

# 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 (*Pennisetumpurpleum*) and Guinea grass (*Megathyrusmaximus*) 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 culinaris*) 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 be applied. 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 avoided and 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. In case 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, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O/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 ( <i>Pahenlo dal</i> )	Buckwheat
<b>Package and practices- Land preparation</b>		
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
<b>Package and practices- Organic nutrient management</b>		
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>i.e.</i> , 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>i.e.</i> , ½ at the time of sowing and half 45 days after sowing in furrows.
<b>Time of sowing</b>		
Second fortnight of March- first week of April	Second fortnight of July	First fortnight of November
<b>Varieties</b>		
Vivek QPM-9, C-1415, NMH-51 Lines: RCM 1-1, RCM 1-76, RCM 1-3	PD-3, local <i>cv Pahenlo dal</i>	Local <i>cv Mithe</i>
<b>Method of sowing:</b>		
<b>a. Seed rate and seed inoculation,</b>		
20-25 kg/ha seed should be inoculated with <i>Azospirillum</i> , <i>Azotobacter</i> etc. and Phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing.	20-25 kg/ha seed should be treated with <i>Rhizobium</i> and PSB @ 200 g/kg seed.	35-40 kg/ha seed should be treated with Azophos @ 20 g/kg.
<b>b. Spacing and depth of sowing</b>		

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.
<b>Weed management</b>		
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.
<b>Crop protection</b>		
<b>a. Insect pest management</b>		
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 <i>Helicoverpa armigera</i> is highly effective for management. Spraying of entomopathogenic fungi like <i>Beauveria bassiana</i> and <i>Metarhizium anisopliae</i> @ 5 g/l.	
<b>b. Disease Management</b>		
<p><b>Turcicum leaf blight</b> (<i>Helminthosporium turcicum</i>)</p> <ul style="list-style-type: none"> <li>❖ Grow resistant hybrids like DHM-1.</li> <li>❖ Remove plant residue from the previous crop.</li> <li>❖ Plough under the infected crop residue in the field to reduce the inoculum.</li> </ul>	<p><b>Yellow mosaic virus</b></p> <ul style="list-style-type: none"> <li>❖ Remove and destroy the infected plants.</li> <li>❖ Apply neem oil @ 0.3 per cent or NSKE @ 5 per cent to control white fly.</li> <li>❖ Use increased seed rate (25 kg/ha).</li> </ul>	<p><b>Downy mildew</b> (<i>Peronospora ducometi</i>)</p> <ul style="list-style-type: none"> <li>❖ Select seeds from disease-free plants.</li> <li>❖ Treat the seeds using <i>Trichoderma viride</i> @ 4 g/ kg of seeds.</li> <li>❖ Soil application of <i>Trichoderma viride</i> @ 2.5 kg mixed with 50 kg sand or well rotted FYM.</li> </ul>



<p><b>Maydis leaf blight (MLB)</b> (<i>Bipolaris maydis</i>)</p> <ul style="list-style-type: none"> <li>❖ 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.</li> <li>❖ Remove infected crop debris.</li> </ul>	<p><b>Urd bean leaf crinkle</b> (Urd bean leaf crinkle virus)</p> <ul style="list-style-type: none"> <li>❖ Remove and destroy the infected plants.</li> <li>❖ Use disease-free seeds.</li> <li>❖ Use increased seed rate (25 kg/ha).</li> <li>❖ Hot water treatment of the seed at 55°C for 30 minutes.</li> </ul>	<p><b>Powdery mildew</b> (<i>Erysiphe polygoni</i>)</p> <ul style="list-style-type: none"> <li>❖ Select seeds from disease-free plants</li> <li>❖ Apply wettable sulphur @ 0.25 per cent.</li> </ul>
<p><b>Downy mildews:</b></p> <ul style="list-style-type: none"> <li>❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11.</li> <li>❖ Remove infected crop debris.</li> <li>❖ Provide proper drainage to avoid water stagnation in the field.</li> </ul>	<p><b>Rust</b> (<i>Uromyces phaseoli</i>)</p> <ul style="list-style-type: none"> <li>❖ Adjust the sowing date to escape from the disease.</li> <li>❖ Apply wettable sulphur @ 0.25 per cent.</li> </ul>	
	<p><b>Powdery mildew</b> (<i>Erysiphe polygoni</i>)</p> <ul style="list-style-type: none"> <li>❖ Dust sulphur two to three times during the cropping season.</li> <li>❖ Apply wettable sulphur @ 0.25 per cent.</li> <li>❖ Spray NSKE @ 5 per cent or neem oil @ 3 per cent twice at 10 day interval from initial appearance of disease.</li> </ul>	
<p><b>Harvesting</b></p>		
<p>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.</p>	<p>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.</p>	<p>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.</p>

