

# Access to Minor Millet Genetic Resources in Rural Market Towns of Dharmapuri District, Tamil Nadu, India

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## INTRODUCTION

Minor millets are a group of annual grasses found mainly in arid and semi-arid regions of the world. They are cultivated on 29.1 million hectares in India, accounting for nearly 25 per cent of the total acreage under cereal crops (Department of Agriculture and Cooperatives, 2006). These millets are cultivated primarily in marginal and rain-fed environments, and play a significant role in meeting food and fodder requirements of farming communities. Three species of minor millets – namely, finger millet (*Eleusine corocona*), foxtail millet (*Setaria italica*) and proso, or little millet (*Panicum milliaceum*) – are extensively cultivated in the arid and semi-arid regions of India. These crops are often classified as ‘minor or coarse grains’ in agricultural statistics. ‘Minor’ refers not only to the smaller size of the grains, but also to their lesser importance in trade. Scientific knowledge about these millet crops is also limited. Despite national efforts to collect minor millet germplasm from farmers, research to improve these crops has been negligible.

Liberalization of the Indian seed sector during the 1990s favoured dryland cereals and legumes – including sorghum and pearl millet – but with little impact on research and formal distribution channels for finger millet and other minor

millet. Currently, the states of Karnataka, Andhra Pradesh and Tamil Nadu lead crop improvement research on minor millets. However, the range of improved varieties released from these research programmes is very narrow. In India, while all public-sector varieties are certified, the process is voluntary for private varieties, although uncertified seeds are required to be truthfully labelled with attributes listed on the label (Ramaswami, 2002). Private seed firms or farmer-seed producers often do not submit their varieties for certification, either because they do not wish to go through the time-consuming process of notification or because they have their own quality-control processes.

Crops such as minor millets attract less investment in research and product development by private firms. One reason why most companies are not interested is that most minor millets are self-pollinating and it is difficult to exploit their heterosis for hybrid development. Another reason is their limited commercial importance, although in recent years, minor millets have emerged in very specialized (niche) markets, especially from the nascent health foods sector in urban areas.

Dharmapuri District, located in the north-western part of Tamil Nadu, is a dryland semi-arid production system. The district ranks first in terms of total area (39,500ha) and production (44,500 tonnes) of minor millet crops in the state (Government of Tamil Nadu, 2004–2005). The district receives only 400mm to 500mm of rainfall annually, and less than 10 per cent of farmland is irrigated. Dharmapuri is a major market centre among south Indian states for the sale of little millet and finger millet. The district also has an agricultural research station located in Payyur that conducts crop improvement research on small millets in Tamil Nadu.

Farmers in Dharmapuri District access minor millet crop seeds through informal and formal sources. They either use their own farm-saved stocks or borrow from neighbours through informal exchanges within village communities (key informant interviews, July to August 2006). Since research systems are poorly developed for minor millets, traditional varieties dominate farming systems, and explicit formalized channels of seed are not well developed. Hence, the existing seed systems of these minor crops in India are typically 'autarkic'. In other words, genetic resources embodied in seed are not introduced from locations beyond a given geographical radius and there is no interaction with private companies or public seed corporations (Nagarajan and Smale, 2005). When traditional or autarkic seed systems are stressed either due to crises (e.g. drought and conflicts) or in the process of economic development where traditional relationships may break down, local markets assume importance in exchanging necessary crop genetic resources. Additionally, more and more farmers in this environment are participating in markets, and local market towns have become important centres for exchanging genetic resources. Although well-developed seed supply channels based on advanced breeding systems are rare, very often existing channels for grain double as seed supply. For instance,



improved cultivars of finger millet are distributed locally by private seed dealers and village traders, as well as through seed depots and occasionally via government assistance programmes for farmers.

A few studies have outlined the importance of local markets in the provision of planting materials during normal and emergency times (David and Sperling, 1999; Jones et al, 2001; Sperling and Longley, 2002; Sperling et al, 2006; Nagarajan and Smale, 2007; Smale et al, 2008). In all of these studies, village markets or fairs were identified as the primary mode of commercial exchange. With improvements in infrastructure in rural areas, small, market towns have become the centres of commercial transactions in many parts of the world. They can be considered the primary node or 'top' of the market chain (Fafchamps and Hill, 2005). The scope of the current study includes characterizing different vendors in local markets, especially during the sowing season.

Previous literature related to millet seed systems and markets in India have focused on pearl millet and/or sorghum, although there are exceptions (Pray and Ramaswami, 2001; Pray et al, 2001; Pal and Tripp, 2002; Bantilan and Deb, 2002; Christinck, 2002; Evenson and Gollin, 2003; Vom Brocke et al, 2003). Each of these studies addressed either formal or informal channels, but not both. Furthermore, Nagarajan and Smale (2007) found that village markets, and open-air traders, played a key role in the exchange of planting materials during the sowing season in semi-arid regions of southern India. These markets often acted as the first node in the seed supply chain, especially for crops with little ongoing research efforts. In this chapter, following the methodology outlined in Chapter 3, we are interested in how variations in market transactions and vendor characteristics affect access to planting materials of minor millets in the Dharmapuri District in Tamil Nadu Province, India.

## **SAMPLING AND DATA**

Study sites and the focus crops were selected in consultation with stakeholders and based on detailed key informant surveys conducted both at the farm and market levels during April and May 2006.<sup>1</sup> Based on key informant surveys, a sample structure and survey instruments were designed. The final survey was implemented from March to May 2007 before the planting season. We adopted two types of sampling protocols: one for sampling vendors in markets and another for sampling vendor lots from sampled vendors to measure the diversity in minor millets transacted in local markets. The sampled lots were subjected to detailed agro-morphological characterization through field trial grow outs.

In Dharmapuri District, minor millet trading is conducted primarily at five local market towns: Pennagaram, Dharmapuri, Harur, Pappireddipatty and Palacode. Each market town serves as an important trading centre where farmers participate either in the sale or purchase of grains and necessary planting materials of minor millet crops. Although most of the transactions in these



markets were for grain, seeds of minor millets were also accessed through the same supply channel and actors. Among the market towns, Pennagaram is the leading marketing and production centre (15,000ha) for little and finger millet crops (Department of Agriculture, 2005–2006). The basic structure of the supply channel (and actors) was the same in all the market towns surveyed, although in Pennagaram we also found agri-depots that supply seed exclusively.

The vendors operate all year round and have permanent infrastructures, except open-air vendors, who participated in weekly markets. Although weekly markets were conducted in all the surveyed market towns, minor millets were sold only in the weekly market of Pennagaram. Therefore, our sample of open-air vendors consists of participants from the Pennagaram market only.

