Changes in Agriculture and Village Economies

Research Bulletin no. 21

International Crops Research Institute for the Semi-Arid Tropics

Science with a Human Face

Citation: Rao KPC and Kumara Charyulu D. 2007. Changes in Agriculture and Village Economies. Research Bulletin no. 21. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. ISBN 978-92-9066-507-6. Order code RBE 021. 136 pp.

Abstract

The Village Level Studies of ICRISAT are designed to collect farm level data to assist research in its task of generating new technologies suited to the needs and means of farmers living in the semi-arid tropics. They serve as a vehicle to study the changes in agriculture and village economies. This publication is a comprehensive study of 240 households from six villages, Aurepalle and Dokur in Andhra Pradesh and Kalman, Kanzara, Kinkheda and Shirapur villages in Maharashtra undertaken from 1975 to 1984 and later resumed in 2001-02 with a more representative sample of 446 households. It documents the changes that occurred in agriculture and household economies in these villages over a 26-year period between 1975-78 and 2001-04. The studies while giving a clear picture of farming systems in the rural areas, help in identifying the socioeconomic and institutional constraints faced by the farming community.

The studies reveal the slow disappearance of joint families (dominant in 1975-78) and the emergence of nuclear families. They delve deep into the trends pertaining to average family size, literacy levels, household income, consumption standards, dependence on farming as a major occupation, reduced dependence on crop and livestock enterprises for sustenance, nonfarm sources of income, real wages of labor, etc. The studies reveal that households had less land to operate in 2001-04 than in 1975-78 and that cropping patterns have undergone drastic changes with cash crops overtaking food crops in all the VLS villages. Despite moderate increases in productivity, crop and livestock production have become non-remunerative due to steadily increasing production costs and stagnant product prices.

The publication finally addresses the policy implications of drastically changed cropping patterns and nonviability of crop and livestock enterprises among other issues, and suggests measures to improve the state of rainfed agriculture in the semi-arid tropics.

Changes in Agriculture and Village Economies

Research Bulletin no. 21

KPC Rao and D Kumara Charyulu

ICRISAT

Global Theme on Institutions, Markets, Policy and Impacts

International Crops Research Institute for the Semi-Arid Tropics
Patancheru 502 324, Andhra Pradesh, India

2007

List of abbreviations

AERCs	Agro-Economic Research Centers
APRLP	Andhra Pradesh Rural Livelihoods Project
CACP	Commission on Agricultural Costs and Prices
CCS	Cost of Cultivation Scheme
GATT	General Agreement on Tariffs and Trade
GCA	Gross Cropped Area
IARC	International Agricultural Research Center
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IMD	India Meteorological Department
MSP	Minimum Support Price
NIN	National Institute of Nutrition
PDS	Public Distribution System
PVK	Punjabrao Krishi Vidya Peeth, Akola
RARS	Regional Agricultural Research Station
SAT	Semi-arid Tropics
SAUs	State Agricultural Universities
VLS	Village Level Studies
WTO	World Trade Organization

Acknowledgements

The authors gratefully acknowledge the support of and guidance from Dr MCS Bantilan, Global Theme Leader, Institutions, Markets, Policy and Impacts (IMPI), in conducting the Village Level Studies. The help rendered by Y Mohan Rao and VK Chopde, Senior Scientific Officers, in meticulously supervising the collection and verification of the survey data is also appreciated. So is the patient work of the numerous investigators who worked for short periods conducting the three annual surveys. The whole exercise would have been in vain but for the data entry operators, programmers and scientific officers who assisted in data entry, programming and analysis to bring this publication to life. We are thankful to our referees for their balanced comments and to our editor for his valuable comments and suggestions. We also acknowledge the administrative support provided by H Padmini, VN Krishnan and Kenneth Muir. Last, but not the least, we thank all the respondent farmers in the six VLS villages who gave us their time to patiently respond to our innumerable queries.

Contents

Chapter 1: Introduction

1.1 What are Village Level Studies?

Economists use both micro- and macro-level data to analyze trends. While studying micro-level data, they are often faced with the question as to how many households should be studied given the limitations of time and cost. While drawing inferences, there is also a concern whether the sample studied was representative enough. When representativeness is desired, economists and social scientists collect selective data from a large sample of households; when the emphasis is on thoroughness, they collect a large number of details from a small sample. So there is always a dilemma between maximizing width and depth.

Villages are settlements of people who use diverse skills to produce a range of goods and services and exchange them locally or externally. Study of villages yields knowledge about interrelationships, common property resources and social networks. A systematic effort at carrying out Village Level Studies (VLS) was made by Agro-Economic Research Centers (AERCs) in India during the 1950s and 1960s. The AERCs are usually associated with the economics departments of universities and sponsored by the Directorate of Economics and Statistics of the Ministry of Agriculture.

The VLS surveys focused on demographic, economic and sociological factors to map the structural influences contributing to or hindering development. However, they were criticized for the absence of a statistical framework for village selection, which limited the extrapolation of results. While an abundance of data was collected, relatively little was analyzed and reported (Moore et al. 1976). Moreover, the decision by several centers to follow the standard ethnographic practice of interviewing every household in each village placed an inordinate strain on scarce research resources and greatly increased nonsampling error with single-point interviews and associated memory bias. The absence of a uniform framework for data collection and analysis also vitiated the extent to which comparative inferences could be drawn (Schofield 1974). Today only a few AERCs continue to carry out village studies; they often repeat the surveys done earlier rather than initiate new ones. Nevertheless, the AERC village research is still the only source of empirical enquiry on interesting and relevant developmental issues in India's semi-arid tropics (SAT) (Lipton 1983a; 1983b).

The AERCs also initiated farm management studies in the 1950s to collect data on the structure and performance of farm enterprises. These too were sponsored by the Ministry of Agriculture. They provided a common tabulation and reporting framework on farm structure, yields, cost of cultivation, relative profitability of farm size strata, input and credit use and other farm management variables. However, these studies were limited in scope. They did not include agricultural labor households nor did they pay much heed to the technical and biological aspects of cultivation. Since the original data were not computerized, access to them was not open to many researchers outside the centers where they were collected. In the early 1970s, the farm management studies were replaced by the Cost of Cultivation Scheme (CCS), initiated at the request of the Agricultural Prices Commission, which wanted, for its price policy purposes, more reliable data on the costs and benefits of specific crops. Data collection was mainly assigned to the State Agricultural Universities (SAUs) participating on a voluntary basis. These data too were not freely accessible to the research community.

1.2 ICRISAT's First-generation Village Level Studies (1975-84): Features and Findings

The Village Level Studies conducted by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have created a long-term panel dataset. Instead of including all the households of a village, these studies chose only a sample of them to collect data on various aspects of farming and housekeeping. The resident investigators visited these households once in three weeks to collect data in order to minimize recall bias.

The need to collect uniform data across a panel of households over several years arose from three mutually reinforcing considerations centering on (1.) the nature of interdisciplinary research at ICRISAT, (2.) the variability of agricultural production in the SAT, and (3.) the potential for complementarities in data collection and analysis to address a range of research topics. In interdisciplinary agricultural research, the role of the social scientist is usually supportive, ie, providing information for decision making by biological scientists and research administrators. In particular, biological scientists seek quick answers to diagnostic questions to ensure accurate problem identification and appropriate technology design. What were needed for this purpose were representative benchmark locations which could function as loci for diagnostic research on technology design and adaptation. Further, a more permanent field presence was indispensable to ICRISAT for developing an institutional memory so essential to efficient agricultural research. Emphasizing a longitudinal study approach also meshed well with the comparative advantage of an International Agricultural Research Center (IARC) such as ICRISAT. Imparting continuity and stability to the agricultural research process had been a major motivation for the establishment of IARCs.

The nonstable production environment characteristic of the SAT further underscored the need for a commitment to research in such locations. Questions relating to risk, yield stability and stabilization policies can best be analyzed empirically with time series data from the household level. Lastly, the research agenda of ICRISAT's Economics Program, as it was then called, was broader rather than narrowly focused concerns about technology adaptation. Identifying constraints to agricultural development in the SAT and alleviating them through technological and institutional change figured as an objective in the mandate of the Institute.

Given that objective, the following priority research areas were described with an accompanying set of hypotheses (Binswanger et al. 1974):

- Economic and environmental explanation of cultivation practices
- Seasonal availability of resources – bottlenecks and surpluses
- Human nutrition
- Impact of risk on farmers' behavior, particularly on adoption of technology
- Marketing and consumer acceptance
- Social organization and group action
- Income distribution and distribution of benefits from technology
- Speed of diffusion of new technology.

Several of these areas shared common empirical features which could be exploited by collecting multiple observations on the same units. Moreover, by focusing the analytical capabilities of a number of researchers inside and outside ICRISAT on the same data base, complementarities could be produced which would add up to more than the simple sum of individual results and insights. Thus, developing and nurturing a longitudinal data base appeared to be an effective means of multiplying social science research resources. Based on the three overriding considerations described above, ICRISAT started its Village Level Studies in three broad production regions of India's SAT in 1975. Other benchmark village sites – five in West Africa and two more in India – were opened in the 1980s.

Some of the major findings of the first-generation VLS were:

- Rainfall uncertainty at sowing on soils devoid of moisture distinguishes dryland agriculture in the SAT. When the onset of the monsoon is erratic, farmers often make early- and mid-season corrections in their cropping pattern to adjust to emerging rainfall events. If early-season rainfall is sparse, the land is fallowed during the rainy season. In the face of rainfall uncertainty at sowing time, farmers cannot always adhere to the recommended legume-cereal rotation.
- In general, dryland soils within and across villages displayed much greater spatial variation than irrigated ones. This militates against the targeting of agricultural research and developmental policy at groups differentiated by household resource endowments or personal characteristics within India's SAT villages.
- Bullock power will continue to be the main source of draft power into the 21st century given

the limited scope for tractor rental markets.

- The incidence of covariate risk in production and consumption does not translate into sharply rising foodgrain prices because of the well-integrated, large national economy and the localized effects of droughts within regions.
- With land holdings tending to be small, enforcement of land ceiling legislation would yield enough land for only housing for landless people but not for cultivation.
- Dryland agriculture does not offer scope for absorbing substantial quantities of labor through technical change and diversification.
- Crop improvement in India's SAT should be attuned to the region-specific needs of farmers to break adoption ceilings which are significantly lower than 100% and are largely explained by interregional differences in climate and soil.

1.3 Changes Since the First-generation VLS

Though the first generation of Village Level Studies (VLS) were discontinued in 1985 – a few surveys were carried out in 1989 and 1993, but the data were not analyzed and reported – demand for data remained quite high till 2000.

During the interregnum between 1985 and 2002, many changes occurred in the markets, institutions and policies that were detrimental in the long run to dryland agriculture. The gains from Green Revolution technologies, which were conspicuous in the irrigated areas, did help India achieve self-sufficiency in the production of agricultural commodities in general and foodgrain in particular. There was a gradual buildup of buffer stocks of rice and wheat by procuring them in the predominantly irrigated regions of the country. Facilitated by this, the government aggressively subsidized the consumption of these superior cereals by supplying them at 50% of the economic cost to low-income consumers through the Public Distribution System (PDS). This hastened the shift in low-income consumers' preference from coarse grains to superior cereals, further depressing the demand for and price of coarse grains like sorghum, millet and finger millet, thereby rendering their cultivation nonviable.

This period also witnessed the globalization of agricultural commodity markets. In general, supply of farm commodities tended to be higher relative to demand, which caused a fall in their real prices. The increase in production and the export subsidies given by developed countries to their agricultural sectors contributed significantly to this price fall. The East Asian economic crisis of the 1990s and the partial opening up of agricultural commodity markets under the GATT agreement of 1994 also contributed to the downtrend. As member countries of the World Trade Organization (WTO), including India, reduced tariffs to be in tune with the liberalization trends, prices of agricultural commodities softened even in the domestic market. There was a widespread tendency to cut costs in order to emerge competitive, which put downward pressure on domestic prices. Thus the direct and indirect effects of globalization of commodity markets reduced real prices in both international as well as domestic markets.

During this period, general infrastructure improved in the rural areas, although not as much as in the urban areas. Basic needs like drinking water, link roads, school buildings, vaccination facilities, etc. were addressed to some extent. Several government programs were launched to provide relief to the needy, such as transferring assets like house sites, houses, toilets, agricultural land and irrigation wells to the rural poor; and providing them access to the PDS, employment, pension, scholarships, etc. Several institutional reforms were taken up to improve the performance of schools, irrigation systems, watershed works, self-help groups, etc. Of course, some of these programs and new institutions function at different levels of efficiency. Even well-targeted programs develop leakages, and at times nontargeted households manage to be included among the beneficiaries. Though these new schemes and institutions do help poor households in facing droughts and other income shocks, the asset or income transfers have been too meager to lift them above the poverty line.

1.4 Drivers for the Resumption of Village Level Studies (Second Generation)

The period 1985-2002 also saw greater policy support being given to irrigated areas through input subsidies. What began as capital subsidies on surface irrigation in the first two decades after Independence swelled to include subsidies to cover the under recovery of the operational and maintenance costs of irrigation. In the 1970s and 1980s, subsidies were extended to fertilizers to promote their use, and they grew large enough to overshadow the subsidies on surface irrigation. During the 1990s, the subsidy on power supplied to wells and bore wells emerged as the most significant component of agricultural input subsidies. These irrigation and power subsidies by and large benefited farmers having access to surface or well irrigation. Such farmers also got nearly four-fifths of the fertilizer subsidy because fertilizers are used universally and at high dosage on farms having access to irrigation. Thus, while a good part of the production costs on irrigated farms are subsidized by the government, dryland farmers get only a small fraction of that benefit. This gap in access to subsidies renders dryland farming nonviable and impacts the ability of farmers to invest in soil and water conservation measures to retain/improve soil fertility and productivity. Erosion losses have further marginalized rainfed lands and caused deterioration in soil texture, structure, fertility and water-holding capacity.

These sweeping changes in the markets, institutions and policies have accentuated the prosperity gap between predominantly irrigated and predominantly rainfed areas. Variability in the distribution of rainfall has increased, and droughts have become more persistent. Farmers are investing in bore wells despite a considerable risk of failure. The water table has fallen and substantial farmer investments on water exploration have failed to increase irrigation coverage. Seasonal migration of labor has become common, and is leading to permanent migration in some cases. In addition, demographic pressure has reduced the average size of land holdings and marginal lands are being left fallow more frequently. Even at the macro level, there is concern about the tapering off of gains from the Green Revolution and stagnation of crop yields.

The impetus to resume Village Level Studies came from a curiosity about the state of farm enterprises and household economies in the predominantly rainfed areas of India's SAT. The other aspects that excited enquiry were the assessment of technology adoption in rainfed areas; the investment patterns of rural households; the impact of labor market integration; the role of the nonfarm economy in sustaining rural households; the impact of government programs; the assessment of poverty and nutrition standards; and the role of migration as a risk-coping strategy.

1.5 Representativeness of the First-generation VLS Sample

The sample for the first generation of Village Level Studies was selected in four stages. India's vast SAT encompass 15-20 large regions, each straddling several districts. In the first stage, three contrasting dryland agricultural regions were identified for study on the basis of cropping, soil and climatic criteria: Telangana in the state of Andhra Pradesh (AP) and Bombay Deccan and Vidarbha in Maharashtra. Within these regions, representative districts were selected: Mahbubnagar in Telangana, Solapur in Bombay Deccan and Akola in Vidarbha.

In the second stage, typical talukas (local administrative units) were chosen on the basis of secondary data on about 40 variables. In general, talukas that were most frequently characterized by values falling within the modal intervals of these 40 variables were chosen. The talukas so selected were Kalwakurty and Atmakur in Mahbubnagar district, Mohol and North Solapur in Solapur district and Murtizapur in Akola district.

In the third stage, villages representing the characteristics considered in the selection of districts and talukas were picked. About 12-20 villages in each selected taluka were visited by the research team accompanied by scientists of local agricultural universities and local government officials. Villages located near large towns or along paved roads and those with special development programs or interventions implemented with external resources mobilized by private voluntary organizations were avoided. The villages thus selected were Aurepalle

(Kalwakurty), Dokur (Atmakur), Shirapur (Mohol), Kalman (North Solapur) and Kanzara and Kinkheda (Murtizapur).

In the fourth stage, the village census provided the basis for drawing the sample of households, which were selected mainly based on the size of their operational land holding and occupation. A sample size of 40 households in each village was determined, considering the amount of data to be collected, the memory bias inherent in long interregnums between interviews, and the need for formal statistical analysis to explain variation in interhousehold behavior. Only households which relied heavily on agriculture, either as cultivators or as landless laborers, were sampled, leaving out full-time artisans, shopkeepers and traders. Even after eliminating nonagricultural households, about 95% of the village households still remained in the population of interest. A sample of 30 cultivator and 10 landless labor households was drawn in each village. The cultivating households in each village were stratified according to the size of the operated farm into three equally numerous groups. A random sample of 10 households was drawn from each tercile. Landless labor households were defined as those operating less than half an acre (0.2 ha) and whose main source of income was the casual agricultural labor market.

The fixed sample size of cultivator and landless labor households in each village meant that the sampling fractions and relative farm sizes that demarcated the cultivator terciles varied from village to village. The likelihood that a village household was in the sample ranged from about one in four in the smaller Akola villages to about one in ten in the larger Mahbubnagar villages. Landless labor households were somewhat underrepresented in the sample in all the villages. On average across the six villages, they comprised about one-third of the households in the population of interest, but their share in the sample was only one-fourth. But as their mean household size was less than that of cultivator households, a one-fourth representation in the population of interest was considered fair. Other benchmark village sites – five in West Africa and two more in India – were started in the 1980s. The new sites in India covered two villages in Sabarkantha district of Gujarat and two villages in Raisen district of Madhya Pradesh. However, problems in implementing the surveys and nonreliable data from these sites led to their not being widely analyzed and reported.

1.6 Changing the Sample to Improve Representativeness

Prior to resuming VLS in 2002, focus group meetings were conducted in the study villages. Separate meetings were held with large and small farmers and agricultural laborers to capture different perspectives on issues relating to agricultural and rural development. These meetings helped the research team in identifying the research questions that ought to be addressed by the surveys. The questions that emerged prominently were:

- What changes had occurred in the socioeconomic characteristics and asset structure?
- What changes had agriculture undergone in terms of the enterprise mix, viability and market orientation?
- What investments were the farmers making and how profitable were they?
- How had income and consumption patterns changed?
- What changes had occurred in the labor market?
- How do households cope with risks, and to what extent are they supported by government interventions?
- How do the farmers perceive changes in climate, markets and institutions?

In order to accommodate emerging areas of interest, new modules were added on livestock enterprise economics, investments in soil conservation and water exploration, migration, access to and benefits from government programs, etc.

The focus group meetings brought out the need for changes in the sample to make it more representative. As a first step, a census of all households in the villages was taken. The households were arranged according to the same size-based classification followed in the first-generation studies. Some of the following deficiencies noted in the sampling design of the first generation were corrected.

- In the first-generation VLS, the sampling fractions ranged from 10% in the Mahbubnagar villages to 25% in the Akola villages. A sampling fraction of 15% was uniformly adopted for all the six villages in 2001-02.
- The underrepresentation of landless labor households was rectified by following the probability proportion to size method. However, their representation decreased from 25% in the first generation to nearly 23% in the new sample since the proportion of landless households had decreased from 33% in 1975-76 to 23% in 2001-02.
- Care was taken to include all the households of the original sample if the head of the household was alive. Where he or she had died, at least one of the split-off households (in a few cases, two) was included in the sample. Over the years, there had been a lot of churning in the distribution of the original sample units. For example, some landless laborers had acquired land and some large farmers had moved down to the medium or small land holding group. Such households were picked up as sample units belonging to their present farm-size category. The remaining sample units were randomly drawn from the population of the relevant size group.
- The total sample size increased (by 86%) to 446, reflecting the increase in the number of households and the sampling fraction.
- A statistician who was consulted on the sample design advised us to take account of the variability in key parameters such as income or size of land holding and give higher representation to the size groups that exhibited a higher degree of variability. This implied that a larger representation should be given to the large farm-size group since it exhibited the highest variability of key parameters. But since the focus of the study was on livelihood options and development pathways, a sample in which the poorer households were underrepresented was considered not desirable. Hence, it was decided to stick to the probability proportion to size method of sampling. The details of the sample are given in Table 1.1.
- The sample size more than doubled in the four larger villages: Aurepalle and Dokur (Mahbubnagar) and Shirapur and Kalman (Solapur). Among the two Akola villages, the sample size increased by 30% in Kanzara, but decreased by 25% in Kinkheda, a smaller village. A couple of original sample households were dropped in Kinkheda while in the other five villages, either the original households or their split-offs figured in the sample.

1.7 Comparability of Samples of First-generation and Second-generation Village Level Studies

Changes were made in the new sample design to obtain a sample representative of the population of households in 2002. The objective was to compare an average household in each village studied during 1975-78 with an average household in the same village as it existed during 2001-04. The new sample was eminently suited for that purpose.

Table 1.1. Details of VLS sample households, 2001-04.

	Size of land holding									
	Landless		Small		Medium		Large		Total	
Village	Old	New	Old	New	Old	New	Old	New	Old	New
Aurepalle	10	25	10	21	10	37	10	17	40	100
Dokur	10	20	10	31	10	15	10	14	40	80
Shirapur	10	22	10	43	10	17	10	6	40	88
Kalman	10	24	10	53	10	14	10	3	40	94
Kanzara	10	13	10	20	10	14	10	5	40	52
Kinkheda	10	8	10	14	10	6	10	4	40	32
Total	60	112	60	182	60	103	60	49	240	446

But in a subsequent workshop held in July 2004, it was decided to establish comparability between the samples of the first- and second-generation VLS. Hence all the split-offs from the original households were included in the subsequent sample. All the sons of the households as well as daughters married into other households in the village were included. All such households of the village with at least one member of the original household were included in the sample for surveys done from July 2005. With this, the size of the total sample further increased to nearly 600 households. The next step involved tracking all the members of the original households who had migrated either because of marriage or in search of employment. However, for the purpose of this research bulletin, only the sample of 446 farmers was studied and only those results are reported and discussed here.

1.8 Chapter Plan of the Research Bulletin

Continuing from the evolution of VLS outlined in this chapter, Chapter 2 explains the methodology of the surveys and analysis of data. The changes in the demographic, social and occupational structures of the sample over time are described in Chapter 3, and the changes in the resource endowments of the households are explained in Chapter 4. Chapter 5 elaborates on the changes in cropping patterns, productivity levels and constraints faced by farmers. Chapter 6 discusses in detail the economics of crop and livestock enterprises. Changes in incomes, consumption standards and levels of poverty are dealt with in Chapter 7 while Chapter 8 considers the labor market scenario and the changes that have taken place in it over time. Chapter 9 documents the investments made for the development of natural resources and Chapter 10 deals with the sample households' perceptions on climate change, the strategies followed by them in coping with the risks and the benefits received by them from the government's welfare and development programs. Chapter 11 draws policy implications from the study and sketches the future scenario of agriculture in the SAT.

Chapter 2: Methodology of Surveys and Analysis of Data

The sample size and scope of the VLS were enlarged during 2001-02 to 2003-04. The analytical methods used in this basic report are mainly tabular. All the information collected has been tabulated and subjected to preliminary analysis. The basic purpose of this research bulletin is to give a bird's eye view of village economies in the SAT. In addition to presenting the aggregate picture, the data have been presented by village and by farm-size group and, in a few cases, by year, to highlight the differences between villages, farm-size groups and variability in performance over years. Maximum comparability with first-generation VLS data was sought, but the manner of data presentation by that study had been radically different, and allowed for only a few comparisons to highlight the changes in living standards.

2.1 Survey Methods Used from 2001-04 and Their Limitations

Data pertaining to the three crop years 2001-02, 2002-03 and 2003-04 were collected through one-time surveys carried out at the end of the crop years. Because of the long recall period, some of the details may not have been captured in the data. However, the questions were so designed as to get an average and approximate picture of all important aspects of household economies. The researchers of the first-generation VLS supervised data collection during 2001-04 and provided the vital link with the past. Data collection had been much more frequent during 1975-1984. Heads of households were interviewed once in three to four weeks, and investigators lived in the villages, maintained books on field observations and also recorded some nonquantitative insights and happenings. In comparison, data collection in the annual surveys of the second-generation VLS may not have been as precise. But considering that the annual surveys cost only about a tenth of the earlier surveys, this may have been a small sacrifice to make relative to the cost saved.

2.2 Tabular Methods to Compare VLS

Wherever possible, comparisons were attempted between the triennial averages of 1975-78 and those of 2001-04. Year-to-year variations can be substantial in SAT rainfed agriculture, and therefore, three-year averages were felt necessary for the purpose of comparability, particularly in the case of socioeconomic characteristics, standard dryland-equivalent hectares cultivated, cropping patterns, returns to crop enterprises, income patterns, nutrition standards, employment levels, wage rates, etc.

2.3 Methods Used in the Analysis of Economics of Crop Enterprises

Both incurred and imputed costs of crop enterprises (both sole and intercrops) were computed. At first, the costs were classified as variable and fixed costs. Variable costs are those which vary with the level of output produced and fixed costs are incurred irrespective of the level of output. Some of the fixed costs like the rental value of own land, depreciation and interest on own fixed capital were computed for the farm and were apportioned between different crop enterprises on the basis of the area allocated for different crops. Later, the costs were reported as per the farm management cost concepts used by the Commission on Agricultural Costs and Prices (CACP) to compute Minimum Support Prices (MSP) for farm commodities. The returns were compared with the costs as per the concepts of Cost-A, Cost-B and Cost-C. Cost-A refers to incurred costs; Cost -B adds the rental value of land and interest on own fixed capital; and Cost-C adds even the imputed cost of family labor. Finally, returns to land and management were worked out for different crop enterprises and compared with those of 1975-78. Net crop incomes were computed for the average cropping patterns that prevailed in 1975-78 and 2001-04 for each village.

