Sustainability and Food Security Articulations among Resource Poor Farmers' Groups in Tamil Nadu, South India

HN Chanakya[1], ST Somashekara Reddy[2] and P Balachandra[1,3]

Abstract: *Resource poor farmers (RPF) living below poverty line constitute about a third of the rural population in many Indian states. In this paper we seek to study the status of food security and vulnerability among RPF members of self help groups (SHG) who have adapted and used appropriate technology and eco-friendly inputs in agriculture. The expected outcome is an increased availability of food grains to the RPF family. This higher availability manifests as higher quantities of food intake if farmers have not incurred any credit to be repaid with harvested grain. We seek to quantify food consumption and food security manifestations within this process of change among some of the economically poorest farmers in nine districts of Tamil Nadu (TN). The food consumption pattern was measured after three years of practicing eco-friendly technologies. The average daily per capita food consumption of the study sample during peak drought was only 4% lower than that of the TN state average for a non-drought year – suggesting it to be a sign of improvement in food availability and food (calorie) security. This suggests that promoting SHG mechanisms can effectively address the problem of food security among RPFs. The paper also discusses the impact of demographic features such as the male:female ratio, able:aged ratio, adult:children ratio, young males/females:adult males/female ratios on the daily per capita food consumption. It was observed that increases in daily per capita food intake were always accompanied by an increase in the share of own grains and use of millets in the overall food basket. The major component of the food basket however is dominated by rice even among these rain-fed farmers who raise non-rice crops. This dependence on an externally raised crop is considered non-sustainable. Thus the important policy implication is that there is a need to significantly increase the non-rice component of the food basket to ensure long term sustainability among these rain-fed farmers. Providing short-term credit to self help groups, group based monitoring and promoting use of low external eco-friendly inputs are some of the other policy initiatives that could enable the RPFs to achieve a high level of daily per capita food consumption and concomitant food security components.*

Symbols, Notations and Abbreviations

DPCFC	Daily per capita food consumption
CPR	Common property resources
NSS	National sample survey (organization)
PTD	Participatory technology development
LEISA	Low-external input and sustainable agriculture
PDS	Public distribution systems
RPF	Resource poor farmers
SHG	Self-help groups
g	grams
g/d	grams per day.

[1] Centre for the Application of Science and Technology to Rural Areas (ASTRA, currently Centre for Sustainable technologies and [3]Department of Management Studies, Indian Institute of Science, Bangalore 560 012.

[2] Indian Institute of Management, Bangalore, in Collaboration with the LEISA Network, Trichy, TN

1. Introduction

1.1 Background

Resource poor farmers (RPF) in rural India lead a subsistence life with inadequate access to secure food resources and it manifests large during recurring droughts. Their land holdings are meager, and during drought the food production is minimal. Further, the employment opportunities as daily wagers are non-existent during these harsh times. Even the national surveys conducted frequently in rural areas, which estimate poverty and nutrition status, have substantiated this. Such surveys attempt to identify that fraction of the population and corresponding income levels whose daily diet comprises of less than 2400 kCals /capita /day. This calorie intake cut-off for an average rural mildly working adult (60kg body weight) is a convenient measure and is often used to indirectly indicate nutritional sufficiency. Persons falling below this level are considered to be suffering both poverty and malnutrition[1] (Gopalan *et al*, 2000). They may constitute a third of the total population in some states[2]. In South India, Tamil Nadu (TN) is reported to have the largest number of such calorie challenged persons as well as nutritionally challenged in the form of chronic anaemia among women[3] and children. The average calorie intake in the TN is reported to have fallen[4] from 1861 (in 1983) to 1826 kCal/capita/day (1999-2000). Similar figures are available for head count ratio[5] (74.6 in 1983 and 78.7 in 1999-2000; Meenakshi and Vishwanathan, 2003). NSS data[6] (NSSO, 2001) shows that among various sections in rural areas of TN, monthly per capita expenditure (MPCE) for 30 days is lowest among the agricultural labour (Rs.270) and followed by self-employed in agriculture (Rs.310), only marginally better than Madhya Pradesh[7]. This being the case, rural TN offers an interesting case for an examination of calorie intake and its distribution especially in a condition that is conducive to invoke food security threats, namely recurring droughts.

1.2 Origin of food security threats

Food security threats are manifest to a greater extent and severity among resource poor farmers (RPF) in the rain-fed belt. Frequently occurring meteorological and agricultural droughts (insufficient and missed rains during crop growth) have gradually pushed a large segment of these RPFs from transitional food insecurity (in the past) to chronic food insecure situations at present[8]. Among these resource poor farmers the phenomenon of male out migration, decreasing nutrition, strong daily wage dependencies, high levels of credit, etc. have already emerged[9] making this segment of population very high up on the scale of vulnerability[9] (food insecurity; Watts, 1987). Various forms of coping strategies are visible among this group and are discussed later on in the paper.

1.3 Typical food substitution strategies

NSSO (2001) reports[10] various sources of food consumed. This appears to validate the findings of Report 472[6], when it reports that rice is entirely purchased among a large segment of farmers in spite of the fact that TN is known for high rice production. Rice is usually purchased in large quantities from the PDS. In contrast, it reports highest dependency on homegrown food inputs among vegetables and fruits. Potential substitutions of purchased inputs with homegrown foods are interesting to study for their impact on food consumption patterns and as a coping strategy. There is also a need to know whether home grown cereals and millets provide greater food and nutrition in times of scarcity (droughts), how they are distributed among family members, how families with more children or women respond to scarce food, etc.

1.4 The purpose of this study

We seek to determine improvements in food security and vulnerability among self help group (SHG) members who have adapted and used appropriate and eco-friendly technology inputs in agriculture for periods between 1-3 years in about 80 villages of Tamil Nadu. The expected outcome is a sustainable increased availability of food

grains to the RPF family. We seek to quantify food consumption and food security manifestations within this process of change. These RPF form a relatively homogenous group within a narrow range of resource access. For studying such a group from South India there was very little precedence with regards to the methodology, rigour needed, understanding the factors influencing measurements, etc[11] and therefore we could derive little benefit from past studies on such a group. The RPFs have used SHG concepts primarily to escape falling into a credit trap as well as to further and widen their options for food security. From a total size of 100 such SHGs we have sampled 13 SHGs falling within chronically drought affected areas.

1.5 Food security attributes measurement and categorization

Three attributes of measurable food security were examined in the study

1. Calorie nutrition sufficiency
2. Variety of food basket - rice, millets, pulses, vegetables and fruits (milk and meat are ignored being insignificant in the study population).
3. Access and entitlement indicators - where these came from and how much control does the farmer have on these sources (own, purchased, public sources and PDS).

The data collection was made during peak stress periods for food security, namely a year after the previous harvest. The analyses therefore included component of timeliness of food access within the concept of food security. However, issues of risk and insurance were not measured in this study.

