Assessing Farmer's Willingness to Participate in the On-farm Conservation of Minor Millet using Direct Compensation Payment

Tenkasi Raghu, Prabhakaran and Das, Sukanya and S, Bala Ravi and E.D.I, Oliver King

M.S. Swaminathan Research Foundation

August 2012

WORKING PAPER 73/2012

Assessing Farmer's Willingness to Participate in the On-farm Conservation of Minor Millet using Direct Compensation Payment

Prabhakaran T. Raghu
Sukanya Das
S. Bala Ravi
and
E.D.Israel Oliver King

MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

August 2012

Assessing Farmer's Willingness to Participate in the On-farm Conservation of Minor Millet using Direct Compensation Payment

Prabhakaran T. Raghu
International Maize and Wheat Improvement Center (CIMMYT)
New Delhi, India
t.prabhakaran@cgiar.org

Sukanya Das
Madras School of Economics, Chennai, Tamil Nadu, India
sukanya@mse.ac.in

S. Bala Ravi
M.S.Swaminathan Research Foundation, Chennai, Tamil Nadu, India

and

E.D.Israel Oliver King
M.S.Swaminathan Research Foundation, Namakkal, Tamil Nadu, India

WORKING PAPER 73/2012

August 2012

Price : Rs. 35

MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

Phone: 2230 0304/2230 0307/2235 2157
Fax : 2235 4847/2235 2155
Email : info@mse.ac.in
Website: www.mse.ac.in

Assessing Farmer's Willingness to Participate in the On-farm Conservation of Minor Millet using Direct Compensation Payment

Prabhakaran T. Raghu, Sukanya Das, S. Bala Ravi and E.D.Israel Oliver King

Abstract

The farmers, predominantly the small and tribal,, particularly in regions of rich agro-biodiversity immensely contribute to the on-farm conservation and enrichment of this diversity, often at personal cost. The past and present agricultural progress could not have happened without these genetic resources and associated knowledge conserved by farmers. On-farm conservation assumes more importance in the context of climate change in view of the gene evolution it promotes. Therefore, it plays crucial role to the future global food and nutritional security.. Kolli Hills in Tamil Nadu had been a region where six species of minor millets are under cultivation during last several hundred years. Farmers here over this period had evolved significant genetic variability in these crops. They are, however, under threat due to high competition from tapioca as well as the easy access to PDS rice at low prices. This study attempts to examine the role of farmer incentive mechanisms to conserve minor millets in Kolli Hills. The millet varieties were classified either as most preferred varieties (MPVs) or least preferred varieties (LPVs) by the farmer respondents based on their yield and consumption preferences. The farmer willingness to accept compensation to participate in the conservation programme is estimated using a contingent valuation method. Seemingly unrelated bivariate probit regression is used to estimate the determinants of willing to participate in on-farm conservation of minor millets.

Keywords: *Agro-biodiversity conservation, contingent valuation method, food security, kolli hills, minor millets, willingness to accept*

JEL Codes: *Q13, Q18, Q51*

ACKNOWLEDGMENT

This study was carried out by M.S. Swaminathan Research Foundation, Chennai, India with the collaboration of Bioversity International, Rome, Italy using financial support received from Syngenta Research Foundation. The lead author of this study is previously employed with M.S.Swaminathan Research Foundation, Chennai, India during the tenure of the project. Dr. Vijesh Krishna, Senior Research Fellow, Department of Agricultural Economics and Rural Development, Georg-August University of Göttingen, Germany is gratefully acknowledged for developing the contingent valuation method and associated survey instrument which was used to estimate farmers' WTA compensation for participating in the on-farm millet conservation programme.

INTRODUCTION

Underutilized plant species can be characterized by the fact that they are locally abundant but globally rare, that scientific information and knowledge about them is scant, and that their current uses limited relative to their economic potential (Gruère et al., 2009). Minor millets are a group of annual grasses found mainly in arid and semi-arid regions. They are cultivated on 29.1 million hectares (Ha) in India, accounting for nearly 25 percent of the total acreage under cereal crops. In India's dry lands, they play a significant role in meeting food and fodder requirements of farming communities. Three species of minor millets - finger millet (*Eleusine coracana*), foxtail millet (*Setaria italica*) and little millet (*Panicum sumatrense*) are widely cultivated. 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. The scientific knowledge about them is 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 in the 1990s favored dry land cereals and legumes, with little impact on research and formal distribution channels for minor millets. Currently, states of Andhra Pradesh, Karnataka, and Tamil Nadu lead in crop improvement research on minor millets. However, the range of improved varieties is narrow. Private companies show little interest in developing new varieties, due to their lack of commercial importance and the limited scope for developing new hybrids.

In the Kolli Hills of Tamil Nadu, a genetically diverse pool of minor millet varieties has long been grown by the tribal farming communities for their own consumption without being formally traded. Despite a traditional consumption preference for minor millets by the local population, in recent years the area devoted to minor millets has declined considerably to the advantage of substitute crops such as tapioca (cassava), rice, pineapple and coffee, which are grown

exclusively for market. In response to this development, the M.S. Swaminathan Research Foundation (MSSRF), a leading non-governmental organization based in Chennai, India, has led 'conservation-cum-commercialization' intervention programmes over the last 10 years in Kolli Hills. These programmes aim to raise the market potential of minor millets through value addition and help the farming communities maintain their agro-biodiversity by providing economic incentives for its conservation (MSSRF, 2002).

