):** Moderately tolerance to rice gall midge

Disadvantages	High chaffy grains under higher level of nitrogen top dressing at reproductive stage
Recent position	1st Position in crop competition under farmers field during kharif 2009(8.8 t/ha) and kharif 2014-15 (12.3 t/ha)
Average yield	5-6 t/ha

Fig. 1. CAU-R1(*Tamphaphou*)

6. **Critical inputs :** Nitrogen
7. **Observation be recorded :** Plant height (cm), duration and Yield (t/ha)
8. **Contact Address for relevant information:** Directorate of Research, Central Agricultural University, Iroishemba, Imphal-79500

Technology no.2

1. **Name of the Technology**: Upland paddy variety CAU-R2
2. **Source of the technology**: Central Agricultural University, Imphal
3. **Year of release**: 2016
4. **Agro-climatic zone**: Sub tropical plain zone and sub tropical hill zone (upto1300 m MSL) in North east India
5. **Detail description about the technology**

Parentage	Cauvery x V20-B Female parent: Cauvery (TN-1x TKM-6) Male parent: V20B (a Chinese short duration semi-dwarf rice variety)
Breeding method	Modified Pedigree with single panicle descent method.
Adaptation	Upland and *Jhum* ecosystem
Description of variety a) Plant Stature b) Yield improvement (%)over (Check var.China-988) c) Maturity group d) Panicle characteristics i. Panicle length ii. Grains per panicle	 Semi dwarf (80 cm) 10-15 % Extra early (95-100 days) 20cm 100
iii. 1000-grain weight	25g
Levels of fertilizer Application	High Performance under low applied fertilizer level of 60: 40: 40 kg/ha
Average Rice Yield	2.5 t/ha



Fig. 1. CAU-R2 (*Tomthinphou*)

6. **Observation be recorded:** Plant height (cm), duration and Yield (t/ha)

7. **Contact Address for relevant information:** Directorate of Research, Central Agricultural University, Iroishemba, Imphal-795004

Technology no.3

1. **Name of the Technology**: Short duration paddy variety CAU-R3
2. **Source of the technology**: CAU, Imphal
3. **Year of release**: 2012
4. **Agro-climatic zone**: Sub tropical plain zone and sub tropical hill zone (upto1200 m MSL) in North east India
5. **Detail description about the technology**

Parentage with details of its pedigree	**Female parent** - RCM-7 (evolved from the cross between Kalinga-II and Palman having a height of about 100 cm with a duration of 115 days and an average yield of 4.0 t/ha **Male parent** - V20 B (A maintainer line of V20 A but having field resistance to most of the diseases and short duration of about 90 days with an average yield of 3.5 t/ha)
Breeding objectives	To develop an early rice variety as contingency crop for pre-*kharif* and late- *kharif* conditions
Specicific areas of its adaptation/ adoption	Irrigated/rainfed valley areas of Manipur with an altitude from 750 to 950 m above MSL where *rabi* crop is to be grown
Recommended Ecology	Irrigated/Rainfed valley areas with medium to high soil fertility, pre-*kharif* to late-*kharif* sowing with high density planting

Description of the variety	
(a). Plant height	Semi-dwarf (85 cm)
(b). Range	80- 90 cm
50% flowering	≤ 70 days in late-*kharif* and 90 days during pre-*kharif*
85% maturity	≤ 95 days in late-*kharif* and 120 days during pre-*kharif*
(e). Maturity group (early, medium and late – wherever such classification exists)	Very early
(f). Reaction to major diseases (under field conditions)	(a). Blast - Moderately tolerant (b). Brown spot- Moderately tolerant (c). Rice Tungro Virus (RTV)- Resistant
(g). Reaction to major pests (under field and controlled conditions including store pests)	(a). Gall midge- Moderately tolerant (b). Stem borer- Moderately tolerant
Average Yield	4-5 t/ha in rainfed valley land and 2-2.5 t/ha in *jhum* land

Fig. 1. CAU-R3 (*Mangalphou*)

6. **Observation be recorded :** Plant height (cm), duration and Yield (t/ha)
7. **Contact Address for relevant information:** Directorate of Research, Central Agricultural University,
   Iroishemba, Imphal-795004

Technology no.4

1. **Name of the Technology**: Semi-deep water paddy CAU-R4
2. **Source of the technology**: CAU, Imphal
3. **Year of release**: 2012
4. **Agro-climatic zone**: Sub tropical plain zone and sub tropical hill zone (upto1200 m MSL) in North east India
5. **Detail description about the technology:**
   CAU-R4 (*Eenotphou*) evolved from the cross between *Moirangphou Khokngangbi* x *Leimaphou*. The variety matures within 145 days with good eating quality of local preference with a milled rice recovery of about 68 percent. The variety withstands most of the diseases and insect pest of rice to a considerable extent. CAU-R4 performed well as a main paddy crop under low lying semi deep water rice ecosystems prevailing in the periphery of lakes (*Patlou*) of Manipur valley and similar situations in the NEH Region.

Description of the variety	
(a) Plant height	145 cm
(b) Duration	140-145 days
(c) Yield improvement (%) over (Check var. *Moirangphou Khokngangbi*)	15%
(d) Panicle characteristics	
i. Panicle length	30 cm
ii. Grains per panicle	130
iii. 1000-grain weight	24 gm
Reaction to major diseases in the field	Moderately tolerant to blast and brown spot
Average yield	3.8-4.5 t/ha

Fig. 1. CAU-R4 (*Enotphou*)

6. **Observation be recorded:** Plant height (cm), duration and Yield (t/ha)

7. **Contact Address for relevant information:** Directorate of Research, Central Agricultural University, Iroishemba, Imphal-795004

Technology no.5

1. **Name of the Technology:** New Paphiopedilum Variety, SHEETAL 1
2. **Source of the Technology:** ICAR-NRC on Orchids, Pakyong-737106, Sikkim
3. **Year of Release:** 2016
4. **Agro-Climatic Zones:** Sikkim, Arunachal Pradesh, Assam & Meghalaya
5. **Details description about the Technology:** Potted variety, medium plant height (17.73 cm), early flowering (Sept-Oct) and prolonged vase life, terminal spike emergence, moderately thin peduncle with shiny & deep maroon purple colour pubescence. Flower colour dominated by dorsal sepal colour in light shiny green colour with white margin, with medium brownish purple colour petals; dorsal sepal in orbicular ovate (semi-funnel) shaped with unique moderate purple colour on white background on upper surface. Nose of staminode pointed downwards with greenish yellow colour. Faster proliferation for vegetative multiplication, resistant to important diseases (root rot, blight) and insect pests (stem fly, mites & scale insects). Potted vase life > 4 months.

6. **Critical inputs requires:** Suitable for partial shaded, cool and humid mid altitude hill climatic conditions, tolerant to moisture stress and sensitive temperature stress conditions, suitable for growing in pots and protected cultivation.
7. **Observations to be recorded**: Nil
8. **Contact address for relevant information:** Director, ICAR-NRC on Orchids, Pakyong-737106, Sikkim. Phone: +91 3592 257954, E-mail: director.nrco@icar.gov.in, nrcorchids@rediffmail.com

Chapter 7 - Home Science

Technology no.1

1. **Name of technology:** Drudgery reduction of fly shuttle weavers
2. **Source of technology:** Department of Family Resource Management,
3. **Year of release:** 2011
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Ergonomically Designed Weaving Chair for Fly Shuttle Weavers
   - ➢ The weaving chair is made of good quality wood.
   - ➢ The back rest provided in the chair is fixed at 90° angle between seat and back for reduction of physiological fatigue and back pain of fly shuttle weavers.
   - ➢ Provision of drawer facilitates the weavers to keep the necessary weaving accessories.

   Specifications:

   i. Height of chair = 92 cms
   ii. Seat height at back = 62 cms
   iii. Seat height at front = 60 cms
   iv. Length of the seat at front = 45 cms
   v. Length of the seat at back = 38 cms
   vi. Breadth of the seat = 35 cms
   vii. Height of the back rest =29 cms
   viii. Breadth of the back rest = 37 cms
   ix. Angle between seat and back rest = 900

Farming situation/suitability of Technology: Designed for fly shuttle loom of 40 inches height.

6. **Critical inputs required:** Weaving Chair
7. **Observations to be recorded:** Production/ per hour, Comfort level of the weavers, Pain in different body parts, B: C ratio, Farmers' reaction.
8. **Additional information if any:**

Technology no.2

1. **Name of technology:** "**Paddy Stripper**" for paddy seed selection
2. **Source of technology:** Department of Family Resource Management College of Home Science, AAU. Jorhat, 785013.
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones
5. **Detail description of technology:** Circumference of the handle – 8.5 cm Length of the spikes- 16.5 cm Total length of the paddy stripper – 30cm
6. **Critical inputs required:** Paddy Stripper
7. **Observations to be recorded:** Health hazards, benefit cost ration, FW reaction

Technology no.3

1. **Name of the Technology**: Improved *Kokcheng (bamboo basket)*
2. **Source of the Technology**: Dept. of Family Resource Management, College of Home Science, CAU, Tura
3. **Year of release:** 2015
4. **Agro Climatic Zone:**
5. **Detail description about the technology (with suitable Photographs)**: Collecting and carrying firewood cannot be eliminated from day to day an activity of rural tribal women, but it is possible to change how to do it so it is easier on rural women's body. Small changes in materials, work processes, tools and equipment may bring great changes in case of drudgery reduction of hilly tribal women of Meghalaya.

   Rural women traditionally use "*kokcheng*"- a locally made bamboo basket to carry firewood, where there is a rope made with bark of *Omak*tree (local name), which is available in Garo Hills. Such type of rope is very strong to give support to loaded *kokcheng* but at the same time it is very hard and rough to user's body. Therefore, there is a new type of *kokcheng*developed where a new belt is attached and the new belt is a kind of thickly woven cotton belt with adjustable buckle. This belt is very much user friendly as during the time of carrying firewood, tribal rural hilly women were found very comfortable to their body and easy to handle due to adjustable buckle according to their body anthropometry. Traditionally the basket was hanging from head. Now added support is given from two shoulders with belt so that weight or strain on head can be decentralized to shoulders of users. Therefore, this modified basket has considered as user friendly by rural women. So it

Plate 1: Traditional *kokcheng* with rope made with Omak tree skin

Plate 2: Required attachments for improved *kokcheng*.

Plate 3: Improved *kokcheng* with head and shoulder support.

is recommended to women firewood collector to use this type of modified basket instead of traditional one. This basket can be used not only for firewood, but can be used to carry water pot, vegetables etc. for their day to day activities.

Specification of *Kokcheng:*

Height – 43 cm

Diameter (Top) – 48 cm

Size of bottom – 18 x 18 cm

Width of adjustable belt – 4 cm

Size of head support – 7.5 x 24 cm

Size of shoulder support – 7 x 50 cm

Source - local artisan

Technology no.4

1. **Name of the Technology:** Jackfruit Chips
2. **Source of the Technology:** Process protocol for the preparation of Jackfruit chips
3. **Year of release:** 2012
4. **Agro climatic zone:** Entire Northeast Region
5. **Detailed description about the technology**

Jackfruit, *Artocarpus heterophyllus* Lam. is an important underutilized fruit and often called the Poor man's fruit because it is cheaply available in during season. The fruit is rich in carotene, potassium and carbohydrates, moderately rich in ascorbic acid. It also contains some minerals like calcium and potassium and Vitamin B like thiamin, riboflavin, and Niacin. In Meghalaya, West Garo Hills District Jack Fruit is available in plenty without anybody's care in their farmyard and consumed only at household level and enormous quantities of jackfruit are wasted in the Garo Hills region of Meghalaya due to lack of intervention, suitable infrastructure, processing and packaging, storage containers and lack of marketing information every year.

Excess quantity of Jackfruit can be processed into various value added product like squash, chips, Papad, Jam, Jelly, Pickle, jackfruit etc. All part of Jackfruit is utilized in one or other form of value added products. The tender Jackfruit can be utilized as a vegetable, for pickle, matured for chips, papad preparation and ripe for preparation of squash, jam etc.

Ingredients for the preparation of jackfruit chips: - Well matured unripe deseeded bulb, cooking oil, chilli powder, salt, potassium meta bi-sulphite

Equipments required: - Jackfruit chips cutting machine, deep fryer, sealing machine, etc.

Other items: Fuel, labour, packing material

Types of Jackfruit suitable for Chips: Thin Flakes with fine pulps

Procedure for the preparation of jackfruit chips:

- Fully mature unripe jackfruit
- Peeling and deseeding
- Deseeded bulbs
- Cutting longitudinally into finger like pieces (approx, 4 x 1.5 cm slices)
- Blanched in hot water with 1 % KMS for 5-6 minutes
- Dried in drier @ 40-45°C for 10-15 min.
- Deep fried in cooking oil till it turn light brown colour.
- Cooled
- Required quantity of salt and chilli powder sprinkled
- Packed in high density polyethylene bags

Fig: - jackfruit bulbs cut into finger like shape

Fig. jackfruit chips

1. **Name of the Technology**: Development of Sikut wadi from Squash (*Sechium edule*) (Local Name: Chow-chow, Sikut (Garo language), Piskut (Khasi Language))
2. **Source of Technology**: College of Home Science, Tura, Meghalaya.
3. **Description of the product**: The product is a legume based dried (sun dried or hot air oven dried) product made by mixing legumes (Black gram) paste and raw vegetable of Sikut.

Methodology:

Treated raw Sikut vegetable (mixed with KMS @1.5g/kg) | ***Black gram paste*** | ***Spice Mix***

↓

Whisking of black gram paste (To make it fluffy)

↓

Addition of standardized amount of *Sikut* vegetable (40%)

↓

Addition of spice mix

↓

Dividing the paste into small balls (40-50g)

↓

Spreading the balls on stainless steel tray smeared with oil.

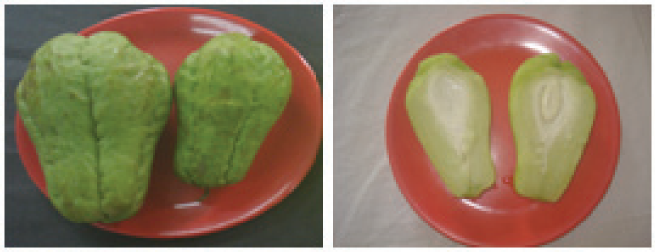
(Distance between balls 1-2 inches)

↓

Drying the sample in hot air drier at $60^0C \pm 5^0C$ for 14-16 hours/ sun drying.

↓

Packing the dried wadis in plastic air tight containers (250g capacity) and store in cool dry place



(a) Raw *Sechium edule* vegetable

(c) Black gram paste

(b)Blanched and Mashed vegetable

(d) *Sechium edule vegetable enriched wadis*

Figure: – Flow diagram for preparation of Sikut wadi

Note:* *Spice Mix includes fenugreek leaves, coriander seeds, cumin, cinnamon, black pepper, red pepper, nutmeg and asafoetida)

Critical inputs required:

✓ Mixer and grinder

✓ Hot air oven

✓ Packaging and sealing machine

4. **Contact address for relevant information**: Dr Puspita Das (In-charge, Dean), College of Home Science, Tura, Meghalaya.

