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Jhum practices of Naga king chilli cultivation in Nagaland

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Naga king chilli is viewed as one of the most prominent spice crops grown in the state of Nagaland. Hence, an attempt has been made to document the *jhum* practices of Naga king chilli from three districts *viz.*, Peren, Dimapur and Mon in Nagaland following descriptive research design. Based on proportionate random sampling 250 Naga king chilli farmers were selected. Primary data/ first-hand information was obtained directly from the farmers through personal interviews with the help of pre-tested interview schedule; further discussion and field survey were included. Following practices were identified: 'slash and burn' of forest vegetation on steep hill slope; bamboo poles, fallen trees and boulders constructed across the slope to check soil erosion; colocasia, ginger, maize, millets and jobs-tears planted along the borders and across the slope for soil and water management; indigenous pest disease management practices include, use of ash, seed treatment with '*bastenga*', growing Naga king chilli between rice were found effective against aphids, thrips, mealy bugs, white fly; bamboo stump, banana growing areas which had been slashed and burned for cultivation purpose, rocky areas were viewed as a site of nutrient deposition among the farmers and hence considered ideal for Naga king chilli cultivation. These traditional practices have adaptive and mitigation properties and could be merged with modern sustainable farming practices to address the challenges of present-day world for efficiency, productivity and sustainability.

Keywords: King chilli, Naga, Nagaland, Traditional knowledge

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Traditional agriculture practices are conservative and localized in the indigenous community[1]. It represents generational interaction of indigenous farmers with the ecosystem without access to any extrinsic resources or modern scientific information, evolved in the shape of diversified farming systems. Traditional farming system in Nagaland is hugely sophisticated. Farming families, for sustenance, maintain multiple forms of agricultural practices, mainly *jhum*/shifting type of farming. The hilly and mountainous regions constrain the farmers to adopt and adapt practices that complement the components of the location, particularly the altitude, temperature, precipitation, soil and biotic and abiotic factors[2]. Some commonly practiced techniques in *jhum*/shifting cultivation include 'slash and burn' of the steep forest land and burning in-situ; boulders, fallen trees and bamboo poles are built across the slope to check soil erosion; incorporation of Alder (*Alnus nepalensis*) and other beneficial trees into *jhum* cultivation for soil improvement and land reclamation; minimum tillage operation to preserve the existing soil structure and organic matters; multiple cropping practices to improve crop diversity, soil fertility, better pest control and diversified food source to the farmers throughout the year; fallow period (8 to 10 years) to allow the natural vegetation to regrow and restore the soil fertility ensuring long term sustainability.

Nagaland, which falls under the Indo-Burma biodiversity hotspots[3] of the world is located in the north-eastern region of India bordered by Assam, Arunachal Pradesh, Manipur and Myanmar. The landscape of Nagaland is predominantly mountainous, except for 9% of the total area bordering Assam valley[4]. The state harbours rich and diverse natural resources that can be attributed to its unique geographical location and contrasting subtropical to temperate seasons across altitudes that range from 194 m to 3840 masl. 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[5]. Agriculture has traditionally been and continues to be the mainstay of Naga way of life with more than 70% of the population in Nagaland engaged and dependent on Agriculture for livelihood. Agriculture in Nagaland is

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largely traditional and rainfed. The area under agriculture is 440,990 ha (26.6% of land area) of which 22% for horticultural crops[4]. Spice is a leading cash crop contributing about 13% to the total horticultural produce in the state. Major spices crops are ginger, garlic, turmeric, chilli and large cardamom.