**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, Umiam, 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
<b>Package and practices- Land preparation</b>	
One ploughing with bullock drawn plough followed by one tilling/harrowing for maize after harvest of buckwheat.	Two-three ploughing for good tilth.
<b>Organic nutrient management</b>	
<ul style="list-style-type: none"> <li>❖ Apply dolomite @ 2 t/ha as basal application 15-20 days prior to the sowing.</li> <li>❖ Conjoint basal application of mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha.</li> <li>❖ Application of vermicompost @ 2.5 t/ha should be done in two equal splits <i>i.e.</i>, half amount applied in rows at the time of sowing and the rest amount at the time of earthing up after second weeding.</li> </ul>	Vermicompost @ 2.5 t/ha should be applied in two equal splits <i>i.e.</i> , half amount applied in rows opened for placing the seeds.
<b>Time of sowing</b>	
<ul style="list-style-type: none"> <li>❖ <i>Pre-Kharif</i> sowing in the rice fields at the lower altitudes is done in mid-February to second week of March.</li> <li>❖ 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.</li> <li>❖ <i>Post-Kharif</i> maize is sown in July and first week of August along with pulses, beans and pulse-type beans.</li> </ul>	Second fortnight of November.

<b>Varieties</b>		
	<p><b>Composites:</b> Vivek Sankul Makka-11, Vijay, Prabhat</p> <p><b>Hybrids:</b> Vivek Hybrid-9, Vivek Hybrid-21, Vivek Hybrid-33, Vivek Hybrid-39</p> <p><b>Quality protein maize (QPM):</b> Vivek QPM-9, HQPM-1</p> <p><b>Lines:</b> RCM 1-1, RCM 1-76, RCM 1-3</p>	VRP-5,VRP-6, TSX-10, Pant Sabzi Matar-3, Pusa Pragati
<b>Method of sowing</b>	<ul style="list-style-type: none"> <li>❖ Line-sowing method</li> <li>❖ Dibbling method</li> </ul>	❖ Line sowing method
<b>Seed rate and seed inoculation</b>		
Depending upon the variety and season, 20-22 kg/ha seed of maize is required for optimum plant population. Seed should be inoculated with <i>Azospirillum</i> , <i>Azotobacter</i> etc. and Phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing		<p>Early maturing dwarf varieties: 80-100 kg seed/ha.</p> <p>Late maturing and tall varieties: 75-80 kg/ha.</p> <p>Inoculate with <i>Rhizobium</i> inoculum @ 20 g/kg seed is sprinkled, mixed in <i>jaggery</i> solution and dried in shade.</p>
<b>Spacing and depth of sowing</b>		
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
<b>Weed management</b>		
Two hand weeding, first at 15-20 DAS and second at 35-40 DAS.		Two hand-weeding at 15-20 and 35-40 DAS.
<b>Crop protection:</b>		
<b>Insect pest management</b>		
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.
<b>Disease Management</b>		

<p><b>Turcicum leaf blight</b> (<i>Helminthosporium turcicum</i>)</p> <ul style="list-style-type: none"> <li>❖ Grow resistant hybrids like DHM-1.</li> <li>❖ Remove plant residue from the previous crop.</li> <li>❖ Plough under the infected crop residue in the field to reduce the inoculum.</li> </ul>	<p><b>Wilt and Root Rot</b> (<i>Fusarium oxysporum</i> and <i>Rhizoctonia solani</i>)</p> <ul style="list-style-type: none"> <li>❖ Early sowing should be avoided to escape from high humidity and high temperature which are congenial for the disease.</li> <li>❖ Drench soil with copper oxychloride @ 0.25 per cent.</li> <li>❖ Crop rotation for at least 2-3 years with suitable non-leguminous crops should be followed.</li> </ul>
<p><b>Maydis leaf blight (MLB)</b> (<i>Bipolaris maydis</i>)</p> <ul style="list-style-type: none"> <li>❖ 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.</li> <li>❖ Remove infected crop debris.</li> </ul>	<p><b>Powdery mildew</b> (<i>Erysiphe polygoni</i>)</p> <ul style="list-style-type: none"> <li>❖ Late planting should be avoided.</li> <li>❖ Remove and destroy plants after harvest.</li> <li>❖ 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.</li> </ul>
<p><b>Downy mildews</b></p> <ul style="list-style-type: none"> <li>❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11.</li> <li>❖ Remove infected crop debris.</li> <li>❖ Provide proper drainage to avoid water stagnation in the field.</li> </ul>	<p><b>Rust</b> (<i>Uromyces fabae</i>)</p> <ul style="list-style-type: none"> <li>❖ After harvest the affected plant trash should be burnt.</li> <li>❖ Follow suitable crop-rotation with non-leguminous crops.</li> <li>❖ Dust Sulphur @ 25 kg/ha or spray wettable sulphur.</li> <li>❖ Early sowing in the month of October.</li> </ul> <p>Grow resistant varieties like Arka Ajit, Arka Karthik and Arka Sampurna and moderately resistant, Arka Apoorva.</p>