We prepared a detailed inventory of the number of wholesale vendors (known as *mandies*), retailers, agro-dealers and open-air traders (traders in markets known as *shandies*) in each of the selected market locations that traded minor millets on a regular basis prior to the sowing season beginning in March. A total of 165 traders were found selling minor millets, either as grain or seed. All were included by adopting a census sampling method. Only the state-sponsored agricultural extension depot at the Pennagaram market sold small quantities of certified varieties of improved finger millet at subsidized rates of 1 to 2 rupees per kilogram to farmers under various development and extension programmes. However, the total quantity of minor millet seeds sold through agri-depots is negligible and accounts for less than 2 to 3 per cent of the total seed requirement and sales in the region (Department of Agriculture, 2005–2006). Since agri-depots only occur in one location, they are not described in the following sections. The sampled markets and remaining vendors are reported in Table 7.1.

Data were collected through three sets of survey instruments administered to agro-dealers, grain traders (*mandies*), local shop owners (retailers) and open-air sellers (*shandy* traders) in order to characterize vendors and vendor lots. The vendor surveys were conducted in June and July 2007, the months when the south-west monsoon rainy season typically begins. The vendor instruments were

**Table 7.1** *Local market towns and vendors surveyed in Dharmapuri District*

Markets	Agro-dealers	Wholesale vendors (mandies)	Retailers	Open-air traders (shandies)	Total vendors
Pennagaram	25	17	14	13	69
Harur	11	8	10	3	32
Pappireddipatti	6	4	4	0	14
Palacode	7	8	10	3	25
Dharmapuri	9	4	12	0	25
Total	58	36	54	17	165

Note: Agri-depots are not included because of their limited occurrence.

Source: vendor survey, March 2007

designed to capture information on the characteristics of exchanges (where, with whom, price, quantity, timing); the market (number of other buyers and sellers, products, location, variety, frequency) and the various transaction cost details.

For measuring diversity in markets, during the second stage of our survey, unique seed lots (samples) were collected from the vendors. We collected 250g to 500g of each unique lot sold by the vendor. Details of each sampled lot, such as name of the market, type of vendor, date of collection, the name or variety (as told by the trader), and any other significant details regarding the lot were recorded. The collected samples were subjected to agro-morphological characterization trials in the Namakkal field site managed by the M. S. Swaminathan Research Foundation.

## MARKET PHYSICAL CHARACTERISTICS

In the following sections we discuss the results from the surveys. Most of our analysis is based on vendor types rather than different market locations. Although we sampled across all the five major markets in Dharmapuri District where minor millets are transacted, the vendor sample in each market was too small to conduct exclusive statistical analyses by vendor type at the individual market level.

### *Infrastructure*

There is a fairly consistent agro-ecology across Dharmapuri District; but the market infrastructure does vary across the towns, mainly due to the size of the market. Table 7.2 summarizes the inventory of the market facilities in each town surveyed.<sup>2</sup>

Dharmapuri town (the district headquarters) is largest in terms of area (7.1ha) and Pappireddipatti market is the smallest. All of the market towns were well connected by paved roads with Dharmapuri. The distance varied from 25km to 70km between these markets. The markets have two kinds of buildings. The first are *pucca*, or permanent structures, consisting of grain stores, food and restaurant shops, agro-dealers, pawn brokers, barbers and mechanic shops. The other type of buildings, semi-permanent or *kutchu* shops, are either plastic or thatched roof structures that house small and petty food retailers, grain and vegetable vendors, and other small traders. Among the five markets, only Pennagaram, Harur and Palacode host weekly open-air trading inside their premises. The open-air trading area consists mainly of floor and mobile vendors, who conduct sales in one exclusive part of the market. The participation of open-air vendors was higher in Pennagaram than others. Pennagaram is located in the interior of Dharmapuri District and covers nearly 25 to 30 farming communities within a 100km to 120km radius around the market. Traders and



**Table 7.2** *Infrastructure and characteristics of the surveyed markets*

Structures	Type	Dharmapuri	Harur	Penna-garam	Pappired-dipatti	Palacode
	<i>(Numbers below indicate the total units available in each market)</i>					
Size of the market	Hectares	7.1	4.0	5.2	2.3	4.0
Permanent stalls	Pucca	57	21	34	18	23
Semi-permanent stalls	Kutchra	15	10	7	6	10
Motorized transport		30	25	30	15	20
Bullock-drawn carts		10	5	7	5	5
Public toilets		4	1	3	1	1
Drinking water						
Overhead tanks		1	1	1	0	0
Mini tanks		4	1	3	1	1
Hand pump		2	1	2	1	1
Telephone facilities		5	5	3	2	1
Banking institutions*		5	3	5	3	3
Bicycles (Rental)		10	6	7	5	5

-Note: \* Banking institutions were not present inside the markets but found very close to the market, generally within a 1km to 2km range.

Source: collected information at the time of the survey

farmers from the neighbouring state of Karnataka often participate in this market.

All of the surveyed markets are equipped with access to water and sanitation facilities in proportion to their size. Although all markets have public telephone facilities, most of the traders in permanent and semi-permanent stalls have access to mobile phones. The common form of motorized transport ranges from large trucks and mini trucks to motor bikes. Pennagaram is the major assembling and transaction centre for the sale of little millet in southern India, though other markets transacted relatively limited quantities of minor millet crops. Dharmapuri and Harur supplied a range of agricultural products from rice, cotton, turmeric, sorghum and vegetables. Palacode and Pappireddipatti supplied almost all the cereals crops and cash crops as that of other markets, but in limited quantities.

### **Regulations**

A seed licence is required for the legal sale of seeds. Legal seeds include truthfully labelled (TFL) seeds, and proprietary and public varieties. Only agro-dealers possess a licence for selling seeds. Grain traders have a licence for trading grains only. However, for crops such as minor millets, other minor cereals and legumes, grain traders (retailers and wholesale) and open-air traders also sell 'grain' for 'seed' purposes during sowing season. In the case of truthfully labelled seeds, improved varieties of either public or private firms can be multiplied by an authenticated individual, farmer seed producer or a farmer organization and sold as TFL seeds under the name of the released variety.