Naga king chilli (*Capsicum chinense* Jacq), the most valued spice of Nagaland, locally called 'Raja Mircha' is chiefly raised in the north-eastern region of India, broadly in Manipur, Assam and Nagaland. This region is acknowledged as a hot spot for genetic heterogeneity of chilli. King chilli (capsaicin 3-5%) is an ethnic food item of the people of Nagaland and is presumed to be the original home[6]. Owing to its vast potential in the food industries and pharmaceutical sector, Naga king chilli has acquired momentous in the world trade. Naga king chilli has been appreciated universally for its distinctive taste, aroma and pungency and was declared as the world's hottest chilli (10,01,304Scoville Heat) in 2007 and later in 2008 obtained the Geographical Indication certificate (GI tag)[7]. The crop has huge potential for economic generation and improving livelihood security among rural communities. Nagaland produces over 4000 MT of Naga king chilli annually of which, 70% is surplus and marketed[4]. The substantial benefits of Naga king chilli sourced within the region is that they are cropped using indigenous techniques since time immemorial and are chiefly organic by nature[8]. Thus, the research was carried out to identify the traditional approaches in Naga king chilli cultivation in Nagaland, as it can offer valuable insights into indigenous agricultural practices which largely shaped the production and management strategies of the farmers against the modern agricultural challenges.

Methodology

The study was conducted from 2020 to 2023 in three leading Naga king chilli cultivating districts of Nagaland *viz.*, Peren (93°74' E, 25°51' N) at an altitude of 1,445 masl, Dimapur (93° 44′ 30" E, 25° 54′ 45" N) at 260 masl and Mon (94°49′ E, 26°45′ N) at 897.64 masl., following descriptive research design. An effort was made to document the traditional cultivation and management practices of Naga king chilli. Two Rural Development (RD) blocks were randomly selected from each district and two villages from each of these selected RD blocks were picked based on random sampling, thus totaling to 12 villages. Finally, an overall of 250 Naga king chilli farmers were selected based on proportionate random sampling. Primary data was obtained based on personal interviews by means of a pre-tested interview schedule, discussion and field surveys. In addition, various literatures were considered for the present study.

Results and Discussion

Area and production

India is the world's largest producer, consumer and exporter of spices. During 2021-23, the single largest spice exported from India was chilli. North eastern region yields over 7 lakh tonnes of spices annually which attributes for 9% of the country's spice production[8]. The area and production of spices in Nagaland during 2021-22 was 124378 ha and 593818 MT, respectively[9]. Naga king chilli is one of the high-value spices cultivated more or less in all the districts of Nagaland covering an area of 1385 ha with a total production of 7739 MT[10]. The top three districts with the highest area and production under Naga king chilli are Peren (230 ha, 1564 MT), Dimapur (200 ha, 1010 MT) and Mon (150 ha, 930 MT)[10]. Moreover, it was revealed that the average area and production under Naga king chilli cultivation during 2021-2023 in the study area was 1.37 acre and 2.06 q respectively, with Peren district reporting the highest average area (1.27 acre) and production (2.48 q) followed by Mon (1.26 acre, 2.36 q) and Dimapur (0.94 acre, 1.36 q).

Land use system

Jhum/shifting cultivation is the predominant land use system, covering nearly 60% of the total agricultural area[11] in Nagaland. As the land is communally owned, the whole community under the leadership of village elders decides to select a patch of forest land for cultivation which is followed by demarcation of individual plots, clearing access to the field, felling of trees, slashing of forest vegetation and later burning in-situ to convert the forest land into cultivable land. The land is used for one to two years for cultivation before abandoning/fallowing it for 10 to15 years to shift to a new site to repeat the same practice. This fallow period allows the rejuvenation of soil and regeneration of vegetation and once the abandoned site is restored, the farmers return for cultivation and this process is called *jhum* cycle[12]. However, due to the increasing pressure on land to meet the need of the swelling population, *jhum* cycle

has been shortened to 7 to 8 years in case for Mon and Dimapur district while 10 years for Peren district.

Land preparation

Land preparation usually starts between December and January. Depending upon the altitude, vicinity and natural habitat the farmer selects a site in the forest with sufficient sunlight, humidity and water sources which are essential for the growth and development of Naga king chilli. Wild banana and bamboo-bearing areas are often considered ideal for Naga king chilli cultivation. The land is cleared by removing trees, shrubs and climbers while maintaining high-value trees such as bonsum, alder, oak species and wild banana plants in between the field to control soil erosion, soil nutrient management and to provide shade for the crops.

