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Millet Cultivation in North-east Hill Region of India: A Review

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ABSTRACT

The millets are climate resilient, most efficient in use of water, adopted to grown in marginal and sub marginal area, suitably grown in hilly and rainfed area, nutrient dense and having low carbon and water footprint. Considering their significance in present context of agriculture, it is important to know about their region-specific cultivation practices and intervention in it. The North East Hill (NEH) region is known for its diversity in terms of soil and climatic condition as well as crop and plant diversity. The marginal and sub-marginal area with different slope, topography and soil related constraints for production, the millets will be one of the important options for arable crop cultivation. The production practices followed by the farmers and recommended practices were highly diverse due to different agro-climatic condition. At the same time, in several locations production practices were even not developed due to cultivation on very less area with less economic impact at regional or state agriculture. Hence it is informative and knowledge impacting exercise to review the production practices followed and interventions made at institutional and stakeholders level for millets cultivation in NEH region. The present review summarizes the interventions in production practices such as seed and sowing requirement, nutrient, water and weed management as well as insect-pest and disease management in context of NEH region. Besides that, interventions from NEH region at post-harvest and value addition were also discussed in this review. The cost effective and high enumerative interventions in production processes such as substitution of low yielding upland rice cultivation partly or completely with millets, transplanting, fertilization, micronutrient foliar feeding, use of herbicide for weed management and promotion/ up gradation of millets cultivation in new areas (North-East Hill region) are important at production level. The interventions at policy level such as promotion for incorporation of millets in public distribution system, inclusion of millets in school age children diet and different schemes related with supply of nutritious food to children and adolescence are important for NEH region. Increase in diversity of product prepared from millets, initiation of organic seed production of millets, exploring export potential of traditional products prepared from millets to different domestic and international market are important interventions at policy level. At research level, the standardization of production practices for different states in NEH region was initiated and need to be further emphasized rather than using recommendation as it is from other part of India.

Key words: Constraints, Foxtail millet, Prospects.

The cereals and millets area acting as staple food for large section of population with significant share of cereals and fewer shares of millets as staple food restricted to hilly and marginal area. Even then, millets are promoted for their ecological significance, nutritional superiority and being climate resilient over major cereals. The millets are a highly variable family of small-seeded grass, growing extensively all over the world as cereal or grain crops for human consumption and animal feed (Nandini and Sridara, 2019). They have been called ¨Nutri grains¨ since they are rich in micro nutrients such as minerals and B complex vitamins. The ecological significance can be indicated by their capacity to grow in hilly, undulating terrain with less fertilize soil as well as capacity to stand the environmental odds such as moisture and temperature stress (Shahane and Shivay, 2023). The nutritional superiority is indicated by the significant higher concentration of micronutrients minerals in millet millets over major cereals. The finger millet has 8 times higher calcium, 4 times higher mineral and two times higher phosphorus over rice grain. The concentration of iron and zinc in millets are being more highlighted due to widespread deficiency of both in human being categorized as hidden hunger among the one important cause of malnutrition (Lowe, 2021). The zinc and iron content in finger millet and pearl millet is 2.3 mg 100 g^{-1} and 3.3 - 14.89 mg 100 g^{-1} and 3.1 mg 100 g^{-1} and 8.0 mg 100 g^{-1}, respectively (Mahalakshmi, *et al*., 2024; Ramashia *et al*., 2019); while same for foxtail millet and proso millet is 2.4 and 2.8 and 1.4 and 0.80 mg 100 g^{-1}, respectively (Ramashia *et al*., 2019; Hariprasanna, 2022). The proso millet is considered rich in protein with protein 12.5% (Hariprasanna, 2022); while fat content of pearl millet (4-5%) is considered as an important nutritional quality. The millets are more nutritious than cereals due to higher amount of vitamins, essential amino acids, dietary fibre, storage proteins, low glycemic index (barnyard millet and foxtail millet) and other

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bioactive compounds. The millets were also referred as whole grains (Himasree *et al*., 2018; Bhat *et al*., 2018; Mahalakshmi *et al*., 2024; Datir *et al*., 2018) and reported to improve diabetics' health. Millets are efficient user of water and grow in soil with low nutrient status.