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
<b>Land preparation</b>		
	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.
<b>Organic nutrient management</b>		
	<ul style="list-style-type: none"> <li>❖ Apply dolomite @ 2 t/ha as basal application 15-20 days prior to the sowing.</li> <li>❖ Conjoint basal application of mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha.</li> <li>❖ Application of vermicompost @ 2.5 t/ha should be done in two equal splits <i>i.e.</i>, half amount applied in rows at the time of sowing and the rest amount at the time of earthing up after second weeding.</li> </ul>	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.
<b>Time of sowing</b>		

<ul style="list-style-type: none"> <li>❖ Pre-<i>Kharif</i> sowing in the rice fields at the lower altitude is done in mid-February to second week of March.</li> <li>❖ 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.</li> <li>❖ Post-<i>Kharif</i> maize is sown in July and first week of August along with pulses, beans and pulse-type beans.</li> </ul>	End of September.
<b>Varieties</b>	
<p><b>Composites:</b> Vivek Sankul Makka-11, Vijay, Prabhat</p> <p><b>Hybrids:</b> Vivek Hybrid-9, Vivek Hybrid-21, Vivek Hybrid-33, Vivek Hybrid-39</p> <p><b>Quality protein maize (QPM):</b> Vivek QPM-9, HQPM-1</p> <p><b>Lines:</b> RCM 1-1, RCM 1-76, RCM 1-3</p>	VL Rajma-63, VL Rajma-125, IPR 98-5 (Utkarsh), HUR-15, HUR-137 and SKR-57 (Promising line)
<b>Method of sowing</b>	
<p><b>Line-sowing method:</b> After preparation of land and mixing of all the organic sources a line should be opened with the help of <i>kudal/deshi</i> plough and seed placed in the line.</p> <p><b>Dibbling method:</b> This method is time taking as the seeds are placed with the help of <i>khurpi</i>/ 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.</p>	Line-sowing
<b>Seed rate and seed inoculation</b>	
<p>Depending upon the variety and season, 15-20 kg/ha seed of maize is required for optimum plant population.</p> <p>Seed should be inoculated with <i>Azospirillum</i>, <i>Azotobacter</i> etc. and Phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing</p>	<p>100-125 kg seed/ha</p> <p><i>Rhizobium</i> inoculum @ 20 g/kg seed</p>
<b>Spacing and depth of sowing</b>	
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.
<b>Weed management</b>	
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.

<b>Crop protection:</b>	
<b>Insect pest management</b>	
<ul style="list-style-type: none"> <li>❖ 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.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Blister beetle can be managed by spraying of entomopathogenic fungi like <i>Beauveria bassiana</i> and <i>Metarhizium anisopliae</i> @ 5 g/l.</li> <li>❖ Spraying Spinosad 45 SC @ 0.3 ml/l and second spraying at 20 days interval is effective to control legume pod borer.</li> </ul>
<b>Disease Management</b>	
<p><b>Turcicum leaf blight</b> (<i>Helminthosporium turcicum</i>)</p> <ul style="list-style-type: none"> <li>❖ Grow resistant hybrids like DHM-1.</li> <li>❖ Remove plant residue from the previous crop.</li> <li>❖ Plough under the infected crop residue in the field to reduce the inoculum.</li> </ul>	<p><b>Powdery mildew</b> (<i>Erisiphe polygoni</i>)</p> <ul style="list-style-type: none"> <li>❖ Spray wettable Sulphur @ 0.25 per cent or dust Sulphur @ 25 kg/ha.</li> </ul>
<p><b>Maydis leaf blight</b> (MLB) (<i>Bipolaris maydis</i>)</p> <ul style="list-style-type: none"> <li>❖ 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.</li> <li>❖ Remove infected crop debris.</li> </ul>	<p><b>Rust</b> (<i>Uromyces phaseoli</i>)</p> <ul style="list-style-type: none"> <li>❖ Spray wettable Sulphur @ 0.25 per cent or dust Sulphur @ 25 kg/ha.</li> <li>❖ Arka Anoop is resistant to rust.</li> </ul>
<p><b>Downy mildews</b></p> <ul style="list-style-type: none"> <li>❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11.</li> <li>❖ Remove infected crop debris.</li> <li>❖ Provide proper drainage to avoid water stagnation in the field.</li> </ul>	<p><b>Anthracnose</b> (<i>Colletotrichum lindemuthianum</i>)</p> <ul style="list-style-type: none"> <li>❖ Growing resistant varieties like Pant Anupama.</li> <li>❖ Spray copper oxychloride or copper hydroxide @ 0.25 per cent.</li> </ul>
	<p><b>Leaf spot</b> (<i>Isariopsis griseola</i>)</p> <ul style="list-style-type: none"> <li>❖ Spray copper oxychloride or copper hydroxide @ 0.25 per cent.</li> <li>❖ Use healthy seeds.</li> </ul>