   Email: deanhomescience@gmail.com

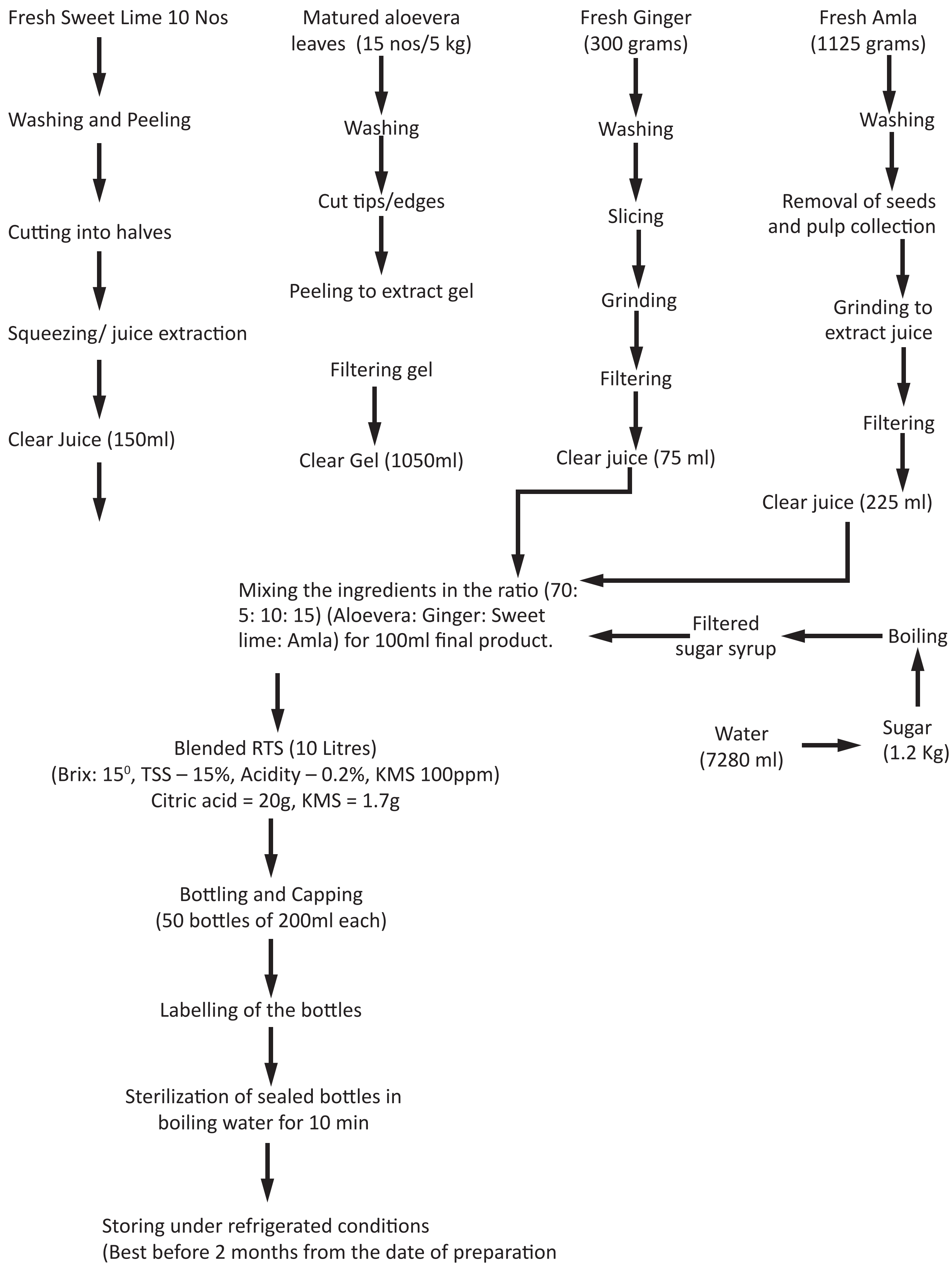
Technology no. 7

1. **Name of the Technology:** Development of Aloe vera based RTS drink supplemented with ginger, amla and sweet lime.
2. **Source of Technology:** College of Home Science, Department of Basic Science and Humanities, Central Agricultural University, Tura, Meghalaya
3. **Year of Release**: 2015
4. **Agro climatic zone**:
5. **Description of the product:** The product is a RTS Drink developed from locally available inputs like Aloe vera, ginger, amla and sweet lime.

Methodology: For Preparation of 10 Litres of Aloe vera RTS blended with ginger, sweet lime and amla.

6. **Critical Inputs Required:**

- ✓ Juice extractor
- ✓ Homogenizer
- ✓ Pasteurizer


Fresh Sweet Lime 10 Nos
Washing and Peeling
Cutting into halves
Squeezing/ juice extraction
Clear Juice (150ml)
Matured aloevera leaves (15 nos/5 kg)
Washing
Cut tips/edges
Peeling to extract gel
Filtering gel
Clear Gel (1050ml)
Fresh Ginger (300 grams)
Washing
Slicing
Grinding
Filtering
Clear juice (75 ml)
Fresh Amla (1125 grams)
Washing
Removal of seeds and pulp collection
Grinding to extract juice
Filtering
Clear juice (225 ml)
Mixing the ingredients in the ratio (70: 5: 10: 15) (Aloevera: Ginger: Sweet lime: Amla) for 100ml final product.
Filtered sugar syrup
Boiling
Water (7280 ml)
Sugar (1.2 Kg)
Blended RTS (10 Litres)
(Brix: 15^0, TSS – 15%, Acidity – 0.2%, KMS 100ppm)
Citric acid = 20g, KMS = 1.7g
Bottling and Capping
(50 bottles of 200ml each)
Labelling of the bottles
Sterilization of sealed bottles in boiling water for 10 min
Storing under refrigerated conditions
(Best before 2 months from the date of preparation

- ✓ Filtration unit
- ✓ Electronic balance
- ✓ Appropriate Utensils
- ✓ Water Purification unit for Water supply (optional).

7. **Observation to be recorded:**

8. **Contact address for relevant Information:** Dr Lokesh K Mishra (Assistant Professor, Biochemistry), College of Home Science, Department of Basic Science and Humanities, Central Agricultural University, Tura, Meghalaya. E mail: lkmishra2005@gmail.com

Chapter 8 - Crop production

Technology no.1

1. **Name of technology:** Variety for shallow submergence/ Flash flood situation
2. **Source of technology:** RARS, Titabar, AAU
3. **Year of release:** 2012
4. **Agro-climatic zone:** All the Agro-climatic zones of Assam
5. **Detail description of technology:**

Variety:	BR 11 Sub 1/ Swarna Sub 1
Characteristics:	HYV Rice
Duration (days):	150-155
Grain characteristics:	Medium slender
Sowing time/Planting time:	Sowing during June/transplanting during July
Harvesting time:	November/December
Seed rate:	40 Kg/ ha.
Spacing:	20 cm X 20 cm
Management Practices:	
Seed treatment:	Mancozeb @ 2.5 g/ kg or Captan @ 2.5 g/ kg
Land preparation:	Thoroughly Puddled
Manu ring:	FYM @ 10 ton / ha is desirable
Fertilization:	40: 20: 20 kg N: P2O5: K2O/ha

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.
8. **Additional information if any:** Can tolerate 12-15 days water submergence.

Technology no.2

1. **Name of technology:** Performance of semi-deep water aromatic rice
2. **Source of technology:** RARS, North Lakhimpur, AAU
3. **Year of release:** 2011
4. **Agro-climatic zone:** North Bank Plain Zone of Assam
5. **Detail description of technology:**

Variety:	Padumoni (KDML 105)
Characteristics:	Aromatic
Duration:	245 days (Direct Sowing), 180 days (Transplanting)
Grain/Fruit character:	Medium size
Sowing time/planting time:	March (Direct Sowing); 15th June/15th July (Transplanted)
Harvesting time:	December
Seed rate:	5 kg/ ha (Direct seeded) and 40 kg/ ha (Transplanted)
Spacing:	20cm x 20cm

Management practices:

Seed treatment:	Mancozeb @ 2.5 g/ kg or Captan @ 2.5 g/ kg
Land preparation:	Thoroughly Puddled
Manuring:	As per package
Fertilization:	As per package

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.
8. **Additional information if any:** Very fine long grain comparable to Basmati

Technology no.3

1. **Name of technology:** Performance of stress tolerant semi-deep water Rice
2. **Source of technology:** RARS, North Lakhimpur, AAU
3. **Year of release:** 2011
4. **Agro-climatic zone:** North Bank Plain Zone, Assam
5. **Detail description of technology:**

Variety:	Panchanan (LPR 106)
Characteristics:	Stress Tolerant
Duration:	245 days (Direct Sowing), 190 days (Transplanted)
Grain character:	Medium slender
Sowing time/planting time:	March (Direct Sowing); 15th June/15th July(Transplanted)
Harvesting time:	December
Seed rate:	75 kg/ ha (Direct seeded) and 40 kg/ ha (Transplanted)
Spacing:	20cm x 20cm

Management practices:

Seed treatment:	Mancozeb @ 2.5 g/ kg or Captan @ 2.5 g/ kg
Land preparation:	Thoroughly Puddled
Manuring:	As per package
Fertilization:	As per package

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C ratio, Farmers' reaction
8. **Additional information if any:** Can tolerate 50 cm water logging

Technology no.4

1. **Name of technology:** Drought mitigation nutrient management in direct seeded *ahu* Rice
2. **Source of technology:** RARS Titabor, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** All Agro-climatic zones of Assam
5. **Detail description of technology:** Seed treatment with 3 % KCl

Seed treatment: Pre sowing treatment of seed with 3% (30g/l)KCl solution (1 liter to be used in 1 kg seed) for 20 hours followed by shade drying for 48 hours before sowing

Land preparation:	Thoroughly Puddled
Manuring:	FYM @ 10 ton / ha is desirable
Fertilization:	Before sowing, apply MOP @ 40 kg/ha as basal
	Apply 20 kg P /ha as basal
	Apply 40 kg N/ ha in two splits ie. at tillering & PI stage
	Apply 3.80 g KCl salt per litre of water (2% K) as foliar feeding at water stress period.

6. **Critical inputs required:** Potassium Chloride (2%)
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m^2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.5

1. **Name of technology:** Boron for correction of spikelet sterility of low land *Sali* Rice
2. **Source of technology:** RARS Titabor, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** All Agro-climatic zones of Assam
5. **Detail description of technology:** Folier spraying of 0.4 ppm boron at anthesis stage of rice

Management Practices:

Seed treatment:	Mancozeb @ 2.5 g/ kg or Captan @ 2.5 g/ kg
Land preparation:	Thoroughly Puddled

Manuring: FYM @ 5 ton/ ha

Fertilization: 40: 20: 20 kg (N: P2O5: K2O)/ha

Boron application: Application of 0.4 ppm boron (Active boron Supplemented as foliar spray of Boric acid @ 2.29 mg H3BO3/litre of water) at anthesis

6. **Critical inputs required:** Boron
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m^2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.6

1. **Name of technology:** Application of boron on productivity of irrigated wheat
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** Lower Brahmaputra Valley Zone, North Bank Plains Zone and Central Brahmaputra Valley Zone
5. **Detail description of technology:**

   Treatment: Basal application of Borax @ 7.5 kg/ha for Lower Brahmaputra Valley Zone,10 kg/ha for North Bank PlainsZone and Central Brahmaputra Valley Zone in addition torecommended dose of NPK fertilizers for wheat.

   Management Practice:

   Variety: Any recommended variety or released variety for NEPZ

   Seed rate: 100 kg/ha

   Spacing: 20 cm row to row

   Sowing time: Nov.5th to 20th (NBP Zone), 5th Nov. to 15th Dec. (CBV & LBV Zone)

   Fertilizer: dose Doses for different Agril. Sub-div. as per package
6. **Critical inputs required:** Boron
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m^2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C ratio, Farmers' reaction.
8. **Additional information if any:** Recommended for soil deficient in Boron

Technology no.7

1. **Name of technology:** Weed management in *kharif* Blackgram and Greengram
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Technology Pre-emergence application of pendimethalin @ 1kg/ha (application of herbicide 1 day after sowing of seed, before germination of crop and weed seeds)

Management Practice:

Seed rate:	Blackgram : 22.5 kg/ha; Greengram : 20 kg/ha
Spacing:	30 X 10 cm
Sowing time:	Mid-August to mid September
Fertilizer:	dose As per package
Land preparation:	3-4 ploughings followed by laddering

6. **Critical inputs required:** Herbicide (Pendimethalin)
7. **Observations to be recorded:** Weed population and dry matter accumulation, Weed Control, efficiency, Date of sowing and harvest, Plant height, plant stand, pod/plant, seed/pod and seed yield (q/ha), Rainfall (mm), and temperature (0C), throughout the crop growing period,B: C ratio, Farmers' reaction.

Technology no.8

1. **Name of technology:** Seed priming in lentil
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Technology: Seeds soaking for 6 hours in water and then bringing down to almost original weight by drying under shade before sowing

Management Practice:

Seed:	rate 30 kg/ha

Spacing: 25 cm between rows

Sowing time: Mid-October to mid-November

Fertilizer dose: 15 : 35 : 15 kg N: P2O5: K2O /ha

Land preparation: 3-4 ploughing followed by laddering

6. **Critical inputs required:** Seed, water

7. **Observations to be recorded:** Soil moisture – initial and at 30 days interval, Plant height (cm), plant stand, pod/plant, seed/pod and seed yield (q/ha),Rainfall(mm) and temperature(0C), throughout the crop growing period, B: C ratio, Farmers' reaction.

Technology no.9

1. **Name of technology:** Foliar nutrition of lentil

2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU

3. **Year of release:** 2015

4. **Agro-climatic zone:** All zones of Assam

5. **Detail description of technology:**

Technology: Application of foliar spray of 2% urea 2 times at branching (35 DAS) and at pod formation (75 DAS) in addition to use of recommended P and K.

Management Practice:

Seed rate: 30 kg/ha

Spacing: 25 cm between rows

Duration: 115-120 days

Sowing time: Mid-October to mid-November

Fertilizer dose: 15 : 35 : 15 kg N: P2O5: K2O /ha

Land preparation: 3-4 ploughings followed by laddering

6. **Critical inputs required:** Urea

7. **Observations to be recorded:** Soil moisture – initial and at 30 days interval, Plant height (cm), plant stand, pod/plant, seed/pod and seed yield (q/ha), Rainfall(mm) and temperature (0C), throughout the crop growing period, B: C ratio, Farmers' reaction.

Technology no.10

1. **Name of technology:** Cultivation of Chickpea under rice-fallow condition
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam except Pant G 186 , KPG 59 , BG 256 in Barak Valley
5. **Detail description of technology:**

Technology: Chickpea varieties under ricefallow situation - JG 14, JG 16,Pant G 186 , KPG 59 , BG 256

Management Practice:

Varieties:	**1. JG 14 (notified)**
Parentage:	(GW 5/7 x P 327) x ICCL 83149
Season and area of adaptation:	Rabi season in Assam
Specific situation:	Suitable for rice fallow condition
Av. duration :	117 days
Disease reaction :	Resistant to collar rot
Yield :	1365 kg/ha
Pod borer damage :	6.3%

2. JG 16

Parentage :	ICCC 42 x ICCV 10
Season and area of adaptation:	Rabi season of Assam
Specific situation :	Suitable for rice fallow condition
Av. duration :	121 days
Reaction to major diseases :	Resistant to collar rot
Yield :	1331 kg/ha
Pod borer damage :	5.6%

3. BG 256

Parentage :	(BG 62 x K 850-31127) x (2250 x H 75-35)

Season and area of adaptation: Rabi season for all zones of Assam except Barak Valley

Specific situation : Suitable for rice fallow condition and relay croping

Duration : 125-130 days

Reaction to major diseases : Tolerant to fusarium wilt, pod borer

Yield : 12-15 q/ha

4. KPG 59

Parentage : Radhey x K-468

Season and area of adaptation: Rabi season for all zone of Assam, except Barak Valley

Specific situation : Suitable for rice fallow condition and relay croping

Duration : 125-130 days

Reaction to major diseases : Tolerant to fusarium wilt, pod borer, collar rot.