The fallen trees and plant remains are left to be dried in the open field and are burnt in situ before the onset of monsoon between March and April (Fig. 1). While, un-burnt residues are collected and burned once again. This process costs additional hours of the farmers and therefore, the farmers usually try to completely burn down the vegetation in the first phase. This process of slash and burn besides adding essential nutrients to the soil, also helps to control soil acidity and eradicate soil surface inhabiting micro-organisms including pathogens and other pests making the field suitable for cultivation[13]. Hence, the use of external input was negligible. Moreover, to minimize soil disturbance and to retain residues, the farmers avoid practicing deep ploughing in the field.

Slashing and burning of vegetation, construction of contours across the slope with boulders, bamboo poles and fallen trees are usually performed by the men-folks. While, women bag the task of clearing undergrowth, creepers, climbers and collecting wood for fuel purposes. The study revealed that an average of 15.3 man-days are required for preparing 1 acre of *jhum* land for Naga king chilli cultivation.

Seed treatment

Seed treatment is one of the crucial elements of agricultural production. Quality seed treatment significantly encourages germination percentage, plant vigor, and crop protection especially in the initial phase of development[14]. Various indigenous techniques of seed treatment used by Naga king chilli farmers of the region are:

Seed treatment with fermented bamboo shoot water

Fermented bamboo shoot, generally referred as *'bastenga'* by the local people, is an indigenous food item of Nagaland. After the onset of monsoon, usually during May to June, new shoots emerges from the rhizome nodes. These soft and succulent shoots are harvested and crushed to pieces using a traditional wooden pounding tool (Fig. 2a). The crushed pieces are collected in a conical bamboo basket to filter out the bamboo water in a container placed below the conical bamboo basket (Fig. 2b). To speed up the process of filtration, a heavy object is placed over the basket to press out the water into the container. The water is then stored for fermentation in air tight plastic containers for 30 to 35 days before consumption. Besides using as taste-maker in food preparation, there are reports of using fermented bamboo shoot water as a stimulant to treat ant and bee stings among the people of Nagaland[15]. Likewise,

Fig. 1 — Farmers engaged in land preparation for Naga king chilli cultivation in Peren district, Nagaland.

Fig. 2 — Traditional Tools for preparing '*bastenga'* fermented bamboo shoot water (a) Pounding tool (b) Conical bamboo basket

farmers of Peren district had also found a traditional way to protect Naga king chilli seeds from insect pests and soil-borne diseases. This traditional method of seed treatment involves soaking dried Naga king chilli seeds in fermented bamboo shoot water for 5 to 6 h before the sowing day. This step is usually carried out just before the farmer go to bed at night and later in the morning the water is drained and seeds are sowed in the field. This method has helped significantly in increasing the germination percentage (90%) of Naga king chilli seeds and has been in used since time immemorial by almost all the farmers of the region.

Seed treatment with water

Naga king chilli farmers of Mon and Dimapur district usually depend on an age-old practice of seed treatment, where the farmers usually soak Naga king chilli seeds in a bowl of water (room temperature) for 24 h just before the sowing day. The sprouted seeds are sowed the following day. This technique is efficient in breaking seed dormancy, accelerating and synchronizing the process of germination, improving plant vigor and reducing crop failure.