		<p><b>Common mosaic</b></p> <ul style="list-style-type: none"> <li>❖ Remove and destroy infected plants.</li> <li>❖ Use disease-free seeds for sowing.</li> <li>❖ Spray neem oil @ 0.3 per cent NSKE @ 5 per cent or petroleum oil-based agro spray @ 1 per cent</li> </ul>
<b>Harvesting</b>	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, Umiam, 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
<b>Land preparation</b>		
<p>The land should be properly prepared with two-three ploughing and uniform leveling with peripheral bund.</p> <p>One ploughing and puddling may be done to make the field weed-free and water retentive.</p> <p>Excessive tillage results in degradation of soil quality, causes soil and nutrient loss through erosion during heavy rains and finally leads to yield reduction.</p> <p>Organic manures like farmyard manure or composts should be applied about 15 days before transplanting and mixed with the soil during ploughing.</p>	<p>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.</p>	<p>One ploughing should be done after sunflower harvesting.</p>
<b>Organic nutrient management</b>		
<p>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.</p> <p>Mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha should be used as basal application in maize.</p> <p>Application of goat manure/poultry manure @ 1-2 t/ha as basal dose helps to overcome micronutrient deficiencies.</p>	<p>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.</p> <p>Application of goat manure/poultry manure @ 1-2 t/ha as basal dose helps to overcome micronutrient deficiencies</p>	
<b>Time of sowing</b>		

Second fortnight of June	Sunflower should be sown as <i>Rabi</i> season crop after harvesting rice.	<i>Sesbania</i> should be grown immediately after harvesting sunflower.
<b>Varieties</b>		
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	
<b>Method of sowing</b>		
Line sowing (transplanting)	Line sowing	Broadcasting
<b>Seed rate and seed inoculation</b>		
40-50 kg/ha Inoculate with <i>Azospirillum</i> , <i>Azotobacter</i> 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
<b>Spacing and depth of sowing</b>		
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.	
<b>Weed management</b>		
	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.
<b>Crop protection:</b>		
<b>Insect pest management</b>		
Spray neem oil 0.15 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval. Spray <i>Beauveria bassiana</i> @ 7 g/l at the boot leaf stage to reduce Gundhi bug population.	Application of <i>Bacillus thuringiensis</i> (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.	
<b>Disease Management</b>		
<p><b>Blast</b> (<i>Pyricularia grisea</i>) Field sanitation; and burn straw and stubbles in the field.</p> <p>Seed treatment with <i>Pseudomonas fluorescens</i> @ 6 g per kg seed.</p> <p>Dry seed treatment with <i>Pseudomonas fluorescens</i> talc formulation @ 10 g/kg.</p> <p>Use resistant/tolerant varieties.</p>	<p><b>Sclerotium wilt or rot</b> (<i>Sclerotium rolfsii</i>)</p> <p>Collect and destroy plant debris and infected plants.</p> <p>Broadcast enriched FYM @ 2.5 kg/sq m during land preparation.</p> <p><i>Trichoderma</i> spp. enriched FYM @ 2.5 kg/sq m can be applied in lines after plant emergence.</p>	
<p><b>Brown spot</b> (<i>Helminthosporium oryzae</i>)</p> <p>Hot water treatment of seed at 53-54°C for 10-12 minutes.</p> <p>Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.</p> <p>Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.</p>	<p><b>Alternaria blight</b> (<i>Alternaria helianthi</i>)</p> <p>Foliar spray of copper oxychloride @ 0.3 per cent or Bordeaux mixture @ 1 per cent from the initial appearance of disease.</p>	
<p><b>Sheath blight</b> (<i>Rhizoctonia solani</i>)</p> <p>Apply neem cake @ 150 kg/ha as basal dose.</p> <p>Spray neem oil @ 3 per cent and NSKE @ 5 per cent.</p> <p>Foliar spray of <i>P. fluorescens</i> @ 0.2 per cent at boot leaf stage and 10 days later.</p>	<p><b>Necrosis</b> (Sunflower necrosis virus)</p> <p>Spray neem oil @ 0.3 per cent or NSKE @ 5 per cent or petroleum oil-based agro spray @ 0.7 per cent.</p>	
<p><b>Bacterial leaf blight (BLB)</b> (<i>Xanthomonas oryzae</i> pv. <i>Oryzae</i>)</p> <p>Use disease-free seeds.</p> <p>Hot water treatment of seed at 52-54°C for 10 minutes.</p> <p>Use tolerant varieties.</p>		