Millets tolerate drought to considerable extent due to its different agronomical (Seed number, biomass, seed yield and flowering time), morphological (Shoot length, root length and root tensile strength), physiological (water extraction and chlorophyll content) and biochemical traits (anti-oxidant, free proline, ROS scavenging enzymes, glycine betaine and superoxide) (Tadele, 2016). Saleem *et al*. (2021) reported that different morpho-physiological, biochemical and molecular mechanisms present in different millet allow them to grow in marginal dry land in arid and semi-arid region and survive low rainfall and poor soils. The morphological characters mentioned for responding drought were short life span, small plant height, small leaf area, dense root system, adjusted flowering time, increase root and decrease shoot length, high tillering and leaf folding. The capacity of pearl miilet to avoid, escape, tolerate or recover from drought due to osmotic adjustment, stomatal conductance, ROS scavenging ability and abscisic acid and ethylene transduction was reported in Shrestha *et al*. (2023). Besides that millets have low carbon and water footprint as compared to other crops make them a climate resilient crop (NAAS, 2022). The capacity of pearl millet to grow with low water (350 mm) and having higher water use efficiency was reported by Ullah *et al*. (2017); while superiority of finger millet to cereals crops in tolerating drought and grown in semi-arid region with frequent drought occurrence was reported by Reddy and Reddy (2023). Millets were grown in on large extend in Rajasthan, Karnataka, Maharashtra, Uttar Pradesh, Haryana, Gujarat, Madhya Pradesh, Tamil Nadu, Andhar Pradesh and Uttarakhand states in India with three major state growing millets on large extent were Karnataka, Rajasthan and Maharashtra, respectively (Anonymous, 2023). Considering the diversity of millet crops, their capacity to grow in different environmental odds as well as in diversified Agro-climatic conditions, exploring the millets cultivation of NEH region will be worthy.

The North east region is known for very high diversity in soil, land topography and climatic conditions. The agricultural activities in NEH region in dominated by shifting cultivation, organic farming, forest collection, diversity of plant and animals, soil acidity, marginal and fragmented land holding, terrace cultivation, zebu cultivation, predominance of animal component in agriculture, farming system based approach of farming, growing of traditional land races and crop varieties, more use of ITKs in crop production, very less use of purchased agrochemical based inputs (fertilizers and plant protection agrochemicals) and rice-fallow or rice-legume/ winter vegetables/ cole crops/ pulses cropping system. Besides that, present NEH region agriculture is also adding the dimension such as changes in shifting cultivation, increase adoption of feed and health based intervention in animal production, promotion of allied enterprises in agriculture as well as introduction and testing of new crops and varieties. The crop/ species/ variety introduction of varieties were most going on at institute level; while getting information about superiority of crop/ species cultivar as well as emphasis on input distribution programme by different institutions create scopes for testing of millets under different cropping across NEH region. Different states in NEH region such as Nagaland, Arunachal Pradesh, Meghalaya, Mizoram grows few millet crops traditional with ITK based practices and land races creates scope for get in the production practices followed and possible interventions in production practices to achieve superior crop performance. The traditional way of uses of millet and promotion of millets products and recipes among the region will also play important role in achieving the nutritional security through millet consumption.