**Table 7.3** Market regulations in the surveyed market towns in Dharmapuri District, Tamil Nadu

	Agro-dealers	Wholesale vendors (mandies)	Retailers	Open-air traders (shandies)	Total
Number of vendors	58	36	54	17	165
Requiring a permit (%)	98.3	94.4	81.5	93.8	91.5*
Mean permit fee paid (rupees)	1668.5	2577.8	420.4	6.5	1287.2
Inspected at least once (%)	100	68.6	49.1	0	66.1*

Notes: Agri-depots are not included because of their limited occurrence.

\* Statistically significant difference between vendor types according to either parametric (Chi-squared) or non-parametric (Kruskal-Wallis) tests, at 5%.

Source: authors' survey, 2006–2007, from five markets surveyed

For minor millet crops, dominated by traditional cultivars with very negligible research products available in the market, it is difficult for any enforcement agency to distinguish between seed and grain sales among vendors. All of the markets surveyed were administered by local town administrators. They were also responsible for conducting regular inspection for quality assurance of products and sanitation purposes.

Most of the agro-dealers go through inspections more often than grain traders since they also store and sell other farming inputs on their premises (fertilizers, pesticides and farm equipment). Among the different type of vendors, only agro-dealers (2 per cent of the total) reported paying any 'fine'. It was observed during the survey that all vendors, including open-air traders, were required to obtain a permit to operate in the market towns. The permit fee varied significantly among vendor types, ranging from 7 rupees to 2500 rupees per annum. The fees for the open-air traders are charged per market day (i.e. once per week). Wholesale traders paid the maximum fee as many of these traders also stored grains within their shop premises.

## VENDOR CHARACTERISTICS

In each major market town, there are five channels through which farmers access minor millet genetic resources during the planting season. Four permanent channels consist of *mandies* (wholesale grain traders), retailers, agro-dealers, and government-sponsored agro-depots or centres. Another channel through which seeds are exchanged operated at the village or community level at weekly markets known as *shandies* (Nagarajan and Smale, 2005). The participants in *shandies* are mainly petty vendors or farmer traders, and they sell small quantities (5kg to 100kg) of minor millets to buy other consumption goods for their



households. The *shandies* are usually located in village communities in and around the major market towns and are held once a week on different days and locations. Farming communities with poor market access and low surpluses transact in *shandies* for grain and seed. During the key informant survey, it was noted that minor millet trading occurred only in *shandies* located in and around Pennagaram town as it served as the leading marketing and production (15,000ha) centre for little and finger millet (Department of Agriculture, 2005–2006).

Wholesale grain traders, also known as *mandi* traders, have permanent trading structures, operate all year round and are involved in wholesale trading and shipping to larger markets in bulk quantities (100 million tonnes to 150 million tonnes). The *mandies* are classified as large, medium and small depending on their storage capacity and sales volume. They also engage in commodity price speculation with grains held in storage. Most of the *mandies* engage in grain trade, and seed sales constitute only 3 to 5 per cent of their total minor millet sales. The *mandi* traders are organized and have their own traders' association based in Pennagaram that facilitates the selling and purchasing of grains in the region.

Compared to retailers, *mandi* owners have extensive knowledge about their products and origin. Retailers are not entitled to sell seeds of any crops, so they do not keep records of the varieties they purchase and they often mix different types. Retailers sell millets in small quantities in market towns; but these sales are mainly for consumption purposes. They are also classified as small, medium and large depending on the volume of sales. Retailers usually trade between 0.5kg and a maximum of 500kg of minor millets on a daily basis. The retailers source their grains (seeds) either from *mandies* or intermediary petty traders. In general, seeds of minor millet crops are not traded through retail shops. Frequent inspections by authorities are made to control the sales of seeds by retailers.

Agro-dealers are the only formalized source of seed provision found in these market towns. They are licensed to sell seeds legally. They primarily sell pesticides and fertilizers (75 per cent) apart from seeds (15 to 20 per cent) and small farm implements. Although minor millet seed sales are very negligible in their total portfolio (less than 0.5 per cent), they do sell improved varieties or truthfully labelled seeds of finger millet, based on farmer demand. The major advantage of purchasing from agro-dealers is their extensive knowledge about the varieties and guarantees of seed quality in the case of germination failure.

Vendor characteristics are reported in Table 7.4. Statistical tests indicate that vendor characteristics vary significantly among vendor types and across the markets surveyed. Almost 90 per cent of total traders in the markets were male, though women vendors dominated in the open-air trader category (82 per cent of a total 17 vendors sampled). A small proportion of women vendors (2 to 4 per cent) were present in the other category of traders. However, in these market towns, most of the grain trading and ownership is controlled by males who



**Table 7.4** Characteristics of vendors by vendor type

Vendor characteristics	Agro-dealers	Wholesale vendors (mandies)	Retailers	Open-air traders (shandies)	All vendors	Significance
Number of observations	58	36	54	17	165	
Age (mean)	39.2	47.9	44.2	53.8	44.2	*
Years in school (mean)	12.2	10.9	9.9	3.8	10.3	*
Years of selling in market (mean)	14.0	19.6	14.4	17.6	15.7	
Number of crops sold (mean)	5.4	5.1	4.5	2.6	4.8	*
Female (%)	3.5	0.0	1.9	82.4	10.3	*
Literate (%)	100.0	100.0	94.4	64.7	94.6	*
Ownership of assets (%)						
Mobile phone	72.4	66.7	55.6	5.9	58.8	*
Fixed phone	62.1	77.8	59.3	0.0	58.2	*
Weighing scale	100.0	80.6	90.7	5.9	83.0	*
Bicycle	56.1	37.1	53.7	0.0	45.4	*
Motorbike	51.7	60.0	42.6	0.0	45.1	*
Store						
Own	37.9	63.9	42.6	0.0	46.0	*
Rent	62.1	30.6	55.6	0.0	52.0	*
Truck						
Own	0.0	8.8	0.0	0.0	1.8	*
Rent	94.8	50.0	92.6	0.0	74.9	*

Note: \* Statistically significant difference between vendor types according to either parametric (Chi-squared) or non-parametric (Kruskal-Wallis) tests, at 5%.

Source: authors' survey, 2006–2007, from five markets listed in Table 7.2

handle bulky transactions. In some local market towns, the grain trade is controlled by a clan of members belonging to a particular caste.<sup>3</sup>

The overall literacy rate among the vendor types was highest among agro-dealers (95 per cent) and *mandi* owners (100 per cent) and the lowest among *shandy* traders (65 per cent). The overall levels of literacy are attributed to the free public school education (during the early years) and adult education schemes that operate throughout Tamil Nadu state. The mean number of years of schooling was ten (i.e. most of the vendors have completed high school). However, among the *shandy* traders, the average education level is only four years and many of them have not even completed elementary school. All of the traders (98 per cent) surveyed spoke Tamil as their maternal language. Since Dharmapuri District borders Karnataka and Andhra Pradesh states, a smaller fraction of traders spoke *Kannada* and *Telugu*, the native language of those states, respectively. In general, it was observed that all the traders were well experienced and were involved in sales for more than 15 years. Indeed, *shandy* traders participated in trading activities for a greater number of years (18 years) than other types. Most are farmers and rely upon local market participation to meet their subsistence or immediate cash needs.

