CHAPTER 3

Zabo (Zabü) Farming of Kikruma Village, Nagaland, India

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Introduction

The Naga farmers have since time immemorial worked closely with nature by understanding the rich resources to innovatively develop farming systems to their advantage. Tested indigenous knowledge of farming is orally passed down through generations and is still in practice along with the modern agriculture farming technologies. One such farming system that has already been accepted and acknowledged by all stakeholders to be one of the best practices and sustainable farming approaches is the cultivation method developed by the Kikruma village of Phek district, Nagaland, India.

The Zabo (Zabü) farming method is similar to IFS (Integrated Farming System). The only difference is in the involvement of the entire farming families of the village and the sharing of the rainwater harvesting during the cropping season and management of land and off-farm activities.

There is ample scope for this indigenous farming system to be adopted with technology intervention in hill agriculture where farmers face water scarcity and soil erosion.

Nagaland

Nagaland is one of the smallest states in India. Located in northeastern India, it occupies an area of 16,579 sq km, having a population of 1,978,502. Agriculture is the main occupation and the state has the potential to cultivate approximately 721,924 lakh hectare, that is, 4.35% of the total geographical area. The topography of Nagaland is largely undulating hilly terrain, situated between 25'06 °N and 27'04 °N latitude and 93'20 °E and 95'15 °E longitude. The state harbors rich and diverse natural resources that can be attributed to its unique geographical location. It is bordered by three states: on the west and north by Assam, on the north by Arunachal Pradesh, and on the south by Manipur. It shares a wide international border with

Myanmar on the east (Directorate of Economics & Statistics, Nagaland: Kohima, 2019).

Climate

The state experiences a typical monsoon marked with contrasting subtropical to temperate seasons across altitudes that range from 194 m to 3840 m above sea level. The average rainfall is 2,500 mm with heavy rains from May to August, and occasionally from September to October, with a dry spell occurring from November to April.

Agriculture

More than 70% of its population depends on agriculture and allied activities for its income and livelihood. The total farming households of 250,360 traditionally practice three types of farming that are mostly rice-based systems. They are classified as:

- Jhum farming or shifting cultivation, often termed as the "slash and burn" method;
- Terrace Rice Cultivation (TRC) practiced in the hilly regions following the monsoon season as their crop calendar; and
- Wet Rice Cultivation practiced in the foothills, lowlands, valleys, and catchment areas where perennial water and irrigation facilities can be sourced.

(Department of Agriculture, Government of Nagaland, 2019)

TRC is practiced more commonly in the districts of Phek and Kohima along the hill slopes cutting them into flat beds through land shaping with provisions for irrigation water to flow. The department has documented 109 indigenous rice varieties of TRC alone cultivated by the rice farmers of the Chakhesang tribe over generations (Department of Agriculture, Government of Nagaland, 1997).

Best Practices: Zabo/Zabü Farming

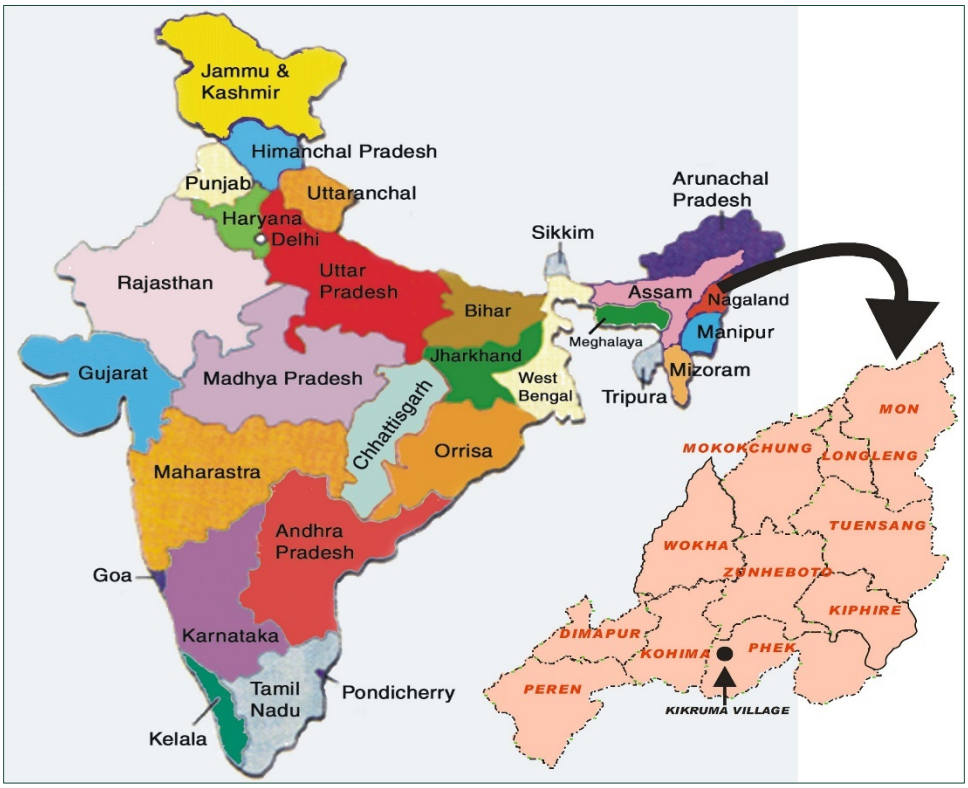
The Naga farmers have, since time immemorial, worked closely with nature and have used the terrain as their natural farming systems. These time-tested indigenously developed farming methods are still in practice today in the remote and sloping farm areas. One such farming system that has already been widely accepted, duplicated, and acknowledged by all stakeholders to be a sustainable method of farming is the Zabo/Zabü of Kikruma village.