Millet vis-a-vis cereals

The cereals crops (rice (*Oryza sativa*), wheat (*Triticum aestivum*), maize (*Zea mays*)) and millet (sorghum (*Sorghum bicolor*), finger millet (*Eleusine coracana*), foxtail millet (*Setaria italicaa*), proso millet (*Panicum miliacium*), little millet (*Panicum Sumatrans*), barnyard millet (*Echinoclua crusgalli*) and kodo millet (*Paspalum scrobiculactum*)) were belong to same family Gramineae. Even then both were compared at several forums for their growing condition, nutritional content, role in food system, grain size and other characteristics, medicinal properties, presence of anti-nutritional factors, area under cultivation, production and productivity. In India millets were grown on 12.14 million ha area with 16.51 million tonnes of production and 1208 kg ha^{-1} productivity (Table 1). India stands first in production of millets with 17.68% share in total production of millets in the world. In general, the size of cereal grain is bigger/larger than millets; while in nutritional point of view millets have more mineral concentration than cereals. The millets are more adapted to climatic odds and low soil fertility as compared to cereals and as mostly varieties and land races were used and less breeding works, the response of millets to input addition is less as compared to cereals. Furthermore, millets are advantageous for the environment because they are rich in varietal diversity, enhance agro-biodiversity and sequester carbon, which increases opportunities for CO_2 abatement (Brahmachari *et al*., 2018), permit intercropping with other important crops for mutual benefit (Maitra *et al*., 2000; Sharmili *et al*., 2021). On the investment/input point of view, the cereal receives the major attention at both stakeholders level and at policy level due to their status of staple food; while millet were neglected at both levels due to their less productivity and market demand availability. Initiatives were taken to distribute the millets through public distribution system increases its market demand.

Millet cultivation in north eastern region

The major millets grown and millets having potential in Meghalaya includes finger millet, foxtail millet, pearl millet

and Jobs Tears (APEDA, 2023) (Table 2). For Arunachal Pradesh, finger millet, foxtail millet and buckwheat are grown and have potential in state. For Manipur the trails at research farms were conducted for finger millet, foxtail millet and pearl millet by ICAR; while millet cultivation was mainly reported in shifting cultivation. In Nagaland, pearl millet, sorghum, finger millet and some small millets were grown with their use in diet since long time. In Sikkim, finger millet and buckwheat is grown; while in Tripura, foxtail millets were mainly cultivated. In case of Assam, finger millet, foxtail millet and proso millet were grown on accountable area. The role millets in NEH region in improving nutritional security, reduce poverty and enhance quality of local diet and their uses as grains, snacks and beverages in NEH region states were reported (Pandey *et al*., 2023). The potential of area in Mizoram and need to work on germplasm testing for different stresses and improving productivity of millets also reported by Soni *et al*. (2023).

Prospects and constraints for millet cultivation in neh region

Prospects

- Utilization of marginal, sub-marginal and fragmented land holding with varying level of fertility is possible through millet cultivation considering their capacity to adopt environmental odd situation.
- The millets could be considered as intercrop in different orchard based terrace cultivation as well as mixed crop in other arable crops.
- Upland rice cultivation where rice productivity is low can be successfully used for millet cultivation.
- As most of the cultivation practices in NEH region are organic in nature, area can be considered as potential for certified organic millet production.
- Conservation and utilization of traditional land races/ varieties of millets from NEH region can be used for production and further plant/ crop improvement purpose.
- Identification, documentation and evaluation of indigenous technical knowledge for millet production and their further spread in the region is needed.
- The capacity building of stakeholders and farmers for processing and value added product development is important for promotion of millet cultivation and increasing the returns out of millet cultivation.
- Creation of institutional and infrastructural facilities for promotion of export of millets and millet products in domestic and international market will be important for market creation.
- Development of location specific recommended package of practices for organic millet cultivation amended with ITK is one of the important scopes in all NEH states.

Constraints

- Lack of awareness about suitability and potential of millets in NEH region.
- Lack of client specific (crop/ state/ pest/disease/ nutrient management practices) information on millet cultivation.
- Lack of preference or secondary appearance of millets in policy based intervention related with agricultural development activities.
- Rice based and animal product based diet with less preference to millets.

Table 1: Area, production and productivity of cereals and millets in India.