<b>Tungro virus</b> (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).		
<b>Harvesting</b>		
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
<b>Land preparation</b>		
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.
<b>Organic nutrient management</b>		
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.

<b>Time of sowing</b>		
Transplanting: 2 <sup>nd</sup> fortnight of June. Nursery: 25-30 days prior to transplanting.	Second fortnight of November.	Month of February after harvest of fenugreek.
<b>Varieties</b>		
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
<b>Method of sowing</b>		
Line-sowing method Dibbling method	Line sowing method	Line sowing method
<b>Seed rate and seed inoculation</b>		
40-50 kg/ha Inoculated with <i>Azospirillum</i> , <i>Azotobacter</i> etc. and phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing of the crop.	25-30 kg/ha	18-20 kg/ha
<b>Spacing and depth of sowing</b>		
25 cm x10 cm Transplanting of rice should be done at a depth of 2 cm.	20 cm main- tained between rows.	45 cm x15 cm
<b>Weed management</b>		
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
<b>Crop protection:</b>		
<b>Insect pest management</b>		
<ul style="list-style-type: none"> <li>❖ Timely planting of rice.</li> <li>❖ Spray neem oil 0.15 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval.</li> <li>❖ Spray <i>Beauveria bassiana</i> @ 7 g/l at the boot leaf stage to reduce Gundhi bug population.</li> </ul>	<p><b>Powdery mildew</b> (<i>Erysiphe polygoni</i> and <i>Leveillula taurica</i>)</p> <ul style="list-style-type: none"> <li>❖ Dust sulphur @ 25 kg/ha or spray wettable sulphur @ 0.25 per cent.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Cut worm, army worm, semi-looper, stem borer and cob borer are some major pests of maize.</li> <li>❖ Spraying neem formulations 1500 ppm @ 3 ml/l or Spinosad 45 SC @ 0.3 ml/l and second spray at 20 days interval.</li> </ul>

<b>Disease Management</b>		
<p><b>Blast</b> (<i>Pyricularia grisea</i>)</p> <ul style="list-style-type: none"> <li>❖ Field sanitation.</li> <li>❖ Seed treatment with <i>Pseudomonas fluorescens</i> @ 6 g per kg seed.</li> <li>❖ Spray <i>P. fluorescens</i> talc formulation @ 0.5% three times from 45 days after transplanting at 10 day intervals.</li> <li>❖ Spray copper oxychloride @ 0.3 per cent at 7-10 day interval from the initial appearance of disease.</li> <li>❖ Use of bael (<i>Aegle marmelos</i>) leaves extract @ 2.5 per cent.</li> </ul>		<p><b>Turcicum leaf blight</b> (<i>Helminthosporium turcicum</i>)</p> <ul style="list-style-type: none"> <li>❖ Grow resistant hybrids like DHM-1.</li> <li>❖ Remove plant residue from the previous crop.</li> <li>❖ Plough the infected crop residue to reduce the inoculum.</li> </ul>
<p><b>Brown spot</b> (<i>Helminthosporium oryzae</i>)</p> <ul style="list-style-type: none"> <li>❖ Hot water treatment of seed at 53-54°C for 10-12 minutes.</li> <li>❖ Sanitation and crop rotation with legumes and oil seed crops.</li> <li>❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.</li> </ul>		<p><b>Maydis leaf blight</b> (MLB) (<i>Bipolaris maydis</i>)</p> <ul style="list-style-type: none"> <li>❖ Growing resistant varieties viz., VL-42, Prabhat, PEMH-1, PEMH-2 and PEMH-3</li> <li>❖ Remove infected crop debris.</li> <li>❖ It is important to control the disease during the period from 14 days before tasseling to 21 days after tasseling for optimal control.</li> </ul>
<p><b>Sheath blight</b> (<i>Rhizoctonia solani</i>)</p> <ul style="list-style-type: none"> <li>❖ Crop rotation with oil seeds and pulses.</li> <li>❖ Apply neem cake @ 150 kg/ha as basal dose.</li> <li>❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.</li> <li>❖ Foliar spray of <i>P. fluorescens</i> @ 0.2 per cent at boot leaf stage and 10 days later.</li> <li>❖ Soil application of <i>P. fluorescens</i> @ 2.5 kg/ha mixed with 50 kg FYM after 30 days of transplanting.</li> </ul>		<p><b>Downy mildews</b></p> <ol style="list-style-type: none"> <li>1. Sorghum downy mildew (<i>Perenosclerospora sorghii</i>):</li> <li>2. Brown stripe downy mildew (<i>Sclerophthora rayssiae</i>):</li> </ol> <ul style="list-style-type: none"> <li>❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11.</li> <li>❖ Early planting is recommended for sorghum downy mildew.</li> <li>❖ Provide proper drainage to avoid water stagnation in the field.</li> </ul>