2.4 Methods Used in the Analysis of Livestock Enterprises

Relative to crop enterprises – which complete their life cycle in a season or, at the most, a year – livestock enterprises and horticultural and plantation crops pose methodological challenges. Livestock asset values are relative to age, appreciating up to a point and then depreciating. The economics of such multiyear enterprises can be worked out only through life-cycle analysis using project analysis techniques. Since stand-alone annual surveys cannot capture the intricacies of livestock rearing or horticultural plantations, only variable costs were computed and returns relative to them were worked out. But even within a year, the costs of and returns from livestock enterprises like dairying vary from season to season. Data were collected with reference to winter, summer and rainy seasons to capture seasonal variations in the economics of livestock enterprises. Since grazing is a common practice in livestock rearing, the approximate cost of grazing rights and the proportion of roughage consumed through grazing were also recorded for different seasons.

2.5 Computation of Income and Expenditure

We obtained the estimates of income from different sources given by the heads of households. However, income from crop and livestock enterprises was worked out in detail from input-output modules designed separately for crop and livestock enterprises. Returns to land and management in the case of crop enterprises and returns over variable costs in the case of livestock enterprises were thus estimated for each household. But in the case of income from other sources like labor, nonfarm sources, caste occupations, migration, etc, the respondents' estimates were used for computation. Data on food expenditure (daily, monthly or annual) were collected in detail. In the case of nonfood items like clothing, education, medical expenses, travel, etc, the respondents' annual estimates were used as such in the computations.

2.6 Computation of Consumption Standards and Nutritional Deficiencies

The nutritive value of food consumed was calculated on the basis of the values given by the National Institute of Nutrition (NIN), Hyderabad. Data on the expenditure incurred on purchase of fruits and vegetables were obtained from the respondents in value terms. But since they could not recall the exact quantities consumed, their nutritive values were omitted from the estimates of energy and protein consumed. Hence the energy and protein shortfalls of households were estimated based on 2000 calories and 50 gm of protein instead of the 2240 calories of energy and 60 gm of proteins recommended.

2.7 Assessment of Investments in Water Exploration

Data on investments made by the households in water exploration between 1985 and 2004 were collected by the recall method. The weighted average costs of digging new wells, deepening existing ones, drilling new bore wells and drilling bore holes in existing wells were computed for an average attempt, an average successful attempt and an average functional well/bore well/in-well bore. Similarly, the average depths of wells, bore wells, and in-well bores were also computed by taking the weighted averages. The average command area per each irrigation source was also computed using the weighted average method.

2.8 Analysis of Qualitative Data

Qualitative data were collected with respect to perceptions about climate change, information sources about new technology, production constraints and benefits from soil and water conservation measures. In the case of climate change, the proportion of respondents who subscribed to views on the quantum of rainfall, variability in rainfall, onset of monsoon, temperatures in winter and summer and availability of water in wells, bore wells and tanks were computed and presented by village and by farm-

size group. Similarly, the proportion of farmers getting information about new technologies from different sources like progressive farmers, relatives, agricultural extension officials, shopkeepers, etc, were worked out. The ranking of production constraints like drought, excessive rains, pests, diseases and weeds were analyzed by crop and by village. Similarly, benefits like reduction in soil erosion, improvement in fertility and increase in yield perceived by farmers were analyzed by village and farm-size group.

Chapter 3: Demographic, Social and Occupational Changes in the Sample

During the interregnum between the first and second generations of VLS, many changes can be expected to have taken place in terms of the family size, literacy level and occupational structure of the households. This chapter highlights these changes and their possible implications for the household economies.

3.1 Changes in Demographic Characteristics

Data on the demographic features and educational levels of the sample households in the six VLS villages are presented in Table 3.1. The average family size decreased from 8.37 in 1975-78 to 5.38 in 2001-04 as more and more families became nucleated. Among the six villages, Aurepalle had the smallest family size (4.41) and Kalman the largest (6.29). The average literacy rates were 86% in the Akola villages (Kanzara and Kinkheda), 69% in the Solapur villages (Shirapur and Kalman) and 44% in the Mahbubnagar villages (Aurepalle and Dokur). Besides higher literacy, the Maharashtra (Akola and Solapur) villages also reported higher levels of education among literates than the Andhra Pradesh (Mahbubnagar) villages. Gender educational inequality continued to be substantial in Andhra Pradesh while it has been almost eliminated in Maharashtra, where young females had about the same literacy rates as young males. The literacy rates in the 5-30 age group were the same for men and women in the Akola villages, while women lagged slightly behind in Solapur. While the goal of universal education has been nearly reached in all the four Maharashtra villages, the Andhra Pradesh villages have a long way to go. Nearly 49% of the young females and nearly 30% of the young males in the 5-30 age group are not yet literate. The VLS surveys of 1975-78 had found about 50% literacy among men and 15% among women above 18 years. Compared to that, literacy levels among women improved to 55% and male literacy to 75%. While female literacy is still lower, the improvement in 25 years has been more dramatic for women than for men.

3.2 Relationship Between Farm Size and Socio-demographic Characteristics

Data on family size and literacy levels are presented in relation to the size of land holding by VLS households in Table 3.2. There was a clear and direct relationship between the size of land holding and the average family size, which was 4.49 for

Table 3.1. Family size and literacy levels of sample households in VLS villages, 2001-04.

Variable	Aurepalle	Dokur	Kanzara	Kinkheda	Shirapur	Kalman	Average
Total family members	441	458	278	146	468	484	379
Average family size	4.41	5.85	5.34	4.70	5.67	6.29	5.38
Percentage of literates	43.71	44.74	83.63	88.15	68.76	69.49	66.41
Distribution of literates (%)							
Primary school	57.07	48.42	35.78	31.20	38.72	39.72	41.82
Secondary school	15.93	17.07	17.60	17.47	17.37	24.68	18.36
High school	17.99	23.39	26.99	27.59	26.53	23.72	24.37
Intermediate	7.39	9.62	12.36	14.72	9.27	5.11	9.75
Graduation	1.03	1.50	7.27	5.36	7.44	6.49	4.85
Post-graduation	0.58	0	0	3.65	0.66	0.27	0.86
Literacy rate of young males[1]	70.73	66.79	94.43	90.25	83.08	88.83	82.35
Literacy rate of young females[1]	51.44	50.85	93.77	87.63	77.84	78.62	73.36

1. In the age group of 5-30 years.

Table 3.2. Family size and literacy levels in relation to farm size, 2001-04.

Variable	Household group				
	Large	Medium	Small	Landless	Overall
Total family members	49	94	151	84	379
Average family size	6.55	5.53	4.93	4.49	5.38
Percentage of literates	70.23	66.80	65.97	62.64	66.41
Distribution of literates (%)					
Primary school	33.97	42.32	43.54	47.45	41.82
Secondary school	17.58	17.90	20.38	17.56	18.36
High school	25.79	25.73	22.92	23.04	24.37
Intermediate	11.04	8.54	9.89	9.53	9.75
Graduation	9.56	4.41	3.00	2.43	4.85
Post-graduation	2.05	1.11	0.28	0	0.86
Literacy rates of young males[1]	81.05	85.69	82.59	80.07	82.35
Literacy rates of young females[1]	70.42	75.06	72.88	75.07	73.36

1. In the age group of 5-30 years.

landless households, rising to 6.55 for those with large farms. More large farm-size households seemed to be joint families than the other groups. Literacy levels too were directly related to the size of land holding. More than 70% of the household members were literate in the large farm-size category, while only 63% were literate in the landless category. Individuals from larger households tended to be better educated than those from the other groups. Nearly 50% of the literates from the large farm-size group had had high school education or more. In contrast, the majority of literates in the other groups had had educational levels lower than high school. But this trend was not in evidence in the case of younger people. Among them, other farm-size groups recorded even better literacy rates than the large farm-size group.

3.3 Occupational Distribution by Village

The distribution of sample households in terms of their principal occupation is summarized in Table 3.3. For more than 50% of the households in the two Andhra Pradesh villages, agriculture was not the principal source of income. In Aurepalle, 46% of the households cited agriculture as their principal source of income, while only 25% did so in Dokur. Persistent drought and water scarcity may have forced these sample households to look for alternative occupations. As many as 30% of the households in Dokur depended on other occupations, a choice most notably reflected in their recourse to migration.

In contrast, about two-thirds of the households in the Maharashtra villages considered agriculture as

Table 3.3. Distribution of sample households by occupation, 2001-04.

Primary occupation	Aurepalle	Dokur	Kalman	Kanzara	Kinkheda	Shirapur	Total
Agriculture	46 (46.0[1])	20 (24.6)	62 (66.0)	35 (67.3)	22 (67.7)	57 (65.2)	242 (54.2)
Labor	23 (23.0)	21 (25.8)	17 (17.7)	10 (18.6)	8 (24.0)	19 (21.6)	97 (21.7)
Business	3 (2.7)	5 (6.7)	2 (2.5)	2 (4.5)	0 (0.0)	1 (0.8)	13 (3.0)
Service	0 (0.00)	0 (0.0)	7 (7.1)	2 (3.2)	2 (5.2)	6 (6.8)	16 (3.6)
Caste occupation	25 (25.3)	10 (12.9)	6 (6.7)	3 (6.4)	1 (3.1)	5 (5.7)	51 (11.5)
Others	3 (3.0)	24 (30.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	27 (6.1)
Total	100 (100.0)	80 (100.0)	94 (100.0)	52 (100.0)	32 (100.0)	88 (100.0)	446 (100.0)

1. Figures in parentheses represent percentages to the column total.

their principal occupation and source of income. Seventeen households in the four Maharashtra villages considered service as their primary source of income, but none from the two AP villages. Apparently, the higher literacy and education levels seen in Maharashtra catapulted some of the households into the service sector. Labor, caste occupations and migration sustain a higher proportion of households in AP than in Maharashtra. About 3% of the sample households derived their major source of income from business. Sample households in Dokur and Aurepalle depended more on business as their principal occupation than those in the Maharashtra villages. Besides migration, other miscellaneous sources of occupation were also of some importance in the AP villages. These were in the informal service sector.

3.3.1 Occupational Distribution by Farm-size Group

Large-farm households predominantly depended on agriculture as the principal source of livelihood while about 10.5% of them had turned to the service sector (Table 3.4). Most of the landless households and a considerable proportion of the small-farm households depended on labor. Interestingly, it was the landless households and small-farm households that took to petty business and were able to earn a major part of their income from it. Dependence on caste occupations was spread over all farm-size groups but less of it was seen in the large farm-size group. Similarly, dependence on other occupations including migration was spread over all farm-size groups, but more so in small-sized farms and landless households.

3.4 Summary and Inferences

The sample households in the 2001-04 surveys had much fewer people than those in 1975-78. This was because of the gradual disintegration of joint families and the emergence of nuclear families. Family size was the smallest in the landless labor category and the highest in the large-farm category. There seemed to be a direct relationship between size of land holding and family size, and similarly, a direct relationship between size of land holding and proportion of literates. This indicated that literacy levels are influenced by the economic status of the household. But this relationship was true only of the past generation. It did not hold among younger males and females, in fact, younger individuals from large-farm households recorded lower literacy levels than those from groups having access to less land. This emerging trend showed that education can help in bridging socioeconomic disparities.

When compared with 1975-78, a smaller proportion of households counted agriculture as their primary source of income, particularly in the Andhra Pradesh villages which are more prone to droughts and water scarcity. As crop and livestock enterprises failed to provide enough income for sustenance, households owning less land looked for alternative occupations that might provide a more reliable income. Some of the better-educated households in Maharashtra could earn a major chunk of their family income from the service sector. Interestingly, it was landless households that turned to petty business more than land-owning groups and made it a major source of income. Dependence on caste occupations was spread over all farm-size groups

Table 3.4. Occupational pattern of households by farm-size group, 2001-04.

	Household group				
Primary occupation	Large	Medium	Small	Landless	Overall
Agriculture	40 (74.7[1])	75 (73.9)	120 (65.2)	6 (5.7)	242 (54.2)
Labor	3 (5.6)	3 (2.9)	30 (16.1)	61 (58.1)	97 (21.7)
Business	0 (0.0)	0 (0.0)	3 (1.6)	10 (9.2)	13 (3.0)
Service	6 (10.5)	4 (3.9)	6 (3.1)	1 (0.6)	16 (3.6)
Caste occupation	4 (6.8)	14 (14.0)	16 (8.5)	18 (16.8)	51 (11.6)
Others	1 (2.5)	6 (5.6)	10 (5.4)	10 (9.5)	27 (6.1)
Total	54 (100.0)	102 (100.0)	184 (100.0)	105 (100.0)	446 (100.0)

1. Figures in parentheses represent percentage to the column total.

except the large-farm category, who continued to depend on farming. In the Andhra Pradesh villages, migration and informal service occupations emerged as principal income sources for a substantial number of households. Smaller family sizes, better literacy rates and more diversified occupational patterns have placed the households in VLS villages in a position to attain rapid development on many pathways than two and a half decades ago.

Chapter 4: Resource Endowments and Changes Over Time

Improvement in the economic status of a household is likely to be reflected in its income in the short run and its resource endowment in the long run. As the rural economy progresses, one can expect to see a more diversified asset structure. The more prosperous households are likely to build better homes and paddocks and invest more on wells, bore wells, tractors and other farm equipment. As rural households are exposed to urban lifestyles, they may invest more on consumer durables. This chapter covers the asset diversity of households belonging to different farm-size classes.

4.1 Land Ownership in VLS Villages

Land is the most important asset for agriculture. Due to population growth and subdivision of families, pressure on land is expected to increase and render ownership holdings smaller and smaller. The average size of ownership holdings, which was 5.17 ha in the VLS sample during 1975-78, fell to 2.93 ha in 2001-04. Similarly, the average size of operational holdings fell from 5.90 ha in 1975-78 to 3.00 ha in 2001-04. In all the study villages except Kinkheda, operational holdings exceeded ownership holdings because leased-in land was higher than leased-out land.

Walker and Ryan (1990) reported that tenancy had declined during the 1980s when compared with the 1950s. We found a further decline in 2001-04 (Table 4.1). The sum of land leased in and leased out by households as a proportion of land owned by them ranged from 7% in Shirapur to 20% in Aurepalle. The average incidence of tenancy in the six villages was only about 14%.

Interestingly, landless labor was the only group in which more land was leased out than leased in (Table 4.2), suggesting that these households were looking to maximize other income opportunities by

Table 4.1. Pattern of land ownership and operation (ha) in VLS villages, 2001-04.

	Average land per sample household				
Village	Owned	Leased in	Leased out	Fallow	Operated
Aurepalle	1.72	0.30	0.04	0.02	1.96
Dokur	1.47	0.17	0.05	0.01	1.58
Kalman	4.72	0.53	0.10	0.06	5.09
Shirapur	2.78	0.18	0.02	0.08	2.86
Kanzara	3.64	0.44	0.18	0.12	3.78
Kinkheda	3.23	0.04	0.35	0.24	2.68
Mean	2.93	0.28	0.12	0.09	3.00

Table 4.2. Average land ownership and operational holding (ha) of households, 2001-04.

	Farm-size group				
Land	Labor	Small	Medium	Large	Overall
Owned	0.33	1.19	3.03	7.16	2.93
Leased/shared-in	0.04	0.08	0.23	0.76	0.28
Leased/shared-out	0.20	0.06	0.08	0.15	0.12
Fallow	0.02	0.02	0.04	0.27	0.09
Operated	0.15	1.19	3.14	7.50	3.00

leasing out their land. In the small-farm category, the average land owned and land operated were equal. In the medium- and large-farm categories, operational holdings were larger than ownership holdings because they leased in more land than they leased out. This suggests that medium- and large-farm households leased in land from others, indicating the prevalence of reverse tenancy. As the average size of holdings becomes smaller, medium- and large-farm households seek to increase the size of their operational holdings to attain better economic viability. In contrast, landless laborers and small-farm groups tend to look for alternative sources of income after leasing out a part or whole of their holding. As can be expected, the average size of operational holdings increases as we move from landless-labor to large-farm households through small- and medium-farm households. On an average, the sample households increased their operational holdings by 0.07 ha through more leasing in than leasing out.

4.2 Comparison of Land Holdings in Terms of Standard Dryland-equivalent Area

Walker and Ryan (1990) noted that the share of irrigated area in the gross cropped area increased from 12% in 1975-76 to 20% in 1983-84. They also observed that irrigation figured prominently in the AP villages, particularly in Dokur, when compared with the Maharashtra villages. But, over the past two decades, irrigation coverage has declined in Dokur while remaining stagnant in the other AP village, Aurepalle. On the other hand, irrigation facilities improved remarkably in Maharashtra. Except Kalman, the other Maharashtra villages received the benefit of canal irrigation (although not very assured), which also helped in improving the ground water levels. The share of irrigable area in the gross cropped area now ranged from 45% to 60% in Maharashtra, compared to 25% in Aurepalle and 46% in Dokur. The actual irrigated fraction was of a still smaller magnitude in AP, as the irrigation tanks were rarely filled during the past one decade. The Maharashtra villages, which are endowed with better soils, are even better off now with irrigation support, while the two AP villages are worse off in respect of both soils as well as irrigation support. Wherever irrigation facilities have increased, intensity of cultivation has increased.

We compared the land ownership pattern of 2001 with that of 1982 in the six VLS villages (Table 4.3). Following the same methodology used by Walker and Ryan in 1982, we computed the median size of ownership holdings in 2001. Each farmer's land was converted to standard dryland-equivalent hectares by multiplying the irrigable hectares by four and adding the dryland hectares to the product. This holding in terms of standard dryland-equivalent hectares was arranged in an ascending order and the median land holding was computed.

Table 4.3. Median owned land holding in terms of dryland-equivalent hectares, 1982 and 2001.

Village	Year		Percentage change
	1982	2001	
Aurepalle	2.91	2.63	-9.70
Dokur	3.24	1.62	-50.00
Shirapur	4.98	4.05	-18.70
Kalman	5.79	5.81	0.35
Kanzara	2.47	4.05	64.00
Kinkheda	2.96	3.24	9.50
Average	3.73	3.57	-4.29

Since two opposite forces (fission of holdings and increase in irrigable area) were at work, land holding in terms of dryland-equivalent hectares decreased in some villages (Aurepalle, Dokur and Shirapur), remained about the same in Kalman but increased in Kanzara and Kinkheda. The most dramatic reduction was in Dokur, where dryland-equivalent land holding fell by 50%. This would have been steeper had we considered the actual irrigated area instead of the irrigable area. Dokur has a large tank which, all through the 1970s and 1980s, used to fill up every year and support two rice crops in the command area. But during the past one decade, the tank held little water due to scanty rainfall and cessation of inflows from the upper catchment. As a result, most of the command area under the tank lay fallow. Yet some respondents reported this land as irrigable. In Aurepalle, there was no significant increase in the irrigable area

despite an increase in the number of bore wells. The village tank has dried up in this village too as have many of the open wells. Overall, a 9.7% reduction was recorded in Aurepalle in terms of dryland-equivalent hectares.

In the two VLS villages (Shirapur and Kalman) in Solapur district of Maharashtra too both forces were at work. Irrigation facilities improved in Shirapur due to canal irrigation from the Ujni reservoir (although it is nonreliable) and bore wells sunk in the village. But the effect of subdivision of land holdings seemed to be stronger here, and the size of holdings (in terms of dryland-equivalent hectares) declined by 18.7%. In Kalman, bore wells are the only source of irrigation. The subdivision effect did not seem to be very strong in this village, due to which the size of holdings remained about the same as in 1982. In both the Akola villages (Kanzara and Kinkheda), which receive canal water for the postrainy season crop (although uncertainty is quite high), the effect of irrigation seemed to be much stronger than the effect of fractionation of holdings. Median land holding increased by 64% in Kanzara and by 9.5% in Kinkheda.

4.3 Livestock Ownership of Households in VLS Villages

Livestock are considered important sources of income as well as wealth in rainfed areas. Farmers interviewed for the VLS studies said they were cutting down on livestock for several reasons. Common property resources were depleting and it was becoming difficult to arrange for grazing and feeding. Water shortages were leaving farmers a choice between livestock and crop production and not both. Moreover, the increasing use of tractors had reduced the need for draft animals. The paucity of farm labor on annual contracts also discouraged farmers from rearing large numbers of livestock. Increased dependence on chemical fertilizers has led to a reduction in the number of animals maintained for manure production.

The data furnished in Table 4.4 show the average number of animals owned by the sample households. Farmers reported a reduction in the number of draft cattle, buffaloes in particular. However, the number of small ruminants increased in some villages because of the increasing meat prices. Goats outnumbered sheep, particularly in the Maharashtra villages. In the case of milch animals (cows and buffaloes), there seems to have been a shift toward quality from quantity. She buffaloes are the important source of milk in AP villages, while both cows and she buffaloes contribute to milk production in Maharashtra. Poultry was not common in any of the six villages studied.

4.3.1 Livestock Ownership by Households of Different Farm Sizes

Livestock ownership is directly related to the size of land holding (Table 4.5). The average number of livestock owned increased from 1.3 in landless labor households to 3.15 in small-farm, 5.83 in medium-sized and 16.52 in large-farm households. This is explained by the fact that medium- and large-sized farms have greater access to feed, water, labor and the capital resources needed to own and maintain livestock.

Table 4.4. Livestock ownership (number per household) in VLS villages, 2001-04.

Type	Aurepalle	Dokur	Kalman	Kanzara	Kinkheda	Shirapur	Average
Bullocks	0.91	0.32	0.50	1.05	0.73	0.51	0.67
She buffaloes	0.39	0.49	0.37	0.08	0.17	0.70	0.37
Cows	0.22	0.20	0.23	0.84	0.59	0.73	0.47
Young cattle	0.34	0.49	0.45	0.85	0.59	0.94	0.61
Sheep	1.84	3.00	0.57	0.04	0	0.19	0.94
Goats	1.77	2.10	1.16	2.06	0.36	1.16	1.44
Poultry	0.92	0.62	0.13	0	0	1.34	0.50
Others	0	0	0	0	0	0.23	0.04
Total	6.40	7.22	3.42	4.92	2.45	5.80	5.03

Table 4.5. Ownership of livestock (number per household) by farm-size groups, 2001-04.

Type	Landless	Small	Medium	Large	Weighted average
Bullocks	0.02	0.37	1.18	2.18	0.67
She buffaloes	0.07	0.23	0.59	1.09	0.37
Cows	0.16	0.35	0.79	0.97	0.47
Young cattle	0.19	0.47	1.00	1.33	0.61
Sheep	0.01	0.55	0.84	2.44	0.94
Goats	0.61	0.80	0.88	5.81	1.44
Poultry	0.15	0.35	0.54	2.70	0.50
Others	0.10	0.03	0	0	0.04
Total	1.31	3.15	5.83	16.52	5.03

4.4 Asset Ownership of VLS Households

The average value of assets owned by sample households in the VLS villages was Rs 384594 (Table 4.6). The asset values were much lower in the AP villages than in the Maharashtra villages, likely on account of the lower land prices and smaller holdings in AP. Land accounted for more than three-fourths of the total value of assets in Kinkheda village, but only 50% in Dokur. Land accounted for an average of 70% of the total value of assets in the six VLS villages. The shares of livestock and farm equipment were about 4% each. Farm buildings accounted for 16% of the total asset value in the aggregate sample, while being relatively higher in AP than in Maharashtra. Consumer durables made up the remaining 6% of the total value of assets in the aggregate sample. Andhra Pradesh villages recorded lower values of consumer durables than Maharashtra villages but they had a higher share in the total value of assets.

4.4.1 Assets Owned by Households of Different Farm-size Groups

Large farmers recorded higher values in all categories of assets. An average large-farm household had more than 11 times the assets of an average landless labor household (Table 4.7). In case of the latter category of households, the value of land owned by them accounted for only one-third of the value of their total assets. Labor and small-farm households had about the same value of farm buildings which included the value of the house, cattle shed and storage structures. Even in terms of consumer durables, small-farm households are not significantly better off than labor households.

Table 4.6. Value of assets (Rs per household) owned by sample households in VLS villages, 2001-04.

	Values of assets					
Village	Land	Livestock	Farm equipment	Farm buildings	Consumer durables	Total
Aurepalle	122359 (55.0[1])	11903 (5.4)	18827 (8.5)	54325 (24.4)	14913 (6.7)	222327 (100)
Dokur	103534 (50.1)	13185 (6.4)	12025 (5.8)	62657 (30.3)	15085 (7.3)	206486 (100)
Kalman	308002 (76.4)	14793 (3.7)	17256 (4.3)	46625 (11.6)	16638 (4.1)	403314 (100)
Kanzara	439594 (72.1)	18083 (3.0)	25631 (4.2)	98158 (16.1)	28513 (4.7)	609979 (100)
Kinkheda	319819 (76.9)	10702 (2.6)	6642 (1.6)	50582 (12.2)	28207 (6.8)	415952 (100)
Shirapur	333929 (74.3)	21437 (4.8)	17123 (3.8)	52688 (11.7)	24332 (5.4)	449509 (100)
Average	271206 (70.5)	15017 (3.9)	16251 (4.2)	60839 (15.8)	21281 (5.5)	384594 (100)

1. Figures in parentheses are percentages of the row total.

Table 4.7. Value of assets (Rs per household) by farm-size group, 2001-04.