Lack of attention from researchers, policy makers, donors, farmers and consumers is increasingly threatening the genetic diversity of minor millets. This is an irreversible loss to the humanity, particularly the poor who heavily depends on these crops for their food and nutritional security and meager income generation. In this context, the main objective of this study is to facilitate the conservation of agro-biodiversity, improved indigenous farmer livelihoods and policy through the development of innovative economic analytical methods and incentive mechanisms. This paper investigates the farmer's decision for the conservation of minor millets at Kolli Hills. To this end, a non-market valuation method the Contingent Valuation (CV) study on minor millet conservation was undertaken in January-May 2010 over 454 respondents from 50 villages. An open-ended questionnaire was applied to assess the potential Willingness to Accept (WTA) for payment on agro-biodiversity conservation services (PACS) schemes to create incentives for the conservation of agro-biodiversity and improve indigenous farmer livelihoods.

Of the five small millet varieties, there are 19 landraces under cultivation in our study area in Kolli Hills. They are six landraces in little millet, six landraces in finger millet, five landrace in Italian millet, each one landrace in proso millet and kodo millet. This paper contributes to the literature in two ways. First, only a few previous applied economics studies have investigated the determinants of minor millets in India

(Gruere et al., 2007, 2009; King et al., 2009). Second, this study adds to the growing literature that employs of stated preference method mostly contingent valuation method (CVM) to estimate farmer valuation of various components of agro-biodiversity (Ndjeunga and Nelson, 2005; Scarpa et al., 2003a, 2003b).

In the context of agricultural biodiversity, CVM has not been widely employed, though it has been applied extensively in valuing rare and endangered animal species such as pandas (Kontoleon *et al.,* 2003), habitats like the riparian forests and landscapes (Desaigues and Ami, 2001). It has been especially useful in ex ante and ex post assessment of conservation policy (Pearce and Moran, 2001). Some studies have undertaken the stated preference techniques to estimate the economic value of genetically modified (GM) crops like rice, maize (Birol et al., 2007; Horna et al., 2005).

The next section presents the background. Then, we describe the study area, theoretical framework, data collection, and the analysis. After that, we report and discuss the econometric results. In the final section, we draw conclusions and discuss the policy implications.

BACKGROUND

Seed systems of minor millet crops are mostly autarkic; farmers depend on themselves or other farmers in their community for seed. During crop failure, local markets assume greater importance as a source of seed for locally adapted varieties. Traditionally, the Kolli Hills region is known for its genetic diversity in minor millets: finger millet, foxtail millet, little millet, kodo millet and proso millet. Each of these crop species is represented by diverse land races, displaying diverse morphological and agronomical characters and thereby contributing to preserving agro-biodiversity. Until the mid 1980s, minor millets were extensively grown and widely consumed in the Kolli Hills mostly as a subsistence crop

(Gruere et al., 2007). However, their cultivation has declined due to changing consumption and production preferences in favour of other crops such as tapioca, rice and pineapple.

Table 1: Trends in cultivation area under Minor Millet, Tapioca and Pineapple (Ha)

Year	Small millets	Finger millet	Tapioca	Pineapple
1970-1971	1799	N/a	0	40
1995-1996	950	N/a	2020	740
1996-1997	967	N/a	5000	900(est.)
1999-2000	465	841	6255	323
2000-2001	667	903	5460	295
2001-2002	651	764	7540	616
2002-2003	647	953	4454	602
2003-2004	766	545	5848	610

Source: Gruère et al. (2009).

As shown in Table 1, minor millet production in Kolli Hills started declining in the mid-1980s and has been progressively replaced, since the early 1990s, by tapioca. By 2001–2002 tapioca represented 56 percent of total cultivated area while minor millets represented only 10.5 percent; pineapple covered 4.6 percent, and other crops occupied 29 percent of the total area. In the Kolli Hills, the agro-biodiversity has been declining and there has been a rapid shrinkage in the area under minor millet cultivation in the last three decades. The introduction of cash crops, declining soil fertility, drudgery involved in processing, lack of market channels, increasing transport facilities, availability of cheap rice under the public distribution system (PDS) are factors which have affected the cultivation and consumption of minor millets in the Kolli Hills. Although the drastic changes in cropping patterns have taken place in the last three decades only, the region seems to have undergone a major change in cropping pattern. The change in the land use pattern, cultural practices and food habits brought the importance of the conservation of millet landraces in Kolli hills. Seeds of all available landraces of millets were collected by MSSRF and series of biodiversity projects were

launched using an integrated approach for conservation and sustainable use addressing biodiversity, hidden hunger and poverty.