Yield : 12-15 q/ha

5. Pant G 186

Parentage : ILG 613 x Pant G-114

Season and area of adaptation: Rabi season for all zone of Assam except Barak Valley

Specific situation : Suitable for rice fallow condition and relay croping

Duration : 125-130 days

Reaction to major diseases : Tolerant to fusarium wilt, pod borer, collar rot.

Yield : 12-15 q/ha

Seed rate: 45-50 kg/ha

Spacing: 30 X 10 cm

Seed treatment: Carbendazim @ 2g/kg of seed

Sowing time: Mid-October to mid-November

Fertilizer dose: 40: 20: 20 kg N: P2O5: K2O/ha

Land preparation: 4-5 ploughings followed by laddering

6. **Critical inputs required:** Variety
7. **Observations to be recorded:** Important agronomic characters, Date of sowing and harvesting, Incidence of pest and diseases, Rainfall (mm), and temperature throughout the

crop growing period, Seed yield (q/ha), B: C ratio, Farmers' reaction.

Technology no.11

1. **Name of technology:** Optimum spacing for Rajmah
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Technology:	Spacing 30 x 10 cm instead of recommended 30 X 20 cm
Management Practice:	
Variety:	HUR 301/HUR 203
Seed rate:	75 kg/ha
Spacing:	30 X 10 cm
Duration:	95-105 days
Sowing time:	November 20-30
Fertilizer dose:	60: 45: 40 (N: P2O5: K2O) kg/ha
Land preparation:	3-4 ploughings followed by laddering
Bio – fertilizer:	PSB 50 g/kg seed Irrigation One each at pre-flowering and pod development stage

6. **Critical inputs required:** -
7. **Observations to be recorded:** (including cost benefit ration) Plant height, plant stand, pod/plant, seed/pod and seed Yield (q/ha), Rainfall (mm), and temperature (0C) throughout the crop growing period, B: C ratio, Farmers' reaction.

Technology no.12

1. **Name of technology:** Optimum sowing time of Rajmah to escape leaf crinkle disease
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam

5. **Detail description of technology:**

Technology: Best time of sowing – November 20-30 within the recommended time of sowing from mid-Oct to end of Nov

Management Practice:

Variety:	HUR 301/HUR 203
Seed rate:	75 kg/ha
Spacing:	30 X 10 cm
Duration:	95-105 days
Sowing time:	November 20-30
Fertilizer dose:	60 : 45 : 40 (N: P2O5: K2O) kg/ha
Land preparation:	3-4 ploughings followed by laddering
Bio – fertilizer:	PSB 50 g/kg seed Irrigation One each at pre-flowering and pod development stage

6. **Critical inputs required:** -

7. **Observations to be recorded:** Incidence and severity of leaf crinkle virus, Plant height, plant stand, pod/plant, seed/pod and seed yield(q/ha), Rainfall(mm), and temperature throughout the crop growing period ,B: C ratio, Farmers' reaction.

Technology no.13

1. **Name of technology:** Effect of Mulching on Linseed
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Technology:	Rice stover /straw mulching @10t/ha
Management Practice:	
Variety:	T-397
Seed rate:	20 kg/ha
Spacing:	25 cm x 10 cm

Sowing time: Mid October to mid of November

Fertilizer dose: 40: 20: 10 kg of N: P_2O_5: K_2O/ha

6. **Critical inputs required:** Rice stover /straw mulching

7. **Observations to be recorded:** (including cost benefit ration) Soil moisture before sowing and after harvest, Initial fertility status of the soil, Date of sowing and harvest, Incidence of pest and diseases, Yield and yield attributing characters, B: C ratio, Farmers' reaction.

Technology no.14

1. **Name of technology:** Intercropping of linseed and chickpea
2. **Source of technology:** RARS, Shillongoni, Nagaon, AAU
3. **Year of release:** 2017
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Technology: Intercropping of linseed with chickpea (4: 2) with variety Shekhar and Chickpea variety BG-256

Management Practice:

Variety:	Shekhar (Linseed)
	BG -256 (Chickpea)
Seed rate :	linseed -20 kg/ha and Chickpea- 60 kg/ha
Spacing:	linseed 25 cm x 10 cm
	Chickpea 40cm x 10cm
Sowing time:	Mid October to mid of November
Fertilizer dose:	linseed @40: 20: 10 kg of N: P_2O_5: K_2O/ha
	Chickpea @ 20: 40: 20 kg of N: P_2O_5: K_2O/ha

6. **Critical inputs required:** Variety- Shekhar (Linseed), BG -256 (Chickpea)

7. **Observations to be recorded:** Initial fertility status of the soil, Date of sowing and harvest, Incidence of pest and diseases, Yield and yield attributing characters, B: C ratio, Farmers' reaction.

Technology no.15

1. **Name of technology:** Cultivation of HYV of Sugarcane
2. **Source of technology:** RARS,AAU,Buralikson, Dergaon, AAU
3. **Year of release:** 2012
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Technology:	HYV 'Kakodonga'
Characteristics:	High yielder in rain fed situation of NE zone.
Duration:	360 days
Cane Characters:	Medium thick cane, small buds, Auricle long.
Management practices:	
Sett treatment:	Setts dipping in 0.2% solution of Captan/ Mancozeb or 0.1% solution of Carbendazim.
Sowing time/planting time:	March- April
Harvesting time:	February -March
Seed Rate:	45000 – 52000/ ha.
Spacing:	75-90 cm row to row

6. **Critical inputs required:** HYV 'Kakodonga'
7. **Observations to be recorded:** Temperature, Rainfall(mm), Date of Planting, Germinatin% at 45 days, Date of weeding/spraying, Date of earthing up, Plant height, Cane girth, Number of millable cane, Pest infestation, Disease infestation, Cane yield, Gur yield/recovery, B: C ratio, Farmers' reaction.

Technology no.16

1. **Name of technology:** Cultivation of drought tolerant sugarcane variety Doiyang
2. **Source of technology:** RARS,AAU,Buralikson, Dergaon, AAU
3. **Year of release:** 2010
4. **Agro-climatic zone:** All zones
5. **Detail description of technology:**

Technology:	HYV 'Doiyang'
Characteristics:	Drought tolerant, Good for autumn planting
Duration:	360-540 days
Cane Characters:	Straight, Medium thick cane
Management practices	
Sett treatment:	Setts dipping in 0.2% solution of captan/ mancozeb or 0.1% solution of carbendazim.
Sowing time/planting time:	March- April
Harvesting time:	December -March
Sett rate:	45000 – 52000/ ha
Spacing:	75-90 cm row to row

6. **Critical inputs required:** Drought tolerant sugarcane variety Doiyang
7. **Observations to be recorded:** Temperature, Rainfall(mm), Date of Planting, Date of weeding/spraying, Date of earthing up, Plant height, Cane girth, Number of millable cane, Pest infestation, Disease infestation, Cane yield, Gur yield/recovery, B: C ratio, Farmers' reaction.

Technology no.17

1. **Name of technology:** Medium duration rice varieties for double cropping areas
2. **Source of technology:** RARS, Titabar, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All the Agro-climatic zones of Assam
5. **Detail description of technology:**

Varieties:	1. Shraboni (TTB 404)
Duration:	135 days
Yield:	5000 kg/ha
Adaptation:	Sali
Zone for which recommended:	All Zones
Disease & pest reaction:	Resistance

To: Moderately resistant to sheath rot, neck blast & RTD; moderately resistant to GLH, PH & stem borer.

2. Mulagabhoru (TTB103-21-1)

Adaptation:	Early Ahu and Sali in multiple cropping.
Duration:	135 days
Grain yield:	4600 kg/ha.
Disease & pest reaction:	Tolerant to blast, brown spot & sheath blight BLB &stem borer.

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.18

1. **Name of technology:** Rice varieties for waterlogged areas
2. **Source of technology:** RARS, Titabar, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** UBVZ, NBPZ, LBVZ & BVZ of Assam
5. **Detail description of technology:**

Varieties:	1. TTB 303-18-3 (Chakra lahi)
Days to flower:	138 days
Yield:	4.76 t/ha
Adaptation:	Kharif or Sali with waterlogged situation up to 50 cm
Zone for which recommended:	UBVZ, NBPZ, LBVZ & BVZ
Disease & pest reaction:	Resistant to brown spot; MR to blast & BLB; tolerant to sheath blight & stem borer.

2. TTB 303-2-23 (Diphalu)

Days to flower:	137 days
Yield:	5.11 t/ha
Adaptation:	Kharif or Sali with waterlogged situation up to 50 cm

Zone for which recommended: UBVZ, NBPZ, LBVZ & BVZ

Disease & pest reaction: MR to blast, brown spot, BLB & Sheath blight;tolerant to stem borer

3. TTB 303-1-42 (Dhansiri)

Days to flower:	139 days
Yield:	4.84 t/ha
Adaptation:	Kharif or Sali in waterlogged situation (up to 50 cm)
Zone for which recommended:	UBVZ, NBPZ, LBVZ & BVZ
Disease & pest reaction:	MR to brown spot sheath blight; tolerant to blast, BLB & stem borer.

4. TTB 303-1-26 (Manah)

Duration:	138 days,
Yield:	4.66 t/ha
Adaptation:	Kharif or Sali in waterlogged situation (up to 50 cm)

Zone for which recommended: UBVZ, NBPZ, LBVZ & BVZ

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Temperature (0C), Rainfall (mm), Date of sowing, Date of germination, Date of planting, Date of weeding, Days to 50% flowering, Plant height (cm), Number of ear bearing tillers/m2 , Grain per panicle, Grain type, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no. 19

1. **Name of technology:** Black gram varieties for delayed sowing (up to 30 September)
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Varieties:	1. Beki (SB 27-3)
Pedigree:	NDU 94-1 x DPU 88-31
Duration:	80-85 days

Yield: 12-13 q/ha

Disease reaction: Resistant to CLS, YMV and WB

2. Kolong (SB 25-19)

Pedigree: T 9 x NDU 94-1

Duration: 80-85 days

Yield: 12-13 q/ha

Disease reaction: Resistant to CLS, YMV and WB.

6. **Critical inputs required:** Seed

7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, Date of weeding, no. of branches, no. of pods, no. of seed/pod, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.20

1. **Name of technology:** Blackgram varieties for normal sowing
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:**
5. **Detail description of technology:**

Varieties: **1.Sonkush (SB 23-5)**

Parentage: T9 x DPU 88-31

Season and area of adaptation: Kharif season under delayed sowing

Duration: 80-90 days

Disease reaction: Resistant to CLS, YMV and WB

Yield: 917 kg ha-1 (18.8% over PU 19)

Protein content: 25.1%

2. Manas (SB 32-13)

Maturity group: 80-90 days

Grain yield: 10 q/ha

Reaction to major diseases: Resistant to CLS, YMV and WB

Recommendation for All Zones.

3. SBC 40

Duration:	75-85 days
Disease reaction:	Resistant to CLS & YMV, moderately resistant to WB
Reaction to insect-pests:	MR to pod borer, leaf roller, aphids & bruchids
Yield:	1189 kg/ha
Protein content:	25.2%
Cooking quality:	Very good

4. SBC 47

Duration:	75-80 days
Disease reaction:	Resistant to CLS and YMV
Yield:	14-16 q/ha
Adaptation:	Suitable for all zones of Assam except BVZ
Specific situation:	Both summer & Kharif season
Protein content:	25.5%
Cooking quality:	Very good

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** (including cost benefit ration) Rainfall (mm), Date of sowing, Date of germination, Date of weeding, no. of branches, no. of pods, no. of seed/pod, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.21

1. **Name of technology:** Greengram varieties for normal sowing
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** Given above
5. **Detail description of technology:**

Varieties:	1.SGC 16
Av. duration:	65-68 days

Disease reaction:	Resistant to CLS, YMV &
	Moderately resistant to WB
Yield:	1252 kg ha-1 (29.6% over Pratap)
Protein content:	24.5%
Cooking quality:	Very good
2. SGC 20	
Parentage:	AAU 34 x T 44
Duration:	65-68 days
Disease reaction:	Resistant to CLS & YMV
Adaptation:	Suitable for all zones of Assam except BVZ
Specific situation:	Kharif season
Yield:	12-13 q/ha
Protein content:	24.4%
Cooking quality:	Very good
3. Sonai (SG 21-5)	
Parentage:	SG 1 x AAU 34
Reaction to major diseases:	Resistant to CLS, YMV and MR to WB
Yield:	993 kg ha-1 (8.9% over Pratap)
Protein content:	24.7%
Adaptation:	Kharif season

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, Date of weeding, no. Of branches, no. Of pods, no. Of seed/pod, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.22

1. **Name of technology:** New recommended Lentil varieties
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015

4. **Agro-climatic zone:** All zones of Assam

5. **Detail description of technology:**

Varieties:	1.**HUL 57** (Small Seeded Lentil Variety)
Season and area of adaptation:	Rabi season of Assam
Duration:	112-115 days
Reaction to major diseases:	Resistant to rust & tolerant to wilt
Yield:	1226 kg ha-1 (24.5% over Pl 406)
Zone for which recommended:	CBVZ, LBVZ & UBVZ of Assam
2. **Axom Masur 1** (SL 2-24)	
Parentage:	SL-2-24 (ILL 7617 X ILL 2573)
Season and area of adaptation:	Rabi season of Assam
Duration:	115-120 days
Reaction to major diseases:	Moderately resistant to wilt
Yield:	1065 kg ha-1 (15.8% over Pl 406)
Protein content:	27.6%
3. **Axom Masur 2** (SL 2-28)	
Parentage:	SL 2-28 (ILL 7617 X ILL 2573)
Season and area of adaptation:	Rabi season of Assam
Duration:	115-120 days
Reaction to major diseases:	Moderately resistant to wilt
Yield:	1059 kg ha-1 (15.1% over Pl 406)
Protein content:	26.9%

6. **Critical inputs required:** Seed

7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, Date of weeding, no. of branches, no. of pods, no. of seed/pod, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.23

1. **Name of technology:** New Rapeseed or *toria* varieties for delayed sowing
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** Given above
5. **Detail description of technology:**

   1. JT 90-1 (Jeuti)

   Duration: 89 days

   Seed yield: 6.97 q/ha

   Adaptation: Rabi; delayed sowing in rice fallow

   Recommended for: All zones except Hills Zone & BVZ

   Disease & pest reaction: Moderately Susceptible to *Alternaria* blight (leaves and pods show symptoms); moderately susceptible in case of incidence of aphids and sawfly

   Oil content: 42.82% Suitable for late sowing

   2. TS 67

   Duration: 90 days

   Seed yield: 701 kg/ha

   Adaptation: Rabi

   Recommended for: CBVZ, NBPZ, LBVZ & UBVZ

   Oil content: 40.7- 42.3%

   Suitable for late sowing

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, germination%, Date of weeding, no. of branches, no. of siliqua, no. of seed/siliqua, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.24

1. **Name of technology:** HYV of Toria
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU

3. **Year of release:** 2015
4. **Agro-climatic zone:** CBVZ, NBPZ & LBVZ of Assam
5. **Detail description of technology:**

Varieties:	**TS 46**
Duration:	94 days
Seed yield:	906 kg/ha
Adaptation:	Rabi

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, germination%, Date of weeding, no. of branches, no. of siliqua, no. of seed/siliqua, Pest infestation, Disease infestation, Grain yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.25

1. **Name of technology:** New Jute variety
2. **Source of technology**: RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Varieties:	**Apeswaree (*C capsularis*)**
Sowing time:	Mid Feb to April
Fibre yield:	Av. 25.5 q/ha
Reaction to diseases:	Resistant to stem and root rot
Adaptation:	Suitable for upland, medium and low land situation
Fibre quality:	Better with high Fibre Tenacity, 25 g/tex

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, germination%, Date of weeding, Plant height, fibre length, Pest infestation, Disease infestation, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.26

1. **Name of technology:** New Lathyrus variety
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:**

Variety:	**Madhuri (JL-1)**
Duration:	150-180 days to maturity.
Green forage yield (GFY):	250-280 q/ha
Dry matter yield (DMY):	45-50 q/ha
Adaptation:	Rabi; fits in relay crop
Drought reaction:	Tolerant
Disease & pest reaction:	Resistant to rust, powdery mildew & many important Insect pests
Quality:	Dual type
Crude protein:	15.5-16.7%
Crude fibre:	24.6-28.00%
	Ash: 2.3%

6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, germination%, Date of weeding, Plant height, Pest infestation, Disease infestation, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.27

1. **Name of technology:** Integrated weed management in Ahu rice
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:** Application of Pretilachlor @ 750 g/ha as preemergence

followed by use of grubber at 30 days after sowing (DAS) for weed management.