Asset type	Labor	Small	Medium	Large	Weighted average
Land	25772 (33.6[1])	112306 (62.4)	280305 (68.6)	666441 (76.3)	271206 (70.5)
Livestock	2071 (2.7)	7238 (4.0)	17591 (4.3)	33170 (3.8)	15017 (3.9)
Farm equipment	3609 (4.7)	8382 (4.7)	21994 (5.4)	31018 (3.6)	16251 (4.2)
Farm building	35829 (46.7)	40447 (22.5)	65369 (16.0)	101711 (11.6)	60839 (15.8)
Consumer durables	9392 (12.2)	11655 (6.5)	23142 (5.7)	40936 (4.7)	21281 (5.5)
Total	76673 (100)	180028 (100)	408402 (100)	873276 (100)	384594 (100)

1. Figures in parentheses represent percentages of the column total.

Large-farm households had more than three-fourths of the value of their assets in the form of land. Interestingly, the value of assets more than doubled at every level as we moved from labor households to small farms; from small to medium farms; and from medium farms to large farms. This showed considerable differentiation between the different categories of households in terms of asset/wealth holding.

4.5 Investment on Farm Implements, Tractors and Wells/Bore Wells

Ownership of tractors and bore wells per 100 ha of gross cropped area (GCA) was higher in Dokur than in Aurepalle (Table 4.8). Due to persistent drought and meager inflows from the catchments, the large tank in Dokur did not fill in more than a decade. Consequently, there was a lot of fallowing in the tank command area due to which the GCA declined. All the open dug wells dried up in Dokur while about four remained partially in use in Aurepalle. Both villages witnessed a lot of water exploration activity in the form of bore wells and in-well bores. But since the gross cropped area is very less in Dokur, the number of irrigation sources per 100 hectares of GCA turned out to be greater. Similar was the case with tractors. More tractors are owned in Dokur; that is not because of any high intensity of agricultural activity; owners earn a livelihood from tractors by lending them to contractors for transporting gravel and stone.

Similarly, Kalman village in Solapur, Maharashtra, had a higher density of tractors than Shirapur (Table 4.9), owing to the diverse uses of tractors including transport besides agricultural operations. But Shirapur led in water exploration efforts, especially bore wells. Surface irrigation facilities were extended to Shirapur in the past decade as a

Table 4.8. Ownership of tractors and irrigation sources by sample households in Andhra Pradesh VLS villages, 2001-04.

Particulars	Labor	Small	Medium	Large	Total	Number per 100 ha of GCA[1]
Aurepalle						
Tractors	0	0	0	1	1	0.6
Open dug wells	0	3	0	1	4	2.5
Bore wells	0	6	52	31	89	57.2
In-well bores	3	3	0	3	9	5.8
Dokur						
Tractors	0	0	1	4	5	7.9
Open dug wells	0	0	0	0	0	0
Bore wells	3	16	15	25	59	92.9
In-well bores	0	3	0	3	6	9.4

1. GCA = Gross Cropped Area.

Table 4.9. Ownership of tractors and irrigation sources by sample households in Solapur villages, 2001-04.

Particulars	Labor	Small	Medium	Large	Total	Number per 100 ha of GCA[1]
			Shirapur			
Tractors	0	1	2	0	3	2.3
Open dug wells	0	22	3	3	28	21.5
Bore wells	1	23	17	9	50	38.5
In-well bores	0	9	3	3	15	11.6
			Kalman			
Tractors	0	6	3	0	9	3.9
Open dug wells	0	37	21	3	61	26.7
Bore wells	0	7	9	0	16	7.0
In-well bores	0	18	0	0	18	7.9

1. GCA = Gross Cropped Area.

result of which ground water levels improved. This motivated the farmers to invest in bore wells. But the water yield from open dug wells has decreased, rendering them noneconomical to operate. Farmers are investing in in-well bores to improve the water yield. Despite the investments made, irrigation coverage has declined in Kalman while it has improved in Shirapur through the conjunctive use of surface and ground water sources of irrigation.

Intensity of tractor use was far less in the two Akola villages than in Solapur (Table 4.10). Unlike the Solapur villages which have deep black soils, the Akola villages have medium deep black soils. In Solapur, sorghum is grown during the postrainy season after conserving moisture through repeated plowing. Hence, farmers use more draft power in the form of tractors as well as bullocks. But in Akola crops are grown under rainfed conditions during the rainy season and under irrigation during the postrainy season. Farmers mainly depend on bullock power complemented by hired tractor power during peak periods of agricultural operations. The farmers of Kanzara made higher investments, both in tractors as well as water exploration, than those of Kinkheda.

Table 4.10. Ownership of tractors and irrigation sources by sample households in Akola villages, 2001-04.

Particulars	Labor	Small	Medium	Large	Total	Number per 100 ha of GCA[1]
			Kanzara			
Tractors	0	0	3	0	3	2.0
Open dug wells	3	3	6	8	20	13.6
Bore wells	0	0	4	3	7	4.8
In-well bores	0	0	3	3	6	4.1
			Kinkheda			
Tractors	0	0	0	0	0	0
Open dug wells	0	0	0	0	0	0
Bore wells	0	0	0	1	1	1.5
In-well bores	0	0	0	0	0	0

1. GCA = Gross Cropped Area.

Table 4.11. Average financial savings and borrowings (Rs per household) of sample households in VLS villages, 2001-04.

Village	Financial saving/lending	Borrowing			Net savings (+) or borrowings (-)
		Institutional sources	Noninstitutional sources	Total	
Aurepalle	9135	3877	18606	22483	-13348
Dokur	5739	5057	31035	36092	-30353
Kalman	5846	19409	7566	26975	-21129
Kanzara	24709	21366	13747	35113	-10404
Kinkheda	25674	10152	2080	12232	13442
Shirapur	4708	19573	7375	26948	-22240
Average	12635	13239	13401	26640	-14005

4.6 Financial Liabilities of Households in VLS Villages

Although the sample households own considerable assets, most of them are in material form. This usually leaves them short of the liquid financial resources required for investment in their farm. A large majority of them borrow from financial institutions or money lenders (Table 4.11).

The average households in the VLS sample saved or lent to others Rs 12635 and borrowed Rs 26640, with a net borrowing of Rs 14005. Institutional sources provided 50% of the loans taken by the sample households, with the remaining 50% coming from noninstitutional sources. There were considerable differences among the six villages with respect to their financial assets and liabilities. Both the AP villages reported very little financial savings/lending, when compared with the Maharashtra villages. They also borrowed much less from financial institutions (15%) and many times more from noninstitutional sources (85%). Dokur, which suffered persistent droughts, had the highest net borrowing per household among the six VLS villages. Among the Maharashtra villages, Kinkheda stood out in terms of savings/lending, closely followed by Kanzara. The Maharashtra villages depended on institutional sources of credit more (59%) than on noninstitutional sources (41%). Kinkheda had the lowest borrowing per household among the six villages. It was the only village where savings/lending exceeded borrowings. Drought-stricken Dokur had the lowest savings and the highest net borrowing among the VLS villages, resulting in the lowest net savings per household.

4.6.1 Financial Liabilities of Households

Analysis of the pooled sample showed that landless labor households had relatively higher savings than small-farm households (Table 4.12). Savings were the highest for large-farm households. So were borrowings. These households borrowed on an average Rs 50988, which was more than five times the average borrowing of labor households. Landless labor and medium-farm households depended more on noninstitutional sources of credit than on institutional sources quite unlike

Table 4.12. Financial savings and borrowings (Rs per household) of farm-size groups, 2001-04.

Savings/borrowings	Labor	Small	Medium	Large	Average
Financial savings/lending	5797	5120	9875	29749	12635
Borrowings					
Institutional sources	3031	10713	12267	26944	13239
Noninstitutional sources	6899	8136	14527	24044	13401
Total	9930	18849	26794	50988	26640
Net savings (+) or borrowings (-)	-4133	-13729	-16919	-21239	-14005

small- and large-farm households. All categories of households were net borrowers ie, their savings were less than their borrowing. Labor households had the least debt while large-farm households had the highest net borrowing. In the total sample, borrowing was more than twice the savings. The average net borrowing of a household was Rs 14005.

4.7 Net Worth of Sample Households by Village

The net borrowing of sample households in the VLS villages was quite low relative to their asset values. In Kinkheda, because of the positive net borrowing, the net worth was higher than the asset value (Table 4.13). Kanzara had the highest net worth of approximately Rs 600 000 per household. Kinkheda and Shirapur were nearly equal in terms of net worth. The AP villages had the lowest net worth. In fact, the net worth of an average household in Dokur (Rs 176 133) was less than half of the net worth of an average household in Kalman, the poorest of the four Maharashtra villages. The average net worth of the four Maharashtra villages was about 139% higher than the average net worth of the two AP villages. During the first generation of VLS surveys, the position of the two AP villages had not been as bad as it was in 2001-04. During the interregnum, while the AP villages had suffered erosion of their wealth due to persistent droughts, the Maharashtra villages had grown wealthier due to the advent of irrigation and better education.

Table 4.13. Net worth (Rs per household) of households in VLS villages, 2001-04.

Village	Assets	Net borrowing	Net worth
Aurepalle	222327	-13348	208979
Dokur	206486	-30353	176133
Kalman	403314	-21129	382185
Kanzara	609979	-10404	599575
Kinkheda	415952	13442	429394
Shirapur	449509	-22240	427269
Average	384594	-14005	370589

4.7.1 Net Worth of Sample Households by Size Group

For all categories of households, net borrowing was quite insignificant compared to their asset values (Table 4.14). Net worth showed a positive relation with size of holding. It ranged from Rs 72539 for labor households to Rs 852037 for large-farm households. The net worth figures reflected the same trend as the asset figures.

Table 4.14. Net worth of households (Rs per household) by farm-size group, 2001-04.

Category	Assets	Net borrowing	Net worth
Labor	76673	-4134	72539
Small	180028	-13729	166299
Medium	408402	-16920	391482
Large	873276	-21239	852037
Average	384595	-14005	370589

4.8 Changes in Resource Endowments and Their Implications for the Welfare of Rural Communities

Due to population pressure, the average size of land holdings has decreased in all the study villages over the last 25 years. Walker and Ryan (1990) noted a similar reduction between 1950 and 1982. They also noted that tenancy had declined considerably over that 32-year period. During the last 25 years, it declined further, reaching about 14% of the total operated area in the VLS villages. But the nature of tenancy has undergone a fundamental change. In earlier days, it had been quite common for landless labor and small-farm households to lease in land from medium- and large-farm households. But now we see reverse tenancy with medium and large farmers leasing land from small farm and landless labor households. While the size of both ownership and operational holdings has declined, irrigation coverage has gone up. Three of the four Maharashtra villages (Kalman being the exception) gained access to surface irrigation which resulted in the improvement of ground water levels. In contrast, the Andhra Pradesh villages almost lost their access to even tank irrigation. The depletion of ground water has rendered open dug wells nonfunctional. Investment in ground water exploration through

bore wells and in-well bores has failed to improve irrigation coverage. In terms of standard dryland-equivalent hectares, the two Akola villages showed some improvement while there was no change in Kalman. But in the other three VLS villages, there was a sharp decline in standard dryland-equivalent hectares.

Asset values have gone up in all the six villages with the exception of Dokur. The decline in the size of holdings has been more than compensated by the sharp increase in land prices. Typically, the unit land price increased by 20-25 times in all the villages. Even the asset structure has become more diversified with consumer durables and farm equipment contributing significantly to asset values. Only the contribution of livestock declined because of the reduction in their numbers. The number of draft cattle declined very sharply in all the villages. In respect of milch cattle there was a shift toward quality from quantity. But the number of small ruminants reared by the households increased because of the soaring meat prices. As can be expected, there was a direct relationship between the size of holdings and the value of assets. Overall, the value of physical assets has gone up much faster than the rate of inflation. But the sample households continued to lack in financial assets with savings falling short of borrowing. Households in the Maharashtra villages borrowed more from financial institutions while those in Andhra Pradesh villages still depended more on moneylenders. The net worth of households increased in Maharashtra but remained stagnant in Andhra Pradesh.

4.9 Summary and Inferences

The VLS households had less land to operate in 2001-04 than in 1975-78. Irrigation has made a big difference in changing the fortunes of households. The Maharashtra villages improved their position due to better access to irrigation while the Andhra Pradesh villages became much worse off due to setbacks in irrigation. But asset values improved everywhere but more prominently in Maharashtra. Increase in asset values enables households to invest in education or business after disposing of a part of the land. For the well-off households, new livelihood opportunities have been created by the increase in asset values. For the poorer households, the pathway to development seemed to lie in making use of the opportunities in the labor market by taking up nonfarm labor or by migrating to places of high wages and more assured employment.

Chapter 5: Cropping Pattern, Productivity Levels and Constraints

The relative prices of different commodities change over time. Therefore, one expects to see changes in the cropping patterns as well. Globalization of markets and changes in the supply-demand scenario have brought about rapid changes in the real prices of different agricultural commodities. As a consequence, the proportion of the gross cropped area that is devoted to foodgrain cultivation has decreased at the macro level while that of cash crops has increased. We can expect to see a similar trend in the VLS villages. Intensification of agriculture through use of improved seeds, fertilizers and plant-protection chemicals has improved crop yields everywhere. It would be interesting to see to what extent this has happened in the predominantly rainfed areas of the SAT, where production constraints remain as serious as ever. Crop production may be relatively insulated from such hindrances wherever irrigation coverage has improved, but in rainfed SAT areas, variability in crop performance may continue to be acute. It might have even increased as a result of climatic variations and persistent droughts.

5.1 Cropping Patterns in VLS Villages

Cropping patterns change over time in response to changes in weather patterns, technological improvements and relative prices. Over the last several decades, Indian agriculture has moved from a scenario of foodgrain deficit to one of surplus. An elaborate Public Distribution System is now in place, and competitive private trade has emerged. Food insecurity, which used to be a matter of concern, has been by and large dispelled. Transaction costs have come down and farmers have to some extent been freed from the compulsion to produce foodgrains and other agricultural commodities for their own consumption. Given the advances in foodgrain productivity, there is no longer an urgent need to allocate ever more land for food production. For instance, a few decades ago, nearly three-fourths of the cultivable land in India was allocated to foodgrain crops; now this proportion has fallen to two-thirds.

Cropping pattern changes at the micro level can be revealing. Our survey found cotton to be the most important rainy-season crop in Aurepalle (Table 5.1), occupying 55 ha out of a total area of 144 ha. It is followed by castor and castor-based cropping systems, which together occupied 48 ha. Sorghum and paddy are the important food crops, together occupying 23 ha. Rainfed crops can hardly be grown in the postrainy season in Aurepalle. So paddy occupies most of the irrigated land during this season. Other crops of importance are safflower, horse gram, fodder and groundnut.

Castor and castor-based intercrops occupy about two-thirds of the rainy-season area in Dokur. This village was once a rice bowl but during 2001-04 the area under rice was only 8.7 ha. Other crops grown are cotton, sorghum, maize and fodder in the rainy season, and paddy, sorghum, groundnut, finger millet and castor in the postrainy season. Some irrigated area is allocated for fruit orchards like sweet orange and mango and vegetables like gherkins and smooth cucumber. These crops cover both seasons.

In Aurepalle, cotton and cotton-based systems cover about 40% (Table 5.2) of the rainy-season area. Castor and castor-based systems occupy 33% and sorghum and sorghum-based intercrops nearly 13%. Paddy accounts for 8.6% while other food crops cover another 2.6%. Pulses like pigeonpea and horse gram account for only 1.2%. In contrast, 77% of the cropped area during the postrainy season is given over to paddy and minor proportions to safflower, fodder crops, coriander and groundnut. Overall, 37% of the gross cropped area is under cash crops, 32% under castor-based intercrops, and the remaining 31% under foodgrain crops led by paddy and distantly followed by sorghum and others.

As is the general pattern in the Solapur area, postrainy-season crops occupy more than 61% of the total cropped area in Shirapur village (Table 5.3). Rainy-season crops account for only 21%. Sugarcane, which has emerged as an important

Table 5.1. Acreage (ha) of different crops in Mahbubnagar (Andhra Pradesh) VLS villages, 2001-04.

Crop	Aurepalle			Dokur		
	Rainy season	Postrainy season	Total	Rainy season	Postrainy season	Total
Cereals						
Paddy	12.34	9.00	21.34	8.70	3.90	12.60
Maize	0.27	0	0.27	1.01	0	1.01
Sorghum	10.87	0.13	11.00	1.41	2.77	4.18
Finger millet	0	0	0	0.34	0.47	0.81
Pearl millet	2.26	0	2.26	0	0	0
Sorghum + pigeonpea	6.62	0	6.62	1.38	0	1.38
Sorghum + pearl millet	0.40	0	0.40	0	0	0
Pearl millet + pigeonpea	1.42	0	1.42	0	0	0
Maize + pigeonpea	0	0	0	0.30	0	0.30
Fodder	0	0.28	0.28	0.88	0.17	1.05
Sorghum + cotton	0.14	0	0.14	0	0	0
Sorghum + pigeonpea + green grass	0.54	0	0.54	0	0	0
Total	34.86	9.41	44.27	14.02	7.31	21.33
Pulses						
Pigeonpea	1.35	0	1.35	0.13	0	0.13
Horse gram	0.44	0.47	0.91	0.27	0	0.27
Total	1.79	0.47	2.26	0.40	0	0.40
Cash crops						
Cotton	55.07	0	55.07	1.97	0	1.97
Chilli	0.47	0.04	0.51	0	0.03	0.03
Tomato	0	0.03	0.03	0	0	0
Vegetables	0.27	0.16	0.43	0	0.13	0.13
Fruit crops	0	0	0	1.21	0	1.21
Cotton + pigeonpea	1.55	0	1.55	0	0	0
Coriander	0	0.27	0.27	0	0	0
Smooth cucumber	0	0	0	0	0.07	0.07
Gherkins	0	0	0	0.13	0.37	0.50
Total	57.36	0.50	57.86	3.32	0.60	3.92
Oilseeds						
Castor	15.45	0	15.45	14.51	0.24	14.75
Groundnut	0.13	0.27	0.40	0.20	0.67	0.87
Safflower	0	0.67	0.67	0	0	0
Sunflower	0.85	0	0.85	0	0	0
Castor + pigeonpea	32.79	0	32.79	20.30	0	20.30
Total	49.22	0.94	50.16	35.02	0.91	35.93
Other crops	0.54	0.40	0.94	1.55	0.39	1.94
Grand total	143.77	11.72	155.49	54.31	9.21	63.52

Table 5.2. Acreage (%) of different crops in Mahbubnagar (Andhra Pradesh) VLS villages, 2001-04.

Crop	Aurepalle			Dokur		
	Rainy season	Postrainy season	Total	Rainy season	Postrainy season	Total
Cereals						
Paddy	8.59	76.7	13.7	16.0	42.3	19.8
Maize	0.19	0	0.2	1.9	0	1.6
Sorghum	7.56	1.2	7.1	2.6	30.1	6.6
Finger millet	0	0	0	0.6	5.1	1.3
Pearl millet	1.57	0	1.5	0	0	0
Sorghum + pigeonpea	4.61	0	4.3	2.5	0	2.2
Sorghum + pearl millet	0.28	0	0.3	0	0	0
Pearl millet + pigeonpea	0.99	0	0.9	0	0	0
Maize + pigeonpea	0	0	0	0.6	0	0.5
Fodder	0	2.4	0.2	1.6	1.8	1.6
Sorghum + cotton	0.09	0	0.1	0	0	0
Sorghum + pigeonpea + green grass	0.38	0	0.3	0	0	0
Total	24.25	80.3	28.5	25.8	79.4	33.6
Pulses						
Pigeonpea	0.94	0	0.9	0.2	0	0.2
Horse gram	0.30	4.0	0.6	0.5	0	0.4
Total	1.24	4.0	1.5	0.7	0	0.6
Cash crops						
Cotton	38.30	0	35.4	3.6	0	3.1
Chilli	0.33	0.3	0.3	0	0.4	0.1
Tomato	0	0.3	0	0	0	0
Vegetables	0.19	1.4	0.3	0	1.4	0.2
Fruit crops	0	0	0	2.2	0	1.9
Cotton + pigeonpea	1.08	0	1.0	0	0	0
Coriander	0	2.3	0.2	0	0	0
Smooth cucumber	0	0	0	0	0.7	0.1
Gherkins	0	0	0	0.2	4.0	0.8
Total	39.90	4.3	37.2	6.1	6.5	6.2
Oilseeds						
Castor	10.74	0	9.9	26.7	2.6	23.2
Groundnut	0.09	2.3	0.3	0.4	7.3	1.4
Safflower	0	5.8	0.4	0	0	0
Sunflower	0.59	0	0.5	0	0	0
Castor + pigeonpea	22.80	0	21.0	37.4	0	32.0
Total	34.24	8.0	32.3	64.5	9.9	56.6
Other crops	0.38	3.5	0.6	2.9	4.2	3.1
Grand total	100	100	100	100	100	100

Table 5.3. Acreage (ha) of different crops in Shirapur, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Summer	Annual	Perennials	Total
Cereals						
Wheat	0	5.51	0	0	0	5.51
Maize	3.16	1.21	0.54	0	0	4.91
Sorghum	0	69.07	0	0	0	69.07
Sorghum + chickpea	0	0.27	0	0	0	0.27
Fodder	3.71	1.20	1.07	0	0	5.98
Total	6.86	77.27	1.61	0	0	85.74
Pulses						
Pigeonpea	9.13	0	0	0	0	9.13
Chickpea	0	1.59	0	0	0	1.59
Black gram	0.27	0	0	0	0	0.27
Pigeonpea + matki	0.07	0	0	0	0	0.07
Matki	0.22	0	0	0	0	0.22
Matki + hulga	0.34	0	0	0	0	0.34
Matki + kulthi	4.39	0	0	0	0	4.39
Total	14.41	1.59	0	0	0	16.00
Cash crops						
Cotton	0.74	0	0.47	0	0	1.21
Sugarcane	0	0	0	18.35	0	18.35
Chilli	0.14	0	0	0	0	0.14
Brinjal	0.01	0	0	0	0	0.01
Vegetables	1.15	0.96	0.20	0	0	2.31
Fruit crops	0	0	0	0.84	0	0.84
Amla	0	0	0	0	0.07	0.07
Citrus	0	0	0	0	0.13	0.13
Lemon	0	0	0	0.07	0	0.07
Onion	1.72	0	0	0	0	1.72
Total	3.76	0.96	0.67	19.26	0.20	24.85
Oilseeds						
Groundnut	0.40	0	0.59	0	0	0.99
Other oilseeds	1.08	0	0	0	0	1.08
Total	1.48	0	0.59	0	0	2.07
Others	0.61	0.07	0.37	0	0	1.04
Grand total	27.11	79.88	3.25	19.26	0.20	129.71

crop since the advent of canal irrigation, takes about 15%. Mainly fodder crops are grown in the summer. A few plots are planted with perennials like citrus and amla. Postrainy-season sorghum still occupies the preeminent position in this village, covering 69 ha. Wheat, chickpea, maize and fodders together occupy another 10 ha. Pigeonpea is the most important rainy-season crop, covering about 9 ha while other rainy-season cropping systems like matki + kulthi, maize, onion (*Allium cepa*), fodders, vegetables, other pulses, groundnut and other oilseeds together take about 11 ha of the cropped area. Groundnut and vegetables are some of the summer crops grown besides fodders.

Postrainy-season sorghum accounts for more than 53% of the total cropped area (Table 5.4) in Shirapur.

Sugarcane is next in importance with 14%. Pigeonpea as a sole crop has a share of 7%, and other pulses combined have 5%. Wheat and maize are the other important food crops, covering about 8% of the cropped area. Fodder cultivation, which has attained prominence in Shirapur since the introduction of crossbred cows, takes nearly 5% of the cropped area. Vegetables, onion, cotton, groundnut and other oilseeds together account for the remaining cropped area.