Crop	Area (Lakh ha.)	Production (lakh tonnes)	Productivity (kg/ha)
Rice (*Oryza sativa*)	464.0	1303.0	2809
Wheat (*Triticum aestivum*)	305.0	1068.0	3507
Maize (*Zea mays*)	100.0	336.0	3349
Sorghum (*Sorghum bicolor*),	38.08	48.12	1110
Pearl millet (*Pennisetum glaucum*)	67.03	96.24	1436
Finger millet (*Eleusine coracana*)	12.11	16.96	1401
Small millets	4.23	3.75	885

(Anonymous, 2023).

Table 2: Area, production and productivity of millets in North Eastern states of India.

Name of the state	Area (ha.)	Production (metric tonnes)	Productivity (kg/ha)
Arunachal Pradesh	26790	27460	1025
Meghalaya	2924	2780	1050
Nagaland	12460	12483	1001
Sikkim	5160	5200	1012
Tripura	458	380	829
Assam	6602	4447	674
India	15.48	18.02	1164
World	71.9 million ha.	91.5 million tonnes	1300 kg/ha.

(APEDA, 2023; G20AWG, 2023).

- Not considering millets as important source of fodder to animal during lean period due to availability of forest vegetation.
- Unexplored potential of organic seed production and organic millet cultivation in different states in NEH region.
- Lack of quality seed materials as well as low seed replacement ratio.
- Soil and weather odd situations such as rainfall during flowering to harvesting, soil acidity, *etc*.

Interventions in production practices

The large numbers of interventions were suggested at different levels such as production, consumption (value addition and processing), policy initiatives and institutional level which create scope for reviewing and drawing a conclusion from the scientific material generated. These interventions were highlight in recent time due to International Year of Millet-2023 (IYM-2023) and different programme, conferences, workshop and other such social gathering arranged in different places across the India and entire world. The Asia and Africa were more highlighted due to major area of cultivation and consumption. As the production practices were dynamic with respect to time and space dimension, there was large number of interventions reported across the world; while their significance was restricted with particular region (except plant based interventions which includes varieties development). Considering this dynamism, we are focusing only on the intervention in the NEH region for millet cultivation. The major interventions reported were introduction of new varieties, testing of traditional and new practices of cultivation on new varieties, testing of new inputs in production system, detection of insect-pest and disease attack and changes in their occurrence, feasibility of use of different machinery in production system of millets and preparation of different ready to cook and ready to eat products from millets as market interventions. There are wide range intervention on each of these practices mentioned above; while their economic and social impact were may not be accounted due to population density and use of millets in the day to day life. This section will describe the interventions reported and significant impact out of these interventions on millet cultivation in NEH region.

