

Integrated Approaches in Small Millets Conservation: A Case from Kolli Hills, India

E.D. Israel Oliver King and
V. Arivudai Nambi
M.S. Swaminathan Research Foundation
III Cross Road, Institutional Area
Taramani, Chennai
India

Latha Nagarajan
Environment and Production
Technology Division,
International Food Policy
Research Institute, 2033 K Street,
NW, Washington, DC 20006, USA

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Abstract

Selective utilisation of crops and varieties in recent times have threatened agrobiodiversity leading to rapid erosion of natural resources and consequently affecting the nutritional security of people. One of the possible pathways for conservation of such neglected agrobiodiversity resources is to bring them into use thereby making them viable crops within the contemporary social and economic context. The paper elaborates on the traditional agricultural practices of millets like little millet (*Panicum sumatrense*), Italian millet (*Setaria italica*), finger millet (*Eleusine coracana*), common millet (*Panicum miliaceum*), and Kodo millet (*Paspalum scrobiculatum*) in different landscapes and management conditions of the Malayali tribes in the Kolli Hills, Namakkal District, Tamil Nadu, South India. Factors responsible for transition of agriculture in the landscape over the last two decades and its impact on food and nutritional security are discussed. The work of the M. S. Swaminathan Research Foundation (MSSRF) that implements several biodiversity projects in the Kolli Hills aimed at sustainable use of millets adopting an integrated approach consisting of four Cs: (i) Conservation, (ii) Cultivation, (iii) Consumption, and (iv) Commerce, are also discussed.

THE SETTING AND BACKDROP

The Kolli Hills, located in Tamil Nadu, South India in Namakkal District (78° 17'05''E to 78° 27'45''E and 11° 55'05''N to 11° 21'10''N), are low ranging hills spread over an area of 441.41 km². The place is inhabited by a group of tribals known as the *Malayali Gounders* who are supposed to have migrated from the plains of Kanchipuram and settled in various hill ranges of the Eastern Ghats including the Kolli Hills (Vedavalli et al., 2002) about five centuries ago (Thurston and Rangachari, 1975). During settlement, they cleared forests and utilized land for cultivation of food crops, notably millets.

Presently, 21 landraces of little millet, Italian millet, common millet and kodo millet are cultivated under different agro-climatological and landscape conditions. A range of locally suited traditional agricultural practices that include intercropping, multiple cropping, mixed cropping and crop rotation based on soil types and rainfall pattern that fit into agro climatic and landscape conditions has evolved. Many such practices had strong subsistence focus which supported food and nutritional security of people. For example, mixed cropping is practiced to maintain food security of the farm family. The system involves a combination of crops having different food value, maturity period, input period, capacity to withstand the vagaries of monsoon, and ability to help in

minimizing risks and stabilizing household food supply. Crop rotation helped in maintaining soil health through enrichment and recycling, making optimal use of precipitation, and meeting the multiple needs of households.

THREAT TO AGROBIODIVERSITY IN KOLLI HILLS

The agrobiodiversity in Kolli Hills has been declining over the last three decades due to several factors such as expansion of commercial agriculture, market links, unsustainable use of forest resources, modification of the landscape, land alienation and land use changes and cultural erosion, all resulting in the shrinkage of area under millet cultivation. The introduction of cash crops like tapioca, drudgery involved in the processing of millets, lack of market linkages for millets, expanding transport facilities, availability of food grain especially rice at reasonable cost through the Public Distribution System (PDS), rice consumption as a symbol of social status and mobility, are the major factors responsible for the decline in the cultivation and consumption of minor millets.