As in Shirapur, postrainy-season crops dominate the cropping pattern in Kalman (Table 5.5), accounting for 125 ha of the total cropped area of 229 ha. However, since Kalman has more diverse soil types ranging from shallow black to deep black,

Table 5.4. Acreage (%) of different crops in Shirapur, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Summer	Annual	Perennials	Total
Cereals						
Wheat	0	6.9	0	0	0	4.2
Maize	11.6	1.5	16.6	0	0	3.8
Sorghum	0	86.5	0	0	0	53.3
Sorghum + chickpea	0	0.3	0	0	0	0.2
Fodder	13.7	1.5	33	0	0	4.6
Total	25.3	96.7	49.6	0	0	66.1
Pulses						
Pigeonpea	33.7	0	0	0	0	7
Chickpea	0	2	0	0	0	1.2
Black gram	1	0	0	0	0	0.2
Pigeonpea + matki	0.2	0	0	0	0	0.1
Matki	0.8	0	0	0	0	0.2
Matki + hulga	1.2	0	0	0	0	0.3
Matki + kulthi	16.2	0	0	0	0	3.4
Total	53.1	2	0	0	0	12.3
Cash crops						
Cotton	2.7	0	14.6	0	0	0.9
Sugarcane	0	0	0	95.3	0	14.1
Chilli	0.5	0	0	0	0	0.1
Brinjal	0.05	0	0	0	0	0.01
Vegetables	4.2	1.2	6.2	0	0	1.8
Fruit crops	0	0	0	4.4	0	0.7
Amla	0	0	0	0	33.3	0.1
Citrus	0	0	0	0	66.7	0.1
Lemon	0	0	0	0.3	0	0.1
Onion	6.3	0	0	0	0	1.3
Total	13.9	1.2	20.7	100	100	19.2
Oilseeds						
Groundnut	1.5	0	18.3	0	0	0.8
Other oilseeds	4	0	0	0	0	0.8
Total	5.5	0	18.3	0	0	1.6
Other crops	2.2	0.1	11.4	0	0	0.8
Grand total	100	100	100	100	100	100

Table 5.5. Acreage (ha) of different crops in Kalman, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Summer	Annuals	Perennials	Total
Cereals						
Paddy	0.07	0	0	0	0	0.07
Wheat	0	2.35	0	0	0	2.35
Maize	3.14	1.01	0	0	0	4.15
Sorghum	0	112.16	0	0	0	112.16
Pearl millet	0.54	0	0	0	0	0.54
Sorghum + sunflower	0	2.67	0	0	0	2.67
Fodder	0.24	0	0	0	0	0.24
Total	3.99	118.18	0	0	0	122.17
Pulses						
Pigeonpea	49.50	0	0	0	0	49.50
Chickpea	0	2.46	0	0	0	2.46
Black gram	4.65	0	0	0	0	4.65
Pigeonpea + black gram	0.94	0	0	0	0	0.94
Pigeonpea + matki	0.13	0	0	0	0	0.13
Pigeonpea + pearl millet	0.20	0	0	0	0	0.20
Pigeonpea + sunflower	3.91	0	0	0	0	3.91
Pigeonpea + sunflower + pearl millet	1.16	0	0	0	0	1.16
Pigeonpea + sunflower + matki	0.67	0	0	0	0	0.67
Pigeonpea + others	9.80	0	0	0	0	9.80
Matki	1.58	0	0	0	0	1.58
Matki + hulga	1.35	0	0	0	0	1.35
Matki + kulthi	2.21	0	0	0	0	2.21
Total	76.10	2.46	0	0	0	78.56
Cash crops						
Sugarcane	0	0	0	2.82	0	2.82
Chilli	0.35	0	0	0	0	0.35
Tomato	0.07	0	0	0	0	0.07
Bitter gourd	0.13	0	0	0	0	0.13
Soft gourd	0.27	0	0	0	0	0.27
Bhendi	0.13	0	0	0	0	0.13
Brinjal	0.13	0.13	0	0	0	0.26
Cluster bean	0.47	0	0	0	0	0.47
Drumstick	0	0	0	0	0.03	0.03
Vegetables	3.71	1.74	0.44	0	0	5.89
Fruit crops	0	0	0	3.36	0	3.36
Citrus	0	0	0	0	0.81	0.81
Grapes	0	0	0	0.27	0.17	0.44
Lemon	0	0	0	0.03	0	0.03
Onion	0.86	0.27	0	0	0	1.13
Cucumber	0.20	0.71	0	0	0	0.91
Total	6.32	2.85	0.44	6.48	1.01	17.10
Oilseeds						
Groundnut	1.35	0	0.64	0	0	1.99
Sunflower	5.66	1.41	0	0	0	7.08
Sunflower + matki	0.20	0	0	0	0	0.20
Total	7.21	1.41	0.64	0	0	9.27
Other crops	1.21	0	0.20	0	0.13	1.55
Grand total	94.83	124.91	1.28	6.48	1.14	228.65

rainy-season crops there have relatively more importance (95 ha) than in Shirapur. Farmers sow on the shallow to medium black soils during the rainy season and keep the medium to deep black soils for postrainy-season crops. Postrainy-season sorghum is the most important crop in Kalman, taking 112 ha of the cropped area, while pigeonpea and pigeonpea-based intercropping systems are predominant (65 ha) during the rainy season. Black gram and matki are the other pulses cultivated during the latter season, together accounting for 11 ha. Sunflower, vegetables and maize are the other important rainy-season crops. During the postrainy season, apart from sorghum, wheat, sunflower, vegetables, chickpea and maize are grown in small areas. In summer, the total cropped area is quite limited due to the lack of irrigation facilities, which allows only a small area to be sown to groundnut and vegetables. The area under sugarcane and annual fruit crops is similarly limited by the irrigation constraint. Perennials citrus, grapes and drumsticks together occupy a little more than 1 ha. Many Kalman farmers have removed grapes from their fields due to the shortage of water.

Postrainy-season sorghum accounts for nearly 50% of the total cropped area in Kalman (Table 5.6). Other foodgrains like wheat, maize and pearl millet aggregate 4%, pigeonpea and pigeonpea-based intercrops nearly 30%. Black gram and matki-based intercrops 6% and oilseed crops about 4%. The remaining area is given over to sugarcane, fruits and a variety of vegetables. Very little is allocated for fodder crops in Kalman unlike in Shirapur, which had more crossbred cows and irrigation facilities.

Unlike in the two Solapur villages (Shirapur and Kalman) discussed above, rainy-season crops are dominant in the cropping patterns of the two VLS villages (Kanzara and Kinkheda) in Akola, Maharashtra. Cotton and cotton-based intercropping accounted for about 91 ha out of the total cropped area of 147 ha in Kanzara (Table 5.7) during the 2001-04 survey. Foodgrain crops like wheat, sorghum and maize covered 32 ha. Wheat has gained in importance in this village since the advent of irrigation and replaced sorghum as the most important foodgrain crop. Different pulses led by green gram covered about 11 ha of the cropped area. Soybean is the leading oilseed crop in Kanzara, covering more than 4 ha. Vegetables, chilli and onion are the other important cash crops. Very small areas are earmarked for fruit orchards. Cotton and cotton-based intercrops account for nearly 62% of the cropped area (Table 5.8). Wheat has a share of 16% and other foodgrain crops like sorghum and maize nearly 6% of the total cropped area. Pulses account for nearly 8% and oilseeds about 3%. The remaining share (about 5%) of the cropped area is given over to vegetables, condiments and fruit crops.

As in Kanzara, cotton and cotton-based intercrops dominate the cropping pattern in Kinkheda, occupying 47 ha out of the total cropped area of 68 ha (Table 5.9). Wheat is the most important foodgrain crop (6 ha) followed by sorghum (3 ha). Hybrid varieties of sorghum are sown as much as local varieties. Green gram and pigeonpea together occupied 4 ha. Soybean is the important oilseed crop (5 ha) in this village. The rest of the area is shared between vegetables, condiments and fruit crops.

In terms of share of the cropped area, cotton and cotton-based intercropping systems (69%) are the most important in Kinkheda (Table 5.10) followed by wheat (9%). The share of sorghum is a mere 4%. Pulses have a combined share of nearly 6%. Just as in Kanzara, green gram is the most important pulse crop followed by pigeonpea. Soybean has a share of nearly 7%. The remaining 4% area is shared between vegetable and fruit crops.

5.2 Comparison of Cropping Patterns with the Base Year (1975-76)

In a comparison of the cropping patterns of 1975-76 and 2001-04 (Table 5.11), we see that the average size of land holding fell by more than 50% in Aurepalle and Kinkheda and 30-40% in the other four villages. The average for the VLS sample as a whole fell by 42% from 5.2 ha to 3.0 ha. The relative importance of food crops – both as sole and inter/mixed crops – decreased in all the villages over the 26-year period. Taking the VLS sample as a whole, the proportion of area under sole crops of foodgrains fell from 72.5% of the gross cropped area in 1975-76 to 34.6% in 2001-04.

Table 5.6. Acreage (%) of different crops in Kalman, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Summer	Annuals	Perennials	Total
Cereals						
Paddy	0.07	0	0	0	0	0.03
Wheat	0	1.88	0	0	0	1.03
Maize	3.31	0.81	0	0	0	1.81
Sorghum	0	89.79	0	0	0	49.05
Pearl millet	0.57	0	0	0	0	0.24
Sorghum + sunflower	0	2.14	0	0	0	1.17
Fodder	0.26	0	0	0	0	0.11
Total	4.20	94.61	0	0	0	53.42
Pulses						
Pigeonpea	52.18	0	0	0	0	21.65
Chickpea	0	1.97	0	0	0	1.08
Black gram	4.91	0	0	0	0	2.03
Pigeonpea + black gram	0.99	0	0	0	0	0.41
Pigeonpea + matki	0.14	0	0	0	0	0.06
Pigeonpea + pearl millet	0.21	0	0	0	0	0.09
Pigeonpea + sunflower	4.12	0	0	0	0	1.71
Pigeonpea + sunflower + pearl millet	1.23	0	0	0	0	0.51
Pigeonpea + sunflower + matki	0.71	0	0	0	0	0.29
Pigeonpea + others	10.33	0	0	0	0	4.28
Matki	1.66	0	0	0	0	0.69
Matki + hulga	1.42	0	0	0	0	0.59
Matki + kulthi	2.33	0	0	0	0	0.96
Total	80.24	1.97	0	0	0	34.36
Cash crops						
Sugarcane	0	0	0	43.47	0	1.23
Chilli	0.37	0	0	0	0	0.15
Tomato	0.07	0	0	0	0	0.03
Bitter gourd	0.14	0	0	0	0	0.06
Soft gourd	0.28	0	0	0	0	0.12
Bhendi	0.14	0	0	0	0	0.06
Brinjal	0.14	0.11	0	0	0	0.12
Cluster bean	0.50	0	0	0	0	0.21
Drumstick	0	0	0	0	2.92	0.01
Vegetables	3.91	1.39	34.38	0	0	2.58
Fruit crops	0	0	0	51.85	0	1.47
Citrus	0	0	0	0	71.05	0.35
Grapes	0	0	0	4.17	14.91	0.19
Lemon	0	0	0	0.51	0	0.01
Onion	0.91	0.22	0	0	0	0.50
Cucumber	0.21	0.57	0	0	0	0.40
Total	6.68	2.28	34.38	100	88.89	7.49
Oilseeds						
Groundnut	1.42	0	50	0	0	0.87
Sunflower	5.97	1.13	0	0	0	3.09
Sunflower + matki	0.21	0	0	0	0	0.09
Total	7.60	1.13	50	0	0	4.05
Other crops	1.28	0	15.63	0	11.12	0.68
Grand total	100	100	100	100	100	100

Table 5.7. Acreage (ha) of different crops in Kanzara, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Summer	Total
Cereals				
Wheat	0	23.14	0	23.14
Maize	0	0	0.73	0.73
Sorghum	3.00	0	0	3.00
Hybrid sorghum	4.42	0	0	4.42
Hybrid sorghum + green gram	0.27	0	0	0.27
Hybrid sorghum + green gram + black gram	0.40	0	0	0.40
Fodder	0	0.13	0	0.13
Total	8.10	23.27	0.73	32.10
Pulses				
Pigeonpea	1.42	0	0	1.42
Chickpea	0	1.24	0	1.24
Cowpea	0.07	0	0.10	0.17
Black gram	0.10	0	0	0.10
Green gram	3.40	0	0	3.40
Green gram + pigeonpea	0.81	0	0	0.81
Other pulses	4.15	0	0	4.15
Total	9.95	1.24	0.10	11.29
Cash crops				
Cotton	45.41	0	0	45.41
Chilli	0.93	0	0.03	0.96
Chilli + spinach	0.19	0	0	0.19
Brinjal	0.35	0.33	0.40	1.08
Cabbage	0.07	0	0	0.07
Cauliflower	0	0.10	0	0.10
Coriander	0.07	0.01	0	0.08
Vegetables	2.06	0.46	0.64	3.16
Cotton + pigeonpea	22.30	0	0	22.30
Cotton + green gram	1.48	0	0	1.48
Cotton + others	11.26	0	0	11.26
Cotton + black gram + pigeonpea	0.54	0	0	0.54
Cotton + green gram + pigeonpea	0.81	0	0	0.81
Cotton + hybrid sorghum + pigeonpea	1.21	0	0	1.21
Cotton + hybrid sorghum	0.54	0	0	0.54
Cotton + green gram + pigeonpea	2.77	0	0	2.77
Cotton + green gram + pigeonpea + soybean	2.56	0	0	2.56
Cotton + green gram + pigeonpea + sorghum	0.54	0	0	0.54
Cotton + pigeonpea + green gram + black gram	0.40	0	0	0.40
Cotton + pigeonpea + sesamum	0.27	0	0	0.27
Cotton + pigeonpea + sesamum + black gram	0.40	0	0	0.40
Cotton + pigeonpea + soybean	0.40	0	0	0.40
Cotton + cucumber	0.40	0	0	0.40
Onion	0	0.40	0.27	0.67
Cucumber	0.20	0	0.10	0.30
Total	95.17	1.31	1.44	97.92
Oil seeds				
Soybean	2.56	0	0	2.56
Soybean + pigeonpea	1.75	0	0	1.75
Soybean + green gram + black gram	0.13	0	0	0.13
Sunflower	0	0	0.27	0.27
Sesamum	0.01	0	0	0.01
Total	4.45	0	0.27	4.72
Others	0.40	0.05	0.07	0.52
Grand total	118.07	25.87	2.61	146.55

Table 5.8. Acreage (%) of different crops in Kanzara, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Summer	Total
Cereals				
Wheat	0	89.41	0	15.79
Maize	0	0	27.84	0.50
Sorghum	2.54	0	0	2.05
Hybrid sorghum	3.74	0	0	3.02
Hybrid sorghum + green gram	0.23	0	0	0.18
Hybrid sorghum + green gram + black gram	0.34	0	0	0.28
Fodder	0	0.52	0	0.09
Total	6.86	89.93	27.84	21.90
Pulses				
Pigeonpea	1.20	0	0	0.97
Chickpea	0	4.80	0	0.85
Cowpea	0.06	0	3.83	0.11
Black gram	0.08	0	0	0.07
Green gram	2.88	0	0	2.32
Green gram + pigeonpea	0.69	0	0	0.55
Other pulses	3.51	0	0	2.83
Total	8.42	4.80	3.83	7.70
Cash crops				
Cotton	38.45	0	0	30.98
Chilli	0.78	0	1.28	0.65
Chilli + spinach	0.16	0	0	0.13
Brinjal	0.30	1.29	15.45	0.74
Cabbage	0.06	0	0	0.05
Cauliflower	0	0.39	0	0.07
Coriander	0.06	0.05	0	0.05
Vegetables	1.74	1.79	24.52	2.16
Cotton + pigeonpea	18.89	0	0	15.22
Cotton + green gram	1.26	0	0	1.01
Cotton + others	9.54	0	0	7.68
Cotton + black gram + pigeonpea	0.46	0	0	0.37
Cotton + green gram + pigeonpea	0.69	0	0	0.55
Cotton + hybrid sorghum + pigeonpea	1.03	0	0	0.83
Cotton + hybrid sorghum	0.46	0	0	0.37
Cotton + green gram + pigeonpea	2.34	0	0	1.89
Cotton + green gram + pigeonpea + soybean	2.17	0	0	1.75
Cotton + green gram + pigeonpea + sorghum	0.46	0	0	0.37
Cotton + pigeonpea + green gram + black gram	0.34	0	0	0.28
Cotton + pigeonpea + sesamum	0.23	0	0	0.18
Cotton + pigeonpea + sesamum + black gram	0.34	0	0	0.28
Cotton + pigeonpea + soybean	0.34	0	0	0.28
Cotton + cucumber	0.34	0	0	0.28
Onion	0	1.55	10.22	0.45
Cucumber	0.17	0	3.83	0.20
Total	80.60	5.06	55.30	66.81
Oilseeds				
Soybean	2.17	0	0	1.75
Soybean + pigeonpea	1.49	0	0	1.20
Soybean + green gram + black gram	0.11	0	0	0.09
Sunflower	0	0	10.39	0.18
Sesamum	0.01	0	0	0.01
Total	3.78	0	10.37	3.23
Others	0.34	0.21	2.59	0.36
Grand total	100	100	100	100

Table 5.9. Acreage (ha) of different crops in Kinkheda, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Annuals	Total
Cereals				
Wheat	0	6.21	0	6.21
Sorghum	1.15	0	0	1.15
Hybrid sorghum	1.41	0	0	1.41
Hybrid sorghum + green gram	0.20	0	0	0.20
Total	2.76	6.21	0	8.97
Pulses				
Pigeonpea	0.67	0	0	0.67
Green gram	2.72	0	0	2.72
Green gram + others	0.54	0	0	0.54
Total	3.93	0	0	3.93
Cash crops				
Cotton	18.29	0	0	18.29
Sugarcane	0	0	0.27	0.27
Vegetables	0	0.54	0	0.54
Fruit crops	0	0	0.40	0.40
Citrus	0	0.13	0	0.13
Lemon + soybean	0	0	0.27	0.27
Cotton + pigeonpea	11.60	0	0	11.60
Cotton + green gram	6.07	0	0	6.07
Cotton + green gram + pigeonpea	0.27	0	0	0.27
Cotton + hybrid sorghum + pigeonpea	2.36	0	0	2.36
Cotton + hybrid sorghum	0.27	0	0	0.27
Cotton + pigeonpea + hybrid sorghum + green gram	2.02	0	0	2.02
Cotton + green gram + hybrid sorghum	0.47	0	0	0.47
Cotton + pigeonpea + others	6.00	0	0	6.00
Onion	0	0.03	0	0.03
Total	47.35	0.70	0.94	48.99
Oilseeds				
Soybean	2.43	0	0	2.43
Soybean + pigeonpea	2.16	0	0	2.16
Total	4.59	0	0	4.59
Others	0	1.01	0	1.01
Grand total	58.63	7.92	0.94	67.49

The decline in the proportion of area under foodgrains in mixed/intercropping systems was even sharper, down from 63.5% to 1.8%. Thus, the shift away from foodgrains has been greater in the VLS villages than at the macro level. At the national level, the proportion of area under foodgrain crops fell from about 77% of the gross cropped area in 1960-61 to about 66% in 2000-01. This shift in favour of cash crops was particularly pronounced in the case of the VLS villages in Mahbubnagar and Akola districts. In the two Solapur villages, postrainy-season sorghum is still highly preferred by farmers – or there is no better alternative – due to which the share of area under sole crops of foodgrains remains high. Mixed cropping (mixing seeds of 4-5 crops and broadcasting them) has given way to

Table 5.10. Acreage (%) of different crops in Kinkheda, Maharashtra, 2001-04.

Crop	Rainy season	Postrainy season	Annuals	Total
Cereals				
Wheat	0	78.37	0	9.20
Sorghum	1.96	0	0	1.70
Hybrid sorghum	2.41	0	0	2.09
Hybrid sorghum + green gram	0.34	0	0	0.30
Total	4.71	78.37	0	13.29
Pulses				
Pigeonpea	1.15	0	0	1.00
Green gram	4.63	0	0	4.03
Green gram + others	0.92	0	0	0.80
Total	6.70	0	0	5.82
Cash crops				
Cotton	31.19	0	0	27.10
Sugarcane	0	0	28.72	0.40
Vegetables	0	6.78	0	0.80
Fruit crops	0	0	42.56	0.60
Citrus	0	1.68	0	0.20
Lemon + soybean	0	0	28.72	0.40
Cotton + pigeonpea	19.79	0	0	17.19
Cotton + green gram	10.35	0	0	8.99
Cotton + green gram + pigeonpea	0.46	0	0	0.40
Cotton + hybrid sorghum + pigeonpea	4.03	0	0	3.50
Cotton + hybrid sorghum	0.46	0	0	0.40
Cotton + pigeonpea + hybrid sorghum + green gram	3.45	0	0	3.00
Cotton + greengram + hybrid sorghum	0.81	0	0	0.70
Cotton + pigeonpea + others	10.23	0	0	8.89
Onion	0	0.34	0	0.04
Total	80.76	8.80	100	72.59
Oilseeds				
Soybean	4.14	0	0	3.60
Soybean + pigeonpea	3.68	0	0	3.20
Total	7.82	0	0	6.80
Others	0	12.83	0	1.50
Grand total	100	100	100	100

intercropping (sowing two or three crops in different rows). It has become uncommon to have more than three crops even in intercropping systems.

5.3 Average Productivity of Important Crops in VLS Villages

The average productivity levels of major crops in the two VLS villages in Andhra Pradesh are given in Table 5.12. Paddy productivity was higher in Aurepalle than in Dokur, but the important rainfed crops, castor and sorghum, yielded better in the latter village. Dokur also recorded a better cotton yield but it is receiving different levels of irrigation support on different farms. Intercropping systems yielded better in Aurepalle as did pigeonpea, chilli and vegetables. Aurepalle has better soils (black soils in Nalavaripalle hamlet) than Dokur where

Table 5.11. Changes in the acreage of foodgrain crops in sole and mixed cropping systems between 1975–76 and 2001–04.

Village	1975-76[1]			2001-04		
	Average size of holding (ha)	Proportion of area under foodgrains in sole crops (%)	Proportion of area under foodgrains in mixed crops (%)	Average size of holding (ha) (operational)	Proportion of area under foodgrains in sole crops (%)	Proportion of area under foodgrains in mixed crops (%)
Aurepalle	4.4	39.0	88.0	2.0	22.6	5.9
Dokur	2.6	85.0	40.0	1.6	32.6	2.9
Shirapur	4.4	83.0	86.0	2.9	66.6	0.2
Kalman	8.1	93.0	99.0	5.1	52.5	1.2
Kanzara	5.8	59.0	47.0	3.8	20.7	0.5
Kinkheda	6.1	76.0	21.0	2.7	12.7	0.3
Average	5.2	72.5	63.5	3.0	34.6	1.8

1. Figures for 1975-76 were drawn from Jodha (1977).

Table 5.12. Average productivity (kg ha^{-1}) of crops in Andhra Pradesh VLS villages, 2001-04.

Crop	Aurepalle	Dokur
Cereals		
Paddy	4717.67	4129.00
(in terms of rice)	3160.85	2766.43
Maize	782.33	1007.33
Sorghum	474.67	665.67
Finger millet	0	988.00
Pearl millet	593.00	0
Sorghum + pigeonpea	438 + 184	283 + 84
Sorghum + pigeonpea + green gram	165 + 15 + 21	0
Pearl millet + sorghum	124 + 132	0
Pearl millet + pigeonpea	247 + 62	0
Pulses		
Pigeonpea	403.67	162.67
Horse gram	132.67	0
Cash crops		
Cotton	736.67	779.33
Chilli	427.33	230.67
Vegetables	764.67	0
Coriander	82.33	0
Smooth cucumber	0	1158.33
Gherkin	0	4899.00
Bitter gourd	828.33	0
Bhendi	0	1663.00
Cotton + pigeonpea	346 + 33	0
Oilseeds		
Castor	512.67	555.67
Groundnut	1667.33	1582.33
Safflower	370.67	0
Sunflower	430.33	0
Castor + pigeonpea	407 + 115	399 + 66

soils have turned saline after the village tank dried up. In general, yields were low and varied from season to season.

The productivity levels of major crops in the Maharashtra VLS villages are presented in Table 5.13. Kanzara reported better yields of wheat, cotton, soybean, chilli and rainy-season sorghum (hybrid). Onion and chickpea yields were best in Shirapur. This village has also reported higher yields than Kalman for postrainy-season sorghum, sugarcane and groundnut, due in part to its better soils and irrigation coverage than Kalman. Similarly, Kanzara recorded better yields than Kinkheda of most of the crops grown by both villages. Kinkheda is handicapped by soil salinity and low labor productivity. Kalman fared better than Kanzara in the case of cucumber. There is broad diversity in Kalman in terms of the vegetable crops grown.

5.4 Major Production Constraints of Rainfed Crops

The major production constraints of rainfed crops, as perceived by farmers, varied for crop and village. In Aurepalle, drought was felt to be the most important constraint irrespective of the crop grown (Table 5.14). Pests, diseases and weeds were the other constraints in that order of importance. In Dokur, persistent drought has rendered paddy fields into long-term fallows. As a result, prosopis weeds have assumed shrub-like proportions, harbouring wild boars which have become a

Table 5.13. Average productivity (kg ha^{-1}) of crops in Maharashtra VLS villages, 2001-04.

Crop	Shirapur	Kalman	Kanzara	Kinkheda
Cereals				
Wheat	1264.33	703.33	1850.67	1096
Maize	1071.67	963.33	0	0
Rainy-season sorghum	0	0	1812.33	858.33
Postrainy-season sorghum	694	553	0	0
Hybrid sorghum	0	0	0	457.67
Pearl millet	0	225	0	0
Sorghum + chickpea	124 + 29	0	0	0
Pulses				
Pigeonpea	285	275	58.67	214
Chickpea	575.67	424	444.67	0
Black gram	0	154	74	0
Green gram	0	0	206	74.33
Cowpea	0	0	1948.67	0
Kulthi	33	0	0	0
Matki	127	63.67	0	0
Pigeonpea + sunflower	0	37 + 51	0	0
Pigeonpea + matki	49 + 33	0	0	0
Cash crops				
Cotton	292.67	0	1037	343.33
Sugarcane	46455	30931.67	0	0
Chillies	2219	2534	3065.33	0
Onion	9586.67	4163	3030	823.33
Cucumber	0	4007	2634.67	0
Brinjal	988	1235	9194	0
Tomato	0	1317.33	0	0
Bhendi	0	411.67	0	0
Coriander	0	0	576.33	0
Cabbage	0	0	12350	0
Cauliflower	0	0	597	0
Grapes	0	3835	0	0
Cotton + pigeonpea	0	0	247 + 101	380 + 165
Cotton + green gram	0	0	153 + 120	252 + 108
Cotton + sorghum	0	0	0	82 + 41
Cotton + pigeonpea + sorghum	0	0	0	164 + 30 + 87
Oilseeds				
Groundnut	1159.33	792	0	0
Sunflower	0	144.67	0	0
Soybean	0	0	760	103
Sesamum	0	0	329.33	0
Soybean + pigeonpea	0	0	259 + 103	21 + 464
Sunflower + matki	0	220 + 55	0	0

Table 5.14. Ranking of major crop production constraints in VLS villages, 2001-04.

Village	Crop	Drought	Pests	Diseases	Poor seed	Poor soil	Weeds	Excess rain	Others (wild boar damage)
Aurepalle	Castor	1	3	2			4		
	Cotton	1	2	4			3		
	Pigeonpea	1	2	3			4		
	Sorghum	1	2	4			3		
Dokur	Castor	1	2	3			4		
	Cotton	1	2	3			4		
	Millet	1		4			3		2
	Groundnut	2	3	4					1
	Pigeonpea	2	1	4			3		5
	Sorghum	2	1	4			5		3
Shirapur	Sorghum	1	2	4			3		
	Pigeonpea	2	1	3			4		
	Groundnut	1	2						
	Matki	1	2						
	Cotton	2	1	4			3	5	
Kalman	Sorghum	1	2	3	4				
	Pigeonpea	2	1	3		4		5	
	Groundnut	2	1	3					
	Chickpea	1	2	3					
Kanzara	Sorghum	1	2	3					
	Pigeonpea		2	1					
	Chickpea	1	2	3					
	Cotton	3	1	2					
	Green gram			2			3	1	
Kinkheda	Sorghum	1	2						
	Pigeonpea	2	1						
	Green gram	1		2				3	
	Cotton		1	2			3	4	

menace to all the edible crops in the village. Damage by wild boars was in fact rated as the most serious production constraint of groundnut and as an important constraint of sorghum and pigeonpea in Dokur. The farmers of Dokur also rated drought as the most important constraint of castor, cotton and millet and the second most important constraint of groundnut, pigeonpea and sorghum. Pests were regarded as the most important constraint of sorghum and pigeonpea. Diseases and weeds were important constraints of some crops.