6. **Critical inputs required:** Herbicide, Grubber
7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, and yield (q/ha), B: C Ratio, Farmers' reaction

Technology no.28

1. **Name of technology:** Integrated weed management in Lentil
2. **Source of technology:** Assam Agricultural University
3. **Year of release: 2015**
4. **Agro-climatic zone: All Zones of Assam**
5. **Detail description of technology:** For weed management in lentil, application of Oxfluorofen @ 150 g a.i./ha as pre-emergence followed by 1 hand weeding at 20 DAS or two hand weeding at 20 DAS and 30 DAS.
6. **Critical inputs required:** Herbicide
7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, and yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.29

1. **Name of technology:** Control of Ipomoea
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:** For control of *Ipopmoea carnea* (BAM-KOLMOU), application of post-emergence herbicide Glyphosate @ 1.5 kg/ha + 2,4-D (amine salt) as tank mix with a spray volume of 500-600 liter/ha at active growing stage with repetition of the spray when new leaves appear.
6. **Critical inputs required:** Herbicides
7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.30

1. **Name of technology:** Surface drainage method in Sesamum
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:** Surface drain of 15 cm depth and 25 cm width spaced at6 m distance connected to a collector drain by the side of the field.
6. **Critical inputs required:** Surface drain
7. **Observations to be recorded:** Rainfall (mm), germination, plant stand, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.31

1. **Name of technology:** Cultivation of Yellow sarson
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All Zones of Assam
5. **Detail description of technology:**
   - Variety: Benoy (Duration : 95-100 days)
   - Sowing time: mid October - end of November
   - Seed rate: 8 kg/ha (line sowing) & 10 kg/ha (broadcasting)
   - Spacing: 25 cm x 10 cm (line sowing)
   - Fertilizer dose: - 60: 30: 30 kg/ha N: P2O5: K2O (for rainfed)

     - 75: 50: 50 kg/ha N: P2O5: K2O (for irrigated)
   - Time of fertilizer application: half of N and full quantity of P2O5 and K2O should be applied as basal and rest half at 30 DAS (after thinning and intercultural operation).
   - Irrigation: two irrigations of 4 cm at flowering (40 DAS) and at pod formation stage (60 DAS).
6. **Critical inputs required:** Seed, fertilizers, irrigation water
7. **Observations to be recorded:** Rainfall (mm), germination, plant stand, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.32

1. **Name of technology:** Cropping sequence for hill zone
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** Hill Zones of Assam
5. **Detail description of technology:** On 25-40% hill slopes of Hill Zone, following crop sequences under rainfed conditions:
    - Direct seeded ahu rice (var. Inglongkiri) – Toria (var. TS 38)
    - Direct seeded ahu rice (var. Inglongkiri) – Blackgram (var. KU 301)
6. **Critical inputs required:** Seed, fertilizers, irrigation water
7. **Observations to be recorded:** Rainfall (mm), germination, plant stand, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.33

1. **Name of technology:** Intercropping system for NBPZ of Assam under rainfed condition.
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** NBP Zones, Assam
5. **Detail description of technology:** Intercropping systems for NBPZ under rainfed condition:
    - Intercropping system

(a) Sesame + blackgram in 1: 1 row proportion

(b) Sesame + greengram in 2: 2 row proportion

- Sowing time: Mid August – Mid September
- Row spacing: 30 cm
- Fertilizers: 30: 20: 20 N: P_2O_5: K_2O/ha

6. **Critical inputs required:** Seed, fertilizers
7. **Observations to be recorded:** Rainfall (mm), germination, plant stand, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction, LER.

Technology no.34

1. **Name of technology:** Packages for oat and Lathyrus Intercropping system after Sali rice.
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:**
5. **Detail description of technology:**
   - ➢ Cutting three rows of rice stubbles at ground level leaving next three rows without cutting.
   - ➢ Application of FYM @ 2 ton /ha along with 10: 20: 20 kg/ha N: P2O5: K2O as basal
   - ➢ Broadcasting the seeds of Lathyrus to the strips with rice stubbles using seed rate 25 kg/ha.
   - ➢ Sowing of seeds of oat in lines behind the plough to the three row strips without stubbles with seed rate 50 kg/ha and row spacing of 25cm.
   - ➢ Top dressing of N @ 10 kg/ha to be done after first cut at 50 DAS.
6. **Critical inputs required:** Seed, fertilizers, FYM
7. **Observations to be recorded:** Rainfall (mm), germination, plant stand, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction, LER.

Technology no.35

1. **Name of technology:** Cultivation of oat crop after sali rice
2. **Source of technology:** Assam Agricultural University
3. **Detail description of technology:**
   - ➢ cutting of rice stubbles at ground level.
   - ➢ Application of minimum tillage with one cross ploughing.
   - ➢ Application of recommended dose of fertilizer @ 20: 20: 20: : N : P2O5 : K2O kg/ha
   - ➢ Seed inoculation with *azospirilum* @ 40 g/kg seed and PSB @ 40g/kg seed.
   - ➢ sowing of seeds behind the plough with row spacing 25 cm
   - ➢ Top dressing N@ 20 kg/ha after the first cut at 50 DAS.
4. **Critical inputs required:** Seed, fertilizers, biofertlizers

5. **Observations to be recorded:** Rainfall (mm), germination, plant stand, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction, LER.

Technology no.36

1. **Name of technology:** Weed management in marigold
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Pre-emergence application of herbicide (0-3 days after planting) Butachlor @ 1.0 kg/ha followed by grubber at 35 days after planting and alternatively, garden hoeing at 20 and 40 days after planting.
6. **Critical inputs required:** Herbicide, grubber, garden hoe
7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no. 37

1. **Name of technology:** Control of *Ipopmoea carnea* (BAM-KOLMOU)
2. **Source of technology**: Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Application of post-emergence herbicide Glyphosate @ 1.5 kg/ha + 2,4-D (amine salt) as tank mix with a spray volume of 500-600 liter/ha at active growing stage with repetition of the spray when new leaves appear.
6. **Critical inputs required:** Herbicide
7. **Observations to be recorded:** Rainfall (mm), weed population, weed growth, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no. 38

1. **Name of technology:** Irrigation management in Sugarcane
2. **Source of technology:** Assam Agricultural University

3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Three irrigations of 6 cm depth during April, October and November with alternate furrow for sugarcane
6. **Critical inputs required:** Irrigation water
7. **Observations to be recorded:** Rainfall (mm), soil moisture status, yield attributes, yield (q/ha), B: C Ratio, Farmers' reaction

Technology no.39

1. **Name of technology:** Indian mustard varieties recommended for the farmers
2. **Source of technology:** RARS, Shillongoni, Nogaon, AAU
3. **Year of release:** 2015
4. **Agro-climatic zone:**
5. **Detail description of technology:**

   1. **PM 26**

   Duration: 107 days

   Seed Yield: 12-14 q/ha (across three years in MLT)

   Adaptation: Rabi

   Recommended for: All zones except BVZ and Hills Zone

   Oil content: 40.32%

   2. PM 27

   Duration: 107 days

   Seed yield: 13.44 q/ha (across three years in MLT)

   Adaptation: Rabi

   Recommended for: All zones except BVZ & Hills Zone

   Oil content: 43.03%
6. **Critical inputs required:** Seed
7. **Observations to be recorded:** Rainfall (mm), Date of sowing, Date of germination, No. Of siliqua/plant, seeds/siliqua, Plant height, Pest infestation, Disease infestation, yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.40

1. **Name of technology:** Setaria grass variety 'PSS-1'
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:**
5. **Detail description of technology: PSS-1**

   GFY: 900-1100 q/ ha/year

   DMY: 180-220 q/ha/year

   Adaptation: Rabi.

   Recommended for: UBVZ, NBPZ, CBVZ & LBVZ

   Disease & pest reaction: Resistant to leaf spot; tolerant to insect-pests -buffel grass seed caterpillar, armyworm and pasture webworm

   Crude protein: 8.2-9.4

   Crude fibre: 30.6-39.6

   Ash: 3.9
6. **Critical inputs required:** Seed/rooted slips
7. **Observations to be recorded:** Rainfall (mm), Plant height, Pest infestation, Disease infestation, No. Of cuts/year, Days taken to first and subsequent cut, fodder yield (q/ha), B: C Ratio, Farmers' reaction.

Technology no.41

1. **Name of technology:** New recommended Oat varieties
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Detail description of technology:** **1. Phule Hariata (RO-19)**

   GFY : 320-340q/haa

   DMY : 50-60 q/ha

   Adaptation : Rabi.

   Disease & pest reaction : Resistant to

Anthracnose, Crown rust, Loose smut, Powdery

mildew, Barley yellow dwarf virus, Army Worms,

Stinkbugs, Wireworms, Aphids

Crude protein : 12.5 to 14.5%

Crude fibre : 30-35%

2. JHO-99-2 (Multi cut purpose)

GFY : 320-340 q/ha

DMY : 50 - 60 q/ha

Adaptation : Rabi.

Disease & pest reaction : Resistant to diseases -

PM, anthracnose, CR, LS & bean yellow dwarf

virus; resistance to insect pests armyworm, sting

bug, wireworm & aphids.

Crude protein : 2.5-14.5

Crude fibre : 32-35%

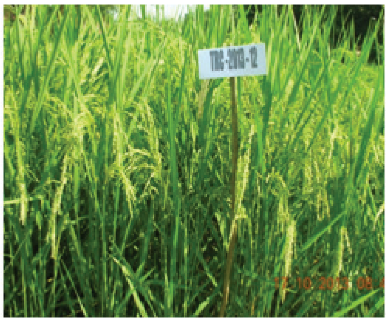
Ash : 1.9-2.1%

5. **Critical inputs required:** Seed
6. **Observations to be recorded:** Rainfall (mm), Plant height, Pest infestation, Diseaseinfestation, No. Of cuts/year, Days taken to first and subsequent cut, fodder yield (q/ha), B: C Ratio, Farmers' reaction.

Technology 42

1	Name of the Technology	Rice Variety: - **TRIPURA AUS DHAN**
2	Source of the Technology	ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3	Year of Release:	2014
4	Agro Climatic Zone:	Tripura. Also promising for other North Eastern States

5	Details description about the Technology:	• Recommended for transplanted as well as direct seeded *aus*. However, the variety can be grown in all seasons • Drought tolerant, short duration variety with duration of 98-100 days under transplanted condition and 85-90 days under direct seeded condition. • Medium tall, non lodging, non-shattering, responds to fertilizer up to 100 Kg. N. Vigorous plants with high biomass stands tall up to 119-125 cm • moderate resistant to blast, BLB and sheath blight • Under transplanted condition yields 5.0 - 5.45 t/ha on an average in 100 days; with an average productivity of about 50 kg/day. Yield potential under transplanted condition is 6.2 t/ha. Under direct seeded condition yields up to 3.9 t/ha. • The variety has long slender grains with HRR (Head Rice Recovery) of 61.7%, intermediate Amylase content of 22.67%
6	Critical inputs requires:	• Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha and for direct seeding in upland 60 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: March 1st week for aus season and latest by 7 July for kharif season
7	B: C ratio	1.4-1.6
8	Observation to be recorded:	Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9	Contact Address for relevant information:	• The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura



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Technology 43

1. **Name of the Technology:** Rice Variety: - **GOMATI DHAN**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2012
4. **Agro Climatic Zone:** Tripura. Also performed very well in Assam, Meghalaya and Mizoram. Promising for other states of North East.
5. **Details description about the Technology:**
   - Recommended for rainfed shallow lowland and irrigated land in *kharif* season.
   - Yielding 5.8 -6.0 t/ha in *kharif* season, 6.0-6.4t/ha in *boro* in 130-135 days.
   - Very dark green foliage, erect tillers and leaves with intermediate height (105-110 cm); non lodging.
   - Become very popular due to fine grains with good cooking quality.
   - Moderately resistant to blast, sheath blight and BLB.
   - Very high head rice recovery (HRR) of 69.8% , fine grain with kernel length 5.13mm, kernel breadth 1.91mm, completely free from chalkiness with intermediate Amylase content (22.14%).
6. **Critical inputs requires:**

- Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing

7. **B: C ratio:** 1.5-1.7
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. Contact Address for relevant information:

- The Director, ICAR Research Complex for NEH Region, Umiam, Meghalaya -793103
- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Gomati dhan

Gomati dhan

Gomati dhan

Technology 44

1. **Name of the Technology: TRIPURA JALA DHAN – 1**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also promising for Assam and some parts of Meghalaya
5. **Details description about the Technology:**
   - Long duration rice variety recommended for fields with water stagnation or *utlaland* in kharif season.
   - Yields 4.8-5.2 t/ha in *Kharif* season even under 50-60 cm standing water throughout the crop season.
   - Matures in 145 days, medium tall (115-120 cm).
   - Moderate resistant to blast, sheath blight, sheath rot, stem borer and leaf folder.
   - Very high head rice recovery (HRR) of 68.5%, kernel length 6.28 mm, kernel breadth 1.98 mm, L/B ratio of 3.7 with intermediate amylase content 22.14%.
   - Very good for making high quality puffed rice
6. **Critical inputs requires:**

Seed rate 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 25 cm (row to row) x 20cm (hill to hill) spacing

7. **B: C ratio** 1.3-1.5

8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

- The Director, ICAR Research Complex for NEH Region, Umiam, Meghalaya -793103
- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Jaladhan 1

Tripura Jaladhan 1

Tripura Jaladhan 1

Technology 45

1. **Name of the Technology:** Rice Variety: - **TRIPURA KHARA 1**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also for drought prone rainfed lowlands of other North Eastern states
5. **Details description about the Technology:**
   - Recommended for rainfed drought prone lowlands. Under moderate to severe drought stress the variety performed very well.
   - Plants with light green foliage, long heavy and well exerted panicle, flag leaf semi erect at flowering and grain filling. Matures in 115-120 days.
   - Plants 104 -110 cm tall under normal rainfall, which may reduce to 92cm and 72cm under moderate and severe water stress, respectively.
   - Head rice recovery of 52.9%, intermediate amylase content (24.35%). Other quality parameters are similar to IR 64.
   - Yield: 5.6-5.8 t/ha under normal conditions.