Profile & Location of Kikruma Village

The Kikruma village in Nagaland lies in geo-coordinate latitude 25.58 and longitude 94.21. It is situated at an altitude of 1,643 meters above sea level. The village is 68 km away from its district headquarter Phek and approximately 52 km east from the state capital Kohima. The village has 1,664 households that make a population of 7,298 with a literacy rate of

78.31%. It is located on a hilltop where perennial water sources are scant. The villagers belong to the Chakhesang tribe, considered to be one of the hardest working communities having traditional knowledge and experience in hill farming (see Figure 3-1).

Figure 3-1. India map with Kikruma village.



The farming community of Kikruma village has developed its own unique, indigenous system of water harvesting that nurtures the soil and enhances agriculture production specifically to irrigate the rice fields. This simple and effective method is known as the *Zabo/Zabü farming system of Kikruma*. It combines agriculture and forestry land use with built-in water-harvesting-recycling systems and conservation measures. In the process, soil erosion is checked, and the water sources and soil fertility are managed sustainably involving the entire village community.

The history of the unique farming system can be traced back to the village forefathers who faced acute water scarcity, leading them to develop an elaborate water and land efficient management system (Nagaland Environmental Protection and Economic Development & International Institute of Rural Reconstruction, 1999).

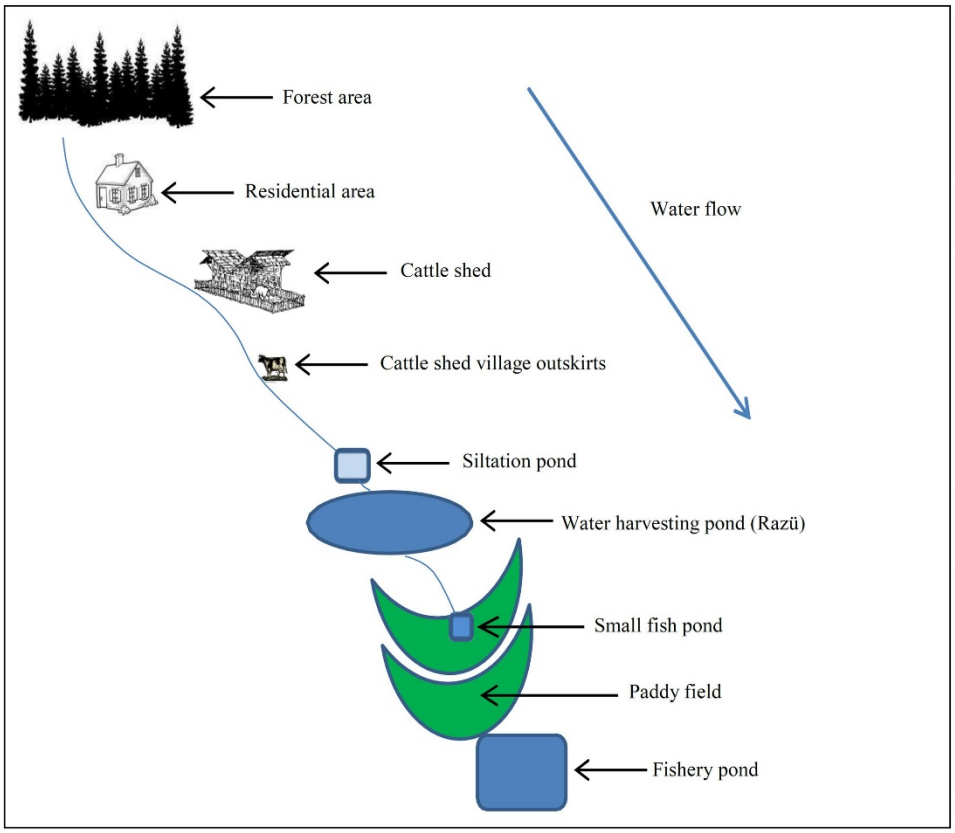
What Is Zabo/Zabü Farming?