Sowing

Sowing of seeds at an ideal time is an essential intangible input in achieving a larger return. Sowing time influences yield and all yield attributing characters significantly. Direct seeding of Naga king chilli between March and April had been found successful among the farmers. However, for transplanting purposes, the seeds are usually sowed from February to March and transplanted during April to May. More than half (56.80%) of the farmers in the study area were found practicing direct seeding in *jhum* fields where bamboo culms had been slashed and burned for cultivation purposes (Fig. 3c). Banana growing areas and rocky areas are also considered ideal for Naga king chilli cultivation among the farmers of Mon district (Fig. 3 a,b). Generally, farmers prefer growing Naga king chilli in cooler areas rather than in sunny places as it encourages yield and enhanced pungency. Banana growing areas provide cool atmosphere and maintain the temperature around the plants, while rocky areas are considered a site of nutrient deposition and retain moisture for the plants during drought periods. The seeds are sowed using locally made manual dibblers of wood or bamboo. 43.20% of the farmers were found raising seedlings in nursery beds. Nursery beds are usually maintained nearby the farmer's house where the farmer has every day access for nurturing and watering the seedlings. A mixture of garden soil, Farmyard Manure (FYM), burnt ashes of bamboos

Fig. 3 — Naga king chilli cultivation in (a) Banana growing areas (b) rocky areas and (c) bamboo burned areas at Mon district, Nagaland

and other vegetation is prepared and spread over a small area in the garden. The seeds are generally broadcasted and covered with a thin layer of soil. To protect the seeds from unwanted garden intruders, bamboo fences are raised around the nursery bed. The saplings are ready to be transplanted in 45 to 60 Days after sowing (DAS). Just after the pre-monsoon shower the saplings are transplanted to the *jhum* field in small pits (1 sapling/pit) made with the help of '*tatapeina*' traditional hand hoe or Naga-dao. Both men and women equally participate in the sowing and transplanting of Naga king chilli. It was recorded that an average of 50 man-days are required for dibbling seeds/transplanting for an area of 1 acre of *jhum* land. As there is yet not any released variety of king chilli, different types of local cultivars of king chilli are cultivated[7]. On average, a plant density of 1000 plants/acre is usually maintained for sole cropping while 500 plants/acre for mixed/intercropping.

Cropping pattern

Considering the socio-economic and cultural benefits of mix cropping in *jhum*, majority (77.60%) of the farmers are holding on to the traditional way of cultivating Naga king chilli as sporadic intercrop with rice (Fig. 4a) and other summer crops (Fig. 4b). Crops like colocasia, ginger, maize, millets and jobs-tears are usually grown in rows across the slop and in the borders which also act as vegetative barrier for soil and water management. Despite the risks associated with sole cropping, almost half of the farmers (49.60%) in the study area grow Naga king chilli as sole crop (Fig. 4c), while 29% practice both (Table 1). The farmers of Peren district often intercrop Naga king chilli with rice. While, in the case of Mon and Dimapur district Naga king chilli is mixed cropped with summer crops like maize, cucumber, gourds, tomato, beans, garlic, colocasia, etc.

Intercultural operations

Naga king chilli requires over 5 months to attain the harvesting stage after sowing. While, harvesting period may last for over 3 months. On top of a longer growing period of Naga king chilli (210-240 days), the crop is very prone to weed infestation as it is grown under monsoon climatic conditions. Hence, a total of three intercultural operations are usually

Table 1 — Cropping pattern of Naga king chilli in Nagaland

Sl. No.	Cropping pattern	Mon (%)	Dimapur (%)	Peren (%)	Total (%)
1	Sole cropping	57.89	9.52	80.00	49.60
2	Multiple cropping	78.94	100.00	55.55	77.60
3	Both	36.84	9.52	41.11	29.00

Fig. 4 — (a) Inter cropping of Naga king chilli with Rice, (b) Mixed cropping of Naga king chilli with summer crops and (c) Sole cropping of Naga king chilli at Peren district, Nagaland

incorporated by the farmers after every 30 to 35 days in a season. Unchecked weeds can reduce chilli yield by 60 to 70%[16]. Hence, 30 to 60 DAT is considered the most crucial period for weed competition. The weeds are controlled mainly through manual effort and therefore weeding is considered the most crucial and labour-intensive activity in the production of Naga king chilli among the farmers. Hence, it demands the participation of both men and women members of the family, including the children, who usually join their parents in the field after school. In case of farmers with larger areas, they often incorporate family labour with hired labour to perform intercultural operations. Other intercultural operations include earthing up, staking and mulching with pulled weeds and other plant matters to protect the soil from runoff and retain its moisture. Staking with bamboo sticks provides support and strength to the top-heavy plants and protects the crop from lodging. Traditional Naga-dao, hand hoes and hand weeders made of iron blade and bamboo or wood handle are some essential tools utilized by the farmers to carry out intercultural operation (Fig. 5). The study revealed that 22.8 man-days are required to perform intercultural operations in 1 acre of *jhum* land under Naga king chilli cultivation.