Calorie sufficiency was estimated directly from the daily per capita food consumption (DPCFC) and the daily per capita energy intake, DPCEI

DPCEI = [(cereals + millets + pulses) X 4 kCals/g]

The presence of a certain minimum pulse intake is considered to cover concepts of sufficiency of protein in food - its sufficiency is not considered in detail. From the per capita daily food intake the daily calorie intake was grouped as below. The daily calorie intake was expected to occur over four distinct ranges as follows

Food intake (g/d)	calorie range (kCal/d)	category
a. <350 g/d	<1400 /d	severe deficiency
b. 351-450	1400-1800 /d	sub maintenance (survival)
c. 451-600	1800-2400 /d	adequate
d. >600	>2401 /d	Unchallenged /comfortable

The study sample comprises of adults in the range of men (45-55kg) and women (35-45kg) and thus the average adult weight is considered to be 45kg. The average daily calorie need (sufficiency) for this group is estimated to be 1800kCal/capita/d (=45*2400/60). A 25% deviation from these corrected to the nearest 50g fraction formed the basis of the classes indicated above and tables presented later on.

2. Methodology: Data Collection and Analyses

2.1 Characteristics and Choice of the Study Sample

In 82 villages across 10 districts of TN, RPF initiated self help groups (SHGs) have networked to form the Low External Input and Sustainable Agriculture (LEISA) Network. A NGO is associated with each of the SHG. Members of these SHGs using principles of appropriate technology, organic farming and participatory technology

development[12] attempt to attain family level food security and overcome credit trap lead undesirable consequences including suicides[13,14], etc. The SHGs routinely measure and monitor the agricultural and household inputs. It was thus easy to obtain reliable data on daily food consumption. Women (most affected[15] by food security threats) constitute nearly 35% of the SHGs. Usually the husband and wife together discuss at the SHG where significant discussions and efforts are carried out on how to reduce family expenditure. All members usually represent the poorest of the village. This group therefore was reasonably well aware about food security[16] and therefore formed a good study sample.

Internal criteria for the sample group

In rural India there are serious difficulties in accurate identification of poor and the vulnerable[17] (Harris, 1987) based on income levels and occupation. Dependence on common property resources (CPR) brings in seasonal variations[18] in vulnerability. This study sample of SHGs was reasonably homogenous and selected on a set of criteria set up by RPFs themselves as indicated below.

- land holding less than a hectare,
- the family needs to be residing in a hut or be a recipient of a house from government,
- needs to be a ration card holder which is exclusive for the poor,
- family members find alternative incomes as wage labourers
- the income of the family from other sources needs to be less than Rs.2,400 per annum.
- Member should not own any irrigation facilities.
- farmers with tank irrigation facilities are included only when such holdings are less than 0.05 ha.

Each SHG had a maximum size limited to 20 members. These individual SHG members provided data inputs in open SHG meetings. Such uncontested information was regarded as information that met verification and approval of the peers or fellow members of the SHG. There were thus no compulsions or chances to give wrong or false data. More importantly, the SHGs were spread across many (9) districts in Tamil Nadu and all data was collected in a span of 5 days.

2.2 Data Collection

Data on the household consumption of food articles were obtained by the recall method. The respondents, namely all the members of the RPFs SHGs were asked to list all the previous days' family household spending in a SHG meeting. This was administered by a staff member of the associated NGO during the first week of September 2002 without any prior intimation to the SHG. The data collected by this was analyzed and was found to have a lot of skew and extremes. This was reported to each of the SHGs and the requirement for accurate estimates was discussed. Subsequently during the third week of October 2002, these SHGs were requested to monitor their food consumption on a specific date during this week. The data reported by each of the families was approved as normal daily expenses when verified by the rest of the SHGs and recorded. This data was then collated and analyzed. Food grains in the typical daily diet, namely rice, millets, pulses, fruits and vegetables used on that particular day was monitored for each of the farmer along with its source (from own stocks /farm land, purchased, from common property resources or from public distribution systems - PDS). These were recorded source-wise at the SHG meetings and used for final analyses. Thus, data was obtained from 260 families belonging to 13 SHGs. Even after so much care during data collection, data from 23 families found to be unreliable and not considered for further analysis.

The timing of data recording was set to match with the time of least grain stock among the RPF, namely in the

middle of a cropping season (SW monsoon region) or early cropping period (for farmers in the NE monsoon belt). It was envisaged that RPF families recording a high level of per capita daily food consumption indicated sufficient food stock to overcome drought risk and consequent low vulnerability. A low vulnerability in turn indicated a successful intervention in terms of a sustainable mode of agricultural production aimed at food security. Similarly a higher dependence on a food basket provided from own sources indicated internalization of the sustainability principles.

2.3 Data Analysis

The analysis of the sample characteristics have been done in two ways

i. The sample population of all the villages combined is divided into various groups formed based on different levels of average per capita food consumption per day. For arriving at per capita food consumption we have used only the consumption of rice, millets and pulses (excluding vegetables and fruits). This measures the ability of a given group of people to meet their daily calorie intake. With this we could form six groups of sample population falling under different per capita food per day ranges (Table 1).

ii. In the second instance, we grouped the sample villages into different per capita food per day range (including rice, millets and pulses) for further analysis. However, in this case we could form only five classes of per capita food ranging from 300 to 550 g/d (e.g. Table 8).

The relationship between per capita daily food consumption (DPCFC) and various factors have been obtained by using standard curve fitting method. The relationships have been analysed - DPCFC and family size, and ratios like adult-child, male-female, able-aged, own-bought and food-vegetable.

Table 1: Demographic Information for various ranges of per capita food consumption (No.)

Per capita Food Range (g/d)	No. of Families	Children (1 - 14 Years)		Adult (14 - 60 Years)		Aged (60+ Years)		Total
		Male	Female	Male	Female	Male	Female	
250 - 350	33	32	32	48	43	13	16	184
350 - 400	55	40	41	78	86	10	15	270
400 - 450	53	35	39	88	78	8	3	251
450 - 500	34	31	25	48	43	13	17	177
500 - 550	33	17	14	51	49	2	5	138
550 - 650	29	14	14	44	38	5	7	122
Total (No.)	237	169	165	357	337	51	63	1142

3. Results and Discussion

3.1 Sample Population and Food Consumption Pattern

Demographic characteristics and food consumption pattern

It may be observed (Table 1) that as the food consumption (range) increases there is a perceptible decrease in both a. number of families and b. population belonging to the higher food consumption ranges. Although this study sample represents the poorest strata of the farming society in Tamil Nadu, the average per capita energy intake is 1750 kCals /capita /d. When compared to the TN average of 1826 kCals/capita/d for a non-drought year, it is only 4% lower. This observation is encouraging in terms of a rise in the calorie intake level among the study sample - reaching from possibly near starvation to a level close to the state average. From data in Table 1 it may be

observed that over 60% of the families fall above the class 400-450g/capita/d (1600-1800 kCals/capita/d). This indicates that not all have benefited equally by the interventions. About 40% are still food security /calorie sufficiency-wise threatened.

A greater fraction of the study sample is in the age category of 14-60 (considered to be able bodied adults for the purpose of potential for daily wages). The family composition is reasonably well distributed between male and female population in all age groups and per capita food consumption levels. The spread is not significantly skewed in favour of any one sex or age group. There was no observable domination of male population in the chosen sample with a female:male ratio (979/1000).

Family composition across food consumption ranges

Another interesting feature is the decrease in the fraction of young and old population with increasing per capita food consumption range (Table 2). Even the family size decreases with increasing food consumption range (with only one exception, the 450 - 500g /capita /d range). The fraction of able bodied adults within a family however, remains constant with only minor fluctuations. Various interpretations may be given for such an observation.