In Shirapur, drought was identified as the most important production constraint of postrainy-season sorghum, groundnut and matki. Insect pests (pod borer) were the most important in the case of pigeonpea and cotton. Diseases and weeds were the other important problems. In Kalman, drought was the most important production constraint of sorghum and chickpea while pests were the most important for pigeonpea and groundnut.

In Kanzara, drought was the major production constraint of sorghum and chickpea while pests were most important for cotton and diseases for pigeonpea. Green gram suffered most on account of excess rains. In Kinkheda, drought was the most important yield reducer of sorghum and green gram. In case of cotton and pigeonpea, pests were the most important constraints. Diseases, weeds and excess rains also affected crops now and then.

5.5 Sources of Information

Farmers depend on several sources of information, besides learning from their own experience. Particularly when they want to try something new, they try to get information and advice from a source in which they have confidence. The different sources of primary information available to villagers in the six VLS villages are presented in Table 5.15. For information on purchased inputs like pesticides and fertilizers, farmers seem to rely more on shopkeepers. But for information on all types of technologies, particularly agronomic practices and improved seeds, they rely more on progressive farmers than other sources. Extension officers are accessible to an extent to farmers in the two VLS villages (Kalman and Shirapur) in Solapur district, but not to those in Mahbubnagar (Aurepalle and Dokur) and Akola (Kanzara and Kinkheda). Relatives and friends and mass media also serve as supplementary sources of information. Overall, informal sources tend to be more relied upon than formal sources like extension officers and mass media in the SAT.

5.6 Utilization of Farm Produce

Farmers in the SAT have been known to be subsistence farmers. But the situation is fast changing with farmers shifting to commercial crops and with better linkages between villages and markets. This change is reflected in the pattern of utilization of farm produce.

For instance, in Aurepalle (Table 5.16) the entire produce of commercial crops like castor, cotton, sunflower and coriander was sold. Only in the case of sorghum and horse gram was more than 50% of the produce retained for own consumption and other uses. More than half of paddy and green gram and nearly two-thirds of pigeonpea and pearl millet production was sold in the market. Similarly, the proportion of marketed produce was quite high for vegetables, maize, safflower and groundnut. In contrast, the entire production of fodder was used for feeding animals on the farm.

In Dokur, of all the crops produced, pigeonpea was used mostly for home consumption with only 29% of its production going to the market (Table 5.17). Similarly, all of the fodder, horse gram and chillies were used on the farm, either for feeding the animals or for home consumption. More than 50% of the paddy and sorghum produced was sold in the market. In the case of all other crops including finger millet, the marketed surplus was above 90%. These trends indicate that farmers are no more subsistence farmers and have a market orientation. The advent of a wide network of markets and reduced transaction costs have caused this change in orientation.

In the case of Shirapur, a stronger subsistence orientation was observed for several of the crops (Table 5.18). The surveyed households retained most of the maize and more than 50% of the sorghum (postrainy season) and wheat. Minor pulses like matki and kulthi, which are produced in small quantities, and all the fodder were retained on the farm. More than half of the chickpea produced was consumed while only 13% of the pigeonpea, production of which was much higher, was retained for consumption. The lion's share of oilseed crops, sugarcane, cotton, fruits and vegetables was sold in the market.

In Kalman too, 80% of wheat and more than 50% of the sorghum was retained for home consumption (Table 5.19). But more than half of the maize produced was sold in the market, unlike the produce of minor pulses like kulthi and matki, most of which was consumed. Most of the pigeonpea, hulga (minor cereal) and black gram was sold in the market. More than 50% of the groundnut production was retained for consumption while most of the produce of sunflower, vegetables and fruits was sold, as was all of the sugarcane.

In the two VLS villages in Andhra Pradesh, where the Public Distribution System is quite strong, households sold most of the foodgrains produced and depended on the PDS rice. But in Solapur, they retained a good part of the foodgrains for home consumption. People use postrainy-season sorghum as staple food. This is not available through PDS. In general, the lower the production of a particular commodity, the less it is sold in the market as the farmers would need it for home consumption.

In Kanzara, where production levels were quite high, more than three-fourths of the maize

Table 5.15. Number of farmers relying upon different sources of information in six VLS villages, 2001-04.

Village	Type of information	Source of information				
		Progressive farmers	Extension	Shop-keepers	Relatives/ friends	Mass media
Aurepalle	Use of improved seeds	33	0	28	1	1
	Use of chemical fertilizers	27	0	31	2	1
	Agronomic practices	29	0	9	8	0
	Pest/disease control	22	0	33	2	1
Dokur	Use of improved seeds	10	0	15	2	2
	Use of chemical fertilizers	7	0	18	2	1
	Agronomic practices	13	0	4	5	0
	Pest/disease control	5	0	16	2	1
Kalman	Use of improved seeds	43	6	5	2	2
	Use of chemical fertilizers	20	3	17	2	1
	Agronomic practices	31	8	1	4	1
	Pest/disease control	5	1	17	1	0
Shirapur	Use of improved seeds	30	4	5	7	3
	Use of chemical fertilizers	19	2	17	3	1
	Agronomic practices	26	5	0	4	0
	Pest/disease control	2	1	16	3	0
Kanzara	Use of improved seeds	19	2	6	3	0
	Use of chemical fertilizers	13	1	11	1	1
	Agronomic practices	19	1	0	1	0
	Pest/disease control	5	0	16	1	0
Kinkheda	Use of improved seed	9	1	4	4	0
	Use of chemical fertilizers	8	1	6	2	0
	Agronomic practices	8	1	0	2	1
	Pest/disease control	1	0	5	1	0
Total	Use of improved seed	144	13	63	18	9
	Use of chemical fertilizers	93	7	100	13	5
	Agronomic practices	127	16	14	23	2
	Pest/disease control	40	2	102	10	2

production was sold in the market (Table 5.20). Nearly half of the production of hybrid sorghum and sesamum was retained for home consumption. In contrast, more than half of the groundnut, black gram and wheat was sold as was all of the produce of cotton and sunflower. The marketed surplus exceeded 80% in the case of pulses (pigeonpea, green gram and chickpea), vegetables, chillies, onion and soybean.

A similar trend was noted in Kinkheda (Table 5.21). Most of the hybrid sorghum production was used up for consumption, but two-thirds of the wheat was marketed. The marketed surplus for sugarcane, cotton, soybean and fruits was 100% and ranged from 70% to 99% for sesamum, black gram, pigeonpea, green gram, safflower, vegetables and onions. In general, marketed surplus was higher in the Akola VLS villages than in the Solapur villages.

Table 5.16. Utilization of farm produce (kg) in Aurepalle, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	90069	26483	493	12058	51035	57
Maize	633	0	0	33	600	95
Sorghum	7393	3597	82	469	3245	44
Pearl millet	2598	775	3	120	1700	65
Pigeonpea	5522	1569	88	267	3598	65
Green gram	33	4	0	10	19	58
Horse gram	122	1	3	106	12	10
Cotton	40269	0	0	0	40269	100
Chilli	323	25	0	31	267	83
Castor	20598	0	30	17	20551	100
Sunflower	673	0	0	0	673	100
Groundnut	1033	23	0	10	1000	97
Safflower	333	33	0	0	300	90
Vegetables	872	42	0	53	777	89
Coriander	67	0	0	0	67	100
Ridge gourd	199	3	0	3	193	97
Fodder	2667	2667	0	0	0	0

Table 5.17. Utilization of farm produce (kg) in Dokur, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	56620	13303	157	10352	32808	58
Maize	1720	0	0	100	1620	94
Sorghum	4396	1927	3	183	2283	52
Finger millet	800	7	0	33	760	95
Pigeonpea	1211	734	17	113	347	29
Horse gram	50	7	0	43	0	0
Cotton	2062	0	0	0	2062	100
Chilli	24	17	0	7	0	0
Castor	12800	0	0	463	12337	96
Groundnut	1579	28	58	20	1473	93
Kheera	1567	0	0	0	1567	100
Gherkin	4969	13	0	23	4933	99
Mango	200	17	0	0	183	92
Fodder	11300	11300	0	0	0	0

5.6.1 Utilization of Farm Produce in Relation to Size of Land Holding

It is generally believed that small farmers are subsistence farmers. In order to test this hypothesis, utilization of farm produce by households belonging to different farm-size groups, ie, labor, small, medium and large, was estimated by adding up the patterns of utilization across the six villages and averaging over the years. These patterns are presented in Tables 5.22 through 5.27 respectively.

Table 5.18. Utilization of farm produce (kg) in Shirapur, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Wheat	9473	4742	289	692	3750	40
Maize	3864	1536	20	1733	575	15
Sorghum	34648	20627	762	1478	11781	34
Sugarcane	645343	0	0	0	645343	100
Pigeonpea	2939	469	67	0	2403	82
Chickpea	567	215	61	23	268	47
Matki	201	58	18	17	108	54
Kulthi	100	30	3	0	67	67
Cotton	892	0	0	0	892	100
Chilli	422	45	0	0	377	89
Sunflower	40	0	0	0	40	100
Groundnut	1822	239	83	17	1483	81
Sesamum	93	23	3	0	67	71
Vegetables	23634	348	33	50	23203	98
Onion	14534	167	0	0	14367	99
Fruits	467	0	0	0	467	100
Hulga	105	5	0	0	100	95

Table 5.19. Utilization of farm produce (kg) in Kalman, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	200	160	23	17	0	0
Wheat	2684	1826	133	192	533	20
Maize	3106	1365	53	20	1668	54
Sorghum	45261	24137	864	1223	19037	42
Pearl millet	588	180	0	0	408	69
Sugarcane	188167	0	0	0	188167	100
Pigeonpea	8683	1735	312	195	6441	74
Chickpea	529	267	45	25	192	36
Black gram	1216	130	30	3	1053	87
Matki	523	269	29	0	225	43
Kulthi	133	38	28	40	27	20
Chilli	2436	66	0	0	2370	97
Sunflower	2276	47	61	0	2168	95
Groundnut	1433	787	47	2	597	42
Safflower	17	0	0	0	17	100
Vegetables	27969	778	17	87	27087	97
Onion	16583	750	0	133	15700	95
Fruits	13565	345	0	35	13185	97
Hulga	102	29	0	0	73	71

Table 5.20. Utilization of farm produce (kg) in Kanzara, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Wheat	42514	8593	2417	1397	30107	71
Maize	4634	467	0	0	4167	90
Hybrid sorghum	22280	9040	117	1883	11240	50
Pigeonpea	16065	1712	681	130	13542	84
Chickpea	1650	53	30	0	1567	95
Black gram	971	163	72	41	695	72
Green gram	7306	477	278	17	6534	89
Cotton	66488	0	0	0	66488	100
Chilli	4019	63	0	19	3937	98
Sunflower	167	0	0	0	167	100
Groundnut	53	20	0	0	33	63
Soybean	3580	37	0	50	3493	98
Sesamum	74	21	1	17	35	48
Vegetables	45781	735	17	212	44817	98
Onion	22643	287	0	333	22023	97

Table 5.21. Utilization of farm produce (kg) in Kinkheda, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Wheat	14857	3840	850	100	10067	68
Hybrid sorghum	6508	3322	0	725	2461	38
Sugarcane	6000	0	0	0	6000	100
Pigeonpea	7605	632	232	45	6696	88
Black gram	130	21	3	0	106	81
Green gram	4504	270	165	47	4022	89
Cotton	18794	0	0	50	18744	100
Safflower	334	0	17	0	317	95
Soybean	703	3	0	0	700	100
Sesamum	13	4	0	0	9	70
Vegetables	3634	67	0	0	3567	98
Onion	3333	33	0	0	3300	99
Fruits	2700	8	0	0	2692	100

Even in labor households, which have limited land holdings and smaller output, the marketed surplus exceeded 50% for all crops (Table 5.22), ranging from 57% to 75% for sorghum, paddy, groundnut and pigeonpea and 100% for sugarcane, castor, sunflower and soybean. In case of the other commercial crop, cotton, 95% of the produce was sold. Lack of storage facilities and an immediate need for cash could be the reasons why labor households dispose of a substantial part of their produce in the market. They may buy the same commodities later to meet their consumption needs.

Unlike labor households, small farmers retained substantial proportions of their produce of some commodities (Table 5.23). All the fodder produced was fed to their animals. In the case of foodgrains

Table 5.22. Utilization of farm produce (kg) by labor households, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	874	287	0	0	587	67
Sorghum	850	367	0	0	483	57
Sugarcane	9333	0	0	0	9333	100
Pigeonpea	532	104	11	17	400	75
Cotton	1067	0	0	50	1017	95
Castor	753	0	0	0	753	100
Sunflower	112	0	0	0	112	100
Groundnut	50	17	0	0	33	67
Soybean	200	0	0	0	200	100

like postrainy-season sorghum, hybrid sorghum, maize and paddy and pulses like matki, kulthi and chickpea, own consumption ranged from about a half to three-fourths of the production. The marketed quantities ranged from half to three-fourths of the production for wheat, horse gram, groundnut, sesamum and hulga. The entire output of sugarcane, cotton, castor and safflower was sold. The marketed surplus ranged from 76% to 98% for all other crops like pigeonpea, pearl millet, finger millet, black gram, green gram, chillies, sunflower, vegetables, onion and fruits.

Medium farm-size households too showed a market-oriented tendency. They retained for their own consumption more than 50% of the produce

Table 5.23. Utilization of farm produce (kg) by small farm-size households, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	13725	5085	157	1508	6975	51
Wheat	22198	8285	975	575	12363	56
Maize	4849	1962	50	827	2010	41
Sorghum (postrainy season)	43594	26553	892	847	15302	35
Hybrid sorghum	6606	3128	0	633	2845	43
Pearl millet	289	47	0	0	242	84
Finger millet	800	7	0	33	760	95
Sugarcane	422677	0	0	0	422677	100
Pigeonpea	12375	2370	501	79	9425	76
Chickpea	647	245	59	23	320	49
Black gram	1080	100	31	3	946	88
Green gram	2740	295	121	10	2314	84
Horse gram	23	1	0	10	12	53
Matki	257	159	11	0	87	34
Kulthi	53	23	13	0	17	31
Cotton	19492	0	0	0	19492	100
Chilli	2529	86	0	0	2443	97
Castor	2432	0	0	0	2432	100
Sunflower	1469	15	31	0	1423	97
Groundnut	1866	593	73	17	1183	63
Safflower	17	0	0	0	17	100
Sesamum	64	9	1	13	41	64
Vegetables	31574	773	23	90	30688	97
Onion	17350	267	0	133	16950	98
Fruits	8965	203	0	27	8735	97
Fodder	467	467	0	0	0	0
Hulga	71	25	0	0	46	65

only in the case of staple foodgrains, sorghum (postrainy season) and hybrid sorghum and minor pulses (matki and kulthi) (Table 5.24). Of course, all the fodder produced on the farm was retained. In the case of other foodgrains like paddy, wheat and pearl millet; and oilseed crops, sesamum and groundnut, the proportions sold in the market ranged from half to two-thirds. The entire production of sugarcane, cotton and kheera and coriander was sold in the market. In case of all the other crops, including pigeonpea, chickpea, green gram, maize, chilli, castor, hulga, safflower, sunflower, soybean, vegetables, onions and fruits the marketed proportions ranged from 76% to 99%.

Large farmers used all the horse gram and fodder they produced to feed their livestock (Table 5.25). They also consumed more than 50% of the postrainy-season sorghum. The marketed proportion of other foodgrains like maize, hybrid sorghum, paddy, wheat, matki and pearl millet ranged from 56% to 70%. In the case of pulses like pigeonpea, chickpea, green gram and black gram, the proportion of produce retained for consumption ranged from 9% to 17%. Nothing was retained of sugarcane, cotton, kheera, kulthi and fruits. For oilseed crops like castor, sunflower, groundnut, safflower and soybean and vegetables, mango, ridge gourd, onion and gherkins, the proportion retained for consumption was less than 10%.

5.6.2 Utilization of Farm Produce by VLS Households

Table 5.26 presents data on the utilization of farm produce by households of all farm sizes pooled over the six VLS villages. The pattern suggests that most of the farm produce is sold in the market. Only fodder, sorghum, hybrid sorghum, horse gram, kulthi and matki are exceptions to this statement: a major part of the produce of these crops is retained for home consumption and less

Table 5.24. Utilization of farm produce (kg) by medium farm-size households, 2001-04

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	64740	18305	290	9527	36618	57
Wheat	24931	6127	1197	1154	16453	66
Maize	5666	233	23	723	4687	83
Sorghum	30990	15290	574	1690	13436	43
Hybrid sorghum	10700	6065	17	933	3685	34
Pearl millet	1907	607	3	47	1250	66
Sugarcane	300167	0	0	0	300167	100
Pigeonpea	14807	2670	555	302	11280	76
Chickpea	1536	224	47	25	1240	81
Black gram	665	177	42	41	405	61
Green gram	4284	231	163	17	3873	90
Matki	274	128	16	0	130	47
Kulthi	146	45	18	40	43	30
Cotton	56764	0	0	0	56764	100
Chilli	2457	17	0	23	2417	98
Castor	13549	0	0	337	13212	98
Sunflower	867	27	23	0	817	94
Groundnut	1564	375	57	2	1130	72
Safflower	266	33	0	0	233	88
Soybean	1603	20	0	0	1583	99
Sesamum	116	40	3	3	70	60
Vegetables	37843	788	10	108	36937	98
Coriander	67	0	0	0	67	100
Kheera	233	0	0	0	233	100
Onion	17409	803	0	33	16573	95
Fruits	5867	142	0	8	5717	97
Fodder	1500	1500	0	0	0	0
Hulga	136	9	0	0	127	93

Table 5.25. Utilization of farm produce (kg) by large farm-size households, 2001-04.

Crop	Total production	Used for own consumption	Retained for seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	67552	16270	227	11392	39663	59
Wheat	22397	4589	1517	651	15640	70
Maize	3442	1172	0	337	1933	56
Sorghum (postrainy season)	16267	8078	246	818	7125	44
Hybrid sorghum	11482	3169	100	1042	7171	62
Pearl millet	992	302	0	73	617	62
Sugarcane	107333	0	0	0	107333	100
Pigeonpea	14314	1708	331	353	11922	83
Chickpea	564	67	30	0	467	83
Black gram	572	37	32	0	503	88
Green gram	4820	225	160	47	4388	91
Horse gram	150	7	3	140	0	0
Matki	194	40	20	17	117	60
Kulthi	33	0	0	0	33	100
Cotton	51182	0	0	0	51182	100
Chilli	2234	112	0	33	2089	93
Castor	16664	0	30	143	16491	99
Sunflower	709	5	7	0	697	98
Groundnut	2440	112	58	30	2240	92
Safflower	400	0	17	0	383	96
Soybean	2480	20	0	50	2410	97
Vegetables	32470	409	33	203	31825	98
Ridge gourd	199	3	0	3	193	97
Kheera	1333	0	0	0	1333	100
Gherkin	4969	13	0	23	4933	99
Onion	22334	167	0	300	21867	98
Fruits	1900	8	0	0	1892	100
Mango	200	17	0	0	183	92
Fodder	12000	12000	0	0	0	0

than 50% of it is actually sold. More than 50% of the produce of other cereals like paddy, wheat, maize, pearl millet and finger millet is marketed as is more than three-fourths of the pulses production. Except groundnut, where 23% is retained for consumption, very little of the produce of oilseeds is retained. More than 90% of the vegetables, fruits and other cash crops is sold in the market. The data indicates that farm households sell a substantial part of their production in the market.

Table 5.27 shows data on the production, sale, consumption and other uses of different agricultural commodities by VLS households per year. The average production of cereals in the six villages was 812 kg and that of pulses 136 kg. Given the average household size of 5.38, the average per capita production is 151 kg of cereals and 25 kg of pulses per year. These production levels do not even meet the households' minimum requirements of foodgrains (cereals and pulses). Yet most of the produce was sold immediately after harvest. Only 54 kg of cereals and 4 kg of pulses were retained to meet the annual requirements of an average person. The main reason for this behavior may be that the farmers want to have cash in hand for their nonfood needs. The existence of fair price shops in the villages, from where food articles can be accessed at subsidized prices, may be another reason. Lack of storage space and fear of storage loss may be the other reasons which deter households from keeping enough stocks of foodgrains. The availability of markets and shops and reduced transaction costs might be encouraging them to sell produce after harvest and buy it back whenever it is needed for consumption. In the case of oilseeds, farmers prefer to sell their oilseeds production and buy edible oil

Table 5.26. Utilization of farm produce (kg) by VLS farm households in six villages, 2001-04.

Crop	Total production	Used for own consumption	Retained or seed	Other uses	Sold in the market	Percentage of produce sold
Paddy	146890	39947	673	22427	83843	57
Wheat	69527	19001	3689	2380	44457	64
Maize	13957	3367	73	1887	8630	62
Sorghum	91700	50288	1712	3354	36346	40
Hybrid sorghum	28788	12362	117	2608	13701	48
Pearl millet	3186	955	3	120	2108	66
Finger millet	800	7	0	33	760	95
Sugarcane	839510	0	0	0	839510	100
Pigeonpea	42027	6852	1398	750	33027	79
Chickpea	2747	536	136	48	2027	74
Black gram	2317	314	105	44	1854	80
Green gram	11843	751	444	73	10575	89
Horse gram	172	7	3	150	12	7
Matki	723	326	47	17	333	46
Kulthi	233	68	32	40	93	40
Cotton	128505	0	0	50	128455	100
Chilli	7221	215	0	56	6950	96
Castor	33398	0	30	480	32888	98
Sunflower	3156	47	61	0	3048	97
Groundnut	5921	1098	188	48	4587	77
Safflower	683	33	17	0	633	93
Soybean	4283	40	0	50	4193	98
Sesamum	181	49	4	17	111	62
Vegetables	101889	1970	67	402	99450	98
Coriander	67	0	0	0	67	100
Ridge gourd	199	3	0	3	193	97
Kheera	1567	0	0	0	1567	100
Gherkin	4969	13	0	23	4933	99
Onion	57094	1237	0	467	55390	97
Fruits	16731	353	0	35	16343	98
Mango	200	17	0	0	183	92
Fodder	13967	13967	0	0	0	0
Hulga	207	34	0	0	173	84

from the market as it would be cumbersome to maintain processing facilities at home. In the case of fruits and vegetables, which are highly perishable, they have no option but to sell the produce after harvest and buy supplies whenever needed. The produce of cash crops is sold as it is not needed for home consumption.

5.7 Summary and Inferences

As hypothesized at the beginning of this chapter, cropping patterns in the VLS villages have undergone drastic changes in the last three decades. The importance of cash crops has increased in all the villages. The share of area under sole crops of foodgrains in the total area under sole crops came down from about 75% to about 35%. In intercropping systems, there was a steeper decline in the share of foodgrain crops. Cotton and cotton-based cropping systems emerged as the dominant crops in Aurepalle, Kanzara and Kinkheda. Castor and castor-based systems were the most popular crops in Dokur. Postrainy-season sorghum was the only food crop that still had a dominant share in the cropping patterns of Shirapur and Kalman. Sugarcane has emerged as an important cash crop in Shirapur while pigeonpea and pigeonpea-based intercrops were next only to postrainy-season sorghum in Kalman. Rainy-season sorghum occupies minor acreage in the Akola and Mahbubnagar villages. But since the advent of

Table 5.27. Average production, consumption and sale of farm produce by VLS households (kg per year) in six villages, 2001-04.

Crop	Production	Quantity sold	Quantity retained	Quantity retained for consumption
Paddy	336	192	144	91
Wheat	159	102	57	43
Maize	32	20	12	8
Sorghum	210	83	127	115
Hybrid sorghum	66	31	35	28
Pearl millet	7	5	2	2
Finger millet	2	2	0	0
Sugarcane	1921	1921	0	0
Pigeonpea	96	76	21	16
Chickpea	6	5	2	1
Black gram	5	4	1	1
Green gram	27	24	3	2
Horse gram	0	0	0	0
Matki	2	1	1	1
Kulthi	1	0	0	0
Cotton	294	294	0	0
Chilli	17	16	1	0
Castor	76	75	1	0
Sunflower	7	7	0	0
Groundnut	14	10	3	3
Safflower	2	1	0	0
Soybean	10	10	0	0
Sesamum	0	0	0	0
Vegetables	233	228	6	5
Coriander	0	0	0	0
Ridge gourd	0	0	0	0
Kheera	4	4	0	0
Gherkin	11	11	0	0
Onion	131	127	4	3
Fruits	38	37	1	1
Mango	0	0	0	0
Fodder	32	0	32	32
Hulga	0	0	0	0

irrigation, wheat has emerged as an important food crop in Shirapur, Kanzara and Kinkheda. Rice still remains the most important food crop in the Mahbubnagar villages. Maize gained importance in some Maharashtra villages, primarily for fodder and secondarily for food. Groundnut has lost its importance over the years and soybean has made inroads in the Akola villages. Vegetables and fruits have gained in importance in the Maharashtra villages.