<ul style="list-style-type: none"> <li>❖ Most of varieties cultivated in Sikkim are found to be resistant under organic conditions.</li> </ul>		
<p><b>Bacterial leaf blight (BLB)</b> (<i>Xanthomonas oryzae</i> pv. <i>Oryzae</i>)</p> <ul style="list-style-type: none"> <li>❖ Hot water treatment of seed at 52-54°C for 10 minutes.</li> <li>❖ Avoid flow of water from one field to the other.</li> <li>❖ Drain the field except during flowering stage.</li> <li>❖ Remove and destroy previous crop residue, volunteer plants and stubbles.</li> <li>❖ Spray copper oxychloride @ 0.3 per cent 35 days after and 45 days after planting.</li> <li>❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.</li> </ul>		
<p><b>Tungro virus</b> (Rice Tungro Virus)</p> <ul style="list-style-type: none"> <li>❖ Deep summer ploughing.</li> <li>❖ Apply neem cake @ 150 kg/ha as basal dose.</li> <li>❖ 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).</li> <li>❖ Destroy weed hosts of virus and leaf hopper.</li> <li>❖ Set up light traps to monitor and destroy hoppers which transmit various RTV in rice</li> </ul>		

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, Meghalaya

## 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)
<b>Land preparation</b>		
2-3 ploughing and one puddling should be done.	Two-three ploughing to good tilth.	Two-three ploughing to good tilth.
<b>Organic nutrient management</b>		
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>i.e.</i> , half amount applied in rows opened for placing the seeds.	FYM @ 10-15t/ha should be applied 20 days before sowing.
<b>Time of sowing</b>		
❖ Transplanting: 2 <sup>nd</sup> fortnight of June. ❖ Nursery: 25-30 days prior to transplanting.	Second fortnight of November.	Mid February to first fortnight of March.
<b>Varieties</b>		



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
<b>Method of sowing</b>		
❖ Line-sowing method ❖ Dibbling method	Line sowing method	Line sowing method
<b>Seed rate and seed inoculation</b>		
@ 40-50 kg/ha Inoculated with <i>Azospirillum</i> , <i>Azotobacter</i> 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
<b>Spacing and depth of sowing</b>		
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.
<b>Weed management</b>		
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
<b>Crop protection:</b>		
<b>Insect pest management</b>		
❖ 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 <i>Beauveria bassiana</i> @ 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.