- The obvious interpretation could be with the relatively less food needs of children compared to adults. The families dominated by children exhibit lower average per capita food consumption.

- Another interpretation is that, the size of the food basket being the same across the sample, a decrease in family size along with a predominance of adults in the family leads to better earning capacities and fewer young and aged (dependent) mouths to feed. A higher proportion of potentially working /earning members concomitantly raises per capita food availability and hence higher consumption in these sample families.

- Finally the families with higher per capita food consumption may belong to a marginally higher income or food producing strata making available more food through other means.

Table 2: Average family composition among various ranges of per capita food consumption (No.)

Per capita food range (g/d)	Children (1-14 years)		Adult (14-60 years)		Aged (60+ years)		Total
	Male	Female	Male	Female	Male	Female	
250 - 350	0.97	0.97	1.48	1.33	0.39	0.48	5.64
350 - 400	0.75	0.78	1.51	1.67	0.18	0.27	5.16
400 - 450	0.68	0.74	1.66	1.45	0.15	0.06	4.74
450 - 500	0.91	0.74	1.41	1.26	0.38	0.50	5.21
500 - 550	0.52	0.42	1.55	1.48	0.06	0.15	4.18
550 - 650	0.48	0.48	1.52	1.31	0.17	0.24	4.21
Average	0.71	0.70	1.51	1.42	0.22	0.27	4.82

With the data available we are unable to quantify to what extent each of these three factors have influenced the per capita daily food intake to rise among predominantly able bodied in the study sample.

Most of the RPF families in the study group raise crops on their land and also work as agricultural labour to supplement their income. Being predominantly rain-fed farmers, they mostly raise millets and a few other crops. The productivity of their rain-fed land is limited with the existing technology and low inputs. This combination is expected to provide only for a part of their total food requirement. Members of this group also work as labour and hence a part of their daily food is also expected to come from purchases made within the village and from PDS. However, the opportunities for employment are finite and limited to the agricultural season. This being the case not all the members of the family will find employment. The daily food budget /stock of the family becomes finite.

As a consequence we expect that larger the family size (brought about by an increase in the non-earning /able bodied members) the per capita food consumption will fall significantly - more intensely under drought conditions. In case the drought lasts longer or for larger family sizes there is a need to augment the family's internal mechanism to increase its food availability or become prepared for migration.

The main food consumption per family (rice, millet and pulses, Tables 3-5) indicate that the families belonging to higher per capita food range have access to greater quantities of food even though their family sizes are small. This suggests that members of this group are better off. Rice dominates the food basket in all the per capita food ranges (Table 3). Millets form the second most important food input for these families. In the per capita food ranges of 450-500 and 550-650 g/d, the per capita consumption of millets and pulses are significantly high compared to other groups (Tables 4-5). The families belonging to these two categories have tried to maintain a proper mix of food basket. Vegetable and fruits are important supplements to the main food. It is surprising to observe the slight domination of bought (either PDS or market) component of food items in the sample (Table 6-7). This indicates that whatever the crops raised in their own land is sufficient to meet only partial food needs.

Table 3: Total Food Consumption per day for the sample families (in kg)

Per capita Food range (g/d)	Rice	Millets	Pulses	Main Food per family	Vegetables	Fruits	Total Food
250 - 350	37.50	13.00	4.95	1.68	11.00	5.25	71.70
350 - 400	74.00	19.00	7.90	1.83	23.55	4.50	128.95
400 - 450	82.75	15.50	7.85	2.00	24.95	1.50	132.55
450 - 500	44.25	28.50	9.20	2.41	8.25	1.75	91.95
500 - 550	61.50	7.50	3.65	2.20	12.35	1.25	86.25
550 - 650	44.50	22.50	7.00	2.55	10.25	1.75	86.00
Total	344.50	106.00	40.55	2.07	90.35	16.00	597.40

Table 4: Daily per capita total food consumption among sample families* (g)

per capita food intake range (g/d)	Rice	Millets	Pulses	Vegetables	Fruits	Total
250 – 350	203.80	70.65	26.90	59.78	28.53	389.67
350 – 400	274.07	70.37	29.26	87.22	16.67	477.59
400 – 450	329.68	61.75	31.27	99.40	5.98	528.09
450 – 500	250.00	161.02	51.98	46.61	9.89	519.49
500 – 550	445.65	54.35	26.45	89.49	9.06	625.00
550 – 650	364.75	184.43	57.38	84.02	14.34	704.92
Total	301.66	92.82	35.51	79.12	14.01	523.12

*=Please note total shown in the last column includes fruits and vegetables and hence exceeds the food range in the first column. Food consumption range uses only total grains for computing calorie sufficiency.

Table 5: Share of Food items in daily per capita Food Consumption for the sample families (%)

per capita food range (g/d)	Rice	Millets	Pulses	Vegetables	Fruits
250 – 350	52.30	18.13	6.90	15.34	7.32
350 – 400	57.39	14.73	6.13	18.26	3.49
400 – 450	62.43	11.69	5.92	18.82	1.13
450 – 500	48.12	31.00	10.01	8.97	1.90
500 – 550	71.30	8.70	4.23	14.32	1.45
550 – 650	51.74	26.16	8.14	11.92	2.03

Total	57.67	17.74	6.79	15.12	2.68

Table 6: Composition of daily food consumption among sample families (in kg)

per capita Food Range (g/d)	Rice		Millets		Pulses		Vegetables		Fruits	
	Own	Bought	Own	Bought	Own	Bought	Own	Bought	Own	Bought
250 – 350	9.50	28.00	6.50	6.50	1.25	3.70	0.75	10.25	0.25	5.00
350 – 400	28.25	45.75	14.50	4.50	1.85	6.05	2.25	20.80	0.50	4.00
400 – 450	45.50	37.25	10.25	5.25	1.00	6.85	8.75	16.20	0.00	1.65
450 – 500	21.50	22.75	18.25	10.25	1.00	8.20	1.25	5.00	0.50	1.25
500 – 550	19.50	42.00	5.00	2.50	0.60	3.05	2.25	9.60	0.00	1.60
550 – 650	25.50	19.00	12.00	10.50	2.70	4.30	2.75	7.00	1.00	1.20
Total	149.75	194.75	66.50	39.50	8.40	32.15	18.00	68.85	2.25	14.70

Table 7: Composition of daily per capita food consumption among sample families (in g)

Per capita Food Range (g/d)	Rice		Millets		Pulses		Vegetables		Fruits	
	Own	Bought	Own	Bought	Own	Bought	Own	Bought	Own	Bought
250 - 350	51.63	152.17	35.33	35.33	6.79	20.11	4.08	55.71	1.36	27.17
350 - 400	104.63	169.44	53.70	16.67	6.85	22.41	8.33	77.04	1.85	14.81
400 - 450	181.27	148.41	40.84	20.92	3.98	27.29	34.86	64.54	0.00	6.57
450 - 500	121.47	128.53	103.1	57.91	5.65	46.33	7.06	28.25	2.82	7.06
500 - 550	141.30	304.35	36.23	18.12	4.35	22.10	16.30	69.57	0.00	11.59
550 - 650	209.02	155.74	98.36	86.07	22.13	35.25	22.54	57.38	8.20	9.84
Total	134.89	176.44	61.26	39.17	8.29	28.91	15.53	58.75	2.37	12.84