Fig. 5 — Traditional tools used for land clearing, sowing and performing intercultural operations

Traditional plant protection practices

Traditional knowledge serves as the cornerstone for local decision-making in crop management including disease and pest control with soil management, time of cultivation, grain storage and combination of mixed crop[17]. Generally, hand weeding is executed by the farmers to manage weed and soil-borne insect pests[18]. Another practice include growing Naga king chilli in bamboo-burned soil to avoid soil-borne insect pests and diseases[19], which largely minimize the incidence of bacterial wilt and leaf spot of chilli in the field. Likewise, the farmers of Peren and Dimapur districts prefer growing Naga king chilli in between rice and among other crops as this acts as a barrier against sap-sucking insect pests like aphids (*Aphis gossypii*), thrips (*Scirtothrips dorsalis*), mealy bugs (*Ferrisia virgata*) and white fly (*Bemisia tabaci*). Similarly, farmers of Mon district prefer growing Naga king chilli around rocky and banana growing areas as lesser infestation of blister beetle (*Epicauta* sp.) was observed in the field, which has caused significant yield loss (80-90%) in the past years.

Another age-old cultural practice which has long been viewed as an important agent in avoiding fungal growth and minimizing damage caused by soft-bodied insect pests like slugs, snails, aphids, thrips and mealy bugs in the *jhum* field is the use of wood ash[20]. Generally ashes from hardwood like alder, oak and bonsum trees are considered ideal among the farmers. Sprinkling a thin layer of ash over the leaf surface and around the foot of the plants on the soil surface was found to be effective. The farmers also put up mannequins or simply hang old used clothes and noisemakers in long bamboo poles as scarecrow in between the field. The movement of the pole along with the wind and the dangling of noisemakers like plastic bottles and steel/aluminium plates scare off intruders like birds, rats, squirrels and deer from the field. Field inspection followed by hand picking and killing medium-sized to larger insects like beetles and caterpillars was found to be effective in managing pest's population during lesser pest incidence. However, on sudden outbreak of insect pests and diseases, these traditional practices were found ineffective in managing the catastrophic damage caused to the crops in the field. Study also revealed that, on severe infestations yield losses can go up to 50 to 90%.

Harvest

Naga king chilli requires about 5 months from the time of sowing to attain harvest maturity. For long-distance markets harvesting is usually carried out at

green stage, while yellow and red stage for drying, pickling and seed purposes. Traditional harvesting of Naga king chilli involves hand picking and collecting in a hand-woven bamboo basket which is usually carried behind over the head (Fig. 6).

Harvesting is done twice a week during peak season which starts from mid-August and extends till mid-October. However, harvesting in smaller quantities continues from November to December. In order to avoid fruit rot in storage, the farmers usually try to pick the chillies before the rain. Moreover, the crop being highly perishable and with no storage facilities in the region, the farmers prefer sending them to wholesale markets immediately after harvest (Fig. 7). Both men and women are equally involved in harvesting. However, in the case of Tsiepama village under Dimapur district, the women folks usually take care of all the harvesting related activities. The study revealed that the average fruit yield of Naga king chilli is 200 kg/acre and 25 kg/acre for dry weight.