<b>Disease Management</b>		
<p><b>Blast</b> (<i>Pyricularia grisea</i>)</p> <ul style="list-style-type: none"> <li>❖ Field sanitation.</li> <li>❖ Seed treatment with <i>Pseudomonas fluorescens</i> @ 6 g per kg seed.</li> <li>❖ Spray <i>P. fluorescens</i> talc formulation @ 0.5% three times from 45 days after transplanting at 10 day intervals.</li> <li>❖ Spray copper oxychloride @ 0.3 per cent at 7-10 day interval from the initial appearance of disease.</li> <li>❖ Use of bael (<i>Aegle marmelos</i>) leaves extract @ 2.5 per cent.</li> </ul>	<p><b>Wilt and Root Rot</b> (<i>Fusarium oxysporum</i> and <i>Rhizoctonia solani</i>)</p> <ul style="list-style-type: none"> <li>❖ Early sowing.</li> <li>❖ Drench soil with copper oxychloride @ 0.25 per cent.</li> <li>❖ Crop rotation for at least 2-3 years with suitable non-leguminous crops should be followed.</li> </ul>	<p><b>Turcicum leaf blight</b> (<i>Helminthosporium turcicum</i>)</p> <ul style="list-style-type: none"> <li>❖ Grow resistant hybrids.</li> <li>❖ Remove plant residue from the previous crop.</li> <li>❖ Plough the infected crop residue to reduce the inoculum.</li> </ul>
<p><b>Brown spot</b> (<i>Helminthosporium oryzae</i>)</p> <ul style="list-style-type: none"> <li>❖ Hot water treatment of seed at 53-54°C for 10-12 minutes.</li> <li>❖ Sanitation and crop rotation with legumes and oil seed crops.</li> <li>❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.</li> </ul>	<p><b>Powdery mildew</b> (<i>Erysiphe Rust</i> (<i>Uromyces fabae</i>))</p> <ul style="list-style-type: none"> <li>❖ After harvest, the affected plant trash should be burnt.</li> <li>❖ Follow suitable crop-rotation with non-leguminous crops.</li> <li>❖ Dust sulphur @ 25 kg/ha or spray wettable sulphur.</li> <li>❖ Early sowing in the month of October.</li> <li>❖ Resistant varieties viz., Arka Ajit, Arka Karthik and Arka Sampoorna and moderately resistant, Arka Apoorva.</li> </ul>	<p><b>Maydis leaf blight</b> (MLB) (<i>Bipolaris maydis</i>)</p> <ul style="list-style-type: none"> <li>❖ Growing resistant varieties.</li> <li>❖ Remove infected crop debris.</li> <li>❖ It is important to control the disease during the period from 14 days before tasseling to 21 days after tasseling for optimal control.</li> </ul>
<p><b>Sheath blight</b> (<i>Rhizoctonia solani</i>)</p> <ul style="list-style-type: none"> <li>❖ Crop rotation with oil seeds and pulses.</li> <li>❖ Apply neem cake @ 150 kg/ha as basal dose.</li> <li>❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.</li> </ul>		<p><b>Downy mildews</b></p> <p>Sorghum downy mildew (<i>Perenosclerospora sorghii</i>)</p> <ul style="list-style-type: none"> <li>❖ Brown stripe downy mildew (<i>Sclerophthora rayssiae</i>)</li> </ul>

<ul style="list-style-type: none"> <li>❖ Foliar spray of <i>P. fluorescens</i> @ 0.2 per cent at boot leaf stage and 10 days later.</li> <li>❖ Soil application of <i>P. fluorescens</i> @ 2.5 kg/ha mixed with 50 kg FYM after 30 days of transplanting.</li> <li>❖ Most of varieties cultivated in Sikkim are found to be resistant under organic conditions.</li> </ul>		<ul style="list-style-type: none"> <li>❖ Use resistant varieties like DMR-1, DMR-5 and Ganga-11.</li> <li>❖ Early planting is recommended for sorghum downy mildew.</li> <li>❖ Provide proper drainage to avoid water stagnation in the field.</li> </ul>
<p><b>acterial leaf blight (BLB)</b> (<i>Xanthomonas oryzae</i> pv. <i>Oryzae</i>)</p> <ul style="list-style-type: none"> <li>❖ Hot water treatment of seed at 52-54°C for 10 minutes.</li> <li>❖ Avoid flow of water from one field to the other.</li> <li>❖ Drain the field except during flowering stage.</li> <li>❖ Remove and destroy previous crop residue, volunteer plants and stubbles.</li> <li>❖ Spray copper oxychloride @ 0.3 per cent 35 days after and 45 days after planting.</li> <li>❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.</li> </ul>		
<p><b>BTungro virus</b> (Rice Tungro Virus)</p> <ul style="list-style-type: none"> <li>❖ Deep summer ploughing.</li> <li>❖ Apply neem cake @ 150 kg/ha as basal dose.</li> </ul>		

<ul style="list-style-type: none"> <li>❖ 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).</li> <li>❖ Destroy weed hosts of virus and leaf hopper.</li> <li>❖ Set up light traps to monitor and destroy hoppers which transmit various RTV in rice.</li> </ul>		
<b>Harvesting</b>		
110-150 days after planting depending upon the varieties.	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
<b>Package and practices - Land preparation</b>	
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 <i>kudal</i> 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 <i>kudal</i> or prototype no-till drill machines.

<b>Organic nutrient management</b>	
<ul style="list-style-type: none"> <li>❖ Mixed compost @ 2.5 t/ha and neem cake @ 0.5 t/ha should be applied as basal dose in rice.</li> <li>❖ Application of vermicompost @ 2.5 t/ha should be done in two equal splits <i>i.e.</i>, half amount applied 40 DAT and half 75 DAT for efficient utilization.</li> </ul>	Apply vermicompost or neem cake @ 1.0 t/ha in furrows open for sowing of the seeds.
<b>Time of sowing</b>	
Second fortnight of June	Second fortnight of November immediately after harvest of rice.
<b>Method of sowing</b>	
Line-sowing method	Dibbling method
<b>Seed rate</b>	
40-50 kg/ha	Early maturing dwarf varieties (80-100 kg seed/ha) and for late maturing and tall varieties (75-80 kg/ha)
<b>Seed inoculation</b>	
Inoculate with <i>Azospirillum</i> , <i>Azotobacter</i> etc. and phosphorus solubilizing bacteria (PSB) @ 20 g/kg seed before sowing of the crop.	<i>Rhizobium</i> inoculum @ 20 g/kg seed is sprinkled, mixed in <i>jaggery</i> solution.
<b>Spacing</b>	
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.
<b>Varieties</b>	
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.
<b>Weed management</b>	
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.
<b>Crop protection:</b>	
<b>Insect pest management</b>	