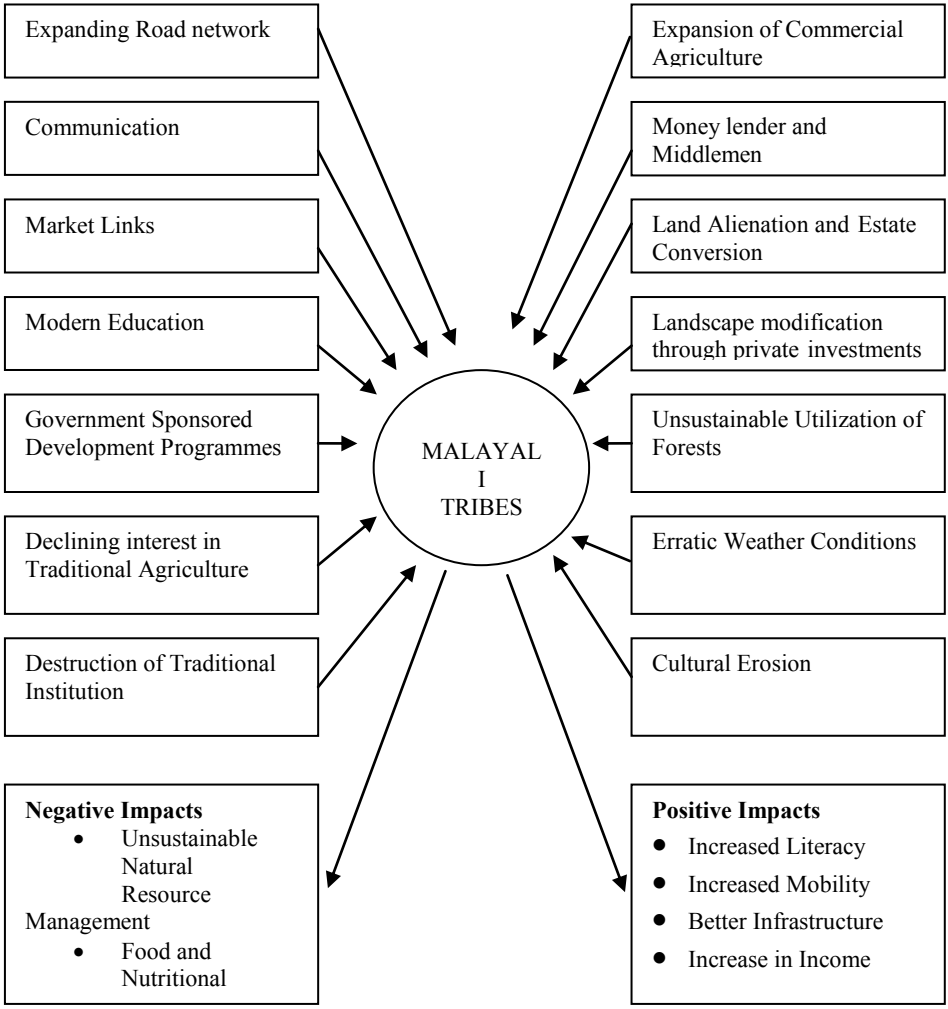
CONTINGENT VALUATION STUDY ON FARMER'S ASSESSMENT OF MINOR MILLETS CONSERVATION

Study Area

Kolli Hills is a mountainous area with a temperate climate located on the eastern border of the Namakkal District in Tamil Nadu, India. Forests occupy 44 percent of the total area of 28,293 ha, while agricultural activities take place in 52 percent of the total area, leaving 4 percent for other activities (Kumaran, 2004). More than 95 percent of the estimated 50,000 inhabitants of Kolli Hills are tribals from the Malayali community (MSSRF, 2002). Pradeep and Rajasekeran (2006) estimated that tapioca land represents about 75 percent of the total dry lands. Irrigated land comprises less than 15 percent of the cultivable area (MSSRF, 2002). The population density is 119 per km^2.

The agro-biodiversity in Kolli Hills has been declining over the last three decades due to several factors (Figure 1) which result in shrinkage of area under cultivation of millets (King et al., 2009). The introduction of cash crops like tapioca, drudgery involved in the processing of millets, lack of market linkages for millets, increasing transport facilities, availability of food grain especially rice at reasonable cost through the PDS.

Figure 1: Driving Forces and Process of Transition in Kolli Hills



Source: King et al (2009).

Interaction with the outside merchants since 1980s had drastically changed the traditional agriculture practices in the Kolli Hills. Financial support like advance crop loan and transportation facilities for tapioca cultivation was provided by merchants and contractors (Kumar-Range, 2001) leading to large-scale expansion of tapioca cultivation in uplands and modification of rocky undulating terrains that are traditionally under mixed cropping and monoculture of millets. The move from subsistence agriculture to commercial agriculture led to loss of not only food but also the nutritive quality of the soil due to continuous monoculture of tapioca.

In addition to this, the interest and the attitude of the tribal community towards commercial horticulture such as plantation of Silver oak, coffee, pepper and cardamom estates have brought more pressure on traditional agriculture. Commercial agriculture also results in abandonment of millet cultivation among the younger generation. Moreover, state policies relate to crop loan, subsidies, favourable conditions for commercial agriculture, supply of food items like rice, wheat, wheat flour, and semolina at reasonable cost through the PDS have shaped the minds of people to neglect minor millets. The change in the land use pattern along with a metamorphosis of cultural practices and food habits brought to the fore importance of conservation of millet landraces. Thus seed collection was the first mission through which all available land races of millets were collected from different agro-climatic regions of Kolli Hills. So there are several strategies put forward by minor millet conservation.