6. **Critical inputs requires:**

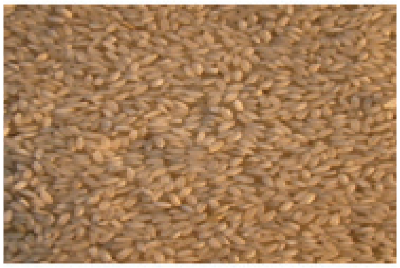
   Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing
7. **B: C ratio**1.4-1.6
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

- The Director, ICAR Research Complex for NEH Region, Umiam, Meghalaya -793103
- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Khara dhan 1

Tripura Khara dhan 1

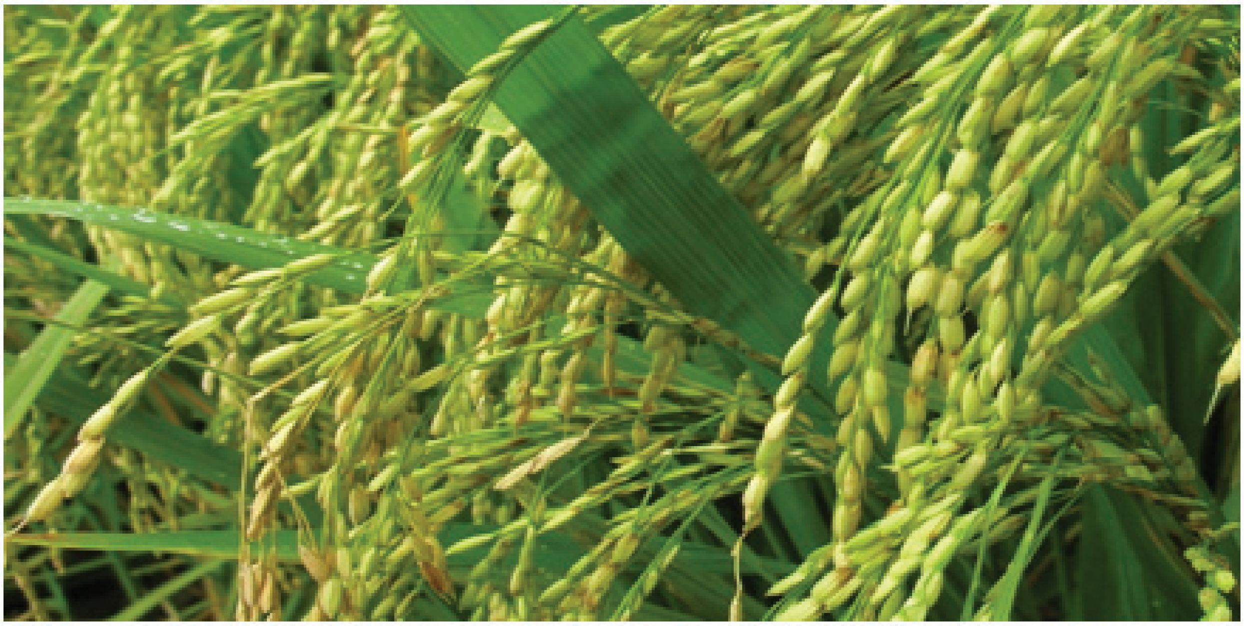


Tripura Khara dhan 1

Technolog 46

1. **Name of the Technology:** Rice Variety: - **TRIPURA KHARA 2**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also for drought prone rainfed lowlands of other North Eastern states
5. **Details description about the Technology:**

   Recommended for rainfed drought prone lowlands. Under moderate to severe drought



stress the variety performed very well.

Plants with light green foliage, long heavy and well exerted panicle, flag leaf semi erect at flowering and grain filling. Matures in 115-120 days.

Plants 105-115 cm tall under normal rainfall.

Head rice recovery of 52.9%, intermediate amylase content (22.96%). Other quality parameters are similar to IR 64.

Yield: 5.6-5.8 t/ha under normal conditions

6. **Critical inputs requires:**

   Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing

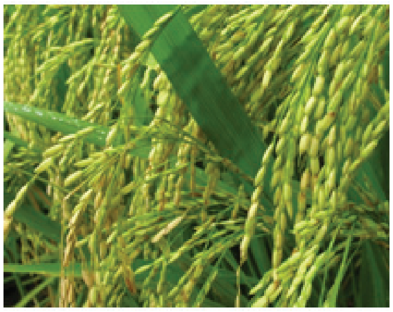
7. **B: C ratio** 1.4-1.6

8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

The Director, ICAR Research Complex for NEH Region, Umiam, Meghalaya -793103

The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura



Tripura Khara dhan 2

Tripura Khara dhan 2

Tripura Khara dhan 2

Technolog 47

1. **Name of the Technology:** Rice Variety: - **KHOWAI**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2012
4. **Agro Climatic Zone:** Tripura. Also promising for Assam, Meghalaya and other North Eastern states
5. **Details description about the Technology:**
    - Recommended for irrigated land in *boro* season.
    - However, suitable for cultivation in both *kharif* and *boro* season.
    - Yield: 5.4 -5.6 t/ha in *kharif* season & 5.6-5.8 t/ha in *boro*.
    - Plants with light green foliage, semi erect flag leaf, 116-120 cm tall and matures in 125-135 days.
    - Non lodging, moderately resistant to blast, BLB and brown spot.
    - Very high head rice recovery (69.8%), medium slender grain with kernel length 5.13 mm and kernel breadth 1.91 mm, free from chalkiness and intermediate amylase content (22.14%).

6. **Critical inputs requires:**

    Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing

7. **B: C ratio** 1.4-1.6

8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Khowai

Khowai

Khowai

Technolog 48

1. **Name of the Technology:** Rice Variety: - **NAVEEN**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2012 Agro
4. **Climatic Zone:** Tripura. Performed very well in Assam and Meghalaya
5. **Details description about the Technology:**
   - Presently No. 1 variety in boro season in Tripura, covers an area of about 90000 ha.
   - 120-125 days & 105 cm tall.
   - Yield: 5.0 – 5.5 t/ha in *kharif* & 5.5-6.0 t/ha in *boro*.

- Tolerant to excess water up to 25 cm at tillering stage. It is also tolerant to blast, brown spot and stem borer
- Head rice recovery of 66.5%, medium bold grains with kernel length 5.53 mm and kernel breadth 2.39 mm, intermediate amylase content 22.50%.

6. **Critical inputs requires:**

Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing

7. **B: C ratio:** 1.4-1.6
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:**

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura


Figure 19 Naveen


Figure 20 Naveen


Figure 21 Naveen

Technolog 49

1. **Name of the Technology:** Rice Variety: - **TRIPURA SARAT DHAN**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also promising in Assam, Meghalaya and other North Eastern states
5. **Details description about the Technology:**
   - Released for Irrigated and favourable rainfed shallow lowand in *boro* season.
   - Plants green, long panicle, 104-110 cm tall and matures in 125-128 days.
   - Yield : 5.5 – 5.7 t/ ha in *kharif* season, 5.8-6.0 t/ha in *boro* season.
   - Moderate resistant to blast and brown spot.

- Head rice recovery (HRR) of 66.9%, kernel length 6.19 mm, kernel breadth 1.91 mm, free from chalkiness and with intermediate amylase 24.62%.

6. **Critical inputs requires:**

   Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing

7. **B: C ratio:** 1.4-1.6

8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Sharat Dhan

Sharat Dhan

Sharat Dhan

Technology 50

1. **Name of the Technology :**Rice Variety: - **TRIPURA HAKUCHUK 1**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura and drought prone lowlands as well as uplands of other North Eastern states
5. **Details description about the Technology:** Released for transplanted lowland as well as direct seeded upland.
    - Early duration drought tolerant variety , matures in 98-100 days under transplanted condition, 90-92 days under direct seeded condition.
    - Vigorous, erect with high biomass, well exerted long panicles.
6. **Details description about the Technology:**
    - Moderate resistant to blast, sheath blight, BLB and brown spot
    - Yield: 5.44 t/ha in 100 days under transplanted conditions. Under upland condition yields 3.5-3.75 t/ha.
    - Head rice recovery of 64.6%, kernel length 5.98 mm, kernel breadth 2.21 mm and intermediate amylase content 23.21%.

7. **Critical inputs requires:**

   Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha and for direct seeding in upland 60 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: April 1st fortnight for direct seeded upland and latest by 7 July for transplanted *kharif* season.

8. **B: C ratio:** 1.3-1.5

9. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

10. **Contact Address for relevant information:**

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Hakuchuk 1

Tripura Hakuchuk 1

Technolog 51

1. **Name of the Technology:** Rice Variety: - **TRIPURA HAKUCHUK 2:**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura and drought prone lowlands as well as uplands of other North Eastern states
5. **Details description about the Technology:**
   - Identified for transplanted early duration as well as direct seeded upland.
   - Selected from the cross IRRI 132 x IR 74371-54-1-1.
   - In State trial conducted by Department of Agriculture, Govt. of Tripura in *kharif* 2013 and *boro* 2013-14 TRC 2013-5 produced 5690 kg/ha and 6790 kg/ha, respectively.
   - In large number of farmers field demonstrations TRC 2013-5 recorded yield advantage up to 23.66% over NDR 97 and 11.04% over MTU 1010.

- Yield: 5.54 t/ha in 100 days under transplanted conditions.

6. **Critical inputs requires:**

   Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha and for direct seeding in upland 60 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: April 1st fortnight for direct seeded upland and latest by 7 July for transplanted *kharif* season.

7. **B: C ratio:** 1.4-1.6

8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

   The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Hakuchuk 2

Tripura Hakuchuk 2

Tripura Hakuchuk 2

Technolog 52

1. **Name of the Technology:** Rice Variety: - **TRIPURA NIROG DHAN**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also performed very well in Assam, Manipur and Meghalaya. Also promising for other North Eastern states.
5. **Details description about the Technology:**
   - Released for irrigated and favourable rainfed shallow lowand.
   - It has very wide adaptability in shallow lowland, matures in 120-125 days, intermediate tall 113-120 cm, foliage dark green, long panicle and non lodging.
   - Exhibited almost disease free reaction to all major diseases in Tripura.
   - Yield: 6.0-6.1 t/ha in *kharif* &6.2 -6.4 t/ha in *boro* season.
   - Very high head rice recovery of 72%, short bold grains with kernel length 5.54 mm, kernel breadth 2.26 mm and intermediate amylase content of 23.94%.
6. **Critical inputs requires:**

   Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing
7. **B: C ratio** 1.5-1.7

8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

   The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Nirog dhan

Nirog dhan

Nirog dhan

Technolog 53

1. **Name of the Technology:** Rice Variety: - **TRIPURA CHIKAN DHAN**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release: 2014**
4. **Agro Climatic Zone:** Tripura and drought prone lowlands as well as uplands of other North Eastern states

5. **Details description about the Technology:**
    - Released for irrigated and favourable rainfed shallow lowand, in *boro* season.
    - Fine grain premium quality rice variety maturing in 125-130 days and 106-110 cm tall.
    - Yield: 5.6-5.8t/ha in *boro* season under irrigated conditions.
    - Moderately resistant to blast. Non lodging.
    - High head rice recovery of 69.4%, kernel length 6.16 mm, kernel breadth 1.93 mm and amylase content of 22.36%.
    - Becoming very popular in Tripura for fine grain and good cooking quality.
6. **Critical inputs requires:**

    Seed rate 6-8 kg for SRI / ICM, machine transplanting 15 kg/ha. NPKS @ 100: 50: 50: 20. Optimum sowing: 1st fortnight of June for kharif season. Line sowing with 20cm (row to row) x 20cm (hill to hill) spacing
7. **B: C ratio** 1.5-1.7
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:**

    The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura chikan dhan

Tripura chikan dhan

Technolog 54

1. **Name of the Technology: TRIPURA MASKOLAI**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also performed very well in other states of North East
5. **Details description about the Technology:**
   - Released for rainfed uplands and medium lands of Tripura for post kharif cultivation.
   - Erect plants with good branching, light green foliage, dark brown colour hairy pods with dull black medium sized seed.
   - Plants grow up to 46 cm tall and mature in 71 days in Tripura condition.
   - Exhibited completely MYMV free disease reaction.
   - Yield: 1500-1600 kg/ha.
6. **Critical inputs requires:**

   Seed rate 25-30 kg/ha. Seed treatment with Thiram or Bavistin 2.5g/kg of seed.. Seed treatment with rhizobium. Line sowing with 30 cm row to row and 7-10 cm plant to plant spacing. Weed free condition for first 40 -45 days. Sowing should be in 2nd fortnight of August to 1st week of September to avoid excess rain.
7. **B: C ratio:** 2.5-2.7
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:** The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Maskolai

Tripura maskolai

Technolog 55

1. **Name of the Technology: TRIPURA MUNG 1**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also performed very well in all the states of North East
5. **Details description about the Technology:**
   - Released for rainfed uplands and medium lands of Tripura.
   - Erect plants with good branching, dark foliage, black coloured pods with shining medium bold seed.
   - Plants grow up to 70 cm tall and matures in 58-60 days.
   - Yield: 1300-1400 kg/ha.
6. **Critical inputs requires:**

   Seed rate 20-25 kg/ha. Seed treatment with Thiram or Bavistin 2.5g/kg of seed.. Seed treatment with rhizobium. Line sowing with 30 cm row to row and 7-10 cm plant to plant spacing. Weed free condition for first 40 -45 days. Sowing should be completed by 2nd fortnight of March for Summer crop. Kharif sowing should be in 2nd fortnight of August to avoid excess rain.
7. **B: C ratio:** 2.2-2.3
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:**

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

TRIPURA MUNG 1

TRIPURA MUNG 1

Technolog 56

1. **Name of the Technology: FIELDPEA : TRCP – 8**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2010
4. **Agro Climatic Zone:** Centrally notified for North Eastern states, Uttarakhand Hills and Jammu & Kashmir
5. **Details description about the Technology:**
   - TRCP – 8 exhibited multi-location disease resistance to Powdery Mildew and Rust, which are very important diseases of field pea in NHZ.
   - Tolerant to pod borer and stem fly. Tolerant to *M. incognita* and *M. javanica* at different locations.
   - Tall type, vigorous, suitable for late sown conditions in North Eastern states, better responsive to low fertilizer doses.
   - Tall, vigorous, green foliage, creamy, spherical and medium bold seed matures in 86 days under Tripura condition
   - Yield: 1800-2100 kg/ha
   - Protein: 19.86%
6. **Critical inputs requires:** Seed rate 60-80 kg/ha. Seed treatment with Thiram or Bavistin 2.5g/kg of seed.. Seed treatment with rhizobium. Line sowing with 30 cm row to row and 7-10 cm plant to plant spacing. Weed free condition for first 40 -45 days. Sowing should be completed by 1st fortnight of November
7. **B: C ratio:** 2.2-2.4
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:** The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

TRCP- 8

TRCP- 8

Technolog 57

1. **Name of the Technology: FIELDPEA : TRCP – 9**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2012
4. **Agro Climatic Zone:** North Eastern states
5. **Details description about the Technology:**
    - TRCP – 9 exhibited multi-location disease resistance to Powdery Mildew and Rust, which are very important diseases of field pea in NHZ.
    - TRCP – 9 exhibited tolerance to pod borer and stem fly.
    - TRCP – 9 exhibited good tolerance to *M. incognita* and *M. javanica* at different locations.
    - It has Medium bold seed size (18.94) with round, smooth and straw white coloured seed
    - Protein content of TRCP 9 seed is 20.89 %
    - TRCP - 9 (1973 kg / ha) has shown better response to lower dose fertilizer application of 20: 20: 20 kg NPK/ha as compared to check varieties and qualified varieties. At recommended doses of fertilizer also TRCP – 9 out yielded check varieties and qualified varieties at Lembucherra.
    - TRCP - 9 also performed much better (2023kg / ha) than the check varieties and qualified varieties under late sown condition.
    - Yield: 1800-2000 kg/ha

6. **Critical inputs requires:**

   Seed rate 60-80 kg/ha. Seed treatment with Thiram or Bavistin 2.5g/kg of seed. Seed treatment with rhizobium. Line sowing with 30 cm row to row and 7-10 cm plant to plant spacing. Weed free condition for first 40 -45 days. Sowing should be completed by 1st fortnight of November

7. **B: C ratio:** 2.2-2.4

8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.

