Enhancement of farm income through crop diversification in Chandel district of Manipur

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Chandel is a hilly district situated in the south-eastern part of Manipur with an area of 3,313 square kilometers, at approximately 24°40'N latitude and 93°50'E longitude. The district is situated under the agro-climatic zone of III Humid Eastern Himalaya Region and Bay Island. The soil type is predominantly red or lateritic, while the hilly regions or the upland are rich in organic matter and are acidic in nature. The main river in the area is the Chakpi.

Lambung is one of the largest villages situated in Chandel district, with a population of 1,021 according to the 2011 census. Of this, 489 were males and 532 females. The village's literacy rate stands at 72.77%, with 71.98% of males and 73.50% of females being literate. The village consists of around 232 households. Lambung village falls under the subtropical agro-climatic zone. Agriculture and allied activities form the backbone of the village economy. Paddy is the main crop grown in the village. Two primary farming practices are prevalent: shifting cultivation, predominantly carried out in rain-fed upland areas with steep slopes, and wetland rice cultivation, practiced on gently sloping rain-fed uplands. The other crops cultivated include maize, soybean, mustard, ginger, groundnut and vegetables, while fruits like banana, lemon, and mango are also grown sporadically. Livestock rearing is also practiced to bring in additional source of income.

Under 'National Innovations on Climate Resilient Agriculture (NICRA)' project, Lambung village was chosen as the model village. The initiative is implemented by the Krishi Vigyan Kendra (KVK) at the district level, regionally overseen by Zonal Project Directorates, and centrally coordinated by the Central Research Institute of Dryland Agriculture, KVK Chandel officially launched the NICRA project in 2022. The primary goal of the project is to strengthen the resilience of agriculture against climate change and associated vulnerabilities through targeted research and the demonstration of innovative technologies. The research focuses on adaptation and mitigation strategies across various domains, including crops, livestock, fisheries, and natural resource management. As part of the project, KVKs have demonstrated climate-resilient technologies under four key modules: Natural Resource Management (NRM), Crop production, Livestock and Fisheries, and Institutional interventions. In addition to these demonstrations, the project also emphasizes capacity-building programs and extension activities.

Climate change has significantly impacted the village, particularly in terms of rainfall. Key climatic vulnerabilities include prolonged dry spells or water stress due to erratic rainfall and high-intensity rain events. The steep topography leads to minimal water retention, causing perennial water sources to dry up during pre-monsoon and post-monsoon periods. Being heavily reliant on rainfall, the village faces considerable challenges in crop production. Moreover, traditional method of cultivation forces farmers for monocropping and results in low yield besides attack of pest and diseases on crops. Because of lack of proper post-harvest management, farmers are facing the problem of distress sale and wastage of agriculture products too.

The village of Lambung experiences subtropical monsoon climate characterized by distinct seasonal variations in temperature, rainfall, and humidity. The summer months are typically hot and wet, while the winter months are cold and dry.

Temperature

The average summer temperatures range from 32°C to 36°C, with the hottest period occurring in June and July. Winter temperatures generally range from 4°C to 6°C, with December being the coldest month. Although the village experiences a favourable temperature for growing both Kharif and Rabi crops, it is prone to pest and disease outbreaks. To mitigate the effects of high temperatures on food crops, it is essential to cultivate heat-resistant or heat-tolerant varieties, ensuring food security for future generations.

Rainfall

The district receives an average annual rainfall of 1164.4 mm, primarily during the south-west monsoon season (May to August). Rainfall is minimal

between November and January. Despite sufficient seasonal rainfall, rainwater use efficiency for crop production is low (30–45%), resulting in substantial losses (600–900 mm) through surface runoff and deep drainage. The rainfall pattern is irregular, particularly during the monsoon season (June to September), with significant fluctuations. There is also a prolonged dry spell during the Rabi and pre-Kharif seasons (January, February, October, November, and December), which poses challenges for crop cultivation.

The climatic pattern in the district

The climatic year is divided into four distinct seasons:

1. **Cold Season (December–February):** Characterized by low temperatures and reduced humidity.
2. **Hot Dry Season (March–April):** Marked by rising temperatures and minimal rainfall.
3. **Rainy Season (May–September):** Associated with high temperatures, heavy rainfall, and high evapotranspiration rates.
4. **Retreating Monsoon Season (October–November):** Transition period with decreasing rainfall and moderate temperatures.

Humidity

Relative humidity in the district is moderate to high throughout the year. Winter months experience low humidity, often accompanied by clear skies post-monsoon. Fog, especially in valleys, is common during winter mornings and typically dissipates by midday.

Wind Velocity

Winds are generally light during the monsoon season and moderate to strong during other periods, often influenced by local topography. Thunderstorms, particularly during May and June, can bring strong winds. Easterly winds are common during foggy winter mornings, while winds in the plains predominantly blow from the northwest throughout the year.

Evapotranspiration

Evapotranspiration rates are high during the monsoon months, contributing to significant water loss. Thunderstorms are frequent between May and September, peaking in May and June. Pre-monsoon thunderstorms can be intense, resembling "nor'westers," while occasional hailstorms are observed between December and April.

The village is categorized into 3 farming typologies:

1. Rain fed Upland (Hills with steep slopes)
2. Rain fed Upland without animal (Hills with mild slopes)
3. Rain fed Upland with animal (Hills with mild slopes)

1. Rain fed Upland (Hills with steep slopes)

Problems: The rainfed upland with steep slope faces several challenges in agriculture, such as erratic and unseasonal/untimely rainfall, prolonged dry spells, low soil fertility, and significant soil erosion. Traditional farming practices often involve long-duration crops that are highly sensitive to climate variability, making them vulnerable to changing weather patterns. On top of this, pests add to the challenges they face.

Introduction of high yielding climate resilient Soybean variety DSB-19 and Maize variety RCM-1-76

Soybean variety DSB-19 is a climate-resilient crop that plays an important role in sustainable agriculture by enriching the soil through biological nitrogen fixation. It integrates well into various cropping systems without interfering with the other crops. However, soybean yields in the region have traditionally been low due to the continuous use of old varieties, higher seed rates, and irregular sowing times. Maize variety RCM-1-76 is another high-yielding crop well-suited to local conditions, maturing in just 75-80 days. This allows it to be successfully followed by main rabi crops. A demonstration on maize and soybean was conducted with six beneficiary farmers, covering an area of 2 hectares.

The results were promising. Farmers achieved a soybean yield of 13.88 quintals per hectare, compared to 10.10 quintals per hectare with traditional varieties—a yield increase of 37%. Similarly, maize yields reached 32.43 quintals per hectare, up from 26.33 quintals per hectare with traditional varieties, reflecting a yield increase of 23.16%. Despite these gains, production was slightly lower than in 2023 due to excessive and untimely rainfall, which damaged some portions of the crops.

The interventions in Lambung village, Chandel district have successfully strengthened the

resilience of agriculture by promoting climate-resilient practices and improving resource management. Key strategies such as introducing drought-tolerant crop varieties, integrated farming systems, and water conservation techniques have diversified farmer incomes and enhanced productivity. The focus on training and capacity-building has empowered local farmers to better cope with erratic weather patterns, pests, and soil degradation. These efforts have led to more sustainable farming practices, improved livelihoods, and a model that can be scaled across the district to address the ongoing challenges of climate change.

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