Theoretical Framework

Following Dupraz et al., (2003), the following theoretical framework is used. The behaviour of the farm household is formalised by the maximisation of its utility. Initially in the absence of any proposed contract with the farmers, the budget constraint involves the off-farm incomes and the profit generated from the on-farm activities:

$$\underset{c,m}{Max}\, U(c,m)$$

Subject to $c \le \prod(p,m,Z) + v$ (1)

$m \ge 0$

Where c is the household private consumption, expressed in monetary values and m is the millet conservation programme. The function is assumed to be increasing, concave and differentiable in c. The vector Z represents the characteristics of the farm and the household. The profit function Π(p, m, Z) is assumed to be convex. The p vector includes the prices of factors and products freely allocated. The v represents off-farm incomes that are assumed to be exogenous in model (1).

To define the household willingness to accept compensation for participating in the millet conservation programme, we assume that the farm household is invited to increase its cultivation of millet by a fixed quantity such that: $\Delta m = m_1^s - m_0 \succ 0.$

Its willingness to accept is classically formalised by the surplus variation (WTA^s). This willingness to accept is derived from equation (2), which defines the expenditure function

$$e(p,m,Z,U_0) = \underset{c}{Min}\{c - \prod(p,m,Z); U(c,m) \ge 0\} \quad (2)$$

$$WTA = e(p,m_1^s,Z,U_0) - e(p,m_0,Z,U_0)$$

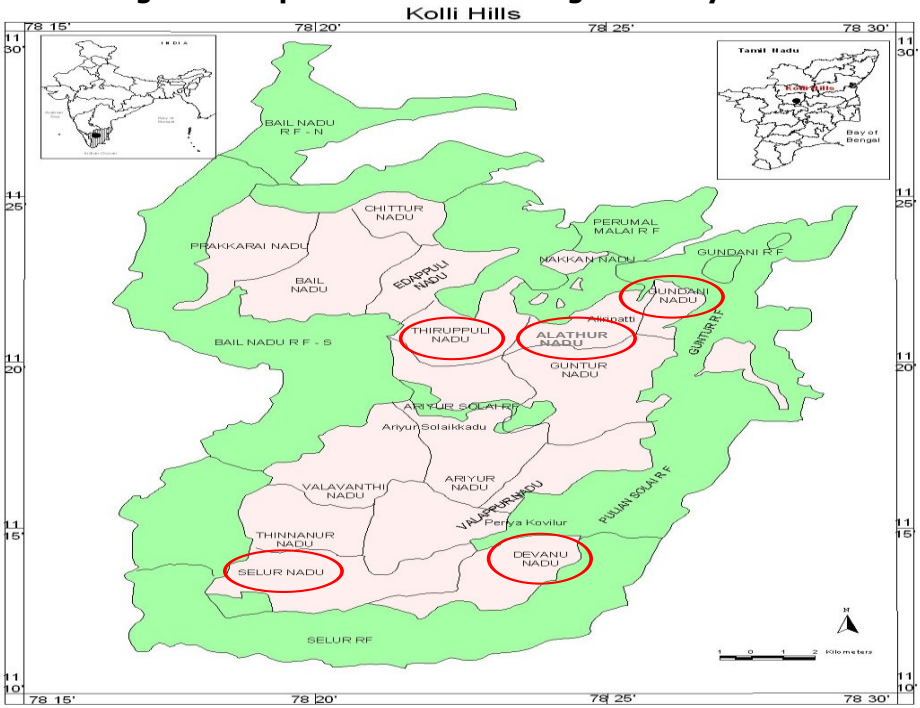
$$= e(p,m_1^s,Z,U_0) - e_0 \quad (3)$$

Equation (3) expresses the minimum payment that the household would accept in order to increase its production of minor millets from m_0 to m_1.

Data Collection

The study was carried out in five zones in Kolli Hills namely Devanur, Alathur, Thiruppuli, Gundani and Selur (five dotted region in Figure 2). Out of 72 villages in the study area, about 69.4 percent of villages were covered for the total survey. The sample size comprises of random and non-random sample of 454 respondents. At least 50 percent of millet cultivators were targeted from each village. From the survey, we find that 69 percent are millet cultivators and 31 percent are non-millet cultivators.

Figure 2: Map of Kolli Hills showing the Study Area



Source: Block Development office, Kolli Hills.

In this study, we use CVM to find WTA to conserve millet cultivation in Kolli Hills. Since the property rights of minor millets and their outputs and functions reside with the farmers (Freeman, 2002), this

proxy monetary attribute represents willingness to accept (WTA) compensation, i.e. a benefit, rather than a cost measured by willingness to pay (WTP). This indirect measure is preferred over a direct monetary variable, because for most families, not so much is traded till now and rather there is a shift in the other crops. Hence, the respondents are not likely to be familiar with a direct monetary measure of millets' output.

The finalization of the WTA questionnaires stretched over 3 months after the pilot study. Pre-testing of questionnaire was done by selecting 10 respondents from farm households of the 5 selected zones and changes were made in the final version. It follows from the pilot survey that the enumerators needed to be clear while depicting true scenario to the respondents. The list of MPV and LPV landraces of the 5 zones are given in Table 2.