9. **Contact Address for relevant information:**

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

TRCP-9

TRCP-9

Technolog 58

1. **Name of the Technology: TRIPURA SIPING**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2014
4. **Agro Climatic Zone:** Tripura. Also promising for other states of North East
5. **Details description about the Technology:**
   - Released for rainfed uplands of Tripura.
   - Plants grow up to 170 cm tall, with more than 5 branches, very vigorous and matures in 83 -90 days under Tripura condition.
   - Number of capsules per plant is 160-170 and number of seed per capsule is 58-64.
   - TRC Til -1-8-1-1 has oil content of (42%).
   - The variety also shown high level of tolerance to *Phytophthora* blight.
   - Pod shattering is also very low, reducing the risk of yield loss during harvest
6. **Critical inputs requires:** Seed rate of 7-8 kg/ha, line sowing with 40 cm row to row and 10-15 cm plant to plant spacing. Weed free condition for first 40 -45 days. Sowing Best time for sowing in the region is after the heavy monsoon showers are over – in August / September. Seed treatment with Thiram or Bavistin 2.5g/kg of seed. Fertilizer @ 30: 20: 20: 20 (NPKS) is optimum for good crop stand and growth.
7. **B: C ratio:** 2.4-2.9
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:**

- The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Tripura Siping

Tripura Siping

Technolog 59

1. **Name of the Technology: TRIPURA TORIA**
2. **Source of the Technology:** ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura
3. **Year of Release:** 2012
4. **Agro Climatic Zone:** Tripura. Also promising in Assam, Manipur and Meghalaya
5. **Details description about the Technology:**
   - It has good adaptability to enhance the cropping intensity as it fits very well in between kharif and boro rice.
   - Under rainfed condition it grows very well on residual moisture after kharif rice.
   - 86 days duration & 116 cm tall.
   - Oil content 42.6% under rainfed zone V, Oil yield is 369kg/ha under zone V rainfed condition
   - Yield: 9 q/ha.
6. **Critical inputs requires:**

   Seed rate of 6 kg/ha, line sowing with 30cm row to row and 10-15 cm plant to plant spacing. Weed free condition for first 40 -45 days. Sowing should be completed by 1st week of November. Seed treatment with Thiram or Bavistin 2.5g/kg of seed. Fertilizer @ 60: 40: 40: 20 (NPKS).
7. **B: C ratio:** 2-2.2
8. **Observation to be recorded:** Yield, maturity, reaction to different stresses such as drought, diseases, insect pests etc, farmers and consumers preference.
9. **Contact Address for relevant information:** The Joint Director, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799210, West Tripura

Figure 58 Tripura Toria

Figure 58 Tripura Toria

Chapter 9 - Animal Science

Technology no.1

1. **Name of technology:** Assessment of growth and performance of crossbreed (Hampshire x Ghungru) pigs under local condition
2. **Source of technology:** NRC, Pig, Rani, ICAR
3. **Year of release:** 2009
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Crossbreed pig (Hampshire x Ghungru)
6. **Critical inputs required:** Crossbreed pig
7. **Observations to be recorded:** Growth rate, litter size, marketable weight, B: C Ratio, Farmers' reaction.

Technology no.2

1. **Name of technology:** Dual purpose poultry breed
2. **Source of technology:** Assam Agricultural University
3. **Year of release:** 2015
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Dual purpose poultry breed 'Kamrupa'
6. **Critical inputs required:** Poultry breed 'Kamrupa'
7. **Observations to be recorded:** Mortality, growth rate, egg production, B: C Ratio, Farmers' reaction.

Technology no.3

1. **Name of technology:** Assessment of growth and performance of crossbreed (Duroc x Hampshire x Ghungru) pigs under local condition
2. **Source of technology:** NRC, Pig, Rani, ICAR
3. **Year of release:** 2010
4. **Agro-climatic zone:** All zones of Assam
5. **Detail description of technology:** Crossbreed (Duroc x Hampshire x Ghungru)
6. **Critical inputs required:** Cross breed pig
7. **Observations to be recorded:** Growth rate, litter size, marketable weight, B: C Ratio, Farmers' reaction.

Technology No. 4

1. **Name of the Technology: "Lumsniang" Upgraded Pig variety**
2. **Source of the Technology:** Division of Livestock Production, ICAR RC for NEH Region, Umiam-793103
3. **Year of release:** 2017
4. **Agro Climatic Zone:** North Eastern Hill Ecosystem
5. **Detail description about the technology:**

Pig husbandry has special significance for improving the social economy status of the tribal

Fig.1."Lumsniang" Upgraded

farmers in northeastern India. Since pork is the most preferred meat, almost every rural household rear 1 – 2 non-descriptive local pigs. These nondescript pigs attain low body weight gain, poor growth rate and low litter size at birth. Therefore the division successfully developed crossbred pig varetiy with NiangMegha (Khasi local) as indigenous germplasm and Hampshire as exotic germplasm for better adaptability and performance in hill ecosystem of the north eastern regionof India. Further the institute has successfully studied the performance, adaptability and stability of different economic traits for over more than 15 years and developed the crossbred pig variety named as "Lumsniang" based on the locality and its features.

Lumsniang" crossbred pig variety with the following features:

- Better adaptability in hill ecosystem
- Climatic resilient traits including the body physiology suitable to hill ecosystem
- Promising growth rate and feed conservation efficiency
- Suitable and well adapated to low input tribal production system
- Good mothering ability with higher litter size at the time of birth and weaning
- Higher litter weight at birth as well as weaning
- Good body condition of sow remain excellent up to 6th farrowing
- Excellent carcass quality and consumer preference in the region.
- Better disease resistance capacity

With the introduction of upgraded pig variety, the productivity of pig was increased significantly in the term of body weight (average adult pig body weight increased from 4-50 Kg to 90-110 kg) and litter size at weaning (mean litter size from 4.87 to 7.34). The upgraded pig developed by the division is one of most popular and widely accepted technology by the farmers.The pig variety attained higher body weight gain (294g Vs 183g/day) and higher litter size at weaning (8.56±0.77 Vs 5.23±0.54) as compared to local non-descriptive pigs in the low input tribal production system. The upgraded pig attains double the body weight of local non-descriptive pigs at the age of 12 months. The adult upgraded pigs were sold by the fattener farmers @ INR 11000 –13000/pig as compared to the earlier local adult pig @ Rs 6000-700/pig. The breeding farmers harvested 2-3 extra piglets per farowing compared to the earlier system and farmers sold each piglet @INR2500-3000/. The beneficiaries got INR 17000-20000/unit through selling the piglet/ farrowing and Rs 5000-7000/ extra per unit than earlier system.

6. **Critical inputs required:** Quality Feed, deworming
7. **Observations to be recorded:** Body weight gain, Disease incidence.
8. **Contact Address for relevant information:** Division of Livestock Production, ICAR RC for NEH Region, Umiam, Meghalaya-793103

Technology No. 5

1. **Name of the Technology: Low cost climate resilient environment-affinitive pigpen model**
2. **Source of the Technology:** Division of Livestock Production, ICAR RC for NEH Region, Umiam-793103
3. **Year of release:** 2013
4. **Agro Climatic Zone:** North Eastern Hill Ecosystem

Detail description about the technology: Innovative integrated low-cost pigpen was designed and developed with locally available natural resources for high rainfall mid and high altitude temperate region in the context of climate variability. The pig housing model was evaluated and compared with conventional concrete floor pig housing in term of micro-environment, physiological adaption, performance, water use efficiency, animal welfare and behavior. The pig housing model was evaluated and compared with conventional concrete floor pig housing in term of micro-environment, physiological adaption, performance, water use efficiency, animal welfare and behavior. The results revealed that the temperature and humidity of the developed pigpen maintained were within the normal range as compared to the conventional concrete pigpen during winter as well as rainy season. In winter, temperature of conventional concrete pigpen recorded average of 62.7^{o}F and floor temperature was 56.3^{o}F. The low temperature in the conventional concrete pen causes stress and energy loss to the pigs during winter. However, the saw dust-floor in developed pigpen provided warm and comfortable environment to pigs. In rainy and summer season, the conventional pigpen

Fig.1. Deep litter pig housing model

has always wet floor and recorded significantly ($P<0.01$) higher humidity and temperature-humidity index (THI) as compared the developed pen, which causes stress to the pigs. The floor in developed pigpen maintain dry and clean due the high moisture absorption capacity of sawdust floor, leading to low range of THI. The physiological parameters like heart rate, respiration rate, pulse rate within normal range during winter as well as summer/rainy season in the developed pigpen. Similarly the stress hormone, cortisol level was recorded within the normal range in developed pigpen, which is significantly higher in the conventional concrete pigpen. The microenvironment of the invented pigpen maintains within the comfort zone and well suited for physiological adaptation during extreme weather events. Since the bad odor is mainly emitted from dung, manure, urine, and waste water in the pig shed, which is absorbed immediately by the sawdust floor in the invented pen, hence the invested pigpen and its surrounding are comparatively better in terms of bad odor.

Body weight	**Developed model**	**Concrete floor**
3 months	9.75 kg	9.36 kg
6 months	64.56 kg	56.83 kg
9 months	106.83 kg	76.28 kg
Average daily weight gain	545.5 g	386.7g

Disease conditions	**Developed model**	**Concrete floor**
Leg problem	Nil	6.6%
Skin disease	Nil	4.7%
Diarrhea	Nil	10.2%
Respiratory problem	Nil	2.8%
Mortality	Nil	1.82%

The daily body weight gain and feed conservation efficiency of the pigs reared in the developed pen were significantly higher as compared to conventional pen. The cross bred pigs reared in the invented pigpen attained the body weight of 148-157 kg within one year. The diseases incidence was significantly lower in the developed pen and the method floor construction keep the floor dry and clean, hoof/nails grow normally and they were free from leg injury and leg lesion. Similarly bacterial load on the floor of developed pen was very low which ultimately lead to less incidences of diarrhea and respiratory disease conditions among pigs. The leg lesion, higher incident of diarrhea and respiratory disease are common problems in conventional pen.

The manure production in the developed pen and the conventional concrete pen was 4,100 and 1,460 kg, respectively. The quality of manure obtained in the developed model was significantly lower due to the inclusion of sawdust. In order to improve the quality and the composition of the litter, the material has to be treating with vermicomposting table.3. The innovative pigpen also provide a comfortable working space which ultimately increase the working efficiency, labor saving, obtain higher productivity, profitability and prevents environmental pollution.

There is a huge potential for the adaptation of this pigpen in the north eastern region of India, where pig population is very high. Since this model is suitable to mid andhigh altitude region hence the demand of the technology is high in the hill ecosystem where enough wood and bamboo are also available.

5. **Critical inputs required:** Saw dust
6. **Observations to be recorded:** Body weight gain, Disease incidence.
7. **Contact Address for relevant information:** Division of Livestock Production, ICAR RC for NEH Region, Umiam, Meghalaya-793103

Technology No. 6

1. **Discipline: Animal Science**
2. **Name of the Technology: Innovative value Addition to Pig Bristles**
3. **Source of the Technology:** Division of Livestock Production, ICAR RC for NEH Region, Umiam-793103
4. **Year of release:** 2014
5. **Agro Climatic Zone:** North Eastern Hill Ecosystem
6. **Detail description about the technology:**

   Pig hair, called “bristle” is completely unutilized and burn during the conventional slaughter process (singeing) or dumped as slaughter waste on the ground, which resulted in environmental pollution as it has highly stable keratinized protein, takes long time in bio-degradation. Therefore, for the first time, Division of Animal Production has investigated the bristle properties, their processing and developed pig bristles into useful value added products in the country.

   An in-house methodology for bristle processing has been developed to a) remove a dirt, epithelial scales and wax,

Fig. 4. Cloth washing brush

Fig. 5.Shoe brush

Fig.6. Soft carpet cleaning brush

b) to destroy microbes and parasitic eggs and c) bleaching for softening and colour removal before dyeing. After proper processing, different products have been developed using the pig bristle with manual method (Figure: 2-4); 1) Coat/Jacket cleaning brush, 2) Cloth washing brush, 3) High quality shoe brush. The pig bristles are natural, more durable, stable, and flexible as compared to synthetic bristles thus different high quality end products can be made from the pig bristles. The pig bristles being flexible, structurally hard and densely packed in the brush/comb, ensures faster and better removal of dirt and dust even in deep or zigzag corners which synthetic bristles may not achieve. Long, flexible with "flagged end" (split end) bristles in dusting brush are effective for cleaning the tables, computers, printers, equipment etc., with better results.It is also a better choice for cloth washing brushes, as the pig bristles are stable and remarkably resistant to hard soaps. The bristle hair brush/comb are densely packed, it remove debris, dust and scales effectively from hair. Therefore pig bristle brushes/combs are more expensive than other brushes in western countries. Since the property of the bristle varies depending on breed, parts of body in which bristle are collected, parts of bristle (base, middle and tip), and accordingly different products were made for different purposes. The bristle requirement for each product varied depends on the size of the products (small comb/brush: 20-30g, medium brush: 50-70g and large size brush: 100-120g). Similarly the cost of production also varied depends on the size (small size brush: INR 80, medium brush: INR 100 and large size brush: INR150). Since the manual method of processing is time consuming, labour cost was the major cost involved in the production cost.

A trained person could make 4-5 medium size brushes/day using manual method. The production cost can be reduced drastically with atomization. Employment opportunities in small scale bristle processing and value added products, 3) Entrepreneurship development in small scale bristle processing and manual production of the various products or large scale processing and manufacturing the products, 4) Enhance revenue through export of processed bristle, that has high demand in the international markets, 5) Effective utilization of bristles to prevent environmental pollution and creation of a value chain.

7. **Critical inputs required:** Pig Bristles
8. **Observations to be recorded:** NIL
9. **Contact Address for relevant information:** Division of Livestock Production, ICAR RC for NEH Region, Umiam, Meghalaya-793103

Technology No. 7

1. **Name of the Technology: Low cost portable Dummy sow with mating grunt voice** system(Patent Filed Application no: 430/KOL/2013, Published on: 24/10/2014)
2. **Source of the Technology:** Division of Livestock Production, ICAR RC for NEH Region, Umiam-793103
3. **Year of release:** 2014
4. **Agro Climatic Zone:** North Eastern Hill Ecosystem
5. **Detail description about the technology:** The great advantage of artificial Insemination (AI) is that the genetic potential of best germplasm can be transferred to a large number of sows,

leading to faster genetic improvement of large population. For the successful AI operation, good quality semen is collected in appropriate manner and diluted in a suitable extender and preserved either in liquid or frozen state. Dummy sow is essentially required for semen collection. Since the cost of dummy sow is one of the major initial investment cost for starting a semen processing unit. Generally the existing dummy sow equipment is imported from abroad (IMV technologies, France and Minitube, German), which is highly expensive. The existing design is more suitable for the larger exotic pigs but not suitable/comfortable to the small indigenous as well as cross bred pigs. Further the existing dummy is heavy weight (60 kg) and fixed type model, it is difficult to move/ transport from one place to another. The recent patented product galvanized dummy sow (IMV technologies, France) without leather coating is highly expensive and did not have the grunting sound voice system. The imported dummy supplied by commercial supplier is not convenient to crossbred or indigenous breeds.The institute designed and developed a low cost portable dummy sow with innovative grunting sound (mating songs) effect for better sexual stimulation, quick training of young boars, and to obtain better semen quality and quantity, and suitable for all types of pig.