3.2 Sample Villages and Food Consumption Pattern

To study the food consumption patterns in the sample villages, we summarized the data based on different per capita food ranges for the chosen villages and the district to which they belong. From Table 8, it may be observed that the Pahukkal village in Kancheepuram district which belongs to 300-350 gm per capita food range (severe deficiency category) exhibits relative dominance of older people in the sample families (about 16%). Other interesting feature is the clear domination of female children and absence of older people in the sample of Mettupatti village in Pudukottai district. Both the villages belong to low daily per capita food consumption range. Does this indicate some relationships between these observed phenomena and per capita food consumption is not clear at this stage. However, the later sections present discussions on these issues. Further, sample families of Pahukkal village completely depend on bought food and share of vegetables and fruits in the food basket are high compared to other sample villages (Table 9). However, sample families of Mettupatti village on the other hand depend mostly on food products grown on their own land. Even the sample families of villages belonging to per capita food range of 450-500 g/d show more dependency on homegrown foods (Table 9). The total food consumption and the per capita food consumption for sample villages are presented in Tables 10 and 11. Rice is a dominant food item in all the villages. However, the villages in the per capita food ranges of 400-450 and 450-500 g/d consume significant quantity of millets and pulses in relation to rice (Table 12). Relative share of vegetables and fruits in the per capita food consumption is very high in Pahukkal village.

Overall the analysis shows that there is a very strong dependence on rice and rice has become staple food for most of the villages studied, irrespective of whether this crop is suitable for or grown in the village by the farmers, etc. Even in areas which are typically suited for millets, rice has replaced millets in the daily food basket. Correspondingly it is expected that there is little drive to raise crops suitable to the area (rainfall, agro-climatic zone and soil). Vegetables and fruit distribution among the villages is highly skewed - the pattern is not easily determined. Fluctuations in the share of pulses in the food basket are small across the samples and the districts.

Table 8: Demographic Details in Sample Villages

Per capita Food Range (g/d)	Villages	Districts	Families	Sample Population	Children (1 - 14 Years)		Adult (14 - 60 Years)		Aged (60+ Years)	
					Male	Female	Male	Female	Male	Female
300 – 350	Pahukkal	Kancheepuram	20	109	24	21	24	23	10	7
350 – 400	Mettupatti	Pudukottai	14	57	1	7	24	25	0	0
400 – 450	T. Narayanapuram, Thailakoundanur-1, Panangkattupakkam, Varadharajapuram, Konampatti-1, Kuttikinathur	Madurai, Salem, Kancheepuram, Trichy, Erode	113	533	76	65	178	167	20	27
450 – 500	Konampatti-2, Kelaparai, Thailakoundanur-2, Vedarpuliankulam	Madurai, Salem, Dharmapuri	72	354	59	62	99	90	20	24
500 – 550	Ozhindhiyapet	Villupuram	18	89	9	10	32	32	1	5
Total			237	1142	169	165	357	337	51	63

Table 9: Food Consumption Pattern in Sample Villages (g/d)

Per capita Food Range (g/d)	**Villages**	**Districts**	Rice		Millets		Pulses		Vegetables		Fruits	
			Own	Bought	Own	Bought	Own	Bought	Own	Bought	Own	Bought
300 – 350	Pahukkal	Kancheepuram	5000	28000	0	1500	0	2550	0	16000	0	7000
350 – 400	Mettupatti	Pudukottai	16750	1000	3000	0	0	1700	0	5750	0	0
400 – 450	T. Narayanapuram, Thailakoundanur-1, Panangkattupakkam, Varadharajapuram, Konampatti-1, Kuttikinathur	Madurai, Salem, Kancheepuram, Trichy, Erode	60500	98750	28250	17000	4850	12000	7000	26850	250	1500
450 – 500	Konampatti-2, Kelaparai, Thailakoundanur-2, Vedarpuliankulam	Madurai, Salem, Dharmapuri	57000	38500	32750	16000	3550	14150	10250	11750	2000	5250
500 – 550	Ozhindhiyapet	Villupuram	10500	28500	2500	5000	0	1750	750	8500	0	950

Table 10: Total Food Consumption in Sample Villages (in kg)

Per capita Food Range (g/d)	Villages	Districts	Rice	Millets	Pulse	Vege-tables	Fruits	Total
300 – 350	Pahukkal	Kancheepuram	33	1.5	2.55	16	7	60.05
350 – 400	Mettupatti	Pudukottai	17.75	3	1.7	5.75	0	28.2
400 – 450	T. Narayanapuram, Thailakoundanur-1, Panangkattupakkam, Varadharajapuram, Konampatti-1, Kuttikinathur	Madurai, Salem, Kancheepuram, Trichy, Erode	159.25	45.25	16.85	33.85	1.75	256.95
450 – 500	Konampatti-2, Kelaparai, Thailakoundanur-2, Vedarpuliankulam	Madurai, Salem, Dharmapuri,	95.5	48.75	17.7	22	7.25	191.2
500 – 550	Ozhindhiyapet	Villupuram	39	7.5	1.75	9.25	0.95	58.45

Total	344.5	106	40.55	86.85	16.95	594.85

Table 11: Daily per capita food consumption for the sample villages (g/d)

per capita food range (g/d)	Villages	Districts	Rice	Millets	Pulse	Vege-tables	Fruits	Total
300 – 350	Pahukkal	Kancheepuram	302.75	13.76	23.39	146.79	64.22	550.92
350 – 400	Mettupatti	Pudukottai	311.40	52.63	29.82	100.88	0.00	494.74
400 – 450	T. Narayanapuram, Thailakoundanur-1, Panangkattupakkam, Varadharajapuram, Konampatti-1, Kuttikinathur	Madurai, Salem, Kancheepuram, Trichy, Erode	298.78	84.90	31.61	63.51	3.28	482.08
450 – 500	Konampatti-2, Kelaparai, Thailakoundanur-2, Vedarpuliankulam	Madurai, Salem, Dharmapuri,	269.77	137.71	50.00	62.15	20.48	540.11
500 – 550	Ozhindhiyapet	Villupuram	438.20	84.27	19.66	103.93	10.67	656.74
Total			301.66	92.82	35.51	76.05	14.84	520.88

Table 12: Share of food items in per capita food consumption per day for the sample villages

Per capita Food Range (g/d)	**Villages**	**Districts**	Rice	Millets	Pulses	Vege-tables	Fruits
300 - 350	Pahukkal	Kancheepuram	54.95	2.50	4.25	26.64	11.66
350 - 400	Mettupatti	Pudukottai	62.94	10.64	6.03	20.39	0.00
400 - 450	T. Narayanapuram, Thailakoundanur-1, Panangkattupakkam, Varadharajapuram, Konampatti-1, Kuttikinathur	Madurai, Salem, Kancheepuram, Trichy, Erode	61.98	17.61	6.56	13.17	0.68
450 - 500	Konampatti-2, Kelaparai, Thailakoundanur-2, Vedarpuliankulam	Madurai, Salem, Dharmapuri	49.95	25.50	9.26	11.51	3.79
500 - 550	Ozhindhiyapet	Villupuram	66.72	12.83	2.99	15.83	1.63
Total			57.91	17.82	6.82	14.60	2.85

3.2 Analyses of factors influencing daily per capita food consumption levels

The relationships between various factors and daily per capita food consumption (DPCFC) have been obtained using standard curve fitting method. For this purpose, first, the average per capita food consumption per day was estimated for the families belonging to each of per capita food ranges shown in Table 1. Thus, six DPCFC estimates were obtained for the six groups of per capita food ranges. Similarly, average values of all the factors were estimated for the same six per capita food ranges. Then, these factor values were plotted against the average values of DPCFC to obtain the relationships.