Table 2: Landraces of the MPV and LPV Varieties of Millets

Zone No.	Zone Name	Most Preferred Varieties	Least Preferred Varieties
1	Devanur	Arisikaizhvaragu (FM) , Sattaikaizhvaragu (FM) and Vellaperumsamai (LM)	Thirivaragu (KM)
2	Alathur	Karunguliyankaizhvaragu (FM) and Karakaizhvaragu (FM)	Mookkanthinai (IM) and Karumsamai (LM)
3	Thirupulli	Sundangikaizhvaragu (FM)	Koranthinai (IM), Sadansamai (LM) and Thirigulasamai (LM)
4	Gundani	Vellaperumsamai (LM) and Kattavettisamai (LM)	Panivaragu (CM) and Senthinai (IM)
5	Selur	Perunkaizhvaragu (FM) and Palanthinai (IM)	Malliasamai (LM) and Perunthinai (IM)

Source: FM-Finger millet, LM-Little millet, IM-Italian/Foxtail millet, CM-Common/Proso millet and KM-Kodo millet**.**

The survey consists of four parts. The first part consists of the socio-economic characteristics of the households. The second part of the questionnaire consists of the land-use pattern of the farmers. Moreover there is information regarding crops that were cultivated by the farmers in the area. The third part consists of the Choice experiment (CE) survey and fourth part is CV survey. The CE results are not discussed in this paper. The farmers were informed about the minor millet crops in Kolli hills and worldwide. The minor millets are being replaced by more profitable crops and thus the number of farmers planting minor millet landraces and the areas being planted within the Kolli Hills has been slowly declining for many years. If this trend continues, it is possible that one day these landraces will disappear from the production system in the Kolli Hills and that it will no longer be possible for farmers to obtain seed of those lost landraces and thus there is a need of conservation of these millet varieties. Farmers were told to ensure that they will be cultivating millet over the coming years. The CV cards for MPV and LPV were shown and were asked farmers that whether they are willing/not willing to participate for this conservation programme. If they choose to participate in the programme, then they were asked to plant a specific landrace and to do cultivation over different numbers of years. They were also told to store 3 kg of quality seed at home for the next production seasons and for doing this would be offered a reward.

Three CV cards are used for both MPV and LPV in the survey, first card with initial bid price, second card with lower price than initial price and third card with higher price than initial price. In the survey, two CV cards are shown to the farmers and ask them, whether they are willing to participate in the conservation programme or not. Respondents are presented with the initial bid prices, following their initial response; they are given new price offer. Lower price is offered if their initial response were "yes" and higher price is offered if their initial response were "no". The attributes used in the CV cards is given in Table 3.

Table 3: The Attributes used in the CV Card

S. no.	Attributes	Description
1	Landrace	Any specific landrace will be asked to cultivate by the surveyed farmer household. (landrace differ between the households)
2	Area	Area to be cultivated, 10 cents as a pure crop or 15 cents as a mixed crop.
3	Contract length	Three types of contract length is used in CV card, they are 1 year, 2 years and 3 years (any one contract length is given to each households)
4	Support	Cash support is given to both MPV and LPV. (50 percent will be paid in the beginning of contract and 50 percent upon successful completion)

RESULTS AND DISCUSSIONS

Descriptive Statistics

The descriptive statistics are reported in Table 4. The average household size in the study area is 4.4 members and 87 percent of the households are headed by males. Only 43 percent of the heads of household are literate and most households depend on agriculture (67.6 percent) for their livelihood. According to this survey, the average area of cultivated land during 2009 was 2.6 acres per household, with 12.3 percent of the land devoted to millet cultivation with a mean yield of 234 kg per acre. About 45.4 percent of the households are engaged in participatory organizations such as self help groups (SHG) and farmers' organizations, 89 percent of the households keep their savings in banks, post offices and life insurance corporations (LIC), while 34 percent of households have taken loans during the year 2006-08, through banks, private money lenders, family friends and Large Scale Multi Purpose Societies (LAMPS). The loans are largely used for household consumption rather than for agricultural purposes.

Table 4: Descriptive Statistics of the Sample Respondents

Household Social and Economic Characteristics	Mean (Std.Dev.)
Age of the head of household	44.59 (11.32)
Household size	4.36 (1.70)
Number of males > 14 years old	1.70 (0.85)
Number of females > 14 years old	1.55 (0.72)
Number of Children <= 14 years old	1.11 (1.09)
Total Cultivated land during 2009 (acres)	2.60 (1.68)
Millet Cultivated land during 2009 (acres)	0.32 (0.38)
Millet yield per acre (in Kg) during 2009	234
	Percent
Distribution of sample in different zones	
Zone 1: (Devanur)	19.8
Zone 2: (Alathur)	19.4
Zone 3: (Thirupulli)	21.1
Zone 4: (Gundani)	18.6
Zone 5: (Selur)	21.1
Male headed household	86.6
Literate of the head of household	42.7
Employment of the head of household Agriculture	67.6
Other than agriculture	32.4
Household organisational participation like SHG, Farmers club, etc.	45.4
Household savings in banks, post office, LIC, etc.	88.8
Household taken loan during (2006-08)	34.4

Seemingly Unrelated Bivariate Model

Seemingly unrelated bivariate probit (SUBP) regression is used to estimate the determinants of willingness to participate in millet conservation of both MPVs (model-1) and LPVs (model-2) in the Kolli Hills. The model estimates are given in Table 5.