Crop and varietal evaluation in NEH region

Layek *et al*. (2023) reported the grain yield of foxtail millet, little millet, brown top millet, barnyard millet, proso millet, finger millet was 1.17, 1.16, 1.02, 1.09, 0.29 and 1.43 t/ha respectively under organic production system in NEH region indicating their potential to be act as important alternative crop to rice in marginal land as well as under water stress condition. They also reported that, finger millet has great potential in the organic production system of the North Eastern Himalayan Region (NEHR) of Indiae and apart from HYVs such as VL Mandua 352, local landraces, *viz.,* Nagaland-2 and Sikkim-1, should also be promoted for ensuring food and nutritional security in this fragile ecosystem. Gohain and Reddy (2020) tested ten finger varieties (VR - 847, OEB 532, OEB 526, GPU 66, GPU 67, VL 149, VL 347, VL 352, VL 376 and OUAT 2) in Nagaland and recorded yield level of 711 to 1590 kg/ha with highest yield in OEB 524 variety. In case of straw yield, it varies from 3177 to 9833 kg/ha. Sachan (2017) conducted the testing of genetic phenotypic combining ability of fifteen genotypes of foxtail millet in Nagaland and recorded the yield level of 70.0 g/plant to 310.6 g/plant with productive tiller per plant and panicle length having higher relation with the yield of foxtail millet. In another similar study Rao and Chaturvedi (2024) reported the foxtail millet varieties *viz.,* G1, G21, G22 and G25 are suitable for cultivation in Nagaland due to their stable and reliable condition for across four planting dates from May to July. Barthakur *et al*. (2001) tested performance of nine varieties of finger millet in Meghalaya and Assam and recorded yield of 1858 to 2897 kg/ha with highest yield in Muskey 5 variety. Rathi *et al*. (2003) reported that, 81 different species of cereals, pseudo-cereals and millet germplasm were collected from Nagaland with foxtail millet as one of the important millet. In a front line demonstration conducted in Ri-Bhoi district of Meghalaya for two years, the yield level of 1.846 t/ha and 1.314 t/ha, respectively was recorded under demonstration plot (var. LV-379) and in farmer's field/ practice (var. Sikkim-1). They recorded net returns of Rs. 27787 per ha and Rs. 14487 per ha, respectively for demonstration plot (var. LV-379) and in farmer's field/ practice (var. Sikkim^{-1}) (Sarma and Islam, 2023). Nayek *et al*. (2014) reported that, intercropping of sorghum in soybean without reducing the plant population of soybean and without any additional fertilization increases soybean equivalent yield of system by 30 kg/ha; while significant increase of 450 kg/ha was reported with application of 60 kg N application per ha. In the same study, application of 40 kg N/ha in pearl millet + soybean cropping system increase the soybean equivalent yield of system by 120 kg/ha.

Soni *et al*. (2023) reported that pearl millet cv. PC 701 performed the best among the tested three different type of millets, *viz*. pearl millet cv. PC 701, finger millet cv. VL Mandua 347 and proso millet in Mizoram region. Nahar *et al*. (2018) reported that salinity stresses also significantly influenced yield and yield contributing characteristics of foxtail millet. He reported that the genotypes BD-897 and BD-881 produced the higher dry matter, grains per panicle and grain yield per plants under the saline level of 6 dS/m. The higher stress tolerance index of both the genotypes demonstrates that the genotypes BD-897 and BD-881 were more salt tolerant. Meherunnahar *et al*. (2018) reported that the BK3, a Bangladeshi cultivar of foxtail millet flour contained significantly higher ($p<0.05$) amount of protein, fibre and lower amount of carbohydrate than BK1 and BK2 foxtail millet flour. He also reported that foxtail millet flour could be potentially used for the preparation of the various nutrient rich recipes and may help to generate technology and to diversify the use of Foxtail millet by the food processing enterprises. Mahmood *et al*. (2010) reported that among the three high yielding varieties of foxtail millet (BARI Kaon 1, BARI Kaon 2 and BARI Kaon 3) grown in Bangladesh BARI Kaon 1 was the most micro minerals rich variety. Adhikari *et al*. (2018) studied the different genotypes of finger millet found that, Acc-6407,

Acc-2339, KLE-2339, KLE-216 and KLE-559 were superior for their grain yield. Similarly, genotypes found promising in Initial Evaluation Trial (IET) were Acc-2370, GE-0012, KLE 178, Acc-0124 which were promoted to and tested in Coordinated Varietal Trial (CVT). Likewise, genotypes, namely, KLE 236, GE-0116 and Acc-6022 were found high yielding genotypes in CVT and they were promoted to and in Farmers' Field Trials (FFT). Similarly, genotypes, namely, Acc-2311, NE-1703- 34, KLE-159 and Acc-433-1 produced high yield, thus these genotypes derived from FFT would be pipeline genotypes for release to high hills areas of Nepal. Rahmana *et al*. (2020) reported that considering some plant physiological and yield contributing characters such as effective tiller per hill, panicle length, days to harvest, root length, 1000 seed weight and yield, all the foxtail millet lines/ varieties may be grown in rainfed condition especially in char land area of Bangladesh.