Family size

The relationship between family size and per capita food consumption was determined by plotting these two factors for the sample population (Figure 1). A strong negative correlation (R^2 value of 0.79) is visible which suggests that with family sizes greater than 4.75, these sample families will begin facing calorie malnutrition during droughts. The daily calorie intake will fall below the targeted 1800 kCals above this family size and has the potential to cause various health and nutrition related problems if this situation is prolonged. It may be recalled that the data for above relation has been obtained during peak 'drought affected' situation. These relationships need to be worked out for non-drought and chronic drought situations in order to determine how and to what extent food security is compromised under drought. These current calorie sufficiency values of per capita daily food intake under a prolonged drought spell suggest significant levels of resilience among the RPF-SHG families.

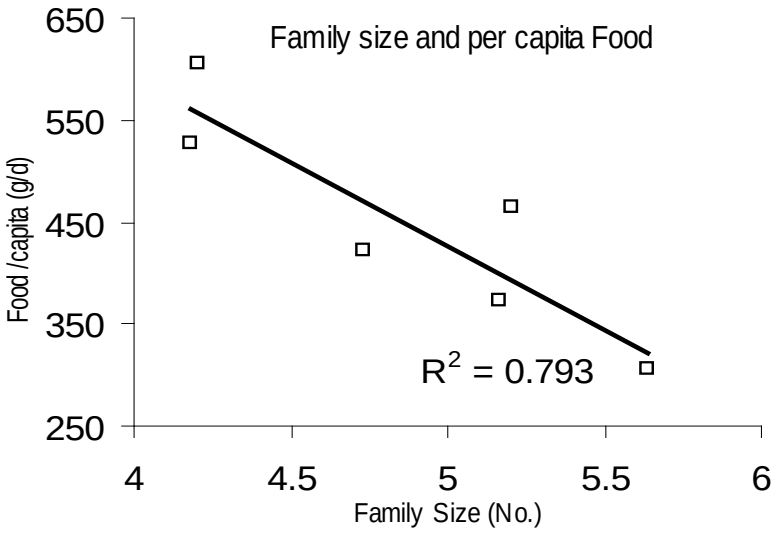

Figure 1: Per capita daily food consumption Vs Family size

Adult-Child ratio

The adult child ratio is expected to influence the DPCFC in two ways namely a. children consume lesser food than adults and b. the food basket is divided among a larger number of dependent persons when children are more in number (low adult:child ratio). A strong positive relationship seen in Figure 2 is a combination of these two influences. For this group, families with adult:child ratios of above 2.5 only exhibit DPCFC of above sub maintenance calorie nutrition. It also suggests that families with greater than one child are vulnerable under drought conditions. This results in a condition of food insecurity bringing DPCFC to sub-maintenance levels.

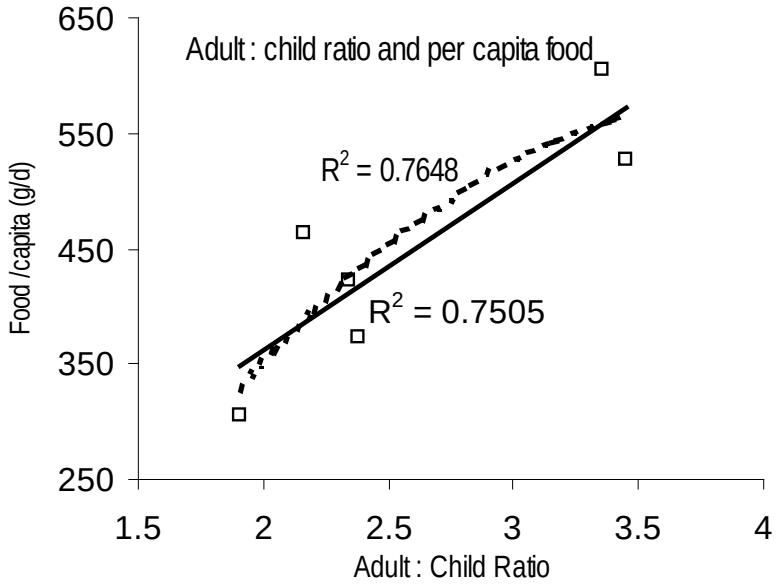

Figure 2: Influence of adult to child ratio on per capita food consumption

Male-Female ratio

The DPCFC has two types of influences from varying male:female ratios. First males are expected to have higher per capita food consumption over females (in a general population and to a lesser extent for working population). Second, it is a convention to believe that males have a greater opportunity for labour /wages and employment potential. Also the bread winner concept creates greater opportunities for men to work and "provide for" the families. In many parts of Tamil Nadu female foeticide is often reported. Here a higher female:male ratio is considered a liability in terms of providing for food, dowry, etc. In most parts of India adult male wages are generally higher than female wages. All these tend to suggest that families with a greater number of males stand a better chance to survive droughts. This is expected to be manifest as a higher DPCFC even during a drought year and even when local resources are on the verge of exhaustion. Male:female (MF) ratio is plotted in Figure 3 against DPCFC. There was no strong relationship observed except that the trend line suggests a positive relationship between the two. The DPCFC rises only gradually with increasing MF ratio. For every one unit rise in MF ratio the DPCFC rises by 300g. With available field data it is difficult to suggest that this 300g increase is brought about solely by a higher level of per capita food intake by adult males. A greater depth of data and analysis is required to understand this phenomenon. However, from the pattern observed in Figure 3, just as is normally believed, families with lower MF ratio (more females) are likely to be more vulnerable during droughts. Various factors that influence this phenomenon need to be studied in detail. This also means that when droughts affect such areas, and family available food stock is limited, men will have a higher need for out-migration.

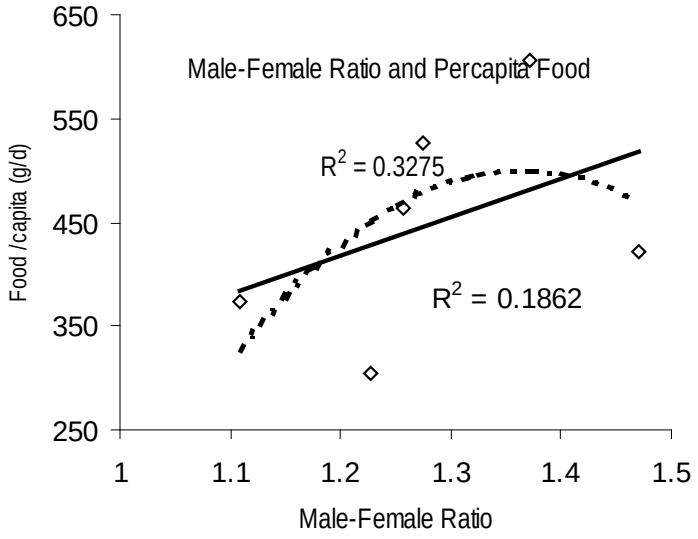

Figure 3: Male female ratio and per capita food consumption.