Table 5: Seemingly Unrelated Bivariate Probit Model Estimation Results

Variables	Coefficient (Std. error)			
	Model - 1 for MPV		Model - 2 for LPV	
	Response 1	Response 2	Response 1	Response 2
Bid price (Rs)	0.0030***	0.0009*	0.0018***	-0.0004
	(0.0003)	(0.0005)	(0.0002)	(0.0003)
Millet land (acre)	-0.4822*	-0.2702	-0.4308*	-0.1579
	(0.2509)	(0.2385)	(0.2547)	(0.2235)
Millet yield (kg/acre)	0.0010	0.0020*	0.0006	0.0020**
	(0.0011)	(0.0011)	(0.0011)	(0.0010)
Household size (nos.)	-0.0703*	-0.0300	-0.0036	0.0333
	(0.0421)	(0.0380)	(0.0381)	(0.0359)
Age of hoh (years)	0.0061	0.0024	-0.0070	-0.0043
	(0.0067)	(0.0060)	(0.0059)	(0.0056)
Sex of household head (male=1)	0.2169	0.1731	-0.1254	-0.1760
	(0.2109)	(0.1872)	(0.1910)	(0.1826)
Education of household head (years)	-0.0365*	-0.0257	-0.0285	0.0109
	(0.0218)	(0.0196)	(0.0199)	(0.0186)
Organisation participation (SHG, farmers club, etc)	0.5519***	0.3226**	-0.0105	-0.0992
	(0.1454)	(0.1344)	(0.1294)	(0.1233)
Intercept	-0.7790*	-0.0501	-0.6871*	0.4037
	(0.4291)	(0.4004)	(0.3944)	(0.3947)
Log likelihood	-489.1666		-582.8664	
rho	0.1727 (0.1402)		-0.1148 (0.1218)	
Wald $\chi^2(16)$	111.49***		76.58***	
No. of observation	453		453	

***, ** and * indicate significance at 1 percent, 5 percent and 10 percent respectively.

The initial response in case of both MPVs and LPVs is significant with the farmers responding positively to the compensation offered, while the follow-up response results suggests that the significant impacts of bid value for both MPVs and LPVs are in different direction. The negative

value for LPVs shows that the probability of participation is low even with the higher compensation. This result reflects from Zone 1 (Devanur) where Kodo millet (LVP) was traditionally grown and farmers have indicated a strong dislike for the cultivation of its landrace due to low consumption value. Area under millet cultivation is negative for MPVs and LPVs, which reflects the fact that the farmers are shifting from their traditional cultivation of millets to other commercial crops. These results are in line with the findings of King et al (2009).

Millet yield per acre has positive influence, with farmers preferring varieties with higher productivity. Farmers with larger household sizes are found not to be more likely to undertake millet cultivation and this is also in line with findings of previous studies. Better educated household heads hold preferences for other crops rather than millets. Nevertheless, larger families and better educated household heads have a positive response to the follow-up bid for LPVs, if offered higher compensation. The age of the household head is taken as a proxy for millet farming experience found that their compensation to participate in LPVs is higher than MPVs. The farmers involved in organizational participation (e.g. SHG, farmers association, etc.) have a positive response to MPVs (significant) and negative response of LPVs in the millet conservation programme. Such a finding is also the result of the fact that in order to generate market linkages for minor millets, MSSRF has actively promoted self-help groups (SHGs) among the millet growing communities.

WTA Respondents

In order to estimate the degree of heterogeneity of WTA compensation across households, six household profiles were generated (Table 6).

Table 6: Household Profiles used for WTA Estimates

Profiles	Millet farmers (percent)	Non-millet farmers (percent)
Average Household	68.7	31.3
Profile 1 : Millet farmers	100.0	0.0
Profile 2 : Non-millet farmers	0.0	100.0
Profile 3 : Literate	42.3	43.0
Profile 4 : Illiterate	57.7	57.0
Profile 5 : Organisation participation	49.7	35.9
Profile 6 : Non-organisation participation	50.3	64.1

The first two profiles are associated with farmers who are cultivating millets and not cultivating millet, whereas the following two profiles are associated with literacy levels. The last two profiles are associated with farmer status related to millet crop-related organisations participation such as SHGs and farmers associations. The statistics related to these profiles are reported in Table 6. It is found that 68.7percent of the farmers were cultivating millets in the study area, the literacy rate is similar for both millet and non-millet farmers group, and organisation participation rates are higher for millet farmers. The SHGs are a common grassroots institution through which development activities are implemented in many regions of India. Participation is voluntary, and the schemes are based on internal lending incentives (Gruere et al., 2009).

The WTA analysis estimates the welfare loss effectively when the respondents have limited knowledge about market conditions. The WTA of farmers who are willing to participate in the millet conservation programme is furnished in Table 7.

Table 7: Marginal WTA for the Given Profiles

Profiles	Average WTA price (Rs/acre)			
	MPV		LPV	
	Initial bid	Final bid	Initial bid	Final bid
Profile 1 : Millet Farmers	4728 (163.14)	3403 (141.95)	7406 (223.90)	6494 (189.28)
Profile 2 : Non-millet Farmers	4840 (253.69)	3468 (208.49)	7462 (317.02)	6566 (328.27)
Profile 3 : Literate	4605 (213.12)	3401 (198.08)	7303 (295.30)	6716 (270.67)
Profile 4 : Illiterate	4872 (179.01)	3437 (143.26)	7500 (232.69)	6359 (202.54)
Profile 5 : Organisation participation	4345 (196.67)	3039 (178.98)	7064 (295.87)	6587 (259.08)
Profile 6 : Non-organisation participation	5176 (185.71)	3781 (148.28)	7699 (226.93)	6458 (212.11)

Note: * WTA price indicates for millet cultivation in 1 acre as mono crop and 1.5 acres as inter/mixed crops; figures in the parenthesis indicate standard error.