During the 1970s, the state sponsored a road-laying program which linked most settlements in the Kolli Hills with metalled roads (Shubh Kumar Range, 2001). This change helped in the mobility of the people to other villages and towns in the plains and brought in its wake a band of merchants and contractors for the marketing links for agricultural produce. Since the 1980s, three market centers were developed in Kolli Hills that covered the entire hills, setting the base for constant interaction of local people with outside merchants. Financial support like advance crop loan and transportation facilities for tapioca produce was provided by merchants and contractors (Shubh Kumar Range, 2001) leading to large-scale expansion of tapioca cultivation in uplands and modification of rocky undulating terrains that were traditionally under mixed cropping and monoculture of millets. Various cash crops like tapioca, pepper, coffee, and the area under pineapple are good indicators of this trend. From 7,287 ha in 2000, the area increased to 7,829 ha in 2004 (Anonymous, 2004). This is approximately 43% of the net cropped area of the Kolli Hills. In contrast, the area of millets stood at 1,306 ha in 2000 and 1,311 ha in 2004, covering only 7.2% of the net sown area in the Kolli Hills. One of the important impacts on agriculture brought about by such a change was the erosion of several agricultural practices like mixed cropping. The move from subsistence agriculture to commercial agriculture led to loss of not only food but also soil fertility due to continuous monoculture of tapioca.

The interest and attitude of the tribal community towards commercial horticulture such as planting of silver oak, pepper, coffee and cardamom estates have increased the pressure on traditional agriculture. For example in 1970, there was only one estate spread over two acres in the Kolli Hills. By 1989, the number increased to eight covering 225 acres. In 1999, there was a quantum jump totaling 59 estates that cover 1,453 acres. The latest figure stands at 97 estates covering 1,975 acres. Such massive changes in the land use led to the dilution of traditional institutions and are challenging traditional cultivation methods, resulting in abandonment of millet cultivation. Many members belonging to the younger generation informed that hand pounding of millets was drudgery and that minor millets have low market value. These factors, along with the option of tapioca cultivation on a commercial scale, have brought down interest in the cultivation of millets. Moreover, state policies related to crop loan, subsidies, favourable conditions for commercial agriculture, supply of food items like rice, wheat, *maida* and *rava* at reasonable cost through the public distribution system (PDS), have shaped the minds of people to neglect minor millets (Swaminathan, 2000).

STRATEGIES FOR SMALL MILLET CONSERVATION

The change in the land use on such a massive scale, and various cultural practices and food habits brought to the fore the importance of conservation of millet landraces. Seeds of all available land races of millets were collected by MSSRF from different regions of Kolli Hills. A series of biodiversity projects were launched using an integrated approach for conservation and sustainable use to simultaneously address various dimensions of biodiversity, nutrition, hidden hunger and poverty.

I. Conservation

The strategies for conservation of millets involve seed collection, multiplication, seed distribution and farmer-to-farmer exchange mediated through the traditional seed storage system. As a first step, seeds of landraces collected from various locations were multiplied in plots with the participation of local people in producing quality seed material. Proper cleaning of seeds, use of farm yard manure, and sowing in the right season were some of the practices adopted for producing good quality seeds. On harvest, seeds were cleaned and stored in traditional seed storage systems like *dhombai* (a storage structure used for storing grain) and *kuthir* that formed a part of the community seed bank. Changes in the cropping pattern led to the abandonment of traditional seed storage systems like *dhombais* and *kuthirs*. The projects revitalized some traditional seed storage practices like *dhombais* and *kuthirs* under new social conditions. The structures were used for storing landraces of millets, and new institutions like self-help groups (SHGs) were organized for storing and exchanging seeds. Seed material was distributed to farmers through such seed storage systems (Rengalakshmi et al., 2003a). To enable a larger outreach, seeds were also distributed to interested farmers during the annual temple festival. Each of the seed banks maintained records of the receipts, lending, and interest over the seed loan. In 2001, a total of 1,989 kg of little and Italian millet seeds were distributed to farmers. By 2006, the quantity of seed distributed was 616 kg of five different species of millets.

