

5.4 Preparing promotional materials on small millets: The project team published or prepared several peer-reviewed articles, research reports, conference presentations, videos and posters for communicating various research approaches, activities and results from the project.

5.5 Promotional events: DHAN organised Walkathon 2013 on the theme of 'Agricultural Biodiversity and Food Security - with a focus on small millets' on February 2, 2013. There were recipe contest, orientation to school and college students, essay writing, drawing, quiz and elocution contests for students on topics relevant to food security, and the winners were felicitated during the Walkathon. There was a film festival as part of this event.

The Walkathon was organised in 20 places across five states. The event included a rally by school students and farmers in the district headquarters followed by an exhibition and seminar on the theme. While around 52000 people, including farmers, women, and school students participated directly in the event, the message on small millets reached more than 100000 people before and during the Walkathon. WASSAN has organised a millet food stall in Srikakulam and took part in exhibitions organised by the Government at Visakapattinam and Paderu to promote millet recipes. LI-BIRD organised *Kahachari* Natak (Forum Theater) on World Environment Day 2012 at three locations on the theme of Green economy and a food fair of underutilized species during the World Food Day. AF organised educational programmes in three schools selected from the project area. In the last two years the project has reached more than 54000 persons with the message on small millets.



5.6 Promotion through Media: Promotion was taken up through Pon Vilayum Bhoomi program of Doordharshan and radio programs with All India Radio in India. Similar efforts were taken in Sri Lanka through two radio programs in Kanduratasewaya (Sri Lanka Broadcasting Corporation, Kandy branch). LI-BIRD broadcasted knowledge associated with millet, news and other relevant information in different episodes of its radio programme called 'LI-BIRD KoChautari'. Publishing in local and national dailies on small millets was also taken up.

Objective 6: To undertake policy analysis and advocate for a policy environment conducive for small millets

6.1 Analysing existing policies: DHAN analyzed existing policies related to production and promotion of millets in India, and LI-BIRD reviewed support given for research, education and production for small millets in Nepal when compared to other crops.

6.2 Building linkages with other relevant stakeholders: Efforts were made to build linkages with State Planning Commission, Tamil Nadu, UAS, Dharwad and Andhra Pradesh Ministerial Subcommittee.

6.3 Pilot project on introduction of millets into ICDS menu: WASSAN, in association with ARTIC, a local NGO, began a pilot project on inclusion of millets in the ICDS programme in Srikakulam district under which 160 children (3 to 6 years old) are provided with finger millet and little millet-based food for 17 days out of 25 days every month.

The Achievements So Far

- In eight sites, so far 129 local varieties of small millet crops (SMC) were identified.
- In the two cycles of PVS trials, 70 local varieties, 62 released varieties and 12 pre-release varieties of small millets were tested at eight sites with 778 men and 533 women farmers. Based on farmers' preferences, 36 varieties were identified for validation and improvement in the next season.
- In Nepal, intercropping with cowpea showed an economic gain of 44 percent in lower altitudes and significant yield increase seen for finger millet with nitrogen fertilizers. In Sri Lanka better yields were seen with row sowing than traditional broadcasting. Suitability of transplanting finger millet to raise yields and controlling weeds in Semiliguda was validated in 2012.
- The project has standardised namely traditional recipes (10 breakfast food, 6 dessert and 8 snacks), bakery products (bread, cake & cookies), pasta products (vermicelli) and instant food mixes (5) using kodo, little and barnyard millets.
- To reduce the drudgery of women, the research team have developed prototype of centrifugal dehulling machine for little millet.
- South Asian partners prepared and disseminated 25 posters, one flip chart, one training manual, five recipe booklets, a booklet on small millets, and a film on making millet bread. These documents are available through the RESMISA project website (<http://www.dhan.org/smallmillets/>).
- DHAN organised Walkathon 2013 on the theme of 'Agricultural Biodiversity and Food Security - with a focus on small millets' on February 2, 2013 and reached 52000 people.
- DHAN prepared a policy landscaping paper – **Supporting Millets in India: Policy Review and Suggestions for Action** – for better-informed policy on millets.
- LI-BIRD completed a review of farm research by various public institutions in Nepal for a comparative analysis of research investments made on small millets and other mainstream crops such as rice and wheat.
- WASSAN has initiated a pilot on introduction of small millets in Integrated Child Development Scheme in Andhra Pradesh, India.
- **Collaboration:** AF has signed an MOU with the Department of Agriculture and the University of Ruhuna for research collaboration. LI-BIRD is working with Hill Crop Research Programme and Nepal Agriculture Research Council. Similarly DHAN is associated with another CIFSFRF project as well as private fabricators for field testing post-harvest machineries.
- **Students research:** Twenty five students (2 undergraduate, 11 Masters, 12 doctoral/ post doctoral levels) are affiliated with the project for pursuing their thesis or practicum research.