Millet famers are willing to participate at higher compensation levels in the initial bid price offered, but they are still WTA a lower bid price than the initial compensation offered for both MPVs and LPVs. The same trend is followed by non-millet farmers, although they are willing to accept the higher compensation more than millet farmers. Literate farmers are willing to participate in LPVs millet conservation programme with higher compensation than that of illiterate farmers, which is reflected in SUBP model. The farmers participating in millet related organisations are willing to participate in the millet conservation programme at lower levels of compensation compared to non-organisation participating farmers. The results suggest that the contingent valuation method used here seems to be an appropriate tool with which to reveal farmer participation decisions regarding a millet conservation programme.

CONCLUSIONS

This paper was developed based on a contingent valuation survey conducted in tribal farming communities in the Kolli Hills cultivating diverse millet varieties, which are under threat due to several factors. The study aims in facilitating the conservation of minor millets, leading to improved farmer livelihoods through the use of incentive mechanisms. The result suggests that the farmers are willing to accept less compensation for the varieties, which produce higher yield of MPVs and LPVs. The farmers involving in millet activities in SHGs and farmers club are willing to accept lower level of compensation for MPVs and higher for LPVs than the farmer who does not participate in the organisation. Given farmers' willingness to participate in a millet compensation programme, it is clear that direct compensation mechanisms can be able to supplement returns so as to encourage the conservation of minor millets in a given year. Periodical re-assessment would nonetheless be needed in order to better understand the compensation demands of the farmers over time. Furthermore, this study shows that direct compensation incentive mechanisms may indeed be able to play a complementary role in the conservation of neglected landraces of millets relative to other types of intervention. These include community-based incentives and policies associated with market linkage development for millets in order to obtain higher prices for farmers, facilitating the availability of quality seeds, improving access to machinery for processing grains and the inclusion of millet in the local PDS.

REFERENCES

Birol, E., Villalba, E. R. and Smale, M. (2009). Farmer Preferences for Milpa Diversity and Genetically Modified Maize in Mexico: a Latent Class Approach. *Environment and Development Economics*, Cambridge University Press, vol. 14 (04): pp.521-540.

Desaigues, B. and Ami, D. (2001). An Estimation of the Social Benefits of Preserving Biodiversity. *Int. J. Global Environmental Issues,* vol. 1(1): pp.73-86.

Dupraz, P., Vermersch, D., Henry De Frahan, B. and Delvaux, L. (2003). The Environmental Supply of Farm Households: A Flexible Willingness to Accept Model. *Environmental and Resource Economics,* Vol. 25: pp.171-189.

Freeman, A. M. (2002). The Measurement of Environmental and Resource Values: Theory and Methods. Washington, DC: Resources for the Future.

Gruere, G., Nagarajan, L. and King, E.D.I.O. (2007). Marketing Underutilized Plant Species for the Poor: A Case Study of Minor Millets in Kolli Hills, Tamil Nadu, India. Report published by the Global Facilitation Unit for Underutilized Species (GFU). Rome, Italy: Biodiversity International.

Gruere, G.P., Nagarajan, L. and King, E.D.I.O. (2007). Collective Action and Marketing of Underutilized Plant Species: the Case of Minor Millets in Kolli Hills, Tamil Nadu, India. CAPRi Working Paper 69.

Gruere, G.P, Nagarajan, L. and King, E.D.I.O. (2009). The Role of Collective Action in the Marketing of Underutilized Plant Species: Lessons from a Case study on Minor Millets in South India. *Food Policy*, vol. 34(1): pp.39-45.

Horna, J. D., Smale, M. and Von-Oppen, M. (2005). Farmer Willingness to Pay for Seed-Related Information: Rice Varieties in Nigeria and Benin. EPTD discussion papers 142, International Food Policy Research Institute (IFPRI).

King, E.D.I.O., Nambi, V.A. and Nagarajan, L. (2009). Integrated Approaches in Small Millets Conservation: a Case from Kolli Hills, India. *International Society for Horticulture Science, vol. 806 (*2): pp.79–84.

Kontoleon, A. and Swanson, T. (2003). The Willingness to Pay for Property Rights for the Giant Panda: Can a Charismatic Species Be an Instrument for Nature Conservation? Land Economics, University of Wisconsin Press, vol. 79(4), pp. 483-499.

Kumaran, M. (2004). Assessment of Development Interventions of M.S. Swaminathan Research Foundation in Kolli Hills Using Geographical Information Systems. Dissertation, Department of Rural Development, Gandhigram Rural Institute – Deemed University, Gandhigram, Tamil Nadu, India.

Kumar-Range, S. (2001). Like Paddy in Rock: Local Institutions and Gender Roles in Kolli Hills. M.S. Swaminathan Research Foundation (MSSRF), Chennai, Tamil Nadu, India.

M.S.Swaminathan Research Foundation (MSSRF). (2002). Rural and Tribal Women in Agrobiodiversity Conservation. Food and Agriculture Organization (FAO) RAP publication 2002/08. Bangkok, Thailand.