Able-Aged ratio

The presence of a large fraction of aged population is expected to signify reasonable levels of health within the study sample. They constitute about 10% of the sample population (Tables 1 and 2). Significant aged population is seen in two DPCFC classes - the lowest and the middle range (Tables 1 & 2). It is believed that under normal conditions a large aged person component in the family will only be marginally productive and contribute to a lesser extent to the family income /food basket. On the other hand during droughts when there is very little labour /daily wage opportunities within villages, the overall food basket of the family would have shrunk (due to low wages), due to exhausting of family food stocks, inadequate coping up strategies, etc. In the presence of a large

fraction of aged persons, the limited size of the food basket will have to be shared by a greater number of persons. It is expected to introduce stressed conditions earlier at the onset of drought and manifest them to an even more severe extent as the drought progresses. Coping strategies will inevitably lead to out-migration. Figure 4 shows the able:aged ratio of various families plotted against DPCFC. This data was collected during a peak drought period and therefore a strong positive relationship has been obtained between the able:aged ratio and the DPCFC - higher the able:aged ratio greater is the DPCFC or food and nutrition security during a drought condition. We expect that the slope of this relationship will reduce or level off during adequate food supply /security periods or when the able:aged ratios are quite high. A reasonably strong positive relationship is seen. The slope suggested that an able:aged ratio greater than 1.75 seems to be needed to keep the food security above sub maintenance levels when aged persons are in the family. Once again the contribution of a higher DPCFC of the able persons influencing this trend needs to be determined by a detailed study.

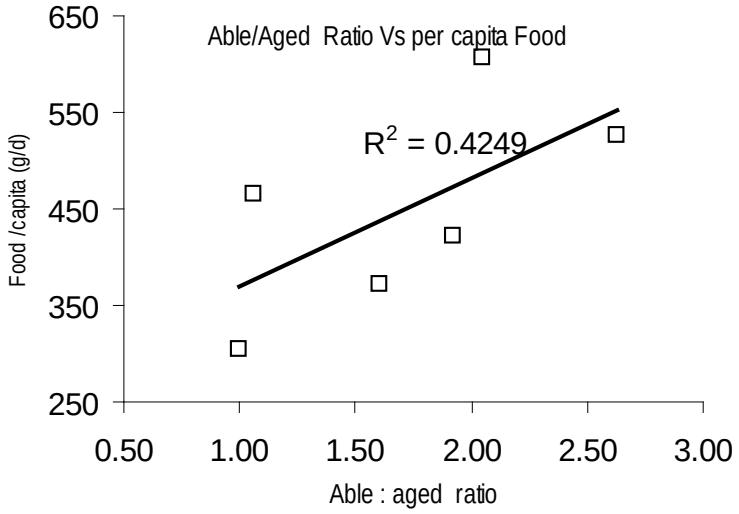

Figure 4: Influence of an aged family component on food consumption is identified by a plot of able-bodied : aged persons ratio Vs per capita food consumption

Gender bias and girl child skew

From various field discussions as well as everyday observations we identified that families with more females, especially girl children are careful and thrift and we also showed that MF ratio significantly influences the DPCFC. In order to quantify the gender bias in terms of food security we compare the DPCFC under various ranges of young girl children in proportion to adult females as well as young male population Vs adult male population (able bodied males). These results are presented in Figures 5 & 6. There is generally a negative relation for both the parameters. Increases in young male:adult male (YM:AM) and young female:adult female (YF:AF) ratios generally reduce the family's DPCFC. The slope YM:AM is more gentle compared to YF:AF slope. This shows that the drop in DPCFC is more rapid with the increase in female children compared to the domination of male children in the family. YF:AF levels above 0.63 tends to bring families to sub-maintenance levels while YM:AM ratio of 0.75 tends to bring the family into sub-maintenance levels of food insecurity (<350g /capita /d). There is thus a slight bias towards the male child in the family of RPFs. This perhaps the first time such a parameter is measured for this study sample. In the absence of an appropriate baseline it is not possible to judge whether this difference is significant or caused by biological factors. It is necessary to measure this parameter more frequently to arrive at a reasonable conclusion.

Own-Bought grain ratio

This group comprises mainly of typical resource poor farmers (75% small and marginal farmers and 25% landless farmers). We expect that the RPF family will go through yearly (transitional) cycles of sufficiency (for a few months immediately after crop harvest) and insufficiency (or sub maintenance calorie nutrition during periods when

a. family stocks of grain are depleted,

b. a large fraction of the daily grain is bought from wages,

c. family stocks are low and coping mechanism of voluntary food reduction to sub-maintenance levels sets in, etc.

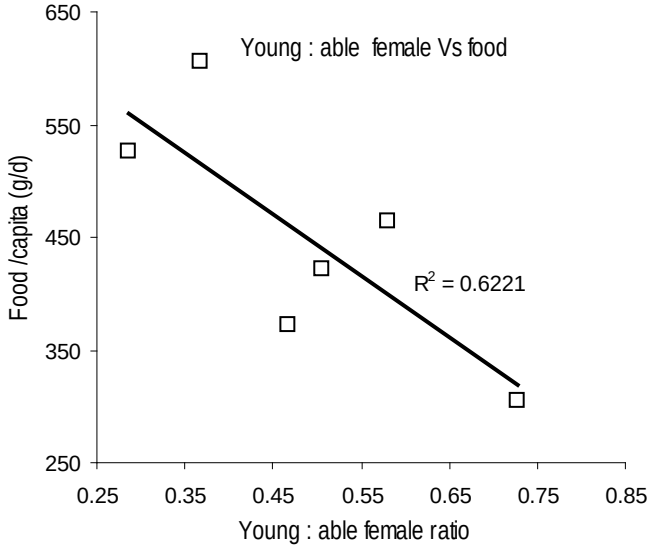

Figure 5: Female children in RPF families and their influence on food consumption is estimated by plotting the ratio of young female children /adult female Vs per capita food intake of the family.

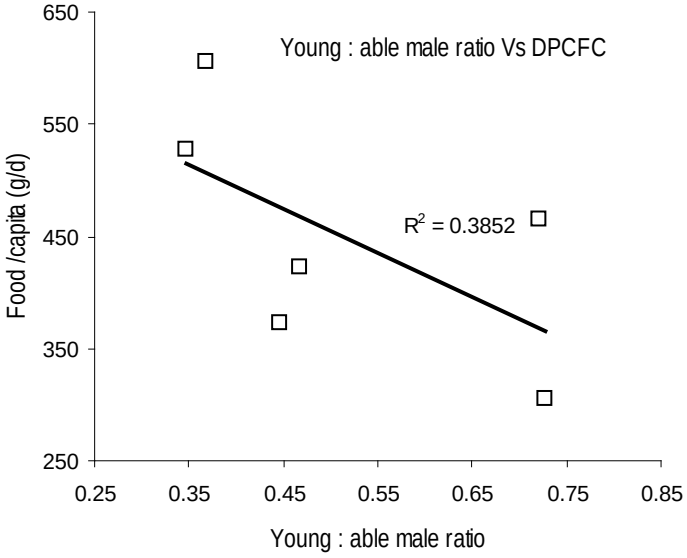

Figure 6: Male children in RPF families and their influence on food consumption is estimated by plotting the ratio of young male children /adult male Vs per capita food intake of the family.