Productivity levels varied across the regions and crops. Either due to better soils or irrigation support, Aurepalle recorded better yields than Dokur; Shirapur fared better than Kalman; and Kanzara performed better than Kinkheda. While the yield levels of 2001-04 were better than those of 1975-78, they are still low when compared with yields recorded in predominantly irrigated areas. Drought remains the most important constraint to crop production in the VLS villages. But pests have emerged as prominent yield reducers of crops like cotton and pigeonpea. Diseases and weeds are also important yield reducers in the Maharashtra villages. Excess rain often damaged short-duration pulses like green gram and black gram in the two Akola villages. Wild boars have become an important problem in Dokur. Progressive farmers, relatives and friends still remain the most important sources of information, particularly relating to

agronomic practices, in the VLS villages. Input dealers hold sway as sources of information relating to improved seeds and plant protection chemicals. Extension officers had a prominent role in supplying information about technology only in the Solapur villages.

The VLS households sold most of their crop produce in the market. This is true of even landless labor and small-farm households. Lack of storage facilities or the immediate need for cash may be the explanation for the postharvest disposal of produce. Only in the case of staple foods like postrainy-season sorghum in Solapur, hybrid sorghum in Akola and sorghum in Mahbubnagar is about 50% of the production retained for consumption and other uses. Almost all of the fodder produced is used for feeding livestock owned by the households. Barring staple foods, the marketed surplus in the case of foodgrains exceeded 50% of the production. About three-fourths of the pulses produced and more than four-fifths of the oilseeds output was sold in the market. In the case of commercial crops, fruits and vegetables, the marketed surplus was close to 100%. We found that households do not retain foodgrains in sufficient quantity to meet their annual requirement. This implies that they meet their later requirements through purchases from the Public Distribution System or the open market. The integration of markets and reduction in transaction costs has enabled farm households to move towards greater market orientation, and away from subsistence orientation, which used to be the dominant factor three decades ago.

Chapter 6: Economics of Crop and Livestock Enterprises

We have seen that the farmers of the six VLS villages changed their cropping patterns over time. It would be interesting to study the viability of different crop and livestock enterprises to assess whether the farmers are better off with the new crops vis à vis the old. In the context of the phenomenon of growing indebtedness and distress of farmers in Vidarbha and Telangana regions of the states of Maharashtra and Andhra Pradesh respectively, such an analysis will be of immense value in understanding the roots of distress there.

6.1 Economics of Crop Enterprises in VLS Villages

The input-output data collected from farmers were aggregated and analyzed to compute the costs and returns of different crop enterprises in the six VLS villages. This data relating to crop enterprises in Aurepalle village in Mahbubnagar district are presented in Table 6.1.

Paddy and pigeonpea were the only crops that allowed farmers in Aurepalle village to recover all their costs. The net return per acre from pigeonpea was a very low 5.6% and from paddy about 11%. The other crops allowed only recovery of the variable costs. In general, for all crops, the variable costs of production tended to exceed the fixed costs. Among the intercrops, the highest loss of 35% was recorded for the intercrop of castor + pigeonpea. Other intercropping systems returned losses of 33% (cotton + pigeonpea) and 17% (sorghum + pigeonpea). Among the sole crops, sorghum yielded the highest loss of 46%, followed by castor (30%) and cotton (12%).

Dokur fared even worse than Aurepalle (Table 6.2). Paddy was the only crop to yield a net profit, Rs 1332 per acre, or a return of 13% on the total cost of cultivation. Six other crops allowed recovery of the variable costs but not all of the fixed costs as well. The loss was lowest for cotton (2%), followed by

Table 6.1. Costs and returns (Rs acre^{-1}) of crops in Aurepalle, Mahbubnagar, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Castor	1973	1797	3770	2649	-1121
Paddy	7196	3311	10507	11667	1161
Cotton	4435	2336	6772	5992	-780
Pigeonpea	1825	1529	3354	3541	187
Sorghum	1719	1646	3365	1828	-1536
Castor + pigeonpea	2224	2118	4342	2843	-1499
Cotton + pigeonpea	2149	1708	3857	2588	-1269
Sorghum + pigeonpea	1866	1693	3559	2938	-621

Table 6.2. Costs and returns (Rs acre^{-1}) of crops in Dokur, Mahbubnagar, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Paddy	6313	3623	9936	11268	1332
Cotton	3410	1663	5073	4983	-90
Sorghum	1759	2991	4750	2091	-2659
Castor	1877	2296	4173	2641	-1532
Castor + pigeonpea	1895	2204	4099	2373	-1726
Finger millet	1755	3232	4987	2189	-2798
Fodder sorghum	2218	2617	4835	4539	-296

fodder sorghum (6%). Fixed costs exceeded variable costs for all the crops with the exception of paddy and cotton. The loss was highest (56%) for finger millet and sorghum. The loss from the castor + pigeonpea intercrop was higher (42%) than for the sole crop of castor (37%).

In recent years, some of the land in Shirapur village in Solapur district of Maharashtra has been able to access water from the Ujni project on the Bheema river for a part of the year. Due to this support, sugarcane, onion and groundnut yielded positive net returns (Table 6.3) in this village. The rate of return on the total cost of cultivation was highest for sugarcane (19%) followed by onion (15%) and groundnut (13%). Fixed costs were higher than variable costs for postrainy-season sorghum, chickpea and pigeonpea while the situation was vice versa for the other six crops. Cotton and pigeonpea performed poorly, not recovering even the variable cost. They yielded losses of 60% and 59% respectively, implying that farmers could recover only about 40% of the total cost incurred by them. The returns fell short of the total costs for the remaining four crops too. Chickpea recorded the lowest loss ratio of them, 9%. Maize, a new introduction to meet the fodder demand of milch cattle in the village, yielded a loss ratio of 30%. Postrainy-season sorghum, the major crop in Shirapur, returned a loss of 31% on the total cost of cultivation. Even wheat, which receives some irrigation support, lost 32% on the total cost.

Farmers fared much worse in Kalman than in Shirapur. Except French bean (*Phaseolus vulgaris*), none of the crops yielded a profit (Table 6.4). Just as in Shirapur, fixed costs were higher than variable costs for postrainy-season sorghum and pigeonpea, but lower for other crops. The lowest losses were recorded for groundnut (4%) and sugarcane (7%). The loss ratios were higher (18%) for maize and onion, and much higher for chickpea (36%) and wheat (40%). Even the most popular crop, postrainy-season sorghum, returned a loss of 23%. Since Kalman is not served by any surface irrigation and ground water is depleting fast, the limited irrigation

Table 6.3. Costs and returns (Rs acre^{-1}) of crop enterprises in Shirapur, Maharashtra, 2001-04.

Crop	Variable costs	Fixed costs	Total cost	Gross return	Net return
Wheat	3687	3032	6719	4547	-2171
Sugarcane	9509	4801	14311	17097	2787
Postrainy-season sorghum	2213	2775	4988	3443	-1545
Chickpea	1348	1948	3296	3010	-287
Cotton	2771	2585	5356	2155	-3201
Groundnut	4373	2692	7065	7960	895
Maize	3578	2683	6260	4386	-1875
Pigeonpea	1902	2535	4437	1823	-2614
Onion	8712	3061	11773	13529	1756

Table 6.4. Costs and returns (Rs acre^{-1}) of crop enterprises in Kalman, Maharashtra, 2001-04.

Crop	Variable costs	Fixed costs	Total cost	Gross return	Net return
Wheat	2518	1555	4074	2428	-1646
Sugarcane	8322	2148	10471	9711	-759
Postrainy-season sorghum	1431	1909	3341	2553	-787
Chickpea	2170	2017	4187	2671	-1515
Pigeonpea	1391	1730	3121	1625	-1497
Onion	4591	1753	6345	5161	-1184
Maize	2430	1700	4131	3336	-795
Groundnut	3979	1842	5821	5589	-232
French bean	1672	815	2487	4366	1879

facilities do not allow cultivation of irrigated postrainy-season crops like sugarcane, wheat and onion.

Cotton and cotton-based cropping systems yielded positive net returns in Kanzara where supplementary irrigation by canals has improved yields and incomes (Table 6.5). Moreover, villages in Akola district of Maharashtra are endowed with medium deep black soils and fairly good rainfall. The availability of irrigation facilities during the postrainy season has improved the water table as well. But availability of surface-irrigation water is contingent on reservoirs receiving inflows from their catchments and therefore uncertain. Cotton + pigeonpea intercropping gave the highest return of 22% on the total cost in Kalman, followed by cotton + green gram + pigeonpea. Both these intercropping systems performed better than sole cotton which gave a 3% return on total cost. Chillies also gave a similar rate of return. The two food crops, sorghum (mostly hybrid) and wheat, failed to return the total cost, losing 15% and 7% respectively. The loss ratio was 30% for onion. Green gram's was the worst performance (49%), possibly due to excess rains during harvest time. However, sorghum, wheat and green gram recovered variable costs.

Crop performance in Kinkheda was poorer than in Kanzara due to the problematic soils and the low income status of farmers (Table 6.6). Cotton-based intercrops yielded profits but not sole cotton. Cotton + pigeonpea + green gram turned in the best performance with a return of 27% on total costs. But cotton + pigeonpea returned only 5%. Sole cotton lost 30%. Wheat proved to be profitable in Kinkheda with a return of 7% on total costs. Rainy-season sorghum (mostly hybrid) was not profitable and lost 28%. Green gram turned out to be the most nonprofitable crop enterprise with a loss ratio of 48%. However, all the three loss-making crops, ie, cotton, sorghum and green gram, recovered their variable costs.

6.1.1 Economics of Crop Enterprises in Relation to Size of Land Holding

The resource endowments of households vary with the size of their land holding. For instance, different

Table 6.5. Costs and returns (Rs acre^{-1}) of crop enterprises in Kanzara, Maharashtra, 2001-04.

Crop	Variable costs	Fixed cost	Total cost	Gross return	Net return
Cotton + green gram + pigeonpea	2986	2102	5088	6210	1122
Cotton + pigeonpea	3178	2493	5671	6958	1287
Chilli	8032	3363	11395	11763	368
Cotton	5967	2930	8897	9137	240
Green gram	1032	1468	2500	1271	-1229
Onion	3629	1799	5428	3783	-1646
Sorghum	2370	2257	4627	3940	-687
Wheat	3748	2761	6509	6057	-452

Table 6.6. Costs and returns (Rs acre^{-1}) of crop enterprises in Kinkheda, Maharashtra, 2001-04.

Crop	Variable costs	Fixed cost	Total cost	Gross return	Net return
Wheat	2013	992	3005	3208	203
Sorghum	1628	834	2462	1780	-682
Green gram	438	411	849	442	-407
Cotton + pigeonpea + green gram	2190	1951	4141	5250	1109
Cotton	2532	1584	4116	2896	-1219
Cotton + pigeonpea	2436	1759	4195	4398	203

farm-size groups may have access to different classes of land, fertility and irrigation facilities. These differences may influence their productivity, costs of cultivation and overall profitability. In this section, we study the economics of crop enterprises in terms of the size of land holding.

Labor-dependent households operate less than 0.2 ha of land and cultivate a smaller range of crops. Since they did not invest much, the total costs of cultivation were much lower than those reported for farmers belonging to other classes of land holding. So were the gross returns (Table 6.7). The yields were poorer. The fact that labor-dependent households tend to operate marginal and less fertile lands also may be responsible for the low investment and poor returns. Wherever crops were profitable for other classes of farmers, these households reaped positive net returns too: cotton + pigeonpea in Kanzara and Kinkheda and sugarcane in Shirapur. Similarly, labor households also lost in case of crops that were not profitable to other farmers.

Small-farm households in the two VLS villages in Mahbubnagar district incurred losses on all crops, except in the case of cotton in Dokur village (Table 6.8). These households carry a high burden of fixed costs, particularly for rainfed crops. These costs were higher than variable costs for all crops except paddy and cotton in both villages and cotton + pigeonpea in Aurepalle.

While small farmers were able to recover their variable costs from all other crops, even this was not possible for castor, sorghum and sorghum + pigeonpea in Aurepalle and sorghum in Dokur. The loss ratios were higher for small farmers than for the average farmer in the two Mahbubnagar villages.

The crop performance of small-farm households was more or less comparable to the average performance in the two Solapur VLS villages (Table 6.9). In both villages, this class of households earned profits from sugarcane. They had positive net returns from onion in Shirapur and French bean in Kalman. They had higher variable costs than fixed costs in the case of irrigated crops. Dryland crops in general showed the reverse trend of fixed costs exceeding variable costs. Small farmers did not recover even their variable costs from cotton and pigeonpea in Shirapur and from groundnut in Kalman. Other crops in both villages allowed recovery of at least variable costs.

Small-farm households performed worse than the average household in the two Akola VLS villages, particularly in Kanzara. They incurred losses on

Table 6.7. Economics (Rs acre^{-1}) of crop enterprises of labor-dependent households in five VLS villages[1], 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Aurepalle					
Castor	801	1553	2354	1182	-1172
Castor + pigeonpea	453	584	1038	876	-161
Dokur					
Paddy	2295	796	3092	2389	-703
Castor	501	579	1081	810	-271
Shirapur					
Sugarcane	3308	1536	4845	7917	3072
Postrainy-season sorghum	770	1100	1870	1293	-577
Chickpea	1046	1299	2345	0	-2345
Kanzara					
Cotton + pigeonpea	862	522	1384	1475	91
Kinkheda					
Cotton + pigeonpea	736	508	1244	1427	184

1. Labor-dependent households did not grow any crops in Kalman village.

Table 6.8. Economics (Rs acre^{-1}) of crop enterprises of small-farm households in Mahbubnagar villages, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Aurepalle					
Castor	781	930	1711	243	-1468
Paddy	8183	4282	12465	10965	-1500
Cotton	5330	3649	8979	7816	-1163
Sorghum	842	1486	2328	733	-1595
Castor + pigeonpea	2203	3459	5662	3006	-2656
Cotton + pigeonpea	2385	2001	4386	3296	-1089
Sorghum + pigeonpea	1012	1969	2981	1908	-1073
Dokur					
Paddy	6175	4520	10696	9334	-1362
Cotton	957	501	1457	1960	503
Sorghum	2111	4995	7107	1702	-5405
Castor	1306	4165	5470	2015	-3455
Castor + pigeonpea	2705	3358	6063	3423	-2640
Finger millet	1755	3232	4987	2189	-2798
Fodder sorghum	380	2788	3168	560	-2608

Table 6.9. Economics (Rs acre^{-1}) of crop enterprises of small-farm households in VLS villages in Solapur, Maharashtra, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Shirapur					
Wheat	4064	3542	7606	4949	-2657
Sugarcane	9045	5304	14349	19455	5106
Postrainy-season sorghum	1921	4163	6084	3717	-2367
Chickpea	1728	2092	3819	2791	-1029
Cotton	3998	3454	7452	2689	-4763
Groundnut	4215	3117	7332	7070	-262
Maize	3919	3228	7146	5657	-1490
Pigeonpea	1690	2729	4419	1472	-2947
Onion	9650	3816	13466	15052	1586
Kalman					
Wheat	1958	1370	3328	2255	-1073
Sugarcane	7572	2192	9764	9955	191
Postrainy-season sorghum	1220	2255	3475	2488	-987
Chickpea	1983	3942	5925	2194	-3731
Pigeonpea	1331	2028	3360	1663	-1697
Onion	4963	1886	6849	5674	-1175
Maize	2311	1914	4225	3685	-540
Groundnut	3985	2639	6624	3930	-2694
French bean	1672	815	2487	4366	1879

cotton and cotton-based intercrops (Table 6.10) which, however, yielded profits to the average farmer. However, they did better with wheat by recording a small profit. Small farmers' performance was at par with that of the average farmer in Kinkheda, where they earned positive net returns with wheat and cotton-based intercrops. Variable costs were higher than fixed costs in both villages except in the case of green gram in both villages and cotton in Kinkheda. Small farmers were able to recover their variable costs in both villages except for green gram in Kinkheda.

Medium-sized farm households performed worse than the average farmer in Aurepalle but better in Dokur (Table 6.11). They earned a small profit only on cotton + pigeonpea in Aurepalle and a positive return on paddy and cotton in Dokur. Their variable costs were higher than fixed costs for all crops except pigeonpea and sorghum in Aurepalle and sorghum and castor + pigeonpea in Dokur. In case of castor, Aurepalle farmers were left with a small surplus after meeting the variable costs. Medium-sized farms had higher loss ratios in Aurepalle than those in Dokur.

In the two VLS villages in Solapur, Maharashtra, the performance of medium-sized farm households was about the same as that of the average farmer (Table 6.12). In Shirapur, only sugarcane and groundnut earned them positive net returns as did groundnut in Kalman. Their variable costs were higher than fixed costs for all crops except pigeonpea, chickpea and postrainy-season sorghum in both villages. These farmers failed to recover even their variable costs from pigeonpea in Shirapur and sugarcane, onion and maize in Kalman. Loss ratios were higher in Kalman than in Shirapur.

In the two Akola VLS villages, the performance of medium-sized farms was comparable to that of the average farmer in Kanzara but superior in Kinkheda (Table 6.13). These households got the highest profit from cotton followed by the cotton-based intercrops, cotton + green gram + pigeonpea and cotton + pigeonpea in Kanzara. In Kinkheda, positive gross returns eluded them only in the case of wheat. The ability to keep down costs was the secret of their profitability. Variable costs were lower than fixed costs for green gram, sorghum and wheat in Kanzara and cotton + pigeonpea in Kinkheda. Not even variable costs were recovered on chilli, green gram and onion in Kanzara, but in Kinkheda, all crops returned gross returns higher than variable costs.

Table 6.10. Economics (Rs acre^{-1}) of crop enterprises of small-farm households in VLS villages in Akola, Maharashtra, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Kanzara					
Cotton + green gram + pigeonpea	2791	1951	4742	4717	-25
Cotton + pigeonpea	2802	2024	4825	4277	-549
Cotton	783	470	1253	953	-301
Green gram	311	660	971	808	-163
Sorghum	2307	1433	3740	3709	-30
Wheat	1769	1549	3319	3353	34
Kinkheda					
Wheat	1678	1048	2726	3040	315
Sorghum	1875	1005	2880	1453	-1426
Green gram	414	424	838	68	-769
Cotton + green gram + pigeonpea	1629	1167	2796	3803	1007
Cotton	994	1453	2447	1333	-1114
Cotton + pigeonpea	2236	1869	4106	4389	283

Table 6.11. Economics (Rs acre^{-1}) of crop enterprises of medium-sized farm households in Mahbubnagar VLS villages, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Aurepalle					
Castor	2084	1998	4082	2742	-1340
Paddy	7566	3463	11029	10283	-746
Cotton	4529	2259	6788	6414	-374
Pigeonpea	278	868	1146	400	-746
Sorghum	1737	1794	3531	1854	-1677
Castor + pigeonpea	2064	1764	3828	3064	-764
Cotton + pigeonpea	943	456	1399	1424	25
Sorghum + pigeonpea	1784	1776	3560	3057	-503
Dokur					
Paddy	5748	3330	9078	10682	1604
Cotton	3553	2118	5671	7281	1610
Sorghum	1746	2021	3767	3462	-305
Castor	1906	1698	3604	3496	-108
Castor + pigeonpea	1139	1270	2409	1772	-637
Fodder sorghum	1678	1437	3115	2215	-900

Table 6.12. Economics (Rs acre^{-1}) of crop enterprises of medium-sized farm households in Solapur VLS villages, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Shirapur					
Wheat	3848	2433	6281	4717	-1563
Sugarcane	8023	4749	12772	16037	3265
Postrainy-season sorghum	1381	1980	3361	3024	-337
Chickpea	917	1763	2680	2408	-272
Cotton	906	765	1671	1157	-514
Groundnut	3260	1377	4638	7511	2873
Maize	3378	1591	4969	3428	-1541
Pigeonpea	2205	2535	4740	1804	-2936
Onion	7561	2290	9851	8456	-1395
Kalman					
Wheat	2188	3252	5440	2855	-2585
Sugarcane	2840	484	3324	1867	-1457
Postrainy-season sorghum	1085	1442	2527	2010	-516
Chickpea	2469	2489	4958	4287	-671
Pigeonpea	907	1688	2595	1265	-1330
Onion	4092	1641	5732	3919	-1814
Maize	1894	1189	3083	1837	-1246
Groundnut	3431	1457	4888	5993	1105

Table 6.13. Economics (Rs acre^{-1}) of crop enterprises of medium-sized farm households in Akola VLS villages, Maharashtra, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Kanzara					
Cotton + green gram + pigeonpea	3052	2389	5441	6920	1479
Cotton + pigeonpea	3659	3365	7025	8303	1278
Chilli	9202	3604	12806	6648	-6157
Cotton	5235	3767	9003	12808	3805
Green gram	485	582	1067	463	-603
Onion	3914	1907	5821	3690	-2131
Sorghum	2693	3289	5982	5132	-849
Wheat	3397	4262	7660	7210	-450
Kinkheda					
Wheat	1678	933	2611	2387	-224
Sorghum	875	293	1168	1493	325
Cotton + green gram + pigeonpea	635	470	1105	1815	710
Cotton	2636	1538	4174	4280	106
Cotton + pigeonpea	476	494	971	1172	201

Large-farm households fared slightly better than average in the two Mahbubnagar VLS villages (Table 6.14). Having better access to well irrigation, they obtained positive net returns on paddy in both villages. They also recorded a small profit on pigeonpea in Aurepalle. In Aurepalle these households' variable costs were higher than fixed costs for all crops, but in Dokur they were lower for castor, sorghum and castor + pigeonpea. Large farmers in both villages recovered at least their variable costs on all crops. Even though they failed to earn positive net returns on several crops, their

Table 6.14. Economics (Rs acre^{-1}) of crop enterprises of large-sized farm households in Mahbubnagar VLS villages, Andhra Pradesh, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Aurepalle					
Castor	1860	1458	3318	2801	-517
Paddy	6541	2927	9468	11158	1690
Cotton	4163	2037	6199	5380	-819
Pigeonpea	1901	1447	3347	3690	343
Sorghum	1368	1225	2593	1592	-1001
Castor + pigeonpea	1966	1707	3672	2678	-994
Sorghum + pigeonpea	1504	1443	2947	2422	-525
Dokur					
Paddy	6615	3511	10126	12410	2284
Cotton	2795	1320	4115	3165	-950
Sorghum	1472	2037	3510	1864	-1646
Castor	1603	1694	3297	2057	-1240
Castor + pigeonpea	1860	1912	3772	2090	-1682
Fodder sorghum	1956	1929	3885	3567	-318

loss ratios were lower than those incurred by other categories of farmers.

Large-farm households performed better than average in both Shirapur and Kalman (Table 6.15). They recorded positive net returns for sugarcane, the most important irrigated crop, as well as for postrainy-season sorghum, the most important rainfed crop in both villages. In addition, they earned profits on groundnut and onion in Shirapur and maize in Kalman. Their fixed costs were higher than variable costs for postrainy-season sorghum and pigeonpea. Only on cotton and pigeonpea in Shirapur did these farmers fail to recover their variable costs. Their loss ratios were lower.

Large-farm households turned out a very impressive performance in the two Akola VLS villages (Table 6.16). Their better resource endowment and progressive attitude seemed to have enabled them to earn positive net returns on most of the crops in both villages. In Kanzara, they recorded positive net returns on all crops except green gram and wheat. In Kinkheda, they failed to earn positive net returns from sorghum, green gram and cotton. But they earned profits on wheat and cotton-based intercrops. Variable costs in both villages were higher than fixed costs for all crops except green gram in Kanzara. In both villages, their returns on all crops were high enough to meet at least the variable costs. Cotton + pigeonpea gave the best return in Kanzara while wheat gave the highest positive net return in Kinkheda.

6.2 Annual Variations in Profitability

Climatic variations have a great influence on the performance of rainfed crops. Average productivity values may mask the year-to-year variability. In this section we discuss the profitability of the most important dryland crop in each of the six VLS villages during for the three-year period 2001-04.

6.2.1 Cotton Crop in Aurepalle

In 2003-04, cotton performed the best among all crops in Aurepalle. It recovered all costs and gave a positive net return of Rs 842 acre^{-1} (Table 6.17). Gross returns were highest (Rs 8622) in that year

Table 6.15. Economics (Rs acre^{-1}) of crop enterprises of large-farm households in Solapur VLS villages, Maharashtra, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Shirapur					
Wheat	3094	1278	4371	3725	-646
Sugarcane	6690	2118	8807	14777	5970
Postrainy-season sorghum	1334	1579	2913	3830	917
Cotton	1081	470	1551	450	-1101
Groundnut	1796	511	2306	2557	251
Maize	2034	1602	3636	3325	-311
Pigeonpea	568	832	1400	536	-864
Onion	4901	1408	6309	6625	316
Kalman					
Wheat	1558	837	2395	2040	-355
Sugarcane	2795	684	3479	5156	1677
Postrainy-season sorghum	651	932	1582	1587	5
Chickpea	1286	694	1980	1485	-495
Pigeonpea	691	1012	1703	794	-910
Onion	1082	412	1493	1300	-193
Maize	1367	936	2304	3881	1577
Groundnut	487	406	892	700	-192

Table 6.16. Economics (Rs acre^{-1}) of crop enterprises of large-farm households in Akola VLS villages, 2001-04.

Crop	Total variable costs	Total fixed costs	Total cost	Gross return	Net return
Kanzara					
Cotton + green gram + pigeonpea	1365	1185	2550	2977	427
Cotton + pigeonpea	3151	2045	5196	6966	1770
Chilli	5145	2754	7899	7988	89
Cotton	5575	2294	7869	8278	410
Green gram	1154	1607	2761	1677	-1084
Onion	3715	1476	5191	5917	725
Sorghum	3092	1514	4606	4933	327
Wheat	4157	2089	6246	5825	-421
Kinkheda					
Wheat	2371	840	3211	4299	1088
Sorghum	1463	769	2232	1097	-1135
Green gram	512	408	919	529	-390
Cotton + green gram + pigeonpea	1853	1710	3562	4603	1040
Cotton	2751	1698	4450	3478	-972
Cotton + pigeonpea	2244	2010	4253	4298	45

Table 6.17. Economics (Rs acre^{-1}) of cotton in Aurepalle, Mahbubnagar, 2001-04.