Revalorizing Small Millets in Rainfed Regions of South Asia (RESMISA)

Project Details

Grantees:

ORGANIZATION	PRINCIPAL INVESTIGATORS
Development of Humane Action Foundation, India	Mr. Karthikeyan
Local Initiatives for Biodiversity, Research and Development, Nepal	Mr. Kamal Khadka
Arthacharya Foundation, Sri Lanka	Mr. Widanelage Sathis Pemruwan de Mel
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Countries: India, Nepal and Sri Lanka

Timing: March 2011 to August 2014

Funding: CA\$3.5 million

Core Partners

- Tamil Nadu Agricultural University (TNAU), India
- All India Coordinated Small Millets Improvement Programme (AICSMIP) of Indian Council of Agriculture Research, India
- WASSAN, India
- University of Guelph, Canada
- University of Manitoba, Canada
- McGill University, Canada

Funders

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Revalorizing Small Millets in Rainfed Regions of South Asia (RESMISA)

At a Glance 2013

Background

Large scale under-nutrition issues are prevalent in major parts of South Asia. Nearly half of all India's children - approximately 60 million - are underweight, about 45% are stunted (too short for their age), 20% are wasted (too thin for their height, indicating acute malnutrition), 75% are anemic, and 57% are Vitamin A deficient (Worldbank, 2013). Situation in Sri Lanka and Nepal is also equally grim.

Small millets are superior in nutritional qualities when compared to commonly consumed crops like rice. They grow under dry conditions, can cope with relatively poor soils and require few external inputs. In addition, small millets sequester carbon, thereby adding to CO₂ abatement opportunities, contribute to improved agro-biodiversity by their rich varietal diversity, allow for mutually beneficial intercropping with other vital crops, meet fodder requirements and have significant cultural value due to their long history in the South Asian Region. Despite these advantages small millets are in a situation of crisis in South Asia. India witnessed a dramatic decrease in cultivated area during the period between 1961 and 2009, saw a 76% decrease in total production and a steep fall in overall millets consumption. Some of the main underlying barriers which have limited—and still are limiting—the production and consumption of small millets are 1) Inadequate investment on research on small millets when compared to other crops and poor reach of limited improved methods of production and technologies, 2) Lack of appropriate post-harvest processing technologies, 3) Near absence of production and marketing support when compared to the support enjoyed by other crops and 4) Changes in preference patterns in consumption moving away from them (Sanskritisation), mainly due to inclusion of only rice and wheat into the Public Distribution System (PDS). There is a strong possibility that revival and promotion of Small millets and associated crops (SMACs) could address major problems of food and nutrition security in large tracts of rainfed South Asia. With this premise Revalorising Small Millets in Rainfed Regions of South Asia Project (RESMISA) was initiated in 2011.

Goal

Enhancing the status of small millets in mainstream diets, especially among rural women and children.