The presence of a significant quantity of grain from within family sources /stocks in the daily diet during periods temporally away from harvest time or during drought periods is an indication that such families are vulnerable to a lesser extent and enjoy a higher level of food security. The extent among other factors is expected to be location specific. The quantities of food grains (cereals, millets, pulses, vegetables, fruits, etc) raised from own resources, purchased from PDS and collected from CPRs were quantified (Tables 6 and 7).

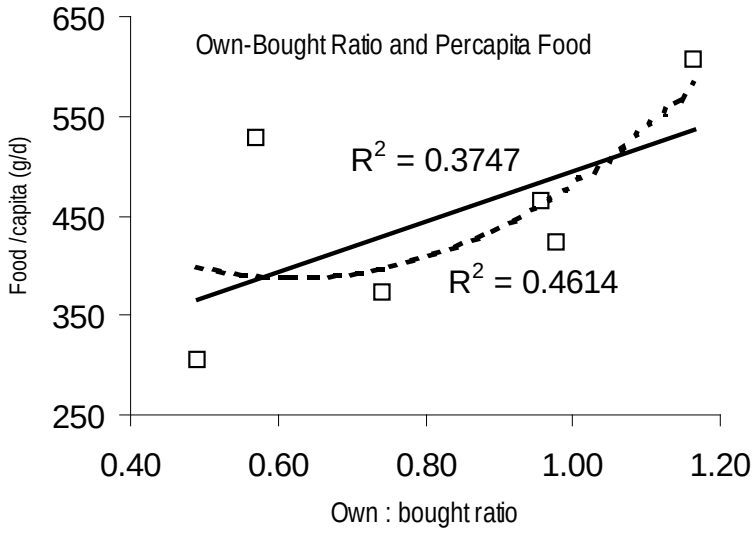

Figure 7: Food security among RPF is directly dependent upon the fraction of the food basket derived from sources within the farmers' control. An indicator of this is arrived at by plotting the ratio of food from own sources /from bought Vs per capita food consumption.

As a part of the interventions, these RPFs run SHGs attempted to raise a greater quantity of millets and cereals for home consumption on their land and reduce the fraction of purchased food grains. The purchased food grains are rarely bought for cash and are most often taken on credit. A greater fraction of grain arising from home grown sources indicates a certain degree of food security and self-sufficiency - as opposed to purchase of grain from market /PDS systems for cash or credit. In times of drought and in the absence of local employment, daily wage source, etc. a significant component of home grown food items in the food basket is indicative of a lesser degree of vulnerability to drought first and credit next and finally a higher level of food security. The ratio of grain obtained from own sources over that bought for cash /credit from local sources or PDS in the daily food basket then becomes a good indication of a lower vulnerability arising from better insurance and lower credit. A higher own /bought ratio coupled with calorie sufficiency even during periods of drought will suggest greater extent of temporally spread food security arising from greater self-sufficiency and other forms of insurance and risk aversion.

The ratio of own food grains to bought food in the daily food basket (rice, millets and pulses) is plotted against DPCFC in Figure 7. The result proves the hypothesis that own food provides higher food security. All increases in DPCFC are accompanied by an increase in the fraction of food from own sources or vice-versa.

Impact of higher own-bought ratio

These farmer groups are all rain-fed farmers and recurring droughts has driven them into credit trap. Credit is first taken to purchase agro-inputs for food crops. A part of the harvested grain is initially traded to cancel the

credit. However, when droughts occur, there is lower harvested grain, lower stocks left after canceling the credit and during the oncoming season credit is taken to meet family food grain needs also. This spirals with every drought year putting farmers deeper into debt. Escaping such credit trap is one of the main objectives of this farmers' network. Increasing own sources of food in the daily food basket overcomes a major pull into the credit trap. Food security provided through internal mechanisms and from local resources is thus much sought after. Greater the farmers' control on resources of production, greater will be his share on the product (food) and on food security implied therein. The farmers in the network have achieved this in two ways firstly, substituting local materials for purchased agro inputs and second by increasing the share of own food grains in the daily food basket.

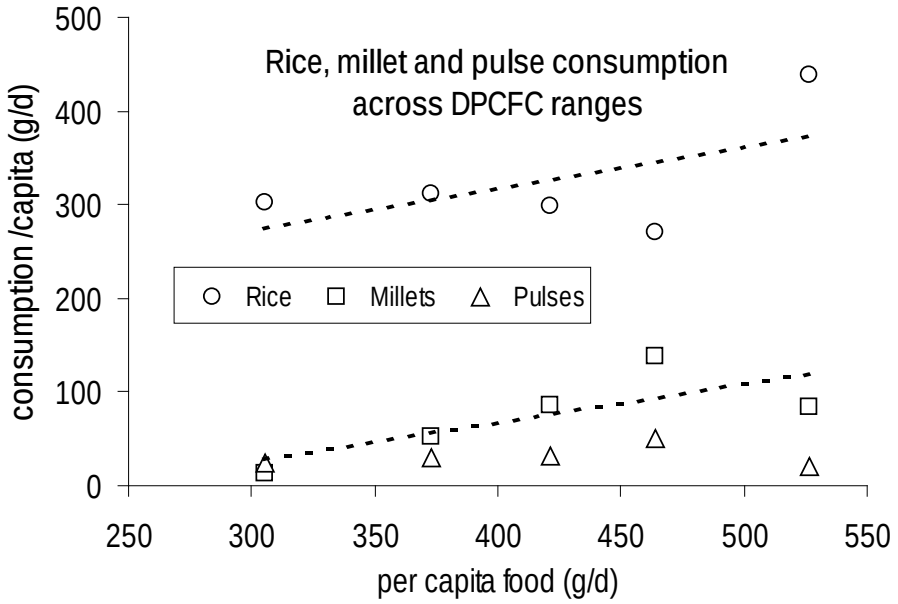

Figure 8: The proportion of various components of the food basket (rice, millet and pulses) change with increasing per capita daily food consumption.

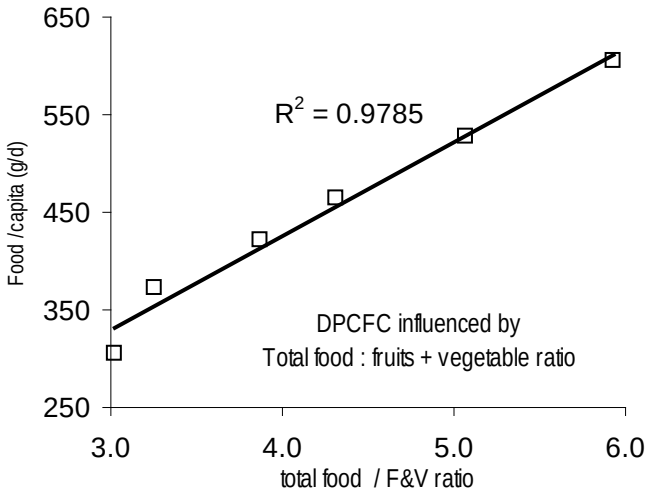

Figure 9: The total grain /total fruit and vegetable ratio is a strong indicator of the food (calorie) security and has a very high correlation to per capita daily food consumption.