Biotic stress (weed, insect-pest and disease) management

Upamanya *et al*. (2019) revealed that the variety PR 1639 showed the highest disease severity with respect to leaf blast (29.06%) and Cercospora leaf spot (8.55%) in Dhubri, Assam. He also revealed that the variety VR1117 was found to be the best over other variety in terms of reduced severity against all the diseases observed. Highest severity of seedling and leaf blight and banded blight was observed in the variety GSMC 1. The result of evaluation of fungicides *viz*. Carbendazim 50% WP, Mancozeb 75% WP, Tricyclazole 75% WP and Hexaconazole 5% EC showed the best performance of Tricyclazole 75% WP over other fungicides in terms of reducing the leaf blast severity (1.15%) followed by Carbendazim 50% WP (3.79%). Gogoi *et al*. (2023) reported that finger millet (locally called Marua in Assam) need very little water for their production which do not burden with demands for irrigation or power. It is also almost pest- free. Dhiren and Chhetry (2022) reported that, Finger millet in Manipur affected by different fungal diseases which includes blast (*Pyricularia grisea*), banded blight (*Rhizoctonia solani*) and brown spot (*Helminthosporium nodulosum*). Singh *et al*. (2021) reported hand-weeding (HW) to be the most popular method of removing weeds in North East region of India. However, Hand-weeding is tedious, time taking and mostly labour oriented. Hence, alternative methods such as mulching are an effective tool for weed management without using chemicals. The use of biomass such as Eupatorium/ Artemisia as mulch has been reported a good source of organic matter and weed suppressor for different crops in NEH region (Das *et al*., 2016). Gopi *et al*. (2016) reported that farmers in Sikkim often use salt and ash to control ants, cutwormset al white grubs at their farms.

Post-harvest technology

In Arunachal Pradesh, Madua Apong is popular beverage prepared using millet through unrestrained fermentation process. The brewing of millets were practices in different tribes of Arunachal Pradesh (Singh and Heisnam, 2023). The Zan is another porridge recipe in Arunachal Pradesh prepared using millet flour. The finger millet is mainly consumed as chapatti, local beverages and porridge in Arunachal Pradesh (Supriya *et al*., 2023). Sarmah and Roy (2022) summarized wide range of traditional food items *viz*., *Kode Dumbu* (millet ball), *Belna Pitha* (millet base roti), *Sunum Pitha* (Millet cake), *Khapra Pitha* (Unleavened dosa), *Kote Halwa* (Millet sweet dish), *Kodu Pitha* (Steamed millet cake), *Ghula* (Millet beverage) and *Kudo Bhat* (Steamed millet) which indicates the product diversity and role/potential of millets to enrich the diet of rural communities. Choudhury *et al.* (2011) reported that, local varieties of foxtail millet (Purpal and yellow varieties) from Assam have great potential for processing through popping and malting. The multiple uses of Job's Tears (*Coix lacryma*-jobi L.) in the form of cakes, soups, porridge and preparation different of sweets was reported by Soni *et al*. (2022). Mal *et al*. (2010) reported that the higher proportion of flour of finger millet and little millet resulted in harder texture of biscuits, while such blending with foxtail millet flour, the texture of biscuit remained soft. The mineral content of millet based biscuits/cookies was higher than refined wheat flour biscuits. The mineral content of biscuits prepared with blending millet flour at 25% ranged from 0.2 to 1.02% and the maximum was found in finger millet based biscuits. Dorji *et al*. (2013) reported that the crops that can be stored for long time include foxtail millet, common millet and finger millet in Bhutan. They also reported that Nagaland had the highest number of varieties for finger millet. Moreover, he revealed that millets survived in Bhutan due to their significance as ritual crop; millets constitute important ingredients of traditional ritual offering. It is considered as the food of the deities, gods and goddesses.