Almost all vendors were resident traders, except *shandy* traders who participated from neighbouring villages, usually within a radius of 15km to 20km. All of the resident traders either rented (52 per cent) or owned shops in the market town from which they operated. The ownership of stores was higher among *mandi* traders (64 per cent) and retailers (43 per cent), as they utilized the space for both sales and storage. The ownership of assets (radio, phone and bicycle) was higher among agro-dealers, retailers and *mandies* compared to *shandy* traders. For instance, out of the 59 per cent of vendors who owned phones in the total sample, the ownership by agro-dealers and *mandi* traders was significantly higher (nearly 68 per cent). In recent years, mobile phone ownership has become prevalent among all traders, especially among *mandi* owners and agro-dealers. More than 80 per cent of the traders owned a weighing scale or machine. Agro-dealers and *mandi* owners invested in more advanced measuring equipment than retailers and *shandy* traders since they were subjected to more rigorous and frequent inspections by regulatory agencies.

On average, farmer traders travelled 30km to participate in the market towns. They either transported their produce through trucks arranged by vendors to collect the produce at the farm gate, or through their own means (bicycle, two-wheelers or public transportation). Seventy-five per cent of the vendors (except open air) rented trucks to transport agricultural commodities from the producing centres. At least 9 per cent of *mandi* owners owned their own trucks, as they dealt with higher volumes of grains.

Significant differences existed among vendors depending on the 'type' of material they handled. On average, each vendor sold five different crops. The highest diversity of crops was found in agro-dealer shops followed by retailer and *mandies* (five crops), and the fewest number of crops sold was through *shandy* traders (three crops). Since most of the *shandy* traders are farmers transporting their own farm produce, the diversity may not be as high as other traders. The number of specific varieties or types (lots) sold under each crop also varied across vendor types.

### ACCESS TO MINOR MILLET GENETIC RESOURCES

This section presents data describing the dimensions of access to minor millet seed through different actors in the supply chain. Dimensions include:

- availability in terms of the diversity of physical and genetic qualities supplied through vendors and markets;
- information exchanged about the materials between the vendors and buyers;
- the transaction costs incurred in distribution; and
- the price differentials that exist between the actors in the supply chain.



### *Millet diversity among vendors*

The number of minor millet crops and varieties sold by vendors just before the planting season in 2007 is presented in Table 7.5. In the surveyed markets, ten distinct types of finger millet, two types of little millet and one of foxtail millet were found. Among the traders, the *mandi* traders sold a greater number of millet types or varieties, with eight distinct types of minor millets, followed by open-air traders who sold six distinct types of minor millet varieties.

*Mandi* traders received grains/seeds from 10 to 12 villages covering a geographical area of 80km to 100km, which may partially explain why their stocks are more diverse. Retailers often buy from *mandi* traders and rarely transact directly with farmers. Agro-dealers sell improved varieties of finger millet purchased from government extension agencies or from the neighbouring state (Karnataka). Agro-dealer shops in Pennagaram sell improved finger millet varieties such as *Rasi* and *GPU 28* that were released in Karnataka and are popular among farmers in Dharmapuri District. Open-air vendors sell limited quantities of minor millets; but they offer more distinct types. Frequently, open-air traders sell their own farm produce and provide more information about the variety, its performance and seed lot physical purity than other vendors.

**Table 7.5** *Census of all minor millet lots sold across the vendors in the surveyed markets\**

<i>Crop/variety</i>	<i>Wholesale vendors (mandesi)</i>	<i>Retailers</i>	<i>Agro-dealers</i>	<i>Open-air traders (shandies)</i>	<i>Total number of lots</i>
<b>Finger millet</b>					
Thool Ariyam	33	52	3	11	99
Kolla Ariyam	32	11	0	11	54
Kattu Ariyam	0	1	0	2	3
GPU 28 <sup>a</sup>	1	0	14	0	15
Saratha	1	0	0	0	1
Chinna Saradha	0	0	0	1	1
Karrupu Saradha	0	0	0	1	1
Vella Suruttai	0	0	0	1	1
Rasi <sup>a</sup>	0	0	1	0	1
Karnataka	0	0	4	0	4
Total	67	64	22	27	180
<b>Little millet</b>					
Nattu samai	34	0	0	0	34
Karun samai	1	0	0	0	1
Total	35	0	0	0	35
<b>Foxtail millet</b>					
Total minor millet varieties	5	0	0	0	5
Total number of distinct varieties	107	64	22	27	220
	7	3	4	6	21

*Notes:* a Denotes improved cultivars. \* Note that the census includes both named and unnamed lots of minor millets.

*Source:* vendor survey, 2007 (the names of the seed lots are grouped based on vendors' descriptions)

**Table 7.6** Sources of minor millet lots (%) among vendor types in Dharmapuri markets

Sourcing of vendor lots	Agro-dealers	Wholesale vendors (mandies)	Open-air traders (shandies)
Number of vendors surveyed	58	36	17
Number of named lots	20	37	12
Source*			
Own farm	0.0	2.0	17.7
Farmers	5.2	63.3	29.4
Village traders	5.1	0.0	23.5
Formal source (public/private)	24.1	0.0	0.0

Note: \* Remaining percentage could not be attributed to a particular source.

Source: vendor survey, 2007

### *Sourcing of vendor lots*

In terms of sourcing minor millet lots, there were significant differences between vendor types. Of the 165 vendors surveyed, 69 named vendor lots were identified. We have detailed transaction details of 'named lots' only. Only 111 vendors (except retailers) identified or had sold 'named types'.<sup>4</sup> Retailers did not sell 'named types' and they were hesitant to provide any details on the vendor lots during the survey for fear of being punished by seed inspectors. The major sources of named lots of minor millets include farmers, own farms and local traders. Open-air traders procured 29 per cent of their named vendor lots from other farmers in their village, and the rest from their own farms or from village traders (Table 7.6).