Fig. 6 — A farmer harvesting Naga king chilli in a bamboo woven basket at old Tesen village, Peren district, Nagaland

Fig. 7 — Freshly harvested Naga king chilli stored in bamboo baskets

Post-harvest management

Sun-drying is one of the simplest and the most economical methods of post-harvest management utilised by the Naga king chilli growers of the region since time immemorial. The fruits are piled indoors or in shade away from direct sunlight for 2 or 3 days to develop a uniform red colour (Fig. 8a) and sun-dried by spreading the harvest on a bamboo woven mat or a flat concrete surface. It takes around 7 to 10 days to completely dry the chillies. However, the peak harvesting of Naga king chilli coincide with the later part of the monsoon and owing to cloudy and rain days, the farmers often face difficulty in sun drying. As a result, the farmers prefer processing them immediately by the traditional way of smoking (Fig. 8b). Although, smoking for longer hours tend to make the chillies blackish reducing market value. Hence, the farmers prefer using fully dried firewood for a steady burn with lesser smoke. In addition, farmers from Mon and Peren districts place newspapers over bamboo woven trays before laying the chillies for drying. Bamboo woven trays are placed over the kitchen fireplaces (3 to 4 feet) in such a way that the flame does not come in contact with the tray but the heat reaches the bottom of the tray. This protects the chillies from direct heat and helps retain its natural bright colour, while maintaining market value. A total of 5 to 6 days are required to dry 10 kg of chillies. The dried chillies are packed in poly bags and stored ensuring protection from storage insect pests and dampness.

This post-harvest management activity of drying/smoking in the case of Peren and Mon districts

Fig. 8 — (a) Naga king chilli stored for drying purposes (b) Traditionally smoked dried Naga king chilli in bamboo woven trays at Tsiepama village, Dimapur district

is usually performed by the men-folks of the family. The crop being highly perishable with minimal shelf life (3 to 5 days), it cause considerable post-harvest losses to the extent of 20 to 25%. To tackle the situation, the female members of the community have found the solution of pickling and pounding dried chillies into flakes or powder for home consumption and for local markets. These products can be stored for over a year when kept in air tight containers. These post-harvest activities at local level during peak season have helped the farmers to cut down the post-harvest losses as well as expand their sources of income.

Seed storage

The seed moisture content and temperature play a key role in preserving seed viability during storage. In addition, moist environments also induce the proliferation of storage pathogens. Therefore, the ideal storage temperature and relative humidity for commercial seed storage is about 15-20°C and 30-45% for 6-18 months[21]. However, maintaining such storage conditions in rural areas is unlikely, due to high construction and maintenance expenses. Hence, the farmers depend on alternative locally available materials, such as dry hard wood ash of alder, oak and bonsum to preserve the seeds for the next season. Due to their hygroscopic nature, they can be used to check seed moisture and extend the shelf life of seeds[22]. The farmer select healthy, disease-free, fully matured fruits that are bright red or orange in colour. The seeds are removed and dusted with wood ash, spread over a bamboo woven tray and sun-dried for 5 to 6 days depending upon climatic conditions. On cloudy and rainy days the seeds are dried over the fireplace to speed up the drying process. Delaying in drying results in the growth of microflora and reduces germination percentage or total spoilage of the seeds. In case of Peren district, the farmers separate the seeds from the pericarp of the fruit with the stalk intact. The stalk along with the seeds are pierced into a metal wire or a fine bamboo strip and hung outside for sundrying or in the kitchen over the fireplace (Fig. 9). After drying, the seeds are carefully wrapped in paper and stored in bamboo baskets or containers made of dried gourd.

Prospects for organic Naga king chilli in the traditional farming system of Nagaland