Ndjeunga, J. and Nelson, C.H. (2005). Toward Understanding Household Preference for Consumption Characteristics of Millet Varieties: a Case Study from Western Niger. *Agricultural Economics*, vol. 32(2): pp.151-165.

Pearce, D.W. and Moran, D. (2001). Handbook on the Applied Valuation of Biological Diversity. Report prepared for Environment Directorate, OECD, Paris.

Pradeep, V. and Rajasekeran, J. (2006). Classification and Characterization of Self Help Groups (SHG's) Enterprises in Kolli Hills Developed by MSSRF. Unpublished: Report submitted for Master of Arts in Social Works, Department of Social Work, The American College, Madurai, India.

Scarpa, R., Drucker, A., Anderson, S., Ferraes-Ehuan, N., Gomez, V., Risopatron, C.R. and Rubio-Leonel, O. (2003a). Valuing Animal Genetic Resources in Peasant Economies: The Case of the Box Keken Creole Pig in Yucatan. *Ecological Economics,* vol. 45(3): pp.427-443.

Scarpa R., Ruto, E.S.K., Kristjanson, P., Radeny, M., Drucker, A.G. and Rege, J.E.O. (2003b). Valuing Indigenous Cattle Breeds in Kenya: An EmpiricalComparison of Stated and Revealed Preference Value Estimates. *Ecological Economics,* vol. 45(3): pp.409-426.

MSE Monographs

* Monograph 9/2010
  Feasibility of Incentive Based Environmental Instruments in State and Central Taxation Regimes
  D.K.Srivastava and C. Bhujanga Rao
* Monograph 10/2010
  Economic Instruments for Environmental Management: International Best Practices and Applicability to India
  D.K.Srivastava Dr K.S. Kavikumar , and C.Bhujanga Rao
  With inputs from Dr Bodhisattva Sengupta, Dr Brijesh C. Purohit, Ms Asha Mariam Abraham, Ms Ishwarya
* Monograph 11/2011
  Taxation of Goods and Services in India
  D.K. Srivastava and C. Bhujanga Rao
* Monograph 12/2011
  Coping with Pollution: Eco Taxes in a GST Regime
  D.K. Srivastava, K.S. Kavi Kumar and C. Bhujanga Rao, with inputs from Brijesh C. Purohit and Bodhisattva Sengupta
* Monograph 13/2011
  Recent Bouts of Inflation in India: Policy Paralysis?
  T.N. Srinivasan
* Monograph 14/2011
  Impact of Fiscal Instruments in Environmental Management through a Simulation Model: Case Study of India
  D.K. Srivastava and K.S. Kavi Kumar, with inputs from Subham Kailthya and Ishwarya Balasubramaniam
* Monograph 15/2012
  Environmental Subsidies in India: Role and Reforms
  D.K. Srivastava, Rita Pandey and C.Bhujanga Rao with inputs from Bodhisattva Sengupta
* Monograph 16/2012
  Integrating Eco-Taxes in the Goods and Services Tax Regime in India
  D.K. Srivastava and K.S. Kavi Kumar
* Monograph 17/2012
  Monitorable Indicators and Performance: Tamil Nadu
  K. R. Shanmugam
* Monograph 18/2012
  Performance of Flagship Programmes in Tamil Nadu
  K. R. Shanmugam, Swarna S Vepa and Savita Bhat
* Monograph 19/2012
  State Finances of Tamil Nadu: Review and Projections A Study for the Fourth State Finance Commission of Tamil Nadu
  D.K. Srivastava and K. R. Shanmugam
* Monograph 20/2012
  Globalization and India's Fiscal Federalism Finance Commission's Adaptation to New Challenges
  Baldev Raj Nayar

MSE Working Papers

Recent Issues

* Working Paper 63/2011
  Determinants of Child Morbidity and Factors Governing Utilisation of Child Health Care: Evidence from Rural India
  Anindita Chakrabarti

* Working Paper 64/2012
  Arsenic Contamination in Water: A Conceptual Framework of Policy Options
  Zareena Begum I

* Working Paper 65/2012
  Learning and Capability Acquisition: A Case Study of the Indian Automobile Industry
  Madhuri Saripalle

* Working Paper 66/2012
  Poverty, Human Development and Health Financing in India
  Brijesh C. Purohit

* Working Paper 67/2012
  Corporate Governance and Product Market Competition
  Ekta Selarka

* Working Paper 68/2012
  Basel l and Basel ll Compliance: Issues for Banks in India
  Sreejata Banerjee

* Working Paper 69/2012
  The Distributional Impacts of Climate Change on Indian Agriculture: A Quantile Regression Approach
  Chandra Kiran B Krishnamurthy

* Working Paper 70/2012
  Efficiency of Raising Health Outcomes in the Indian States
  Prachitha J., K. R. Shanmugam

* Working Paper 71/2012
  Compensating Wages for Occupational Risks of Farm Workers in India
  P. Indira Devi, K.R. Shanmugam and M.G. Jayasree

* Working Paper 72/2012
  Stationarity Test for Aggregate Outputs in the Presence of Structural Breaks
  D.K. Srivastava and K.R. Shanmugam

---

* Working papers are downloadable from MSE website http://www.mse.ac.in

$ Restricted circulation