In addition to their own produce, open-air traders often buy from other farmers or traders in their home village, bulk the seeds and sell it in markets. Wholesale traders depend primarily on farmers for sourcing their minor millets (63 per cent of lots). Agro-dealers are formalized and they procure named lots of minor millets from agriculture departments or private seed firms located in the neighbouring state of Karnataka. Finger millet is the only minor millet species with a narrow range of improved materials. Dharmapuri District borders Karnataka state, where finger millet is an important food crop and where relatively more open-pollinated varieties and pure-line selections have been officially released.

### *Millet diversity in markets*

Three different millet species (finger, little and foxtail) and nine distinct cultivars (comprising 70 vendor lots) were recorded across five local market towns in Dharmapuri District. All of the cultivars were landraces except for finger millet, where two varieties (*GPU 28* and *Rasi*) were identified as 'improved' by vendors. A greater number of distinct vendor lots (57) were found among finger millet, followed by little (12) and foxtail millet (1) in these markets. Details regarding the



**Table 7.7** Frequency of minor millet types stocked, markets where sold and sources of variety, rainy season (2007)

Crop	Variety	Number of vendor lots	Markets where variety is sold	Number of markets	Type of vendors stocking the variety
<b>Finger millet</b>					
	GPU 28	2	Harur, Papparappatti	2	Agro-dealer
	Improved	2	Pennagaram, Harur	2	Agro-dealer, Open air
	Kollaryam	29	Pennagaram, Dharmapuri, Palacode, Harur, Morappur, Nallampalli, Papparappatti	7	Agro-dealer, Mandi, retailer, shandy
	Mettuaryam	17	Pennagaram, Dharmapuri, Palacode, Harur, Morappur, Nallampalli	6	Mandi, retailer, shandy
	Thool aryam	7	Pennagaram, Palacode, Harur, Papparappatti, Pennagaram, Dharmapuri, Palacode, Harur, Morappur, Nallampalli	4	Mandi, retailer, open-air, agro-dealer
	Total	57		21	
<b>Little millet</b>					
	Black samai	3	Pennagaram	1	Mandi
	Nattu samai	7	Pennagaram, Harur	2	Mandi
	White samai	2	Pennagaram, Palacode	2	Mandi, open-air
	Total	12		5	
<b>Foxtail millet</b>					
	Palan thinai	1	Pennagaram	1	Mandi
	Total	1		1	

Source: vendor survey, 2007

availability of minor millet types across markets and sources are presented in Table 7.7.

Two varieties of finger millet – *Kollaryam*, an irrigated type, and *Mettuaryam*, a rain-fed type – were sold in large quantities across the markets. Although *Kollaryam* is a traditional cultivar, even agro-dealers, the most formalized vendor type in the supply channel, choose to stock it alongside improved varieties. In Harur market, which supplied both finger and little millets, improved cultivars of finger millet were sold. Harur market is easily accessed by traders and farmers from other northern districts in Tamil Nadu. In the case of little and foxtail millets, all were traditional cultivars and most of the transactions took place through *mandies*. Unlike finger millet, the other minor millet types were locally specific to a few markets, such as Pennagaram, Harur and Palacode. There were

**Table 7.8** *Diversity of minor millet types among vendors in the surveyed markets*

Vendor types across markets	Number of accessions	Number of clusters with similar characteristics	Number of clusters per accession <sup>1</sup>
<b>Finger millet</b>			
Wholesale	30	18	0.60
Retailers	22	11	0.50
Open air	7	2	0.29
<b>Little millet</b>			
Wholesale	24	11	0.46
Open air	4	2	0.50

Note: <sup>1</sup> This is intended to measure the breadth and overlap of materials sold by the different vendors. A lower number implies more overlap by vendors.

Source: morphological characterization field trials, MSSRF field station, Namakkal, 2007–2008

no improved cultivars of little millet sold by vendors in these markets. Pennagaram emerged as an important centre for the production and sale of all minor millet types, with *mandi* and open-air *shandy* settings being the two major sources for farmers.

In order to assess the diversity of minor millet varieties sold through different vendors, detailed agro-morphological trials were conducted from the seed samples collected at the markets (see Table 7.8). Morphological data (qualitative and quantitative plant characteristics) collected from the grow-out trials and detailed statistical analyses were conducted to determine the variation (diversity) among the samples of little and finger millet. It was found that among the finger millet accessions, samples collected from wholesale traders exhibited higher variation, with 18 different types. The least variation was found in samples from open-air traders (two clusters). This is due to higher level of admixtures and impurities present in the wholesale trader samples when compared to open-air traders. Varietal purity was much higher with open-air traders, though less diverse.

Higher variation (or diversity) of little millet was found among wholesale traders' samples (i.e. a higher number of clusters) compared to samples from open-air traders, and this was mainly due to the pooling of materials from different communities from a wider geographic range. Hence, the purity levels, as measured by the lack of variation in their morphological characteristics, are much higher in the samples collected from open-air traders. Within the markets, the samples collected from Pennagaram market provided the greatest variation (i.e. diversity levels) with a maximum of 15 distinct types of finger millet and 3 distinct little millet types. Samples collected from Pappireddipatti and Harur markets exhibited limited diversity, with only two types of finger and little millet each.



The results from the morphological characterization and their comparison with the survey data reveal that pure or 'good' quality planting materials (i.e. genetic purity) are available through the existing supply systems. Although higher levels of diversity are present among the *mandi* shops, the purity of the varieties is always in question when compared to samples found among open-air traders. Other constraints include limited availability of the right type of materials at the right time through these sources. There are several reported instances during periods of high demand when agro-dealers supplied varieties that were not adapted to local environments. Farm households also reported that the government-owned agri-depots often do not supply seeds during the planting season in a timely manner.

### **Information**

Minor millet growers in Dharmapuri District are well aware of market prices before participating in the market. Neighbours are the most frequent source of information (40 per cent), followed by village traders (20 per cent), the mass media (radio, TV and newspapers) and extension agents (10 per cent). In general, with the exception of open-air traders, increased use of mobile and fixed phones has improved the flow of price information among markets. Farmers received information about new varieties of minor millets when they visited agro-dealers and depots, in addition to the same sources that provided price information.

The reasons for stocking a particular minor millet type varied across vendor types. Fifty-two per cent of *mandi* owners stocked millet types to meet demand from consumers and farmers. It was often found, however, that there was a certain level of information asymmetry between the variety types and the purity levels provided by *mandi* traders. About 15 per cent of the interviewed *mandi* owners indicated that they obtained information on different millet varieties from the agri-extension personnel and not from those from whom they purchased the millet. Open-air traders stocked millet types based on their observations in the field (18 per cent) as most of them sold their own produce. Nearly 47 per cent of open-air traders received varietal information from neighbouring farmers and relatives in their communities. Table 7.9 describes the type of information received by the vendors from various sources, as well as the information passed on to consumers.