Objectives

The major objective of this action research project is to increase production and daily consumption of nutritious small millets, pulses and oil seeds in rainfed regions of India, Nepal and Sri Lanka, by using gender sensitive participatory approaches to address constraints related to the production, distribution, and consumption. This project has the following specific objectives:

- To promote sustainable use and on-farm conservation of agro-biodiversity of small millets
- To increase productivity by minimizing agronomic and production related constraints
- To develop and adapt appropriate post harvest technologies and add value for increasing consumption of small millets
- To revitalize indigenous knowledge and socio-cultural practices that augment cultivation, processing, storage, and utilization of small millets
- To create awareness about the wholesomeness of small millets and enhance their status in mainstream diets
- To undertake policy analysis and advocate for a policy environment conducive for small millets

Expected Results

- Increased production and consumption of nutritious small millets and pulses
- Conservation of threatened millet varieties and development of a breeding program
- Development of tool kits on sustainable agricultural growing practices
- Improved post-harvest technologies to make millet processing easier for women

The Research Activities

Objective 1: To promote sustainable use and on-farm conservation of agro-biodiversity of small millets

1.1 Understanding the varietal diversity in the project sites : A series of research activities were undertaken to understand the crop varietal diversity that is either under cultivation or existed earlier in the project sites.

1.1.1 Scouting for traditional or local varieties of small millets : Scouting was done in all the sites before and during the cropping season by visiting the farms and interacting with the farmers. Based on the information and seeds collected before the cropping season, biodiversity block and mother trials were conducted in the sites.

1.1.2 Diversity fair: Diversity fair was organised in all the sites to document the entire agricultural biodiversity found in the sites, with a focus on SMACs and to create awareness among the local farmers on biodiversity.

1.1.3 Biodiversity blocks for understanding varietal diversity of small millets: Using local varieties of small millets collected from each project sites, biodiversity blocks were established on farmers' fields in all research sites to understand the actual differences between the varieties.

1.2 Compiling information on released varieties and their pedigrees: The project has compiled information on improved varieties of small millets released in India, Nepal and Sri Lanka. They included information on pedigree, breeding method, important yield, and agronomic-related attributes.

1.3 Participatory Varietal Selection (PVS): The project adopted PVS method to provide an opportunity to farmers for evaluating local, creolized, and improved varieties under their farm management and agro-climatic conditions. As a first step towards PVS, mother trials were initiated across eight project sites in Kharif 2011. The selection of local varieties included in mother trials was based on the outcome of scouting activities and the availability of their seeds. These trials also included released varieties recommended by various research institutions for the region. At the maturity stage, preference analysis (PA) was conducted with men and women farmers for evaluating the varieties included in the mother trials. Breeders from AICSMIP and TNAU also participated. The PA exercise empowered farmers to evaluate the comparative performance of different varieties. The data collected from this exercise were analysed for identifying better performing local and released small millet varieties. The baby trials were initiated in the Kharif 2012 - with these identified varieties. In Kharif 2013 varieties identified in the baby trials were included in informal research and development for final verification on the suitability for the research sites.

1.4 Developing a protocol for genetic characterization of local varieties

1.5 Morphological characterization of local varieties: Morphological characterization was carried out at two levels: the one, using the data collected from biodiversity blocks and from mother trials in the first and second year at five sites. At the other level, in Indian and Sri Lankan research institutes.

1.6 Seed network study : Seed network study was completed in three hamlets of Nepal for finger millet, maize and rice.

1.7 Community seed bank and Biodiversity fund : Community seed bank was set up in Nepal and village-level biodiversity fund was initiated at five sites in India to motivate the farmers' experimental groups to conserve endangered local varieties beyond the project period.



Objective 2: To increase productivity by minimizing agronomic and production related constraints

2.1 Organization and strengthening of farmer experimental groups

2.2 On-farm trials of Sustainable Agricultural Kits (SAKs) :

Based on SAK survey, baseline survey and series of participatory consultations with farmers, major production-related constraints for each site were identified. Most of the sites faced the common constraint of low productivity, besides some site-specific constraints. On-farm trials addressing site-specific constraints and opportunities were taken up in all the sites.

Some of the SAK, and other agronomic trials taken up in Indian sites are: (i) Popularising transplanting in Semiliguda over broadcasting, (ii) Line sowing method (using Anchetty model of bullock drawn seed driller) as compared to traditional method of broadcasting in Jawadhu Hills and Peraiyur, (iii) Experiments on *Guli*, a method of planting similar to a system of rice intensification, in Anchetty and Bero, (iv) Trials on micronutrients at Anchetty and Peraiyur, and (v) Trials with bio-pesticide for controlling field bean pod borer, an insect resistant to many common pesticides, at Anchetty.