The word *Zabo* can be traced back to a local dialect word *Zabü*, which is translated as "impounding runoff water and utilization." It is an approach to farming that integrates forestry, agriculture, fishery, and animal husbandry activities by using harvested rainwater.

The three-tier system consists of the top of the hill having protected village forestland (forest area); the mid-hilly section where the village resides (residential area) and maintains the water-harvesting ponds called *Rüza*

(*Razü* in local dialect) and cattle yard and dairy farms (cattle shed and cattle shed village); and the third lower section where rice cultivation or paddy fields, and fishery ponds of the farmers are located (see Figure 3-2).

Figure 3-2. Schematic diagram of Zabo/Zabü farming system.



The Practices & Technique

Upper Section, Tier, or Top Forest Area

The village communities conserved forest area is located at the hilltop of the village. Strict rules are enforced regarding foraging and collecting of wild foods (leaves, berries, fruits, seeds, roots, and barks), and harvesting of the forest timber. Such activities are normally taken up during the dry seasons of winter(see Figure 3-3).

Figure 3-3. Village conserved forest area at the top and paddy field at the lower section.

Mid-Section: Water-Harvesting Ponds or Rüza

The community or farmers themselves hand dig the ponds to harvest the rainwater during the monsoon season. For this work, the bottom surface of the ponds are thoroughly puddled (mixed) and the sides of the ponds are rammed and compressed using a strong coarse sacking jute bag(gunny bag) tied to a wooden or bamboo pole, then hand plastered. This exercise of using mud to plaster and compress minimizes the loss of water through seepage. Sometimes more than one pond is constructed so that the surplus water flows down to the pond or ponds below. If the farming family is unable to find a suitable location for construction of the water storage tanks or water ponds, the runoff from the catchment area is directly led to the paddy fields to store and use for irrigation purposes. To control water seepage, generous amounts of the husk of the rice left after milling is also used and incorporated into the mud bunds (earthen dams) by smoothing them out or plastering them with mud. A pond measuring 3 m by 2 m by 2 m can irrigate terraces that yield 600 kg of rice (see Figure 3-4).

Figure 3-4. Using a pole tied to a gunny bag, a farmer rams and compresses the side wall of a pond.

Water-Harvesting Structures & Channel Preparation

Once the monsoon rain starts, the rainwater flowing from the forest hilltops or even from residential areas and small puddles acts as a catchment area. Through gravitational flow and manmade channels, the rainwater is diverted to the harvesting ponds (see Figure 3-5). The water channels are maintained at suitable locations and small bamboo check dams are erected at intervals to control soil erosion (see Figure 3-6). In addition, silt retention tanks or small ponds are constructed at several points before the runoff water is allowed to accumulate in the harvesting structures. The accumulated rainwater is stored in the silt retention tanks for two or three days before being transferred to the main water-harvesting ponds. Water is then released from the pond for irrigation by opening or cutting an outlet at the base of the water pond by use of bamboo pipes to allow water to flow from one field to the next. To reduce water filter, the water channels are also compacted by hammering or beating down its base (see Figures 3-7 and 3-8).

Figure 3-5. Rainwater from hilltop channeling down to the harvesting pond.

Figure 3-6. Water channel with bamboo check dam made to control soil erosion.

Figure 3-7. Water from siltation pond flowing to the main harvesting pond.

Figure 3-8. Water flowing from harvesting pond to the main paddy or rice field.

Supporting Activities: Sharing Water & Repairing Ponds & Channels

The sharing of water from the catchment area to the harvesting pond is mutually undertaken to ensure that every farmer gets an equal share of irrigation water from the catchment areas during a crop season. In situations where a farmer receives less water, the problem is settled through a rotation basis. Further, diversions from the catchment areas are created with demarcated water channels, usually 6.66 to 20 m long, for each farmer. Sharing of the harvested water between families is exercised through mutual discussions, ensuring that every farmers' plot in the village benefits. The remaining excess water is then drained out to fishery ponds (see Figures 3-9 and 3-10).

The water benefit sharing process is a serious affair since the cultivation of agricultural crops and rearing of animals depends on these exercises. Therefore, all of the families who own the rice terraces, irrespective of the farm size, participate in the clearing, cleaning, and repairing of the siltation tanks, ponds, and channels. During such exercises, the strong bonding that exists within the Kikruma village community is displayed.

Figure 3-9. Water sharing from one crop field to the next.

Figure 3-10. Excess water drained to the fishery pond, the lowest tier or section.