Nearly 53 per cent of the open-air traders provided information on the origin/source of the seed, but less than 50 per cent of *mandi* traders provided any information about the varieties they sold. Among the vendor types, agro-dealers had considerable knowledge about the consumption and production traits as they sold 'certified seed types', though they sold negligible quantities of minor millet seeds and only of finger millet. For the *shandy* traders, farmers were the major source of vendor lots and most of them provided information regarding consumption and production traits besides the origin and name of the variety. In terms of providing information to the buyers in these markets, only



**Table 7.9** *Type of information received and provided by vendors across markets*

Information	Agro-dealers	Wholesale vendors (mandies)	Open-air traders (shandies)	Significance
Number of vendors surveyed	58	36	17	
<i>Information received</i>				
Variety name	0.0	4.9	5.9	
Origin of the seed	0.0	2.4	17.7	
Production traits	6.9	17.1	5.9	
Consumption traits	27.6	31.7	29.4	*
None	0.0	2.4	11.8	
<i>Information provided</i>				
Variety name	0.0	0.0	11.8	
Origin of the seed	0.0	0.0	52.9	
Production traits	8.6	1.9	0.0	
Consumption traits	22.4	0.0	5.9	*
None	1.7	65.4	0.0	

Notes: \* Statistically significant difference between vendor types according to either parametric (Chi-squared) or non-parametric (Kruskal-Wallis) tests, at 5%.

Source: vendor survey, 2007

*shandy* traders, among all the vendors, were very comprehensive in sharing information on their varieties.

### ***Cost and pricing***

Except for agro-dealers, who only deal with seeds, others in the supply chain did not differentiate minor millet as grain or seed; hence, a clear accounting of the cost of seed was not possible. As shown in Table 7.10, only agro-dealers and wholesale traders treated seeds and/or grains to prevent storage losses. For all vendors, transportation from the village or farm gate to the market place was the largest cost. Wholesale traders, many of whom own their own transport means, incurred higher transportation costs (89 rupees per 100kg bag) and covered a wider geographical area to procure grains. For open-air traders, transportation costs include other incidental expenses such as food and lodging while marketing their produce. These traders often travel from their villages to the market using public transportation.

The second largest cost, next to transportation, is for cleaning and packaging for open-air and wholesale traders. Open-air traders spend more time and effort in cleaning their produce to improve physical appearance. During the planting season, they bring well-cleaned grain to obtain a price premium for the 'physical appearance and quality'. Wholesale traders usually handle the product by packaging it in gunny sacks before shipping to other markets. Hence, most of their costs are incurred in bagging, rather than cleanliness.

Although most of the vendors in these local markets are specialized in grain trading, a price premium effectively differentiates seed from grain. Although



**Table 7.10** Average costs incurred by the vendors across Dharmapuri markets (rupees per 100kg of minor millet)

	Agro-dealers	Wholesale vendors (mandies)	Retailers	Open-air traders (shandies)	Significance
Number of vendors	58	36	54	17	165
Cost of transport†	4.2	89.0	8.3	22.1	25.9*
Cost of cleaning and packaging	0.8	4.5	0.00	9.71	2.3
Cost of treatment (seed or grain)	0.5	1.7	0.00	0.00	0.54

Notes: † Includes vehicle-related and other incidental expenses incurred in the process.

\* Statistically significant difference between vendor types according to either parametric (Chi-squared) or non-parametric (Kruskal-Wallis) tests, at 5%.

Source: authors' calculation from vendor survey data

Indian law allows TFL seeds, specialized production of TFL minor millet seeds is not a common activity; but monetized transactions of unlabelled minor millet 'seeds' take place regularly among farmers. Other than trust conferred through social relationships such as a common clan identity, little other assurance of seed quality and variety identity exists (Nagarajan, 2004; Nagarajan and Smale, 2005). Table 7.11 provides the differences in minor millet grains and seed prices through vendors across markets in Dharmapuri District.

Price differences across vendors for 'seed' is higher than price differences for grain; but little millet seeds were sold by wholesale and open-air traders only. The prices of seeds sold by *mandi* owners were higher than seed sold through open-air vendors. Open-air vendors often sell small quantities and dispose of their produce quickly through direct sales or through retailers so that they can return to their farms, especially during the planting season. The seeds of finger

**Table 7.11** Average price of minor millet grain and seed across vendors in the surveyed markets

Name	Variety name	Grain prices (rupees/kg)			Seed price (rupees/kg)		
		Farm gate <sup>c</sup>	Retailer	Wholesale vendor	Government depot/ agro-dealer	Wholesale vendor	Open-air trader
Little millet	Local	9.5	11	12	–	17	14
Finger millet	Thool aryam <sup>a</sup>	5.5	6.5	7	14	10	9
	Mettu aryam	5	6	6.5	–	10	8
	Improved <sup>b</sup>	5	6	7	16	–	–
Foxtail millet	Manjal thinai	6	7	7.5	–	8	8

Notes: a *Thool aryam* is a local cultivar sold by agro-dealers, mostly as TFL material on popular demand from farmers.

b Improved varieties of finger millet are sold as 'certified' materials by agro-dealers.

c The price of the grains sold at the farm gate and by open-air traders was the same as most of them were farmers themselves.

Source: vendor survey, 2007



millet sold through agro-dealers or government shops are always higher than wholesale and open-air traders due to additional expenses in such activities as certification, bagging or branding. Although quality assurance seems to be greater among agro-dealers and agri-depots, they supply a narrow range of improved materials of finger millet. Often, farmers cannot afford the price differential as certified seeds are more than 50 to 60 per cent higher than grain prices through formal actors.

### ***Factors affecting the supply of minor millets genetic resources***

During the planting season we observed considerable exchange of 'planting materials' of minor millet crops through different vendor types. The quantities exchanged can be considered indicators, at given prices, of seed demand (Nagarajan and Smale, 2007). It was difficult, however, to obtain precise information on the total quantity of minor millets traded as 'seed'. Traders were not aware or could not distinguish if the farmers purchased the product for 'grain' or 'seed' purposes. With the exception of the small quantities of seed only sold by agro-dealers, we observed the co-existence of vendors responsible for supplying both seed and grains in the same channel. Therefore, we took extreme care in estimating the quantity of minor millets traded across different vendor types. The assumption upon which the following conjectures rests is that just before the planting season, there is farmer demand for minor millet seeds, which is met mainly through grain markets.