II. Cultivation

Farmers reported that poor financial returns from millets compared with tapioca was one of the reasons for their abandonment of millets. The projects therefore decided to use a number of participatory yield enhancement trials that used agronomic practices like line sowing/row planting and intercropping (Rengalakshmi et al., 2003b) to increase yield towards better financial returns. Trial plots were established in farmer's fields with their active participation and used as a strategy to teach and demonstrate. The activity enhanced production potential and thereby economic returns per unit area of land. During the 2007 cropping season (*khariif* 2007), farmers were able to double the yield in *Panicum sumatrense*. Farmers harvested 500-600 kg per acre through the line sowing method of cultivation compared with 250-300 kg per acre raised through the conventional broadcasting method.

III. Consumption

Small millets are consumed as gruel, *kanji* and in the dehusked form. Little millets and Italian millets are pounded using mortar and pestle to dehusk multiple seed coats then extract the grain. Stone grinders are used for processing finger millet into flour. Women are involved in the manual dehusking and grinding of millets which is a drudgery.

Provision of a low cost milling units for removal of stones and the seed coats would contribute significantly to the revival of interest in millets. The time spent for processing millets is indicated in Tables 1 and 2. Dehusking mills for processing little and Italian millets were established in two locations in Kolli Hills in 1998 and 2003 and managed by members of self-help groups. This intervention benefited households from 21 hamlets. In 2008, six pulverizers, managed by SHGs, were installed in five locations. It is estimated that 36 hamlets would benefit through these small mills.

IV. Commercialization

A network of self-help groups (SHG) was trained in operating mills, processing, packing and labeling. Professionals from the University of Agriculture Sciences (UAS), Dharwad India and Golden Palace Catering Technology Institute, Namakkal (Ranjini, 2005) trained SHG members in culinary preparations of millet-based value-added products. Twenty different products of millets such as whole grain, processed grain, flour and value added products were supplied to local, regional and metropolis markets. The SHGs began sale of little and Italian millet as whole grain in 2002 with a volume of 10,200 kg and this is still active in the market till date. They have progressed to value-added products like flour and other forms. A total of 24,216 kg of millets worth of US \$ 11,737 (1US \$ = INR 40) have been marketed. The cost benefits of these efforts are summarized in Tables 3 and 4.

COMMUNITY INSTITUTIONAL BUILDING

The process-based projects have been facilitated with the active participation of communities and led to the gradual evolution of community-based institutions for taking up the cause of conservation and sustainable use of millets. Consistent efforts have been taken to train and build capacities of farmers on various aspects related to conservation, natural resource management, poverty reduction and community institutional building. It is pertinent to mention that the support of the state in various forms, including provision of credit, subsidies and infrastructure, made a significant contribution to the community based effort.

CONCLUSION: INTEGRATED APPROACHES FOR MILLETS PROMOTION CONSERVATION

- Revival of traditional conventional implements such as *thombai* (grain storage), *man panai* (mud pot used for seed storage), *kuthir* (larger mud pot for grain storage), *kalappai* (for upland ploughing), *rapti* (long cloth bag for carrying millet from threshing yard to home), *parappi* (plate made from bamboo for drying seeds/grain), *ural* and *ulakkai* (pestle and mortar) have become difficult as the associated communities such as *kuyavar* (potter), *thappa kuravan* (bamboo craft workers) and *ottan* (stone worker) are not available in the Kolli Hills to provide support services to agriculture.
- Community-based seed bank operations are largely dependent on an optimal level of literacy and require valued time of a monitoring person, making seed exchange at times difficult.

Cultivation

- It is vital to recognize that holders of traditional knowledge (TK) possess knowledge of seed selection, seed mixtures, seed quantity, seed sowing

methods, crop management, harvesting and storage. Transfer of this knowledge to the younger generation is vital for the continued use of millets.

- Decline in cattle numbers reduced the availability of draught animal power and farm yard manure that are essential for the cultivation of millets. This situation requires immediate and appropriate attention.
- Under changed land-use conditions, effective crop protection measures to safeguard the crop from bird attacks, rats and wild animals are essential.
- Land alienation, landscape modification and expansion in private lands and extension into forest areas in the uplands leads to the expansion of cash crops like tapioca, pepper and coffee that led to the rapid decline in the area under millets.
- State support is required in providing organic inputs and agricultural support services to millet crops. Crop insurance, provision of subsidy and minimum support price to millets as other cash crops would create interest among farmers and encourage cultivation of millets.