Fig.7 Dummy sow

Advantage of the invented dummy sow

- Made up of low cost commonly available material and simple design.
- Simple and low cost height adjustment mechanism.
- Extra feature of mating grunt voice system for boar stimulation
- Design suitable and comfortable to all types of pigs
- It is easy to dismantle and transport hence portable model
- Faster sexual arousal/ stimulation and obtained higher semen volume and spermatozoa/ ejaculate
- Higher number of boar trained at faster rate

Since AI is the simple and cost effective technique for genetic improvement of pigs through upgrading/ cross breeding of local pigs with high yielding pigs, Many central and state departments have proposed the Mission Mode project on AI in pigs in the NE region of India in the 12th five year plan. Establishment of semen processing and supply units continue to increase in different pig breeding farms and boar stud under government and private farms in many south-east-Asian countries. Since the cost of dummy sow is one of the major initial investment cost for starting a semen processing unit, the demand of the product is expected to increase many folds in the developing countries. Further, demand for the dummy sow will increase in research institutes/universities for the reproductive biology research in which semen /and spermatozoa is basic requirement.

Commercialized through non-exclusive licensing with NGOs (Mawphlang Welfare Society) including in-house pig bristle processing methodology and training of educated tribal youth.

The NGO paid royalty fee and made MOU with Institute.

6. **Critical inputs required:** Maintenance
7. **Observations to be recorded:** NIL
8. **Contact Address for relevant information:** Division of Livestock Production, ICAR RC for NEH Region, Umiam, Meghalaya-793103

Technology No. 8

1. **Name of the Technology: Rural Poultry Production with Improved Chicken Varieties**
2. **Source of the Technology:** Division of Livestock Production, ICAR RC for NEH Region, Umiam-793103
3. **Year of release:** 2006
4. **Agro Climatic Zone:** North Eastern Hill Ecosystem
5. **Detail description about the technology:** Low input system, better survivability, good scavengers, attractive plumage color, escape from predators, more tolerant to diseases and better productivity. Its eggs and meat are more preferable by the consumers in the region. The backyard poultry farming with improved varieties like Vanaraja and Gramapriya under low input system. They are allowed for scavenging during day time in the backyard along with supplementation of kitchen wastes, cereal grains etc in the morning and evening. The birds should be vaccinated and de-wormed periodically.

   Performance comparison

Parameters	Desi chicken	Gramapriya	Vanaraja
Annual Egg production (Nos.)	50-60	150-170	130-150
Live body weight (Kg.)	1-1.5	2.2.5	2.5-3.5

   It is very popular for backyard poultry production. The Improved Chicken Varieties provide two fold higher income as compared to Desi chicken.

6. **Critical inputs required:** Balanced Feed
7. **Observations to be recorded:** Body weight gain, egg production
8. **Contact Address for relevant information:** Division of Livestock Production, ICAR RC for NEH Region, Umiam, Meghalaya-793103.

Technology No. 9

1. **Name of the Technology: Turkey Farming and Quail Farming**
2. **Source of the Technology:** Division of Livestock Production, ICAR RC for NEH Region, Umiam-793103
3. **Year of release:** 2011
4. **Agro Climatic Zone:** North Eastern Hill Ecosystem

5. **Detail description about the technology**: Turkeys have unique qualities of hardiness and adaptability to diversified agro-climatic conditions. They are mainly reared for meat purpose. Turkey meat contains lower fat and cholesterol. Good demand for turkey meat in northeastern hill region especially during Christmas and New Year seasons. Japanese quail farming have a bright scope to provide alternative to chicken farming. Quail is reared both for meat and egg production. Quail meat and egg have high nutritive value with good taste. Quail has unique qualities of hardiness and adoptability to diversified agro-climatic conditions. Quail farming requires less housing and capital investment.

   Turkeys can be reared under free range or intensive system. Allow for scavenging during day time with supplementation of grains, kitchen wastes etc. under free range system. Turkey can be produced at the farmers' field by utilizing local broody hen. Regular vaccination and deworming should be followed. Japanese quail can be reared under deep-litter and cage system. Japanese quails are resistant to many diseases as compared to other poultry species and as such do not require vaccination

6. **Critical inputs required:** Balanced Feed
7. **Observations to be recorded:** body weight gain, egg production
8. **Contact Address for relevant information:** Division of Livestock Production, ICAR RC for NEH Region, Umiam, Meghalaya-793103

Technology No. 10

1. **Name of the Technology**: **Compacted feed block making device (portable)**
2. **Source of the Technology**: Division of Livestock Production, ICAR RC for NEH Region, Umiam-793103
3. **Year of release**: 2000
4. **Agro Climatic Zone:** North Eastern Hill Ecosystem
5. **Detail description about the technology:** Feed management tools for livestock owner for maximum utilization of locally available crop residues. It works manually and anybody can operate with minimum instruction. Quantity of the feed ingredients to be incorporated in

Fig. 10. System of rearing: A: Turkeys under free-range system B: Turkeys under deep litter system
C: Hatching of turkey eggs by local broody hen D: Newly hatched poultry by local broody hen
E: Feeding and watering of turkey poultry

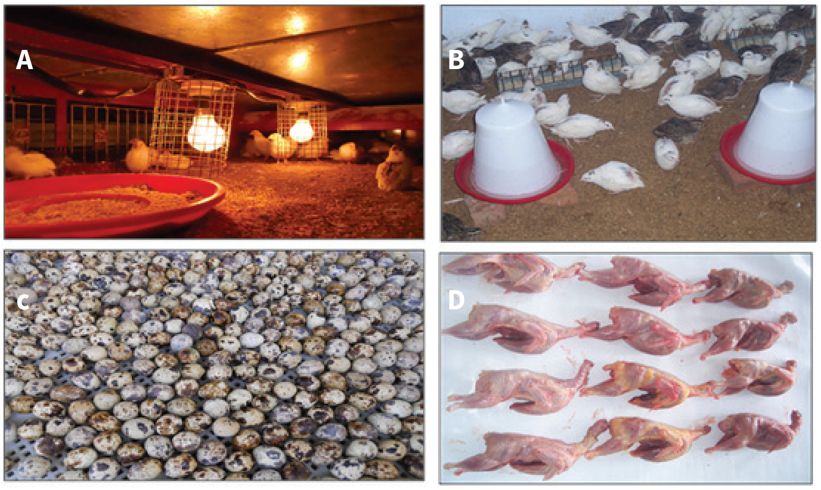


Fig. 11. System of rearing: A: Brooding B: Japanese quail under deep litter system C: Japanese quail eggs D: Japanese quail meat

the block might be determined as per the nutrient requirement of the animal and nutritive value of the feed ingredients.

Fig. 12. Fig. Balanced complete feed block preparation from feed

Feed ingredient should be mixed properly before preparing the feed block. It helps to supply nutrients to the animals in right proportion in balance form. The daily capacity of preparation is 3-4 blocks per hour. A feed block weighing about 3-4kg can be prepared at a time. Row material used are chopped paddy straw, concentrated mixture (crushed maize, mustered cake, wheat bran), dried tree leaves, other agro industrial byproducts like spent grains, etc, binding material like bentonite, etc, mineral mixture and common salt. The balance ingredients are mixed well before adding to the block making device. About 2.5 sq.ft space is required for storing the device. Cost of machine is Rs8000-10,000/- (depending upon cost of iron). Feeding complete feed blocks (CFB) having 1: 1 roughage to concentrate ratio, with chopped and ground paddy straw to crossbred HF lactating dairy cattle resulted in an increase in the daily average milk production and intake of DM, with a smaller reduction in the digestibility of nutrients. Feeding maize kadabi in the form of complete feed block (CFB) increased the palatability and growth in crossbred calves. The keeping quality of these blocks can be prolonged with incorporation of urea. An Average Daily Gain (ADG) of 779g was attained in HF crossbred calves by strategic supplementation of concentrate @ 1.75 to 2.25% of body weight to meet the growth demand along with mixed green grass in rainy season and paddy straw in winter as sole source of roughage.

The devices cost effective, simple in operation with minimum labour, reduces cost of feeding and space requirement for storage, easy to transport and increases feed intake, feed efficiency and production.

Chapter 10 - Fisheries/Aquaculture

Technology no.1

1. **Name of the Technology:** Run-off water harvesting technology for fish based farming system
2. **Source of the Technology:** College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2012
4. **Agro climatic Zone:** Mid-hill region in tropical/sub-temperate zone
5. **Detail Description about the Technology:**

   The main objective of the system is to collect and store catchment rain water of upland and use them by synthetic lined water harvesting structures in different altitude so that the excess catchment water accumulated in the upper water harvesting structures may be accumulated in the subsequent structures of same nature in the lower altitude to utilize it for seasonal aquaculture practices of carps with moderate doses of manure and lime as well as stocking densities.

   1. **1st tier system**: High altitude/Upland location used for nursery rearing of rohu (*Labeo rohita*) spawn to fry.
   2. **2nd tier system**: Medium altitude used rearing of rohu (*Labeo rohita*), common carp (*Cyprinus carpio)* fry to fingerlings.
   3. **3rd tier system**: Grow-out ponds in the lower ridge/valley are used for grow out

   Expected Fish production:

   Tier 1: Nursery: Stocking density was 12.5 lakh ha^{-1} (six day old spawn) and obtained survival at College of Fisheries 31%.

   Tier 2: Rearing: Stocking density was 3 lakh ha^{-1} and obtained survival at the unit developed at College of Fisheries was 57-72% for rohu and about 95% for common carp

   Tier 3: Grow-out: The Production per ha in the grow-out ponds (3rd Tier) at the lower elevation (under scientific management with application of pelleted supplementary feed): 3500-4000 kg ha^{-1} year^{-1} in the initial 1st and 2nd year and it should be > 4000-5000 kg ha^{-1} year^{-1} (from third year onward once the soil fertility and water retention improves)

Cost Involvement for development of this system in Tripura. For construction of ponds (nursing, rearing and grow-out) cost may vary greatly with the states. In Tripura, it would be around Rs. 4-5 lakh ha^{-1} of total area. Besides these costs, the annual expenditure to be incurred towards operation cost to undertake intensified aquaculture would be Rs. 2.5-2.8 lakh ha^{-1}. Additionally, the cost for developing horticultural crops on the slope 2-2.5 lakh ha^{-1} would be required for pine apple.

6. **Critical Inputs Required:** High density PP, Fish seed, Fish Feed, Fertilizer/Manure, turfing with grass.
7. **Observation to be recorded:** Water depth and retention period, rainfall, soil erosion and siltation.
8. **Contact Address for relevant information**

   Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210

   E-mail: cofcau@rediffmail.com

Technology no.2

1. **Name of the Technology:** Floating supplementary carp feed CAU AQUA Feed (carp) using locally available ingredients
2. **Source of the Technology:** Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2015
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology**

   The main objective of the technology is to produce floating extruded fish feed utilizing locally available ingredients using locally available ingredients namely rice bran, mustard oil cake, corn, wheat , rice starch, wheat bran, dry fish waste, taro, cassava, wolffia meal. The formulation and production conditions of the supplementary carp feed 'COF-CAU Aqua Feed' for carphas been developed and its production process has been standardized.

   Technical Description: Floating type Twin screw extruded pellet feed of dia 2-5 mm of high water stability (>1 hour) of following nutritional contents:

   Crude protein: 20-22%

   Crude lipid: 3-4 %

   Digestible carbohydrate: 45-52 %

   Crude Fiber: 14-16 %

   Ash: 10-14 %

   The manufacturing conditions for floating pellets of 3-5 mm dia have been standardized for pilot scale production of floating supplementary feed by twin screw extruder:

   Water addition: 17.5%

   Extrusion Temperature: Zone I-160°C, Zone II-175°C, Zone III-170°C, Feeder speed: 25-28 rpm

Twin Screw speed: 29-32 rpm

Cutter speed: 20-26 rpm

Oven temperature: 115°C

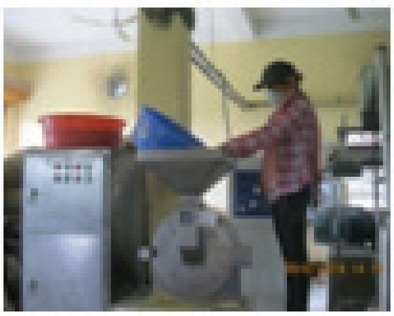
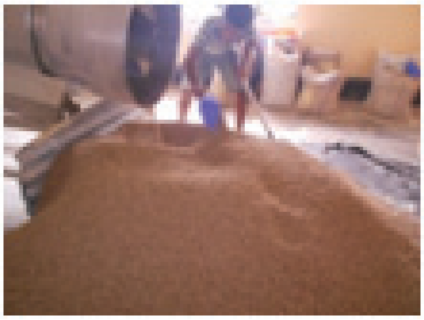
Time of Drying: 18-20 minutes

The apparent feed conversion ratio (AFCR) under tank culture system and pilot scale semi-intensive carp grow-out pond culture system was found to be 1.8-2.2.

So far, about 140 metric ton of fish feed worth Rs. 42 lakh has been sold to various stake holders including farmers, NGOs, public institutions besides of meeting requirements of different ongoing programmes including village adoption programme.






6. **Critical Inputs Required:** Feed grain and grain byproducts, fish meal, tuber (taro, **tapioca or yam) starch**
7. **Observation to be recorded:** Floatability, water stability, feed acceptability, market prices of ingredients, market price of feed, capacity of mill and labour use efficiency
8. **Contact Address for relevant information:** Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com.

Technology no.3

1. **Name of the Technology:** Incorporation of Silver barb *Puntius gonionotus* (bleeker) in feed-based carp polyculture system with particular reference to seasonal ponds in NE region
2. **Source of the Technology:** College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2014
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology:**

   The main objective of the technology is to enhance fish productivity and farmers' income, especially from feed based fish culture in seasonal water bodies with effective culture period of 5-6 months. The technology involves replacement of Indian major carps (IMC) and/or Chinese carps with silver barb in pond culture which has remarkably higher demand and fetch higher market price compared to *Catla catla, Cirrhinus mrigala, Hypopthalmicthys molitrix* (silver carp) *and Ctenopharyngodon idella* (grass carp). Different levels of incorporations of silver barb have been found to enhance fish yield owing to higher specific growth rates viz. 2.79-3.14% d^{-1} exhibited by silver barb as compared to those of 0.7 to 1.6 % d^{-1} shown by IMC. The increase in economic return is even more pronounced owing to 15% to 20% higher market price than that of IMC.