We argue that several factors affect the quantity of genetic resources traded in these markets. First, the location of the market towns accounts for differences in infrastructure, which, in turn, affects access to seed as well as all other goods. We expect that vendors located in markets with better facilities offer more minor millet types, thus attracting more clients and exchanging larger volumes of minor millets. Second, we expect the quantity of minor millets traded to vary across vendor type. For instance, wholesale traders could dominate in terms of larger volumes, while agro-dealers and open-air traders might be able to specialize in supplying specific cultivars or types.

Third, consistent with the economic theory, we postulate that the quantity traded by different vendor types responds to market price. Fourth, we argue that certain vendor characteristics, such as gender and experience (number of years of sale) and their ability to differentiate between grain and seeds (through storage), would affect the total quantity traded. Timely access to, and availability of, communication and other market infrastructure facilities (phone, electricity and distance to markets) also affects the ability of traders to perform their operations effectively as well as increase sales in rural markets (Jacoby, 2000; Fafchamps and Shilpi, 2003; Shilpi and Umali-Deininger, 2007). In addition, access to certain critical complementary inputs (such as credit) would help the traders to attract clients.



We tested our conjectures on the total quantity of minor millet genetic resources supplied across the small market towns in Dharmapuri District using simple ordinary least squares (OLS) regression methods.<sup>5</sup> The results are reported in Table 7.12. Regression I explains the supply of planting materials in the absence of *shandy* traders. Pennagaram market hub is the only location where there was trading of minor millets through *shandy* traders; therefore, by omitting *shandy* traders the regression analysed the sample observation belonging to the remaining vendor types (*mandies*, retailers and agro-dealers) who were present in all the market towns. However, we also included *shandy* traders in II to derive their impact upon the analysis. Overall, the significance and the magnitude of the factors that affect the supply of minor millets do not vary, either in the presence or absence of *shandy* traders.

Among the markets, significantly greater amounts of minor millets were traded through Pennagaram market in comparison to the omitted hub Dharmapuri. As described in the previous sections, Pennagaram is the major production and marketing centre for minor millet crops and particularly for the sale of finger and little millets in Dharmapuri District. The market is highly specialized and offers more opportunities for the sale of minor millets through organized trading activities – namely, a small millet traders' association. Pennagaram is also located very close to a neighbouring state and its large markets and is well connected by roadways. Although most parts of Dharmapuri District are under semi-arid condition, Pennagaram and the surrounding villages are dependent on rain-fed farming with very minimal cash-earning opportunities through other crops (except minor millets). Pennagaram market also offered more minor millet types (species and varieties) compared to the other market hubs.

Wholesale grain traders (*mandies*) sold larger quantities of both minor millet grains and seeds compared to other vendors. More than 50 per cent of the *mandi* traders owned their own storage facilities and 47 per cent of them stored seed bags separately from grains in their storage facilities. Less than 15 per cent of the retailers and agro-dealers owned their own storage facilities. The retailers hardly differentiate between grains and seeds in their premises. However, all the agro-dealers stored seeds separately, as they specialize in seed sales. *Mandi* owners also have well-developed linkages with minor millet output markets and traders in north India who are involved in value added activities. They also have larger building premises where they properly store the product. Nearly 60 per cent of the *mandi* owners procured minor millets directly from farmers and the rest operated through their own appointed village-level agents to facilitate farm gate purchases. Among the traders, only *mandi* owners extended credit to farmers. In general, agro-dealers do not provide credit to farmers for purchasing seeds because it is risky and dealers cannot be held accountable for poor germination (Nagarajan and Smale, 2005). Retailers and open-air traders, on the other hand, had lower sales volume than wholesale or agro-dealers.

**Table 7.12** *Factors affecting the total quantities of minor millet genetic resources sold in local market towns during the planting season (2007) in Dharmapuri District*

Variable	Definition	Regression I without open-air traders		Regression II with open-air traders	
		Coefficient	t-value	Coefficient	t-value
Gender	Gender of the vendor (male: 1; female: 0)	0.353	1.47	0.550	2.08**
Expected price in rupees/kg†	Calculated as the mean of a triangular distribution of prices elicited from the vendor (minimum, maximum and mode)	0.139	1.83*	0.128	1.82*
Distance in km	Calculated as the total distance to be travelled to the nearest big market town (assembling) for the vendors	0.363	1.49	0.314	1.51
Years of selling in market	Denotes experience – number of years selling in the market town	0.008	1.47	0.008	1.41
Credit provision	If the vendors have extended credit or not (yes: 1; no: 0)	-0.529	-1.93*	-0.544	-2.25**
Ownership of phone	Ownership of phone (yes: 1; no: 0)	0.440	2.21**	0.438	2.22**
Seed quality	Storage of grains and seeds separately or not (yes: 1; no: 0)	0.900	3.04***	0.813	3.2***
Markets location <sup>a</sup>	Location of the vendors in markets				
Palacode		0.559	1.77	0.502	1.63
Nallampalli		0.116	0.36	0.071	0.22
Harur		0.322	1.16	0.323	1.14
Pennagaram		0.599	2.00**	0.594	1.99**
Type of the vendor <sup>b</sup>	Type of the vendors in markets				
Wholesale trader		0.895	2.34**	0.853	2.27**
Retailer		0.431	0.61	0.311	0.46
Agro-dealer		-	-	0.858	1.82*
	Number of traders	109		123	
	F statistic	11.06		16.88	
	Probability > F	0.000		0.000	
	R-squared	0.6022		0.6075	

Notes: a The omitted category comprises markets located in Dharmapuri. b The omitted category of vendor type comprises open-air traders (n = 17) in regression I and open-air traders in regression II. † Denotes variables that have been transformed into their natural logarithmic values. Level of statistical significance: \* = 10%; \*\* = 5%; \*\*\* = 1%.  
Source: authors' calculation from market survey data

In the case of retailers, they were hesitant to sell 'seeds' on their premises as they are not legally allowed to sell anything other than food grains. Agro-dealers, the only authorized source of seeds, also had a significant impact upon the



supply of minor millet genetic resources in these market towns because they sold improved varieties of finger millet. Farmers choose agro-dealers as they are more knowledgeable and the most trusted source of genetic resources available in the market. Mostly farmers who cultivated maize or cotton accessed their seeds of minor millets from agro-dealers (Nagarajan and Oliver King, 2008). The gender of vendors had a significant effect on the supply of minor millets in these markets only when *shandy* traders were included.