Variable	2001-02 (57[1])	2002-03 (49)	2003-04 (38)	Average
Variable costs	4883.2	3234.9	5187.9	4435
Fixed costs	2497.0	1920.2	2592.2	2336
Total cost	7380.2	5155.1	7780.1	6772
Gross return	4954.7	4398.4	8621.6	5992
Net return	-2425.5	-756.7	841.5	-780

1. Figures in parentheses are the number of plots in which the crop was grown.

and although total costs had been highest (Rs 7780) too, farmers could return a surplus. In the other two years, 2001-02 and 2002-03, farmers incurred losses on cotton cultivation. In 2001-02, gross returns were higher than in 2002-03, but costs too were much higher. Aurepalle farmers incurred a loss of Rs 2426 that year, which meant a loss ratio of 33%. In 2002-03, both costs and returns were lower because of seasonal conditions. Farmers suffered a modest loss of Rs 757 acre^{-1} in 2002-03, representing a loss ratio of 15%. But in all the three years, farmers recovered their variable costs, a condition that is essential for farmers to retain interest in cultivating a crop. In 2001-02, farmers did not get back most of their fixed costs and complained of a loss. In 2002-03, farmers did not recover about 39% of the fixed costs and yet they felt satisfied with the season. In 2003-04, when farmers made a profit, they were really happy. On an average over the three years, farmers incurred a loss of Rs 780, which translates into a loss ratio of 12%. They failed to recover about one-third of the fixed costs. Yet, they evince interest in continuing with cotton. But these average figures mask a considerable variability in the year-to-year performance of the crop.

6.2.2 Castor in Dokur

Castor is a cash crop that is very popular in Dokur (Table 6.18). Its average performance during 2001-04 was not good with an average loss of Rs 1532 acre^{-1}. Nearly two-thirds of the fixed costs went unrecovered. Although farmers are not happy with its performance, they persist with castor because of

Table 6.18. Economics (Rs acre^{-1}) of castor in Dokur, Mahbubnagar, 2001-04.				
Variable	2001-02 (11[1])	2002-03 (7)	2003-04 (17)	Average
Variable costs	1654.1	2196.7	1779.5	1877
Fixed costs	3112.2	1144.1	2632.2	2296
Total cost	4766.3	3340.8	4411.7	4173
Gross return	1249.9	4034.0	2640.1	2641
Net return	-3516.4	693.2	-1771.6	-1532

1. Figures in parentheses are the number of plots on which the crop was grown.

the lack of a better alternative. But these average performance figures conceal a lot of variability from year to year. Farmers made a profit on castor only in 2002-03, the year in which both costs and returns were highest. Farmers made a profit of Rs 693 acre^{-1}, a gain ratio of 21% on the total cost. Crop performance was moderate in 2003-04 when gross returns were high enough to recover the variable costs. But nearly two-thirds of the fixed costs went unrecovered. Castor performed its worst in 2001-02 when gross returns fell short of even variable costs. The loss ratio was nearly 74% on the total investment. So farmers considered 2001-02 a disastrous year.

The year 2001-02 was the worst year for cotton in Aurepalle and castor in Dokur. But due to differences in rainfall distribution between the two villages, cotton gave an average performance in 2002-03 and its best performance in 2003-04, while castor turned out a good performance in 2002-03 but a mediocre one in 2003-04.

6.2.3 Groundnut in Shirapur

Although it is not a major crop in Shirapur, groundnut is a rainfed crop that sometimes receives protective irrigation (Table 6.19). Its average performance during 2001-04 was good with a positive net return of Rs 895 acre^{-1}. It performed best in 2002-03 with a gain ratio of nearly 84% on the investment. It performed moderately in 2001-02 with a gain ratio of 7% after all costs. But in 2003-04, a lone farmer grew it and failed to recover even his variable costs. The loss ratio was as high as 63%. Such tremendous year-to-year variability is hidden behind average performance figures.

6.2.4 Postrainy-season Sorghum in Kalman

Postrainy-season sorghum is the most important rainfed crop in Kalman (Table 6.20). Comparison of cropping patterns between 1975-76 and 2001-04 has shown that postrainy-season sorghum continues to account for the lion's share of the cropped area in both Kalman and Shirapur. This is perhaps because of the lack of a better alternative. This is a crop for which variable costs are much lower than fixed costs. On an average, gross returns from the crop were high enough to pay for the variable costs and a part of the fixed costs. The loss ratio was about 24% of the total cost. About 41% of the fixed costs were not recovered. Although this crop reported losses in all three years, the degree of loss varied and in all three years, variable costs were recovered. In 2001-02, farmers were able to recover nearly 90% of the fixed costs as well. The loss ratio on total investment was only 5%. In 2003-04, farmers

Table 6.19. Economics (Rs acre^{-1}) of groundnut in Shirapur, 2001-04.				
Variable	2001-02 (4[1])	2002-03 (8)	2003-04 (1)	Average
Variable costs	4520.4	4948.7	3650.0	4373
Fixed costs	1975.5	2871.0	3229.6	2692
Total cost	6495.9	7819.7	6879.6	7065
Gross return	6936.6	14422.8	2520.0	7960
Net return	440.7	6603.1	-4359.6	895

1. Figures in parentheses are the number of plots on which the crop was grown.

Table 6.20. Economics (Rs acre^{-1}) of postrainy-season sorghum in Kalman, 2001-04.				
Variable	2001-02 (107[1])	2002-03 (54)	2003-04 (71)	Average
Variable costs	1838.1	1631.2	824.1	1431
Fixed costs	1918.0	1888.8	1921.4	1909
Total cost	3756.1	3520.0	2745.5	3341
Gross return	3559.8	2126.3	1973.9	2553
Net return	-196.3	-1393.7	-771.6	-787

1. Figures in parentheses are the number of plots on which the crop was grown.

suffered a loss ratio of 28% on total investment and were unable to recover about 40% of the fixed costs. In 2003-04, sorghum's performance was disastrous and farmers incurred a loss of Rs 1394 acre^{-1}. The loss ratio was nearly 40% on total investment. About 74% of the fixed costs could not be recovered.

6.2.5 Rainy-season Sorghum in Kanzara

In Kanzara, cotton and cotton-based intercrops were found to be profitable while sorghum and wheat were noneconomical. The performance of sorghum (rainy-season) during 2001-04 is presented in Table 6.21 to illustrate year-to-year variability in profitability. The average performance of rainy-season sorghum during the three-year period was not very good with a negative return of Rs 687 acre^{-1} and a loss ratio of 15%. Nearly 30% of the fixed costs could not be recovered, considering the three-year average. However, variable costs were recovered in each of the three cropping years. The crop performed well in 2003-04, giving a net profit of Rs 472 acre^{-1} at a gain ratio of 9%. Its performance in 2001-02 was moderate with a net loss of Rs 962 acre^{-1}. That year, farmers recovered variable costs but not 49% of the fixed costs. The performance of rainy-season sorghum was disastrous in 2002-03 when the loss was Rs 1571 acre^{-1}. As much as 80% of the fixed costs could not be recovered.

6.2.6 Cotton + Pigeonpea in Kinkheda

The year-to-year variability of cotton + pigeonpea in Kinkheda is presented in Table 6.22. In this case, the average performance of the crop was positive with a gain ratio of 5% after meeting all costs. But there was considerable year-to-year variability with profits fluctuating from Rs 29 acre^{-1} in 2001-02 to Rs 450 acre^{-1} in 2003-04. The gain ratio varied from 1% in 2001-02 to 3% in 2002-03 and 11% in 2003-04.

6.3 Distribution of Returns from Plots in VLS Villages

Average data can be misleading if there is considerable variation between plots. Table 6.23 gives the distribution of plots in relation to the recovery of costs in Aurepalle in respect of several crops. In the case of paddy, only 19 plots belonging to 10 farmers failed to recover their variable costs. Another 66, belonging to 39 farmers, recovered their variable costs but not fixed costs. In 72 plots (nearly 45%) belonging to 44 farmers, all costs were recovered and some surplus earned. Apart from paddy, cotton was the only crop that gave a net profit in about a third of the total plots. In another 30% of the plots, at least variable costs were recovered. But in the remaining 37%, not even variable costs were recovered. As for the other

Table 6.21. Economics (Rs acre^{-1}) of rainy season-sorghum in Kanzara, 2001-04.				
Variable	2001-02 (11[1])	2002-03 (8)	2003-04 (12)	Average
Variable costs	2485.6	2227.9	2396.0	2370
Fixed costs	1971.8	1957.9	2842.6	2257
Total cost	4457.4	4185.8	5238.6	4627
Gross return	3495.6	2615.3	5710.4	3940
Net return	-961.8	-1570.5	471.8	-687

1. Figures in parentheses are the number of plots on which the crop was grown.

Table 6.22. Economics (Rs acre^{-1}) of cotton + pigeonpea in Kinkheda, 2001-04.

Variable	2001-02 (9[1])	2002-03 (10)	2003-04 (18)	Average
Variable costs	2427.8	2906.0	1973.4	2436
Fixed costs	1871.2	1352.3	2054.6	1759
Total cost	4299.0	4258.3	4028.0	4195
Gross return	4328.0	4388.6	4478.3	4398
Net return	29.0	130.3	450.3	203

1. Figures in parentheses are the number of plots on which the crop was grown.

Table 6.23. Distribution of plots according to returns in Aurepalle, 2001-04.

	Number of plots			
Crop	Total	<VC[1]	>VC and <TC[2]	>TC
Castor	52 (47[3])	20 (19)	26 (24)	6 (4)
Paddy	157 (93)	19 (10)	66 (39)	72 (44)
Cotton	144 (122)	56 (47)	39 (32)	49 (43)
Pigeonpea	10 (10)	2 (2)	3 (3)	5 (5)
Sorghum	51 (50)	36 (35)	12 (12)	3 (3)
Castor + pigeonpea	88 (83)	37 (35)	42 (41)	9 (7)
Cotton + pigeonpea	6 (6)	3 (3)	1 (1)	2 (2)
Sorghum + pigeonpea	31 (31)	15 (15)	16 (16)	-
Total	539 (442)	188 (166)	205 (168)	146 (108)

1. VC = Variable costs.
2. TC = Total costs.
3. Figures in parentheses are the number of farmers.

crops, which were predominantly rainfed, farmers recovered all costs in only 25 out of 238 plots, implying that farmers incurred losses in 90% of the plots. In 113 out of 238 plots, these crops failed to give back even the variable costs. These figures suggest that rainfed crops are unable to recover even the paid-out costs in about 50% of the plots. Both the two major crops, castor and sorghum, returned only losses to farmers.

In general, crop performance was poorer in Dokur than in Aurepalle (Table 6.24). Paddy gave positive net returns in about 50% of the plots in this village. Similarly, about a third of the plots under fodder sorghum, a quarter of the plots under cotton and about one-fifth of the plots under castor yielded positive returns. In the case of the other crops, only 6 out of 74 plots did so. About 50% (33) of the plots failed to recover variable costs. The remaining 35 plots could not recover the fixed costs. These figures reflect the economic nonviability of rainfed crops in Dokur.

In Shirapur, sugarcane and groundnut were the only crops which yielded positive net returns in more than 50% of the plots (Table 6.25). Onion gave positive net returns in about 30% of the plots, while chickpea yielded profits in 25%. Even wheat and maize, which receive protective irrigation, returned profits in less than 20% of the plots. The major crop in this village, postrainy-season sorghum, gave positive returns in only 13% of the plots. In the case of pigeonpea, this proportion fell further to 10%. Farmers did not recover their variable costs in about 49% of the plots, and in another 30%, variable costs were recovered but not fixed costs. Only 21% of the plots yielded a profit.

Crop performance was even poorer in Kalman, a village beset by acute water shortage. Variable costs were not recovered in 60% of the plots (Table 6.26). In another 24% of the plots, variable costs were recovered but not the fixed costs. Profits were made only in 16% of the plots. Among the crops, French bean turned in the best performance with profits earned in 3 out of 4 plots. Sugarcane yielded profits

Table 6.24. Distribution of plots according to returns in Dokur, 2001-04.

Crop	Number of plots			
	Total	<VC[1]	>VC and <TC[2]	>TC
Paddy	67 (47[3])	10 (7)	20 (11)	37 (29)
Cotton	7 (7)	1 (1)	4 (4)	2 (2)
Sorghum	23 (22)	12 (12)	9 (8)	2 (2)
Castor	35 (32)	15 (14)	13 (12)	7 (6)
Castor + pigeonpea	39 (38)	16 (15)	20 (20)	3 (3)
Finger millet	6 (6)	1 (1)	4 (4)	1 (1)
Fodder sorghum	12 (11)	4 (4)	4 (3)	4 (4)
Sorghum + pigeonpea	4 (4)	2 (2)	2 (2)	-
Pigeonpea	2 (2)	2 (2)	-	-
Total	195 (169)	63 (58)	76 (64)	56 (47)

1. VC = Variable costs.
2. TC = Total costs.
3. Figures in parentheses are the number of farmers.

Table 6.25. Distribution of plots according to returns in Shirapur, 2001-04.

Crop	Number of plots			
	Total	<VC[1]	>VC and <TC[2]	>TC
Wheat	49 (46[3])	18 (16)	22 (21)	9 (9)
Sugarcane	41 (37)	8 (7)	12 (11)	21 (19)
Sorghum	206 (156)	114 (81)	65 (60)	27 (15)
Chickpea	12 (12)	7 (7)	2 (2)	3 (3)
Cotton	7 (7)	6 (6)	-	1 (1)
Groundnut	13 (13)	2 (2)	2 (2)	9 (9)
Maize	43 (37)	25 (23)	10 (7)	8 (7)
Pigeonpea	40 (38)	23 (22)	13 (13)	4 (3)
Onion	23 (22)	10 (10)	5 (5)	8 (7)
Total	434 (368)	213 (174)	131 (121)	90 (73)

1. VC = Variable costs.
2. TC = Total costs.
3. Figures in parentheses are the number of farmers.

in more than 50% of the plots, groundnut in 30% and onion in about 25% of the plots. The proportion of profit-yielding plots was even less (20%) for maize. The major crop in this village, postrainy-season sorghum, turned in a profit in only 16% of the plots. Only 10 out of the 138 plots sown to pulses recorded a positive net return.

Among the six VLS villages, Kanzara gave the best performance, with 36% of the plots yielding positive net returns (Table 6.27). But even here, farmers did not recover variable costs in 34% of the plots. In the remaining 30%, they got back their variable costs but not fixed costs. The vegetable crops, brinjal (*Solanum melongena* L) and onion gave profits in 50% of the plots while cotton intercropped with pigeonpea and green gram returned a profit in 56%. Wheat yielded a profit in 44% of the plots while the other food crop, sorghum (hybrid) was profitable in 25%. Sole cotton was profitable in 40% of the plots and cotton + pigeonpea in 27%. The unusual intercropping of cotton + sorghum + pigeonpea was grown in only four plots but yielded a profit in two of them. Minor crops like chilli and green gram were among the least profitable crops.

Table 6.26. Distribution of plots according to returns in Kalman, 2001-04.

Crop	Number of plots			
	Total	<VC[1]	>VC and <TC[2]	>TC
Wheat	26 (25[3])	16 (16)	6 (5)	4 (4)
Sugarcane	12 (10)	4 (3)	1 (0)	7 (7)
Sorghum	232 (162)	139 (91)	57 (47)	36 (24)
Chickpea	28 (27)	12 (11)	12 (12)	4 (4)
Pigeonpea	110 (91)	76 (61)	28 (26)	6 (4)
Onion	33 (31)	22 (20)	3 (3)	8 (8)
Maize	30 (29)	17 (17)	7 (6)	6 (6)
Groundnut	27 (26)	15 (15)	4 (4)	8 (7)
French bean	4 (4)	1 (1)	-	3 (3)
Black gram	4 (4)	2 (2)	2 (2)	-
Chilli	4 (4)	2 (2)	2 (2)	-
Total	510 (413)	306 (239)	122 (107)	82 (67)

1. VC = Variable costs.
2. TC = Total costs.
3. Figures in parentheses are the number of farmers.

Table 6.27. Distribution of plots according to returns in Kanzara, 2001-04.

Crop	Number of plots			
	Total	<VC[1]	>VC and <TC[2]	>TC
Cotton + green gram + pigeonpea	25 (25[3])	3 (3)	8 (8)	14 (14)
Cotton + pigeonpea	70 (53)	32 (25)	19 (15)	19 (13)
Chilli	16 (14)	11 (9)	2 (2)	3 (3)
Cotton	47 (28)	18 (11)	10 (6)	19 (11)
Green gram	6 (6)	2 (2)	3 (3)	1 (1)
Onion	6 (6)	3 (3)	-	3 (3)
Sorghum	31 (30)	7 (7)	16 (15)	8 (8)
Wheat	55 (45)	13 (10)	18 (13)	24 (22)
Cotton + pigeonpea + sorghum	4 (4)	-	2 (2)	2 (2)
Brinjal	4 (3)	2 (2)	-	2 (1)
Total	264 (214)	91 (72)	78 (64)	95 (78)

1. VC = Variable costs.
2. TC = Total costs.
3. Figures in parentheses are the number of farmers.

Crop performance in Kinkheda was nearly the same as in Kanzara (Table 6.28). Profits were earned in 35% of the plots. Variable costs were not recovered in about 30% of the plots and a part of the fixed costs were not recoverable in the remaining 32% although variable costs were realized. Cotton + pigeonpea + green gram yielded profits in 50% of the plots. Wheat gave the next best performance with 47% of the plots returning a profit. Some 40% of the plots under sole cotton gave a positive net return. Cotton + pigeonpea intercrop gave profits in 32% of the plots. Only a quarter of the plots under sorghum gave profits. Green gram yielded profits in none of the plots.

Table 6.28. Distribution of plots according to returns in Kinkheda, 2001-04.

Crop	Number of plots			
	Total	<VC[1]	>VC and <TC[2]	>TC
Wheat	19 (18[3])	4 (4)	6 (6)	9 (8)
Sorghum	8 (8)	6 (6)	-	2 (2)
Green gram	8 (5)	3 (2)	5 (3)	-
Cotton + green gram + pigeonpea	12 (12)	2(2)	4 (4)	6 (6)
Cotton	20 (15)	8 (6)	5 (4)	7 (5)
Cotton + pigeonpea	37 (33)	12 (11)	13 (12)	12 (10)
Cotton + pigeonpea + sorghum	2 (2)	-	1 (1)	1 (1)
Total	106 (93)	35 (31)	34 (30)	37 (32)

1. VC = Variable costs.
2. TC = Total costs.
3. Figures in parentheses are the number of farmers.

6.4 Crop Economics of VLS Villages as Per Farm Management Concepts

Farm management studies in India compute the cost of production, using different concepts such as A1 (owner's out-of-pocket expenses), A2 (tenant's cost), B (sum of the rental value of land and interest on fixed capital) and C (including the imputed value of family labor). Cost C has been made more comprehensive by adding the transportation cost. The bulk line cost, which takes care of the interests of 85% of farmers or production, is used for computation of the minimum support price. Although minimum support prices in India are announced for about two dozen commodities, they are backed up by procurement (purchase by state agencies) of only wheat and rice and that too only in select areas with maximum marketed surplus. It is quite common for market prices, especially of rainfed crops, to fall below the minimum support prices. Due to high land prices, which have no relation with productivity, imputed rental values of land are quite often very high. When rental values are considered, many crops tend to be nonprofitable. In this section, we consider both net returns (above Cost C) as well as returns to land and management (by omitting the imputed rental value of land from the cost).

When the rental value of land was included as a cost, many of the crops returned losses. But if the rental value of land is excluded from the total costs, returns to land and management are arrived at. This was the concept used by the first generation of Village Level Studies. Using the same concept, returns to land and management were computed for different crops grown in the six VLS villages in this study. When the net returns concept was used, only paddy and pigeonpea reported profits in Aurepalle (Table 6.29). But when it was substituted by the concept of returns to land and management, cotton and sorghum + pigeonpea also emerged as profitable crops. Also, the loss ratios of other crops, castor, castor + pigeonpea, sorghum and cotton + pigeonpea decreased. As can be expected, the profit levels of paddy and pigeonpea increased.

In Dokur, paddy was the only crop to yield positive net returns (Table 6.30). But when the concept of returns to land and management was used, cotton and fodder sorghum too turned profitable. Castor and castor + pigeonpea, both important rainfed crops, continued to return losses, although at a lower level. The loss ratios of sorghum and finger millet still ruled high, at 43% and 44% respectively.

Table 6.31 presents the crop economics of Shirapur village as per farm management concepts. The irrigated crops, sugarcane, groundnut and onion, were profitable as per the net returns concept. When the returns to land and management concept was

used, the profit levels of these three crops increased further and chickpea too reported a profit. Important food crops like wheat, postrainy-season sorghum, maize and pigeonpea as well as the commercial crop, cotton, continued to be nonprofitable, albeit at lower loss ratios.

In Kalman, when the net returns concept was used, French bean was the only profitable crop (Table 6.32). But under the returns to land and management concept, sugarcane and groundnut too turned out to be profitable. The losses of maize and postrainy sorghum were quite marginal while they were moderate for wheat, chickpea, pigeonpea and onion.

Cotton, cotton-based intercrops and chilli were the crops with positive net returns in Kanzara (Table 6.33). But when the concept of returns to land and management was applied, all crops turned out to

Table 6.29. Crop economics (Rs acre^{-1}) as per farm management concepts in Aurepalle, 2001-04.

Crop	Total cost	Gross return	Net return	Returns to land and management
Castor	3770	2649	-1121	-386
Paddy	10507	11667	1161	2920
Cotton	6772	5992	-780	55
Pigeonpea	3354	3541	187	837
Sorghum	3365	1828	-1536	-997
Castor + pigeonpea	4342	2843	-1499	-819
Cotton + pigeonpea	3857	2588	-1269	-444
Sorghum + pigeonpea	3559	2938	-621	29

Table 6.30. Crop economics (Rs acre^{-1}) as per farm management concepts in Dokur, 2001-04.

Crop	Total cost	Gross return	Net return	Returns to land and management
Paddy	9936	11268	1332	2832
Cotton	5073	4983	-90	760
Sorghum	4750	2091	-2659	-2059
Castor	4173	2641	-1532	-782
Castor + pigeonpea	4099	2373	-1726	-1066
Finger millet	4987	2189	-2798	-2198
Fodder sorghum	4835	4539	-296	304

Table 6.31. Crop economics (Rs acre^{-1}) as per farm management concepts in Shirapur, 2001-04.

Crop	Total cost	Gross return	Net return	Returns to land and management
Wheat	6719	4547	-2171	-857
Sugarcane	14311	17097	2787	4586
Postrainy-season sorghum	4988	3443	-1545	-610
Chickpea	3296	3010	-287	1139
Cotton	5356	2155	-3201	-2101
Groundnut	7065	7960	895	2130
Maize	6260	4386	-1875	-1004
Pigeonpea	4437	1823	-2614	-1814
Onion	11773	13529	1756	2856

Table 6.32. Crop economics (Rs acre^{-1}) as per farm management concepts in Kalman, 2001-04.

Crop	Total cost	Gross return	Net return	Returns to land and management
Wheat	4074	2428	-1646	-696
Sugarcane	10471	9711	-759	400
Postrainy-season sorghum	3341	2553	-787	-118
Chickpea	4187	2671	-1515	-766
Pigeonpea	3121	1625	-1497	-796
Onion	6345	5161	-1184	-234
Maize	4131	3336	-795	-75
Groundnut	5821	5589	-232	693
French bean	2487	4366	1879	3079

Table 6.33. Crop economics (Rs acre^{-1}) as per farm management concepts in Kanzara, 2001-04.

Crop	Total cost	Gross return	Net return	Returns to land and management
Cotton + green gram + pigeonpea	5088	6210	1122	2197
Cotton + pigeonpea	5671	6958	1287	2437
Chilli	11395	11763	368	1928
Cotton	8897	9137	240	1590
Green gram	2500	1271	-1229	21
Onion	5428	3783	-1646	-145
Sorghum	4627	3940	-687	288
Wheat	6509	6057	-452	648

be profitable with the exception of onion, which recorded a marginal loss. The profit ratios increased substantially for cotton, chilli and cotton-based intercrops.

In Kinkheda, only wheat and cotton-based intercrops had positive net returns (Table 6.34). But when the rental value of land was left out of the computation, green gram too emerged profitable. The loss from sorghum was quite marginal but the loss ratio of sole cotton still exceeded 10%. Cotton + pigeonpea + green gram gave the best profit ratio followed by wheat, green gram and cotton + pigeonpea.

6.5 Comparison of Crop Economics of 1975-78 and 2001-04

Using the concept of returns to land and management, the profits (or losses) made by farmers in the six VLS villages were computed on the basis of the average cropping patterns followed during 2001-04. In this section we compare these results with the crop incomes reported for the 1975-78 period (Singh et al. 1982).

Annual net crop income was positive for all the six VLS villages during the base period (1975-78) but negative for two of them during 2001-04 (Table 6.35). The biggest losses were reported in Kalman followed by Dokur where water scarcity was most severe. Aurepalle and Shirapur reported positive figures during 2001-04 but the profits in absolute terms were lower than what they were for the base period. Kanzara and Kinkheda were the only villages where net crop income during 2001-04 was higher in absolute terms. But in real terms they too had lower crop incomes in 2001-04. These figures reveal dwindling of agricultural income with a characteristic shift from a profit-making to a loss-making scenario.

Table 6.34. Crop economics (Rs acre^{-1}) as per farm management concepts in Kinkheda, 2001-04.

Crop	Total cost	Gross return	Net return	Returns to land and management
Wheat	3005	3208	203	1103
Sorghum	2462	1780	-682	-7
Green gram	849	442	-407	393
Cotton + pigeonpea + green gram	4141	5250	1109	2009
Cotton	4116	2896	-1219	-470
Cotton + pigeonpea	4195	4398	203	1073

Table 6.35. Annual net crop incomes (Rs) of farm households in six VLS villages during 1975-78 and 2001-04.