Policies and institutional effort for millet cultivation promotion in NEH region (under the edges of IYM-2023)

On the front of IYM-2023 and research intention for introduction of different millets in different states from NEH region for their scientific and economic evaluating, the intensity of attempts for promotion of millets was increases in last 2-3 years in NEH region. This section will gives information on state wise activities conducted for millet promotion. In order to promote millet cultivation in North East Hill region different programme had been planned by state government institutions as well as National (ICAR) institutions (Table 3). The ICAR-Indian Institute of Millet Research, Hyderabad promoting millet cultivation in NEH region through scheduled tribal components through providing guidance, seeds of improved varieties and funding for inputs and other activities. The creation in Indigenous millet network in Meghalaya in 2011 which promote millet cultivation across the state is one such successful example for promotion of millet cultivation by local communities considering its importance. Besides the state Government efforts and Institutional support, the NEH region is also going to get benefited by steps taken by the central government for millet promotion which includes: A) Millet awareness through different programmes (competition,

Table 3: Programmes organized form millet promotion in NEH region.

State	Programme	Aims and objectives
Meghalaya	Training and field day programme on "Millet Production Technology and Value Addition" was conducted from October 16 to 18, 202 by ICAR Research Complex for North East Hill Region, Umiam, Meghalaya.	Creating awareness about importance of millets as well imparting training for the farmers about millet cultivation and value addition in millet grains.
Meghalaya	Workshop cum exhibition of the International Year of Millets on the theme 'Millets for Nutritional Security' at All Saints Hall, Shillong on 27th September, 2023 by Department of Agriculture and Farmers' Welfare Government of Meghalaya.	Showcasing of different millet products, facilitation of millet growers and emphasizing the millets cultivation and its importance in human diet.
Meghalaya	Two two-day eat right millet mela under International Year of Millet 2023 at Malki Ground, Shillong was organized by Commissionerate of Food Safety, Government of Meghalaya on March 28 and 29, 2023.	Showcasing of different millet products and sharing of knowledge of different millets grower of state among themselves. Also facilitation of the millet growers and processers.
Sikkim	The Food and drug administration of Namchi district of Sikkim organize "Eat Write Millet Mela" at Namthang on June 12, 2023.	For promotion of inclusion of millets in daily diet as well as creation of awareness about safe food practices. Showcasing of millets and their processed products.
Sikkim	Two day's workshop for conducted by National Institute of Technology, Sikkim on 26th and 27th March, 2023 in Namchi district of Sikkim.	Presentation on development, history and uses of millets, quiz competition and talk secession on millets by student for increasing awareness and promotion of millets.
Arunachal Pradesh	Two days state level millet mela by Department of Agriculture, Government of Arunachal Pradesh at Itanagar on 29th and 30th August, 2023 under the theme mission food and nutritional security.	For dissemination of knowledge about cultivation and post-harvest processing of millets among the stakeholders. Farmer scientist interaction, sale cum exhibition of millets and millet products, technical secession on millet technology and package, practice and health benefits of millet are discussion. More than 500 stakeholders were participated.

quizzes and conferences), b) Celebration of 2023 as International Year of Millets, c) Instruction to all the government officials and concern department at state level for introduction and promotion of millets.

CONCLUSION

The agronomic interventions will play important role in successful cultivation of different millets in North East Hill (NEH) region considering Agro-climatic diversity and potential of organic millet production and seed production. The testing of different millet crops and their varieties is received top most priority in NEH region at present. Besides that, study of pest and disease incidence and potential options for their management, comparing new varieties with local varieties and intervention in post-harvest technology such as way of consumption is other important themes for millets in NEH region. The Agro-techniques such as transplanting in pearl millet and finger millet, organic production of sorghum, finger millet and pearl millet, increase in use of microbial consortia, amending the marginal and sub-marginal area and supplemental irrigation are important intervention with significant contribution to successful millet cultivation in NEH region. Besides that, need of identification and management of disease and pest in organic production mode is expected to increase the productivity and profitability of millets. The standardization of different traditionally available millet food products for increasing the nutrient density is needed both at research and policy level to increase the share of millets in human nutrition.

Conflict of interest

The authors declare that there are no conflicts of interest.

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