Consumption

- Knowledge on processing, cooking and consumption is eroding rapidly, notably among young women and men. Therefore, culinary training aimed at different segments of society is essential.
- State support for mills with smaller capacity is essential. In order to reduce drudgery to women from pounding, these mills should be easily accessible to most millet farm households/hamlets to make it practical to women.
- Inclusion of millets in the Public Distribution System (PDS) scheme, noon meal programme and integrated child development schemes (ICDS) is important.
- Support for demonstration of value-added products of millets to showcase the variety of products could be made from millets to create nutritional awareness among millet and non-millet growers.

Commercialization

- Millets have a niche market in urban and peri-urban centres. However, experience reveals that general consumers normally do not prefer millet products. Therefore, supply of this material into the organic product supply chains would be a suitable and sustainable pathway for its promotion.
- A millet-based entrepreneurship development programme, such as millet-based small scale industries would absorb rural youth and provide alternative livelihoods.
- Rural infrastructure like threshing yards and storage houses are also essential. Regulated market, Large Scale Multipurpose Society (LAMPS), and Tribal Cooperative Marketing Federation of India Ltd. (TRIFED) should encourage millet farming with their support systems.
- Mass campaigning for inculcating the importance of millets in cultivation, nutrition, value addition, consumption and market is essential.

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Tables

Table 1. Manual Pounding / Manual Grinding (MP/MGr).

Millet	Not Dried /Dried	Grain Quantity In Kg	No of MP/MGr	Duration in Hr/Min	Recovery in Kg/g
Little Millet	Not Dried	5	3	3.15	3.25
Italian Millet	Not Dried	5	2	2.08	3.75
Finger Millet	Not Dried	5	1	2.08	4.50
Little Millet	Dried	5	2	1.25	3.50
Italian Millet	Dried	5	2	1.00	4.00
Finger Millet	Dried	5	1	1.40	4.12

Source: Field observation (n= 10)

Table 2. Mechanical Dehusking (MD) and Manual Grinding (MGr).

Millet	Not Dried/ Dried	Grain Quantity In Kg	No of MD/Mg r	Duration in Minutes	Recovery in Kg/g
Little Millet	Not Dried	5	4	4	3.00
Italian Millet	Not Dried	5	3	3	3.60
Finger Millet	Not Dried	5	1	8	4.00
Little Millet	Dried	5	3	3	3.25
Italian Millet	Dried	5	2	3	3.75
Finger Millet	Dried	5	1	2	3.75

Source: Field observation (n=10)

Table 3. Cost benefit of processed Millets.

Regular Products*	Grain cost for 100 kg	Recovery in Kg	Gross Income in USD	Expenditure in USD	Net Income in USD	Margin per USD
Little Millet Rava	650	55	38.5	30	8.5	0.15
Italian Millet Rava	650	60	42	30.6	11.3	0.18
Finger Millet Flour	1000	92	64.4	44	20.4	0.22

Source: SHG records (Records maintained by the self-help groups) 1 USD = 40 Rs

*When processed at 100 kg

Table 4. Cost benefit of Value added products in Millets.

Value Added Products*	Ingredient Cost in USD**	Recovery in kg	Gross income in USD	Expenditure in USD	Net Income in USD	Margin per Kg in USD
Ragi Malt	58.5	100	150	96.5	53.5	0.53
Thinai Payasa Mix	82.7	100	150	121.6	28.32	0.28
Thinai Laddu	110.1	100	195	148.7	46.27	0.46
Samai Bajji Mix	76.2	100	140	112.8	27.15	0.27
Samai Uppuma Mix	72.3	100	130	107.6	22.4	0.22
Samai Rava Dosa Mix	66.7	100	140	100.1	39.9	0.39

Source: SHG Records (Records Maintained by the self-help groups)

*When produced at 100 kg, **1 USD = 40 Rs