Animal Nutrition & Management

The water-harvesting ponds and tanks not only serve as a water reservoir for irrigation but they are also a source of drinking water for cattle and other animals of the village. Cattle, pigs, poultry, and birds are also let loose in the forest, and the cattle under enclosures are provided nutrients from these water-harvesting ponds. Animal husbandry activities are usually located near and above the water-harvesting pond. The water collected in the catchment area is allowed to pass through the cattle yard, carrying with it manure and urine, which is nutrient rich, before holding in the tank or pond or directly passed on. In situ manuring is also practiced using *azolla*, a green manuring crop, and paddy stubbles (see Figures 3-11 and 3-12).

Figure 3-11. Animal manure flow from cattle shed.

Figure 3-12. Manure from cattle shed flowing to the water-harvesting pond.

Water Utilization in the Paddy or Rice Fields

The harvested water from the catchment along with animal dung and urine is left in the water-harvesting pond for about a month. Some farmers rear fishes for additional income. The water is then released to the main field through an outlet maintained about 6 inches in height directly to the main field or through bamboo poles as needed (see Figure 3-13). Fish fingerlings are introduced in June and July right after the transplanting of rice seedlings. The fish is harvested in September and October after the water is drained from the terraces. Some farmers introduce snails as another source of income.

Figure 3-13. Paddy straw or stubbles and pulse crop left in situ.

Use of Water in the Main Crop Field

Paddy fields are terraces, which are generally of 0.2 to 0.8 hectares in size, located at the lower elevations of the village. The bunds are cut at a 45 degree angle by using a specific indigenous spade that is outwardly curved. At the time of puddling, the bunds are thoroughly rammed or pressed and mud plastered manually with wooden sticks to create a hard pan to reduce percolation and filtration of water. Two supplementary irrigations are provided from the water-harvesting ponds to the main field, to maintain a 10 cm height (see Figures 3-14 and 3-15). The paddy-cum-fish culture is practiced by most of the farmers.

Figure 3-14. Bunds cut at an angle slope with indigenous spade or hoe.

Figure 3-15. Bunds or earthen dams prepared by ramping or pressing down and plastering.

Harvesting

When the paddy crop attains ripening stage, the tillers are bunched and tied together by draining out the water (see Figure 3-16). This activity generally takes place during October and November and is followed by harvesting, which extends to December. Right after the harvesting, the threshing operation is carried out in the main field right away to reduce the pest and rodent infestations (see Figure 3-17). Hays, along with the paddy stubbles, are left in the field plots to rot. When water is drained out from the terraces, the fish gets collected in the nearby smaller ponds for the next season. Harvests from paddy and fish range from 3 to 4 tons per hectare and 50 to 60 kg per hectare respectively.

Figure 3-16. Paddy bunched and tied for harvesting.

Figure 3-17. Threshing of paddy in the farm.

Post-Harvest Operations

Once the paddy is harvested, the terraces are again prepared for cultivation of winter crops. During this time, the bunds are rammed again and mud plastered. Some farmers opt to maintain standing water and rear fish for the next season or practice *azolla* culture. During this operation, the paddy straw and stubbles are incorporated into the bunds to clear ways for fish (see Figures 3-18 and 3-19) (Agricultural Technology Management Agency, Phek, 2017).

The Kikruma village agricultural crop system follows a specific calendar. Table 3-1 outlines each month's activities.

Figure 3-18. Bunds rammed after harvesting to check seepage, and water way cleared for fish.

Figure 3-19. Terrace fields left with rice stubbles for next crop season.

Table 3-1. Monthly agricultural crop calendar of Kikruma village, as narrated by Kikruma farmers and village council in 2017.

Month	Activity
March	Preparation of nursery bed outside the main paddy field
April	Preparation of catchment areas and sowing paddy in nurseries and harvesting of early winter crops
May	▪ Harvesting of winter crops sown during the month of January ▪ Clearing and removal of debris in the irrigation channels/drainage ▪ Enriching the main field by incorporation of green manuring plants and forest leaves ▪ Cleaning and preparation of bunds by scraping (cleaning and smoothening) and compacting the soil. ▪ Preparation of water-harvesting ponds ▪ Re-aligning the water channels
June	▪ Lifting the paddy sapling and transplanting in the main field ▪ Addition of fish fingerlings ▪ Plastering of the bunds with mud
July	▪ Addition of decomposed organic leaves and bio compost ▪ Intercultural operation—irrigation
August	▪ Weeding ▪ Cleaning and re-plastering the bunds
September	Intercultural operation
October	▪ Bunching (tying up) of half-ripe paddy stalks to prevent lodging ▪ Harvesting of paddy by last week
November	Harvesting and threshing (separating paddy from stalk) near the main field.
December	▪ Cutting the paddy straw into smaller lengths for compost making ▪ In situ manuring of cut straw ▪ Preparation of the rice fields by ploughing/hand digging/hoeing for cultivation of winter crop.
January	▪ Sowing of winter crop seeds ▪ Addition of manure and compost of poultry, cattle, and rice husk
February	Intercultural operation-weeding and irrigation.

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