Jhum/shifting cultivation is an age-old rain-fed farming system, well suited to the challenging conditions of hilly terrains and heavy rainfall areas. It involves a production system that utilizes natural resources, community-based knowledge, promotes agro biodiversity and crop diversity for food, fodder and fuel. However, despite being an integral part of the indigenous community ensuring food security, economic viability and ecological sustainability, several factors such as the increased human population, land degradation, organic matter reduction, and the subsequent nutrient imbalance has exerted tremendous pressure on land and forest of the state[23]. Consequently, *jhum* cycle and its production is declining excessively and thus protecting biodiversity and improving soil quality has become uncertain[12]. In addition, there have been reports of decrease soil microbial biomass which leads to reduce of certain enzymatic activity vital for soil health and functioning[24]. Hence, to ensure its sustainability, a longer fallow period (up to 15 years) will contribute in reducing soil erosion, while improving and maintaining fertility of the soil[25]. As well as an appropriate and judicious integration of modern technologies with traditional farming wisdom is critical. Climate-resilient and remunerative farming techniques like Sloping Agriculture Land Technology (SALT) and Soil and Water Conservation (SWC) should be encouraged among the farmers. These farming techniques are the perfect amalgamation of soil conservation and agroforestry, where dense hedge rows of fast growing perennial nitrogen-fixing tree or

Fig. 9 — One of the traditional methods (sun drying) of preserving Naga king chilli seeds

shrub species are planted along contour lines thus creating a living barrier that traps sediments and gradually transforms the sloping land to terraced land[23].

If managed conscientiously, *jhum* cultivation provides a suitable condition for growing multiple crops, making it naturally inclined towards organic farming practices. In addition, consumption of agrochemical pesticides and fertilizers remains insignificant with just 1.5 kg/ha compared to the national average of 133.44 kg/ha. Nagaland state has huge potential to be converted into a full-fledged organic state attributing to the existing farming system that largely resembles organic farming. Currently about 13,000 hectares area in 241 villages covering 13,500 farmers are engaged in organic farming in Nagaland[26]. Cognizant of the opportunities of organic Naga king chilli cultivation in Nagaland the government has taken various initiatives. Some of which are: obtained the patent rights of Naga king chilli and Geographical Indication (GI No. 109) tag in 2008[27]; Naga king chilli has been considered under Mission Organic Value Chain Development (MOVCD-NER)[8]; launched Peren Organic Farmer Producer Company Limited[9]; coordinated the first export consignment of fresh Naga king chilli in 2021 to London[27]; tied up marketing linkage with Indian Tobacco Company (ITC), Spices Limited, and Spices Board of India and with the International Competence Centre for Organic Agriculture (ICCOA) Bangalore for marketing of dried Naga king chilli[7]; Old Poilwa village, Peren district was selected as one of the Model Villages for Naga king chilli under Horticulture Model Villages (HMVs, 2023-2024) for sustainable development[28] and last but not the least, the government has earmarked an area of 2240 ha for promoting Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) to develop a more sustainable, environmentally sound and economically viable system[9]. Overall, Nagaland has enormous opportunity to leverage the existing agricultural practices and natural advantages to become a leader in sustainable organic farming, contributing to both environmental protection and economic development for the farming communities.

Conclusion

Until now, *jhum* agriculture has done sufficiently for the indigenous farmers of Nagaland. However, there is an urgent need to take a fresh look in the light of new challenges posed by the swelling population, climate change, shrinking agricultural land, biodiversity loss, depletion of natural resources and other related impact due to change in the preference of the society. That being so, *jhum* cultivation practices must tune to the changing scenarios to meet the challenges of a modern society. Naga king chilli farmers of the region possess diverse repository of innovative wisdom which are undervalued and understudied. These traditional indigenous knowledge should be explored and use effectively. Hence, a scientific intervention in the existing practices of *jhum* is recommended. To achieve realistic agriculture-based development in the region, government initiatives combine with the efforts of community and various other stakeholders must go hand-in-hand. Efforts should be made to blend traditional knowledge with sustainable farming practices to preserve and increase efficiency, productivity and sustainability in food production.

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Conflict of Interest

Authors declare that there are no conflicts of interest.

Author Contributions

Authors have contributed equally to collecting information and preparing the manuscript.

Prior Informed Consent

Prior informed consent was obtained from all the respondents of the study area.

Data Availability

Authors confirm that all the data supporting the findings of this study are available within the manuscript only and will also be made available from the author upon reasonable request.

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