There was no baseline numbers measured for this parameter when the farmers of the LEISA network initiated the planned interventions in terms of

a. use of appropriate technology inputs,

b. eco-friendly and organic agriculture techniques

c. credit aversion strategies

We therefore attempt to compare this current data (drought year 2002 for the network farmers) with TN state average for year 2000 (no drought). The following observations may be made.

a. Extrapolating the results presented in Figure 7 suggests that these farmer can support only a low level of DPCFC (c.150g/cap/d) when own sources of food grain in the daily food basket is nil.

b. All increases in DPCFC have been possible by an increased share of own food grains in the food basket.

c. The average per capita food consumption in the network is just 4% lower than that of the state average of 1826 kCals /capita /d for a non-drought year.

d. Over 60% of the network RPF farmer families have achieved calorie sufficiency levels at /above sub-maintenance levels measured during peak drought.

e. There is not enough data spread to determine limits to substitutions between own and purchased sources of food items. With increasing per capita food used, the share of own sources gradually increases. In other words greater share of own food sources increases the food intake and consequent food security. Therefore for this kind of target group, higher levels of food security can come only by mechanisms that enable farmers to internally raise the outputs of grain and food basket. The obvious policy implication is to enhance this capability in farmers such that a minimum threshold of food security is assured within the system.

f. Figure 9 and Tables 6 and 7 show the various components of the food basket - rice, millets and pulse together provide the basic nutrition and later on food security. Rice is the single largest food component accounting for over 60% of the total food grains in the daily diet. This study group consists of largely resource poor rainfed small and marginal farmers. Depending upon rice to meet a large part of their calorie nutrition and food security is thus not a sustainable option. This level of rice use is now dependent on imports to this ecosystem from another nearby location. Such imports into the ecosystem are not conducive to long term food security and eco-system sustainability. Various measures need to be taken up internally within the SHGs where locally suited grains and millets are raised at these rain-fed locations and food habits gradually switched to more home grown cereals and millets.

g. From Figure 9 and Tables 4 & 5 it is seen that increases in the DFCPC is accompanied with a corresponding increase in the millet component. Table 3 shows that with increasing DFCPC millets obtained from own sources increase significantly (>60%). Nutrition /food security is thus enhanced significantly by an increase in millets raised on own land resources. Policy and enabling measures to increase food availability /security will therefore have to come from enabling an increase in millet production on own land.

Food-Vegetable ratio

The daily intake of vegetables and fruits and its relation to the DPCFC is determined in Figure 10. A very strong relation between food:vegetable ratio vs the DPCFC may be noted (r^2=0.97). This tells us that with the increase in the DPCFC there is a corresponding increase in the consumption of vegetables and fruits. In other

words, the relative share of vegetables and fruits remain same in the food basket irrespective of increase in the consumption of rice, millet and cereals. It appears that the sample group of farmers does not view vegetables and fruits as compensatory items in lieu of main food items. They are used as add-on items to increase the quality of food intake.

Conclusions

Among the resource poor farmers of the study sample food consumption (calorie sufficiency) has risen to levels close to sufficiency brought by an integration of SHG and eco-friendly low external input agricultural practices. Increases in food consumption (and food security) have come about by an increased use of rice from external sources (c.50%) along with a higher proportion of millets from own resources into the food basket. Increased dependence on rice even among these rain-fed farmers and zones (>50% of food basket) is not sustainable in the long run and needs to be reversed. Policy implications of these observations are that food security enhancement efforts need to emphasize the use of locally raised cereals and millets from own resources in order to enhance the sustainability of such food security increases. Vegetables and fruit consumption measured as a ratio to the total cereal, millet and pulses show a good indication of food security (calorie sufficiency under drought conditions) and may be used as a quick measure of food security for a limited purpose. Providing short-term credit to self help groups, group based monitoring and promoting use of eco-friendly and low external inputs are some of the other policy initiatives that could enable the RPFs to achieve a high level of daily per capita food consumption and concomitant food security components.

5. References

1. Gopalan C, Ramashastry BV and Balasubramanian, SC (2000). Nutritive value of Indian Foods Revised Edition. eds. Narasinga Rao BS, Deosathale YG and Pant KC, NIN Hyderabad. c.f. Meenakshi and Vishwanathan 2003 Ibid.

2. Kozel V and Parker B (2003). A profile and diagnostic of poverty in Uttar Pradesh. Econ. Pol. Weekly. Jan 25-2003 p385-404.

3. Radhakrishna R (2002). Food and Nutrition Security in Tamil Nadu -2002. In Parikh K and Radhakrishna R (Eds) India Development Report. 2002. Oxford. Chap.3. p49-58.

4. Meenakshi JV and Vishwanathan B (2003). Calorie deprivation in rural India 1983 to 1999-2000. Econ. Pol. Weekly Jan 25 2003. p369-375.

5. Meenakshi JV and Vishwanathan B (2003). Ibid.

6. National Sample Survey Organization (2001). Differences in level of Consumption among socio-economic groups September 2001. NSSO-Report 472 p 215, Table.5R, Page. A-132

7. c.f. Meenakshi and Vishwanathan ibid.

8. LEISA Network Plan Proposal (1999). Low External Input and Sustainable Agriculture Network. Trichy. South India.

9. Watts 1987 c.f. Maxwell S and Frankenberger TR (eds) Household food security: Concepts, Indicators, measurements – A technical Review. UNICEF-IFAD. p. 92

10. National Sample Survey Organization (2001). Sources of household consumption in India 1999-2000. September 2001 NSSO Report 474. Table 1R

11. Maxwell S and Frankenberger TR Household food security: Concepts, Indicators, measurements – A technical Review. UNICEF-IFAD.

12. Chanakya HN (1999). PTD emerging in South India - an overview. LEISA-India Newsletter. 1:8-12.

13. Jha, Prem Shankar (2003). Agriculture in Distress. The Hindu 25-02-2003.

14 Deol, Rajesh (2003). Farmers on Warpath Deccan Herald, Sunday, March 23, 2003

15. Radhakrishna R Food and Nutrition Security in Karnataka (2002). In Parikh K and Radhakrishna R (Eds) India Development Report. 2002. Oxford. Chap.7. p153-176.

16.- LEISA publication, especially if one such is available in print. Can we get a copy of this from LEISA-India magazine?. This has better reference value compared to LEISA networks documents.

17. Harris B (1987). Poverty in India – Micro level Evidence. Paper presented at Workshop on Poverty in India. Queen Elizabeth House. Oxford. October 1987.

18. National Sample Survey Organization (2000). Common Property Resources in India Jan- June 1998. NSS 54th Round. and

19. Maxwell S and Frankenberger TR ibid. (Seasonal variations in vulnerability).

20. Chanakya HN and Somashekara Reddy ST (2000). A Better Livelihood with Every Drop.

Tamil Nadu Peasants Vision of Water and Livelihood Nexus. In Danielle Morley (Ed), Perspectives on freshwater UNED EarthSummit 2002. Forum on Freshwater Report.

(http://www.earth%20summit%202002.org/freshwater/Freshwater%20Report.pdf)