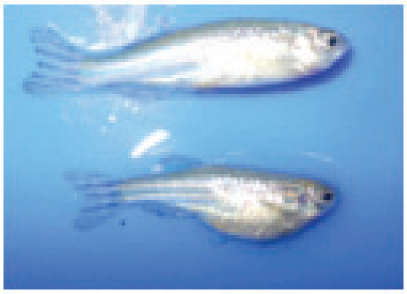
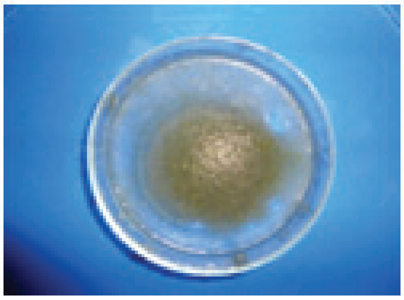
6. **Critical Inputs Required:** Feed grain and grain byproducts, oil cake, fish meal, truber (taro, tapioca or yam) starch, wolffia meal, Twin screw extruder, Electricity
7. **Observation to be recorded:** Market prices of ingredients, floatability, water stability, acceptability, feed utilization efficiency, market price of feed, and capacity of mill
8. **Contact Address for relevant information**

   Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com

Technology no.4

1. **Name of the Technology:** Seed production of zebra fish (*Danio rerio*) in aquarium condition
2. **Source of the Technology:** Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2015
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology:**

   For the present experiment, about 400 *Danio rerio* fry were collected from the drain of the college farm facility. The fry are acclimated and stocked in two rectangular cemented tanks of 1000 l capacity for about two months. Twenty four aquaria (12 aquaria for breeding and 12 for raising fry) of 50 l capacity were used with sponge filter to supply continuous oxygen. Aquaria were divided into four treatments namely treatment 1, 2, 3 and 4 each having three replications viz. T-1: live food (mixed zooplankton), T-2: formulated feed, T-3: commercial aquarium feed (Tokyu), T-4: mixture of all three feeds. Feeding was done twice daily. Faecal matter and leftover feed were removed by siphoning and 20% of the water volume was changed daily. Fish were housed in a photoperiod of 12: 12 h light: dark cycle and reared for 7 months. In terms growth and survival, no significant difference was found among the tested diets, but higher value was reported in the live food group. Feeding with live food (167.67±7.69) and mixed feed (formulated feed and live food) (156.5±2.5) led to improved spawning performance compared to commercial (104.5±5.5) and formulated diet (131.67±2.40).


6. **Critical Inputs Required:** Aquarium of suitable size, good source of water, filtration system with aeration, healthy broodstock, nutritionally balanced feeds, hand nets, plankton nets, spawning baskets, hand pelletizer for making feeds, live food for larval rearing.
7. **Observation to be recorded:** Water quality parameters like pH, dissolved oxygen (DO) and temperature, health of fish, growth performance, survival of fish, maturity of fish, spawning of fish and larval survival.
8. **Contact Address for relevant information:** Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com

Technology no.5

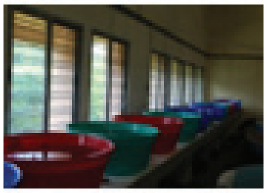
1. **Name of the Technology:** Low cost seed production of Pabda *Ompok bimaculatus*
2. **Source of the Technology:** Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2015
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology:**

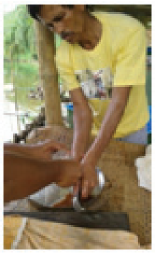
Ompok bimaculatus, commonly known as Pabda is a native species and recently gaining its importance as a promising aquaculture candidate owing to its good taste, excellent nutritional profile and high market value. For breeding this fish, they are induced through hormone therapy using Ovaprim, Ovatide or OvaFH. The females are given the dose of 2.0-2.5 ml / kg body weight of fish and the male are given half of the female dose. At the end of the latency period of 10 hrs stripping of the female spawners is done by gently pressing their abdomen with a thumb from the pectoral fin towards the genital papilla. The belly of the male fish is cut open and testes is taken out. The testes is then kept on a piece of cotton cloth piece and squeezed the milt content on the egg mass on a plastic tray. The eggs are fertilized by adding few amount of water with simultaneous mixing by feather. Then water and egg mass are mixed by gently shaking of the tray.

An indigenous modified micro-hatchery has been developed at College of Fisheries, Lembucherra with polythene made water holding structure and 4 nos. of 500 L glass aquariums. The settled filtered pond water can be used for hatching the eggs. For incubation the fertilized eggs are uniformly distributed in the specially made net baskets which are kept in glass aquarium. It will take 24 hours for hatching in temperature range of 27-30°C. The water level kept at a height about 14-15 cm. The system can accommodate 15000-20000 fertilized eggs in one aquarium with 60-80% hatching rate. After hatching, the larvae will come out of the net basket and settled at the bottom corner of the tanks.

The larvae are reared in the same incubation tanks. After yolk sac absorption, the larvae are fed with live plankton. Other live food such as fish flesh, earthworms, tubifex are also tried in live and freeze dried condition. It has been found that tubifex worms in live condition are most preferred by the larvae if these are given in finely chopped form. A stocking density of 10 nos./l is considered to be optimum for better growth and survival in indoor condition. The larvae grow to 15-20 mm fry during 15-21 days of rearing. After a maximum of 21 days rearing in the indoor, they should be transferred to out-door rearing tanks for fingerling production.





6. Critical Inputs Required:

i. Healthy brooders

ii. Abundant availability of natural food

iii. Continuous aeration

iv. Pollution free water

v. Water holding containers

7. Observation to be recorded:

i. Choose the hormone dose according to the ripeness of brooders.

ii. Always keep an eye on the size of food particles, particularly in larval rearing phase.

iii. Remove/replenish fully or partially the water, excreta and unconsumed food materials from the larval and fry rearing tanks.

iv. Sort out bigger ones from the smaller one to reduce cannibalism.

v. Shed may be provided to reduce cannibalism. Maintain hygienic condition in the hatchery.

vi. Always keep ready an electric generator as stand-by arrangement.

vii. Routine checking of different rearing systems

8. Contact Address for relevant information:

Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com

Technology no.6

1. **Name of the Technology:** FLOATING PELLETED FISH FEED
2. **Source of the Technology:** Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura
3. **Year of release:** 2011
4. **Agro Climatic Zone:** NEH Region/Eastern Himalayan Region
5. **Detail description about the technology:**

The feed was produced through extrusion technology utilizing ingredients namely rice bran, mustard oil cake, broken corn, broken wheat, wheat bran, and dry fish waste. The proximate composition of the feed was as follows: Crude Protein content 20-22 %, Crude lipid 3-5 %, Crude Fiber < 13-15 %, Ash ≤ 10-11 %, Digestible carbohydrate 40-45 %. Pellets floats in water for 30 to 60 minutes.

Floating pelleted fish feed and its application in culture pond

6. **Critical input required:**
   1. Feed.
   2. Seed.
   3. Agrochemicals

7. **Observations to be recorded:**

   a. Survival rate of fishes. **b.** Growth of fishes. **c.** Feed Conversion Ratio.

8. **Contact Address for relevant information:**

   Department of Aquaculture,

   College of Fisheries,

   Central Agricultural University,

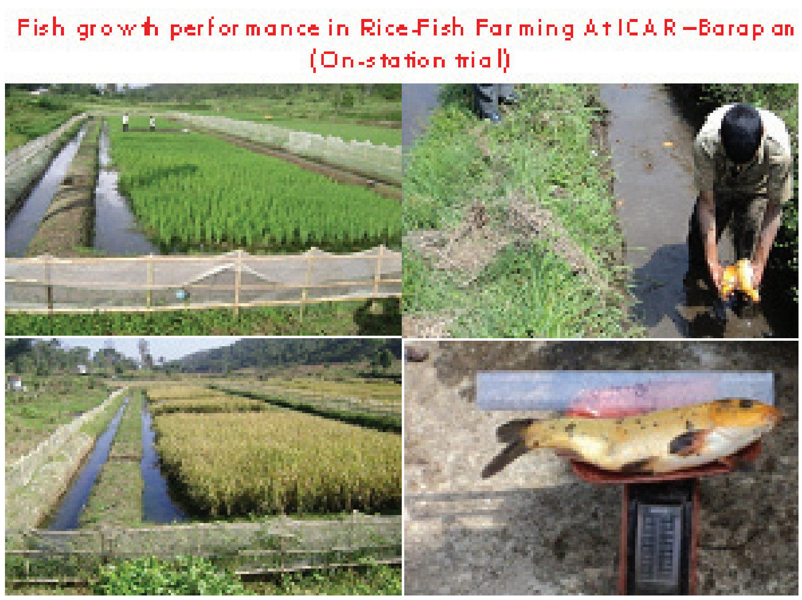
   Lembucherra

   Tripura

Technology 7

1. **Name of the technology**: Rice- Fish Farming under mid hill condition.
1. **Source of technology:** Division of Fisheries; ICAR Research complex for NEH Region, Umiam, Meghalaya
2. **Year of release:** 2013
3. **Agro Climatic Zone/AES:** Mid Hill altitude
4. **Description of the technologywith Critical inputs required Observation to be recorded.**

- ➢ Rice- fish farming is ideal for i.Conservation of water resources and plant nutrients,ii.Intensive production of fish protein and iii.Reduced operating costs relative to either system in isolation.
- ➢ A low lying area connected with a perennial stream was selected nder mid hill condition, Common carp in rice field (plot size: 61 X 12 m=732 Sq.mt) yielded encouraging results.



- ➢ The paddy plot is designed with Perimeter canal (size: 1 m width & 0.75 m depth) and a centre pond (size: 5m Diameter & 0.75 m Depth) for rearing only Common carp, *Cyprinuscarpio var. communis and variety Amur*
- ➢ Stocking density of 5,000 nos/ha. Common carp seeds of average size 7 cm in length and 6 g in weight are introduced after 21 days of paddy plantation .
- ➢ In a rearing period of 237 days a production of 683 kg of common carp per hectare is obtained without supplementary feeding.

Applicability of the technology in specific agro ecosystem (e.g. low land, acid soil, drought resilient etc):

A low lying area connected with a perennial stream is an ideal site for rice–fish farming

Area (appx in ha) to which it is applicable in the region or your state.

Under mid hill condition, *Common carp* in rice field (plot size: 61 X 12 m=732 Sq.mt) yielded encouraging results. However, the area can vary from 500 sq.mt to 5000 sq.mt for better management.

Contact Information:

Principal Investigator: S.K.Das. Division of Fisheries, ICAR Research complex for NEH Region, Umiam, Meghalaya)

Technology 8

1. **Name of the technology**: Simple protocol for seed production of improved variety of common carp (*Cyprinuscarpio*) - Amur variety(Hungarian strain) and Pengba (*Ostebramabelangeri*)- an endangered endemic fish species of Northeast India.
2. **Source of technology:** Division of Fisheries; ICAR Research complex for NEH Region, Umiam, Meghalaya
3. **Year of release:** 2013& 2014
4. **Agro Climatic Zone/AES:** Mid Hill altitude
5. **Description of the technology with Critical inputs required Observation to be recorded.**

   Amur common carp:

   Under mid hill condition maiden attempt was made to breed the genetically improved variety of Common carp on a trial basis successfully in the year 2011. Female Amur common carpa was found to mature fully at the age of 13 months under mid hill condition. Male matured earlier than the female.The first breeding trial with this new variety was conducted successfully in March'2011 when the atmospheric temperature varied between 16^{0}C to 18.3 ^{0} C. One set of genetically improved common carp comprising of fully matured one female and three males were kept in standard hapa fixed in a 0.40 ha fish pond.The fertilized eggs took about 78 to 83 hours to hatch. Water temperature ranged between 19 ^{0} C to 22.8 ^{0} C while water pH varied between 6.5 and 6.8. The best period for Amur common carp seed production was found to be March to April.The Average number of eggs per gram body weight was found to be 107.33.Under mono culture, the Amur common carp has been observed to attain an average growth of more than 400 g in 12 months rearing period at a stocking density of 5000nos/Ha under mid hill condition with regular feeding of rice polish and oil cake (1: 1 ratio) at 2-3% body weight. The best growth of Amur common carp has been recorded during April to August.

   Pengba(Ostebramabelangeri)

   Pengba (*Osteobramabelangeri*)was found to mature fully under mid hill condition at the age of 30 months.The weights of female and male brooders ranged from 110 to 220 g and 80 to 110 g respectively. The average weight of female brooder was 162.5 g while the male brooder was 97.1 g. The inducing agent, Gonopro-FH was administered in single dose to the brooders at different doses in the evening hours between 16.0 to 16.30hr. The injected breeding pairs (one female with two males) were released in a breeding hapa (1.5 x 2.5 x 3.0 m) fitted in an earthen pond. The brooders were removed from the hapas early in the morning and the eggs were collected manually to transfer the fertilized eggs to locally made hatching devices for incubation. A simple hatching device was designed by modifying a 17 litres capacity plastic bucket (45cm in diameter). The fertilized eggs were kept in motion by fitting a water inlet at the bottom of the bucket and an outlet pipe to drain out the overflow water. In addition, the water was continuously oxygenated through a simple air pump commonly used in aquarium. The rate of water flow in the hatching bucket varied between 267 to 625ml/minute during the incubation period.

   The peak breeding season was found to be very short (First week of July to Second week of August) under mid hill condition .The month of July is the best time for induced breeding of matured Pengba.

- **Applicability of the technology in specific agro ecosystem (e.g. low land, acid soil, drought resilient etc):**

  Applicability tested successfully under mid hill climatic situation. Amur common carp is a fast growing species and thus can be best suited for short term aquaculture in seasonal ponds.

- **Area (approx in ha) to which it is applicable in the region or your state.**

  Minimum area required for seed production of both the species is 200sq,mt fish ponds for small-scale operation. However 0.5 ha to 1.0 ha fish farm is recommended for large-scale seed production of Amur common carp and Pengba.

6. **Contact Information:**

   Principal Investigator: S.K.Das. Division of Fisheries, ICAR Research complex for NEH Region, Umiam, Meghalaya)

Technology 9

1. **Name of Technology:** Fish-cum poultry cum Horticulture farming under mid altitude condition
2. **Source of technology:** Division of Fisheries; ICAR Research complex for NEH Region, Umiam, Meghalaya
3. **Year of release:** 2013
4. **Agro Climatic Zone/AES:** Mid Hill altitude
5. **Description of the technology with Critical inputs requiredObservation to be recorded.**

- Why this technology
  - **Effective utilization of one unit area.**
  - Recycling of organic wastes as well as production of high class protein at low cost.
  - Reduces the additional cost for supplementary feeding as well as fertilisation.
  - It is an artificial balanced ecosystem where there is no waste.
  - It provides more employment avenues.
  - It reduces the input and increases output and economic efficiency

- What is this technology
  - 0.10 to 0.2 ha size of earthen pond is easy to manage and ideal for such integration on smaller-scale. Fish in pond, birds in cage over the pond and horticultural crop (Ginger & Turmeric) planted on the embankment.
  - Low-cost Poultry house: 100 sq.ft(Bamboo & Thatched): Cost: Rs. 5,500
  - Stocking density of fish @ 8,000 nos/ha. In a rearing period of 11 months a production of 1500 kg of fish per ha could be obtained without supplementary feeding)-0-input fish production).
  - Poultry: Vanaraja layers 25 Nos.(20% mortality) in 8 months: 2384 eggs.
  - Ginger: 41.5 Kgs from (8X5.5 mt= 43.2 sq.mt).: 960gm per sq.mt
  - Turmeric: 25 Kg from (63 mX1m= 63 sq.mt): 396 gms per sq.mt.

Photos: Multiple products from one unit area.





6. Contact Information:

Principal Investigator: S.K.Das. Division of Fisheries, ICAR Research complex for NEH Region, Umiam, Meghalaya)

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