In Nepal, the main constraints were labour shortage, poor quality manure, weed and damage by wild animals in finger millet production. Six potential kit agronomic interventions - application of NPK, N alone, intercropping with cowpea, micronutrient application, date of sowing, and direct sowing - were tried. In Sri Lanka, weeds and undulating land were identified as the main constraints in finger millet cultivation. Raw sowing in general and on the sloppy land, and weedicide use trials were taken up. In all the sites results were being studied and based on the results further trials and promotion of effective agronomic practices would be undertaken in the coming years.

2.3 Training to farmers on production practices

Objective 3: To develop and adapt appropriate post-harvest technologies and add value

3.1 Evaluation of nutritional content and other attributes of different varieties of small millet crops : The nutritional analysis of different varieties of small millets collected from India, Nepal, and North America (Canada and the US) was completed and the results showed significant differences in dietary fibre, starch fractions, total free lipids and fatty acid profiles. Different small millet varieties grown on project sites were analysed for protein content, crude fibre, calcium, and amino acids (tryptophan, cysteine, methionine).

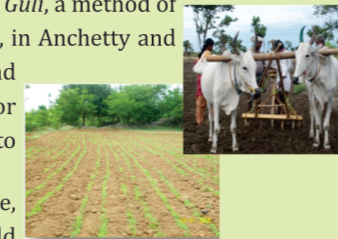
3.2 Bioavailability of nutrients from different product matrices

3.3 Development of healthful products, and assessing consumer acceptance and health impact: Different healthful products were developed from small millets and



their Glicemic Index (GI) was tested. Standardization of both modern and traditional small millets products were carried out. Consumer acceptability trials were taken up. Further studies were done for the products on physical properties, sensory attributes, nutrient analysis, packaging materials and shelf life.

3.4 Identification of finger millet varieties for popping



3.5 Developing/refining dehuller for small millets : A prototype with 85 per cent efficiency has been developed for little millet and is being field tested. The team is doing further study on adapting this prototype for barnyard millet and kodo millet.



3.6 Enhancing the hygiene of roadside pushcart millet porridge sellers: Lab tests of millet porridge sold by the street vendors were conducted. The microbial load of the porridge samples was found to be well within the safe limit. Training-cum-workshop was taken up for porridge push cart vendors to educate them on basic hygiene and care needed while selecting the place for preparing food and storing food products.

3.7 Identification of technologies to reduce blackening of finger millet

3.8 Identification of technologies to reduce poisoning of kodo millet

Objective 4: To revitalize indigenous knowledge and socio-cultural practices

4.1 Community Biodiversity Register (CBR) on small millets: CBRs were prepared in many of the working villages across the sites with the support of local administration.



4.2 Recipe contest: Recipe contest was organised in many of the sites to document the knowledge of the local community, mainly women, on various recipes of SMACs and to create awareness among the local community on importance of consuming small millets. More than 30 recipes were documented in most of the sites.

4.3 School competitions for documenting indigenous knowledge: School competitions involving systematic knowledge tests were conducted on content, process and pathways of the transmission of indigenous knowledge pertaining to small millets.

Objective 5: To create awareness about the wholesomeness of small millets and enhance their status in mainstream diets

5.1 Conducting consumer surveys on small millets:

Consumer survey was done to understand consumers' preferences for street food and their understanding of nutrition, hygiene and other attributes of street food products.



5.2 Study of markets and value chains of small millets : Study of market chain of small millets was taken up in India and Nepal.

5.3 Promoting small millets through local entrepreneurs: DHAN organised seven training workshops in which nearly 150 self-help group (SHG) members involved in small scale food business participated. The training covered small millets recipes, food processing and hygiene, client orientation, mobilizing financial resources from public and private sources, and business management. Twelve participants diversified their products by including small millet based food products. LI-BIRD has supported three local entrepreneurs to promote six finger millet recipes in agro fairs and food fairs.