The ability of vendors to store grains separately from seed also resulted in more trading of minor millet genetic resources across vendor types. In other words, farmers chose to access seeds from sources that provide good-quality materials. During the survey, farmers based their purchase decision on physical purity levels rather than genetic content of the seed lot. The expected prices offered in these markets also significantly affected the supply of minor millets. The positive association of prices and quantities traded may be attributed to higher prices observed in the output market for minor millets, especially for little millet, due to high demand from north Indian states.

In recent years, rural market towns have assumed a greater role in serving farmers than large urban markets that are far away from the farming communities. These rural market towns are highly specialized, mostly agriculturally based, and lower priced than large markets due to higher transportation costs (50 to 75 rupees per round trip). The availability of improved communication facilities has improved access to information, especially prices in other markets. This is important as the demand for minor millet grain is found outside the production areas in northern India. Vendors with better access to infrastructure facilities, especially better access to communication facilities (such as a phone), have a positive impact upon the amount of minor millet seeds exchanged in these rural markets.

## CONCLUSIONS

Dharmapuri District is the leading production and marketing centre for finger millet and little millet in Tamil Nadu. Small market towns, also known as market hubs, located within the district act as primary market centres for the trade of minor millets. We sampled five market towns (Dharmapuri, Pennagaram, Palacode, Pappireddipatty and Harur) to characterize the supply of minor millets to farming communities. We conducted extensive interviews among four different vendor types – namely, agro-dealers, *mandies* (wholesale traders), retailers and *shandy* (open-air) traders. Vendor-level surveys helped us to define the supply chain and actors involved in the exchange of minor millets. These surveys also enabled us to devise several hypotheses related to the supply of genetic resources. Among the market towns surveyed, Pennagaram dominated both in terms of minor millet area and market transactions. All of the markets had similar supply channels and actors, except Pennagaram market, which had two additional actors (agri-depots and open-air vendors) in its supply chain.



Our findings suggest that there are few institutional factors that govern the transactions of genetic resources by vendors. The absence might affect the availability of seeds as well as farmer access. For instance, regulatory procedures such as licensing of seed traders and inspecting them periodically are enforced among the vendors to restrict illegal trading of 'grains' as 'seed'. In practice, however, these procedures are followed for seeds of commercial importance such as maize, cotton and vegetables, and, to a limited extent, rice, and especially those seeds supplied through formal channels. These crops have well-developed commercial seed supply systems that provide improved cultivars (primarily) during the sowing season. In the case of small millet crops, commercial seed systems have not been developed that include improved cultivars. A small share (2 to 3 per cent) of total demand for minor millet seeds is met by agro-dealers and government-sponsored agri-depots. Hence, during the sowing season, in the absence of formalized channels, seeds are accessed mainly through vendors in the grain markets and the regulations are not strictly enforced as there is little difference between the grain and seed in the supply chain. To a limited extent, one might argue that the existing regulations have restricted the supply of planting materials that pass through grain retailers. Grain retailers go through a more rigorous process of regulation than others as more often they sell grains of poor quality and are more likely to be penalized if they are found selling 'seed'. This leads them to bulk all grains irrespective of quality and these mixtures may not be suitable for planting purposes.

Minor millet crop production is still dominated by farmers' varieties, with a high rate of seed exchange through local markets and social networks (Nagarajan, 2004; Nagarajan and Smale, 2005). Despite often overlapping supply channels for seed and grain, a significant price premium for both quality seeds and varietal information exists in the value chain. The Indian seed certification system allows TFL seed of popular, local and improved varieties. This offers more opportunities, especially for the agri-depots and agro-dealers, to provide quality seeds. There are instances where agro-dealers supply local cultivars as well as improved varieties of finger millet. However, since most of these are open-pollinated varieties and the price incentives associated with selling as seed are not profitable, few dealers are interested in selling these varieties.

At the moment, the availability of finger millet varieties is very narrow, though progress has been made due to demand in the neighbouring state of Karnataka. The Indian Council of Agriculture Research (ICAR)-sponsored All-India Coordinated Research Programme for Small Millets located at the University of Agricultural Sciences, Bangalore, has released several finger millet varieties suitable for the region. They are either open-pollinated varieties (OPVs) or pure-line selections, and some private farms and firms engage in foundation seed production. These foundation seeds of both OPVs and improved pure-line selections can be saved and used for generations. For little millet there are no similar popular improved cultivars that are released. Available varieties for little



millet are very limited, and those that are available are traditional cultivars. The present 'output' or 'grain' market is not differentiated according to variety attributes, but rather by physical purity; thus, the incentive for farmers to grow varieties with specific attributes is limited. However, farmers do value certain variety attributes such as drought tolerance and the colour of the grain and use these criteria while purchasing seeds.

In order to improve the availability of quality planting materials through existing supply channels, a continuous flow of new and improved materials from the research system to the seed sector is required. This could be done by providing improved materials from research and further multiplication through selected farmers and agro-dealers, and even under TFL regulations. Farmers in the dryland environments often complain about higher seed costs and limited availability of seeds through formal actors in the chain. In such cases, seed availability could be improved by providing timely access to minor millet seeds in small packs, at affordable rates, through agri-depots and dealers during the planting season, and perhaps allow *mandies* to distribute them as well. In the case of farmers who access their planting materials through grain traders, there is a need for strict enforcement of quality control and grading. According to results from the survey, seed lots supplied through grain traders often exhibit significant variation due to high levels of impurities.

Minor millet crops do not occupy prime irrigated areas, but play a significant supplementary role in dryland farming systems. For many farmers living in dryland environments with few alternative crops, minor millets are a major source of crop income. In the long run, a more focused breeding strategy coupled with stronger seed supply systems could prove vital for yield stability and increased diversity of minor millet crops in these dryland areas.

## NOTES

- 1 The India project was implemented in collaboration with the M. S. Swaminathan Research Foundation (MSSRF).
- 2 The final sample of vendors in the survey also included shops and traders outside the market premises in the respective market towns, who sold minor millets. Nearly half of the vendors surveyed in the sample are present inside the market premises.
- 3 In Pennagaram market town, the wholesale or *mandi* traders belong to a caste, *chettians*, who traditionally specialized in financial and business transactions of farm commodities.
- 4 Named types here referred to 'as recognized by the vendor or perceived by the vendor and not recognized out of morphological characterization'.
- 5 The regressions presented in this section should be considered as qualitative indicators of the determinant affecting the sale of millets that are considered seed not of overall availability of crop genetic resources.



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