<ul style="list-style-type: none"> <li>❖ Spray neem oil 0.15 EC @ 3 ml/l at 10 DAT followed by second spray after 20 days interval.</li> <li>❖ Spray <i>Beauveria bassiana</i> @ 7 g/l at boot leaf stage to reduce Gundhi bug population.</li> </ul>	<p>Aphids: Petroleum oil-based agro spray @ 10 ml/l or neem oil (1500 ppm) @ 3 ml/l can be sprayed for effective management.</p>
<b>Disease management</b>	
<p><b>Blast</b> (<i>Pyricularia grisea</i>)</p> <ul style="list-style-type: none"> <li>❖ Field sanitation; and burn straw and stubbles in the field.</li> <li>❖ Seed treatment with <i>Pseudomonas fluorescens</i> @ 6 g per kg seed.</li> <li>❖ Dry seed treatment with <i>Pseudomonas fluorescens</i> talc formulation @ 10 g/kg.</li> <li>❖ Use resistant tolerant varieties.</li> </ul>	<p><b>Wilt and Root Rot</b> (<i>Fusarium oxysporum</i> and <i>Rhizoctonia solani</i>)</p> <ul style="list-style-type: none"> <li>❖ Early sowing should be avoided to escape from high humidity and high temperature which are congenial for the disease.</li> <li>❖ Drench soil with copper oxychloride @ 0.25 per cent.</li> <li>❖ Crop rotation for at least 2-3 years with suitable non-leguminous crops should be followed.</li> </ul>
<p><b>Brown spot</b> (<i>Helminthosporium oryzae</i>)</p> <ul style="list-style-type: none"> <li>❖ Hot water treatment of seed at 53-54°C for 10-12 minutes.</li> <li>❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.</li> <li>❖ Spray Bordeaux mixture @ 1 per cent or COC @ 0.25 per cent at regular intervals to reduce the disease.</li> </ul>	<p><b>Powdery mildew</b> (<i>Erysiphe polygoni</i>)</p> <ul style="list-style-type: none"> <li>❖ Late planting should be avoided.</li> <li>❖ Remove and destroy plants after harvest.</li> <li>❖ 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.</li> <li>❖ Spraying 10 per cent milk dilution at 10 days interval is effective modification of pH conditions.</li> </ul>
<p><b>Sheath blight</b> (<i>Rhizoctonia solani</i>)</p> <ul style="list-style-type: none"> <li>❖ Apply neem cake @ 150 kg/ha as basal dose.</li> <li>❖ Spray neem oil @ 3 per cent and NSKE @ 5 per cent.</li> <li>❖ Foliar spray of <i>P. fluorescens</i> @ 0.2 per cent at boot leaf stage and 10 days later.</li> </ul>	<p><b>Rust</b> (<i>Uromyces fabae</i>)</p> <ul style="list-style-type: none"> <li>❖ After harvest the affected plant trash should be burnt.</li> <li>❖ Follow suitable crop-rotation with non-leguminous crops.</li> <li>❖ Dust Sulphur @ 25 kg/ha or spray wettable sulphur.</li> <li>❖ Early sowing in the month of October.</li> <li>❖ Grow resistant varieties like Arka Ajit, Arka Karthik and Arka Sampoorna and moderately resistant, Arka Apoorva.</li> </ul>

<p><b>Bacterial leaf blight (BLB)</b> (<i>Xanthomonas oryzae</i> pv. <i>Oryzae</i>)</p> <ul style="list-style-type: none"> <li>❖ Use disease-free seeds.</li> <li>❖ Hot water treatment of seed at 52-54°C for 10 minutes.</li> <li>❖ Use tolerant varieties.</li> </ul>	
<p><b>Tungro virus</b> (Rice Tungro Virus)</p> <ul style="list-style-type: none"> <li>❖ 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).</li> </ul>	
<p><b>Harvesting</b></p>	
<p>100-140 days after planting depending upon the varieties.</p>	<p>The pod of vegetable pea should be ready for first picking 85-95 days after sowing.</p>

**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