Village	1975-78	2001-04
Aurepalle	1145	534
Dokur	1368	-193
Shirapur	1234	613
Kalman	907	-934
Kanzara	2059	6958
Kinkheda	1243	1399
Average	1326	1396

6.6 Economics of Milk Production in VLS Villages

Livestock are believed to have an income-smoothening role in rainfed areas. But we observed that the number of cattle and buffaloes maintained by an average household has declined over the years. One of the reasons for this could be the increase in fodder and labor costs. On the other hand, demand for milk has been increasing and rural areas are becoming better connected to markets. In such a scenario, an analysis of the costs and returns of milk production would be useful in assessing the role of livestock in the economy of farm households. However, data constraints limit us to computing only the variable costs of milk production and reporting returns over variable costs. These data are furnished in Table 6.36 for buffaloes and cows separately in the six VLS villages.

In Andhra Pradesh, buffaloes are the more common sources of milk production, while cows are more common in Maharashtra. Returns from buffaloes exceeded variable costs in both AP villages, while returns from cows did not cover the variable costs in Aurepalle. Dokur had higher returns per buffalo than Aurepalle. Kanzara stood out among the six villages with the highest return per buffalo. Returns from buffaloes and cows were high enough to cover

Table 6.36. Economics of milk production in VLS villages, 2001-04.

	Buffaloes			Cows		
Village	No.	Returns over variable costs (Rs)	Income per animal (Rs)	No.	Returns over variable costs (Rs)	Income per animal (Rs)
Aurepalle	115	61413	534	61	-21442	-352
Dokur	147	153095	1041	1	1267	1267
Total of AP villages	262	214508	819	62	-20175	-325
Shirapur	168	162421	967	152	279338	1834
Kalman	114	95802	840	65	23037	354
Kanzara	10	16803	1680	123	29481	240
Kinkheda	13	21557	1658	49	-2795	-57
Total of Maharashtra villages	305	296583	972	389	329061	846
Total of VLS villages	567	511091	901	451	308886	685

all variable costs in the four Maharashtra villages with the exceptional case being cows in Kinkheda. In Maharashtra too, buffaloes provided better returns than cows except in Shirapur. Even though returns from cows fall short of variable costs, farmers seem to keep them in the hope of getting draft animals from them. Returns over variable costs per animal are quite low, even for buffaloes, and may turn negative if fixed costs such as interest on capital, depreciation (sometimes, appreciation) and other fixed costs are taken into consideration. Thus, the economics of milk production seems to be no better than the economics of crop production in the VLS villages. With common property resources shrinking and labor costs increasing, rearing milch animals is fast becoming nonviable.

6.7 Economics of Maintaining Draft Animals

Tractorization has been taking place in SAT villages, albeit slowly. The practice of custom hiring has made tractors accessible even to small farmers. As a result, farmers are tending to keep fewer draft animals. Table 6.37 presents the economics of maintaining draft animals in the VLS villages. The cost of maintenance of a pair of bullocks was relatively lower in Akola villages (perhaps due to abundance of fodder and low fodder prices) and much higher in Solapur villages, with the Mahbubnagar villages falling between these two extremities. The income earned by the sample households by giving out their bullocks on hire and in terms of the value of manure was substantial in Shirapur. The bullocks were worked for more than 45 days in a year in the Maharashtra villages. At the other extreme, the number of days on which the bullocks worked on their own farm was quite low in the Mahbubnagar villages. In fact, it turned out that an owner of bullocks in Dokur was spending about the same amount on maintenance of bullocks as hire charges. In the two Akola villages, farmers incurred very low maintenance cost for work done on their own farms. In the Solapur villages, the cost of maintenance of bullocks for own-farm work was about two-thirds of the hire charges paid (Rs 150 per day).

6.8 Economics of Small Ruminants in VLS Villages

Sheep and goats are reared commonly in dryland areas as a means of earning supplementary income. Also, it is an important caste occupation in the Mahbubnagar VLS villages. The costs of rearing sheep and goats and the returns from them are given in Table 6.38.

Table 6.37. Economics (Rs per pair of bullocks) of maintenance of draft animals in VLS villages, 2001-04.

Village	Total cost of maintenance per year (Rs)	Income from manure and hiring out (Rs)	Cost of maintenance for own-farm work (Rs)	No. of days worked on own farm	Average cost of maintenance for own-farm work (Rs)
Aurepalle	5489	2174	3315	41	81
Dokur	5471	2890	2581	28	92
Shirapur	10472	5789	4683	45	104
Kalman	7803	2918	4885	54	90
Kanzara	4769	1965	2804	58	48
Kinkheda	3106	2118	988	46	21

Table 6.38. Economics of small ruminants in VLS villages, 2001-04.

Village	Number of sheep and goats	Gross income from sheep and goats (Rs)	Expenditure on sheep and goats (Rs)	Net income (Rs)	
				Total	Per animal
Aurepalle	266	203675	102955	100720	379
Dokur	302	228604	123858	104746	347
Shirapur	87	67775	41906	25869	297
Kalman	128	89581	49488	40093	313
Kanzara	53	81451	26831	54620	1031
Kinkheda	7	3901	1252	2649	378

The number of small ruminants reared and the net income earned thereby was substantial in Aurepalle and Dokur. This enterprise was less common in the two Solapur villages than in Mahbubnagar, but it provided farmers good net income there too. The numbers reared were much fewer in the Akola villages, much less in Kinkheda than in Kanzara. However, income per small ruminant was highest (Rs 1031) in Kanzara. The success of goatery in Kanzara is attracting the attention of farmers there. Net income per animal was lowest in Shirapur.

It can be summarized that rearing of buffaloes was more profitable in the Maharashtra villages. The maintenance of draft animals and small ruminants was profitable in Kanzara and Aurepalle. In fact, all livestock enterprises were profitable in Kanzara, particularly rearing of milch animals.

6.9 Economics of Rearing Young Stock

When young stock is reared, costs will be incurred. As they grow, they appreciate in value. Some of the stock is sold and income earned. Some income is also earned from manure. Yet, during the growing up phase of the stock, costs far outweigh income. The economics of rearing young stock are summarized in Table 6.39.

Both expenditure as well as income from young stock was highest in Shirapur because of the crossbred cows raised by farmers in the village. The cost of rearing a young animal was highest in the Solapur villages (Rs 1397 in Shirapur and Rs 520 in Kalman), moderate in Kinkheda (Rs 379) and Aurepalle (Rs 338) and lowest in Kanzara (Rs 119) and Dokur (Rs 168). These figures reflect the differences in the quality of young stock and the ability of farmers to invest in young stock.

6.10 Economics of Livestock in Relation to Farm-size Group

In this section, we assess the economics of rearing livestock by different farm-size categories after aggregating the costs and returns from such enterprises over the six VLS villages. The economics of livestock rearing by labor-dependent households is presented in Table 6.40.

Since labor households do not hire labor, their maintenance costs tend to be lower. These households achieved a positive income per animal from all types of livestock except draft animals. Their profit from buffaloes was better than from cows. But they incurred losses on rearing draft animals because they did not own land and therefore could not engage draft animals on their own farms. They depended exclusively on the rental market and incurred losses because of their inability to hire out draft animals for a sufficient number of days. They earned reasonably good profits from small ruminants too. Unlike land-owning households, they made a profit even from young stock. This is

Table 6.40. Economics of livestock rearing by labor households, 2001-04.

Livestock type	Number	Returns over variable costs (Rs)	Income per animal[1] (Rs)
Buffaloes	29	17064	588
Cows	40	22080	552
Draft animals	Per pair	-1404	-1404
Small ruminants	187	22873	122
Young stock	34	2549	75

1. In the case of draft animals, income per pair was calculated.

Table 6.39. Economics of rearing young livestock in VLS villages, 2001-04.

Village	No. of young stock	Income from young stock (Rs)	Expenditure on young stock (Rs)	Net income on young stock (Rs)	Investment per young animal (Rs)
Aurepalle	100	5788	39595	-33807	338
Dokur	118	9095	28870	-19775	168
Shirapur	152	171170	383441	-212271	1397
Kalman	125	29745	94794	-65049	520
Kanzara	120	18312	32590	-14278	119
Kinkheda	49	6927	25481	-18554	379

Table 6.41. Economics of livestock rearing by small-farm households.

Livestock type	Number	Returns over variable costs (Rs)	Income per animal[1] (Rs)
Buffaloes	170	144494	850
Cows	163	186368	1143
Draft animals	Per pair	228	228
Small ruminants	971	70563	73
Young stock	227	-318623	-1404

1. In the case of draft animals, income per pair was calculated.

because they sell the stock as soon as they are in demand and try to make a profit. Also, they are not constrained by the need to keep young stock in order to have draft animals or milch cows in future.

Small-farm households also did well with their livestock enterprises (Table 6.41). They got a substantial profit per animal, both for buffaloes and cows, mainly because they keep their costs low and achieve better productivity through direct personal supervision and also because they keep milch animals. They realized only a marginal benefit from a pair of draft animals because they could not utilize them for the maximum number of days. Because of the small sizes of their farms, use of bullocks on their own farm is limited. Profits from rearing of small ruminants were lower for this household class due to lack of personal supervision and use of labor. They incurred a loss of Rs 1404 per young animal which is actually an investment for raising future draft or milch animals.

Of all the farm-size groups in this study, medium farmers realized the best returns from livestock enterprises (Table 6.42). They got better profits from buffaloes than cows. Since they could use their bullocks for a sufficient number of days, either on their own farms or leasing them to others, they got reasonable profits from draft animals too. Second only to small-farm households, their profits from small ruminants were appreciable. Their investment on young stock was lower at Rs 167 per animal.

Table 6.42. Economics of livestock rearing by medium-sized farm households.

Livestock type	Number	Returns over variable costs (Rs)	Income per animal[1] (Rs)
Buffaloes	209	187358	896
Cows	169	67463	399
Draft animals	Per pair	254	254
Small ruminants	800	75905	95
Young stock	247	-41295	-167

1. In the case of draft animals, income per pair was calculated.

Large-farm households earned substantial profits from rearing milch animals (Table 6.43). Because of their large holdings, they could optimally use their draft animals and earned a good surplus from owning them. They recorded only modest profits from rearing small ruminants. Their loss due to maintenance of young stock was the lowest for all farm-size groups, mainly because of the economies of scale.

Table 6.43. Economics of livestock rearing by large-farm households.

Livestock type	Number	Returns over variable costs (Rs)	Income per animal[1] (Rs)
Buffaloes	158	162175	1026
Cows	81	32974	407
Draft animals	Per pair	494	494
Small ruminants	1415	159354	113
Young stock	157	-6364	-41

1. In the case of draft animals, income per pair was calculated.

6.11 Net Income from Livestock

Data on farm households' combined expenditure on and income from all types of livestock in the six VLS villages are presented in Table 6.44.

Net income per household was highest in Kanzara followed by Shirapur and Dokur. In Shirapur, crossbred cows were the major sources of income, while both buffaloes and cows contributed to the income in Kanzara and Kalman. Sheep and buffaloes contributed to the income in Dokur. Income from livestock was relatively lower in Aurepalle, and decidedly loss-causing in Kinkheda.

Returns over variable costs from different livestock enterprises were positive for all four farm-size groups (Table 6.45), with per-household income consistently increasing with the size of land holding. The average income from livestock enterprises was

Table 6.44. Net income (Rs) per household from livestock.

Village	Total income	Total expenditure	Total net income	Net income per household
Aurepalle	759977	649532	110445	1104
Dokur	639308	395307	244001	3050
Shirapur	1481306	1183217	298089	3387
Kalman	1041210	779130	262080	2788
Kanzara	549622	337016	212606	4089
Kinkheda	209380	428651	-219271	-6852

Table 6.45. Income (Rs) from livestock in relation to farm-size groups.

Category	Total income	Total expenditure	Net income	Net income per household
Labor	239633	147030	92603	827
Small	1537563	1342517	195046	1072
Medium	1622323	1267268	355055	3447
Large	1281283	1016040	265243	5413
Total	4680802	3772855	907947	2036

Rs 2036 per household during 2001-04. Returns over variable costs were quite low and might have turned negative in some cases if fixed costs were taken into account.

6.12 Summary and Inferences

Steadily increasing costs of production and stagnant product prices have rendered crop production nonremunerative, negating the benefit of modest increases in productivity levels. Predominantly irrigated crops, buoyed by input subsidies continue to be profitable, while a majority of rainfed crops are not. In Aurepalle, for instance, net returns were positive only for paddy and pigeonpea. In Dokur, paddy was the lone profitable crop. In Shirapur, irrigated crops, sugarcane, groundnut and onion returned a profit while only French bean, an irrigated vegetable crop, was profitable in Kalman. In Kanzara, cotton, chilli and cotton-based intercrops were profitable and in Kinkheda cotton-based intercrops and wheat returned a profit.

Profitability of crops improved with the size of land holding in these VLS villages. Labor-dependent households cultivated few crops due to their limited access to land and other production inputs. They could get some profit from sugarcane in Shirapur and cotton + pigeonpea in Kanzara and Kinkheda. Small-farm households earned profits from paddy in Dokur; sugarcane and onion in Shirapur; sugarcane and French bean in Kalman; wheat in Kanzara; and wheat and cotton-based cropping systems in Kinkheda. Medium-sized farms earned profits from cotton + pigeonpea in Aurepalle; paddy and cotton in Dokur; sugarcane and groundnut in Shirapur; groundnut in Kalman; cotton and cotton-based intercrops in Kanzara; and virtually all crops in Kinkheda. Large farms earned profits from paddy and pigeonpea in Aurepalle; paddy in Dokur; sugarcane, postrainy-season sorghum, groundnut and onion in Shirapur; sugarcane, postrainy-season sorghum and maize in Kalman; chilli, cotton and cotton-based intercrops in Kanzara; and wheat and cotton-based intercrops in Kinkheda.

Variability of crop performance between seasons was quite high. In Aurepalle, cotton performed well in 2003-04 after its performance had been average in 2002-03 and poor in 2001-02. In Dokur, castor suffered heavy losses in 2001-02, performed well in 2002-03 and then again sustained modest losses in 2003-04. Different crops performed differently in different years, possibly due to variations in rainfall distribution. In Mahbubnagar

for instance, 2001-02 was a bad year while castor did better in 2002-03 and cotton performed well in 2003-04. Similarly, in Shirapur, groundnut performed moderately in 2001-02, very well in 2002-03 and poorly in 2003-04. Postrainy-season sorghum performed well in Kalman in 2001-02 but went on to suffer heavy losses in 2002-03 and moderate losses in 2003-04. Rainy-season sorghum (hybrid) recovered to become profitable in Kanzara during 2003-04 after it had incurred moderate losses in 2001-02 and heavy losses in 2002-03. The cotton + pigeonpea intercrop did well in 2003-04, improving on its poor performance in 2001-02 and moderate show in 2002-03 in Kinkheda.

There is great variability in the texture and fertility of plots in the VLS villages. The performance of a crop varied with the plot and the farmer growing it. The distribution of plots on the basis of cost-recovery performance indicated that the two Akola VLS villages earned a profit in more than 33% of the plots, and failed to recover variable costs in another one-third of the plots. In the remaining less than one-third of the plots, farmers could recover their variable costs but not fixed costs. In the Mahbubnagar villages, farmers could make a profit in only 28% of the plots and failed to recover even variable costs in slightly more than 33% of the plots while in the remaining 38% plots they managed to recover variable costs but not the fixed costs. Plot-wise performance was poorest in the Sholapur villages with only 18% returning a profit. Variable costs were not recovered in 55% of the plots while in the other 27% farmers could get back only a part of the fixed costs.

When the returns to land and management concept was used to assess the performance of crops, cotton and sorghum + pigeonpea turned out to be profitable in Aurepalle along with paddy and pigeonpea. In Dokur, cotton and fodder sorghum emerged as profitable crops besides paddy. In Shirapur, chickpea also joined the list of profitable crops along with sugarcane, groundnut and onion when the imputed rental value was ignored. Sugarcane and groundnut emerged as profitable crops in Kalman along with French bean, green gram, sorghum and wheat. In Kanzara virtually all crops with the exception of onion turned out to be profitable when the imputed rental value was deleted from the costs. In Kinkheda, green gram also joined the list of profitable crops along with wheat and cotton-based intercrops.

A comparison of the net farm incomes recorded in 1975-78 and 2001-04 revealed that crop economics has turned adverse and less profitable. In 1975-78, net income had been positive in all the six VLS villages for the average cropping patterns followed at that time. But in 2001-04, these incomes turned negative in Kalman and Dokur; lower in absolute terms in Shirapur and Aurepalle; and lower in real terms in Kanzara and Kinkheda.

Livestock is believed to be have a stabilizing effect on the incomes of farmers in the dryland areas. But the economics of livestock enterprises in the six VLS villages did not support this belief. Even when only variable costs were considered, many of the enterprises reported losses or paltry returns over variable costs. Rearing buffaloes was more profitable than rearing cows, the only exception to this being Shirapur where crossbred cows have been reared in large numbers. In the Andhra Pradesh villages, cows did not pay back even variable costs while in Maharashtra the returns to variable costs were low. But farmers may be keeping cows with an eye on using their offspring as future draft animals. Respondent households testified to a rapid decline in the number of draft animals in the face of tractorization. Perhaps because of this very scarcity, returns to the maintenance of draft animals appeared to be attractive. In the Akola VLS villages, where there were more opportunities of putting bullocks to work on self-owned farms, the cost of maintenance of a pair of them was far less than their hire charges. At the other extreme in Dokur village, where the number of days of bullock use was much less, the cost of maintenance of a pair of bullocks for own-farm work was about the same as the hire charges. In the Solapur villages, the cost of maintenance of a pair of bullocks per working day on the farmers' own farms was about two-thirds of the hire charges prevailing there. Rearing of small ruminants was profitable in all the six villages due to the steep increase in meat prices. As can be expected, rearing of young stock was mainly an investment for future returns.

Labor-dependent households recorded positive returns over variable costs in the case of milch

animals, small ruminants and young stock but failed to make draft animals profitable to keep because they didn't have large enough farms and therefore not enough work for the animals. For the other three farm-size groups, on the other hand, rearing of draft animals was profitable just as in the case of milch animals and small ruminants. They incurred losses only on the rearing of young stock, which is more an investment for future returns rather than a profit-oriented enterprise in itself.

Net returns over variable costs from livestock were negative in Kinkheda while they were highest in Kanzara. If fixed costs such as depreciation on cattle sheds and other fixed assets were also considered in the computation, the net returns might well turn negative for livestock enterprises. Thus both crop and livestock enterprises were not really profitable for the sample households in the VLS villages. These nonprofitable enterprises may be serving the purpose of being means of self-employment for households that do not like to participate in the labor market. In such cases, the households may have to contend with much lower returns to their labor since the opportunity cost for their labor is very close to zero. It is also likely that the farmers do not calculate some costs like depreciation and interest on own fixed capital. These households are happy as long as the crop or livestock enterprise recovers their out-of-pocket costs and leaves a surplus for meeting the needs of the family. But the households are in a constant search for alternatives to these crop and livestock enterprises. These farmers also try to reduce their dependence on rainfed crops by investing in water exploration to capture the input subsidies associated with irrigation and to stay afloat.

Chapter 7: Incomes, Consumption and Levels of Poverty

The income level of a household reflects its well-being. But the annual incomes of agricultural households tend to fluctuate depending on crop performance. Farmers save in the good years and borrow in the bad to maintain their consumption standards. Consumption levels indicate whether or not households are able to meet their minimum nutritional requirements. Poverty levels can be worked out on the basis of either income levels or consumption expenditure. To understand the dynamics of poverty, micro-level data on poverty incidence is of critical importance. We therefore compared the data gathered during the first- and second-generation VLS surveys to map the changes in income and consumption levels that have occurred in the six study villages and assess whether the households have improved or slid back over the years.

7.1 Income Structure of Households in VLS Villages

The average income of households in each of the six VLS villages during 2001-04 was analyzed. As we have seen in the previous chapter, crop income was computed on the basis of returns to land and management and livestock income on the basis of returns over variable costs. Income from agricultural labor was classified as labor income while that from nonfarm labor was designated as nonfarm income. For the purpose of this analysis, income from traditional caste occupations and income from seasonal migration were listed as separate categories while income from other sources included earnings from business, salaried jobs, contracts, money lending and miscellaneous sources.

Table 7.1 presents the average household income from different sources for each farm-size group in Aurepalle. Labor households were able to generate meager but positive income from crops and livestock but their major sources of earnings were other sources, labor, caste occupations, migration and nonfarm income. Interestingly, they had much higher total earnings than small-farm households, which had negative crop income and generated very little from other sources. But small-farm households drew more income from agricultural labor and nonfarm sources and less from caste occupations and migration than labor households. Medium-sized farm households generated a large part of their income from caste occupations followed by other sources. Their income from livestock and labor was substantial too. But their net crop income was marginally negative. Large-farm households made considerable losses from crops. Just as in the case of labor households, they obtained very substantial income from other (miscellaneous) sources. Interestingly, their income from migration was the highest among the four household classes. Also, they derived substantial income from caste occupations and livestock. But among all the categories, they drew the least income from labor and nonfarm sources. The average household in Aurepalle had net negative crop income, which was offset by earnings from livestock. Caste occupations contributed the highest income followed by other sources and labor. Migration and nonfarm sources made a moderate contribution.

Dokur did better than Aurepalle in terms of the average household income, which tended to increase with the size of land holding (Table 7.2).

Table 7.1. Sources of household income (Rs per year) in Aurepalle, 2001-04.

Class of households	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Labor	65	217	5753	2203	3417	3113	9544	24312
Small	-1857	1152	8111	4825	2905	2806	1015	18957
Medium	-340	4112	3637	1634	12370	2636	4359	28408
Large	-3830	5349	2650	711	8735	5372	11859	30846
Average	-1150	2727	4938	2289	7526	3256	6228	25814

Table 7.2. Sources of household income (Rs per year) in Dokur, 2001-04.

Class of households	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Labor	-482	0	4197	1997	572	7067	13124	26475
Small	2780	1208	3989	2962	1802	8662	8835	30238
Medium	10263	5593	4030	4829	2452	5500	4923	37590
Large	-8185	8956	5565	1717	4131	3525	25926	41635
Average	1449	3084	4325	2853	2024	6771	12165	32671

Net crop income was positive but small. Miscellaneous sources contributed significantly to the incomes of labor-dependent, small- and large-farm households. The average household obtained much of its income from these sources. Next in importance were migration and labor, followed by livestock and nonfarm sources. Income from caste occupations was not as important as in Aurepalle. Labor-dependent and large-farm households derived negative crop incomes while small- and medium-farm households had positive income from this source. Income from livestock varied positively with the size of land holding. Interestingly, large-farm households obtained more income from labor and caste occupations than the other classes. Small-farm households derived the highest income from migration. Similarly, medium-farm households derived more income from nonfarm sources than others. Some nonfarm sources of income like contracts, business and salaried jobs were classified under other sources, due to which the latter category emerged as the most important income source for the large-farm group.

Just as in Dokur, other sources, largely representing incomes from the emerging nonfarm sector, accounted for the biggest component of average household income in Shirapur (Table 7.3). Crop income was negative for all farm-size groups except labor-dependent households, with losses increasing with the size of land holding. Livestock contributed significantly to incomes, especially in the case of medium- and large-farm households. Income from labor was significant for labor and small-farm households. These groups also derived higher nonfarm labor income. Caste occupations made hardly any contribution to household incomes in this village except in the case of labor households. Income from migration was also not as significant as in Mahbubnagar.

Crop performance was worse in Kalman than in Shirapur, with losses increasing with the size of land holding (Table 7.4). In contrast, livestock income was positive for all farm-size groups and varied positively with the size of holding. The three large-farm households in this village specialized only in crop and livestock rearing and did not depend much on other sources. These households recorded negative total incomes because their losses from crops had been so huge. Crop losses were substantial for medium-farm households too but were more than compensated for by other sources, which were substantial. Small-farm households

Table 7.3. Sources of household income (Rs per year) in Shirapur, 2001-04.

Class of households	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Labor	190	5303	10376	3270	1624	874	5871	27508
Small	-662	10253	5065	3196	0	833	21867	40552
Medium	-4263	26093	4401	907	0	1529	36785	65452
Large	-19460	18827	1693	800	0	1056	31235	34151
Average	-2426	12660	6034	2609	406	993	21389	41665

Table 7.4. Sources of household income (Rs per year) in Kalman, 2001-04.

Class of households	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Labor	0	1234	4359	5190	2596	538	13235	27152
Small	-2650	4666	5165	3239	1675	738	26553	39386
Medium	-13080	6096	6185	2775	500	0	33539	36015
Large	-48980	15101	200	779	0	0	1144	-31756
Average	-5005	4336	4953	3590	1682	554	23383	33493

emerged as the highest income earners in Kalman because their moderate crop losses were more than offset by income from livestock and other sources. Even labor households, which had quite diversified sources of income, were better off than the large farms. Caste occupations and migration added little income to Kalman households, except for labor and small-farm households. These groups earned substantial incomes from the labor market, both agricultural and nonagricultural.

Only large-farm households earned substantial income from crops in Kanzara. While labor households earned a small surplus, small- and medium-farm households sustained considerable losses (Table 7.5). Returns from livestock were positive for all classes of households. Labor, small- and medium-farm households earned significant incomes from agricultural labor while only labor and small-farm households derived any income from nonfarm labor. Other sources contributed most to the incomes of large-farm households and were the single biggest components of the income of labor and medium-farm households. Migration contributed a moderate amount to the incomes of large-farm households but was not a significant contributor to other farm-size groups. Caste occupations were not important to any size group.

Kinkheda was the only village where all household classes recorded positive crop incomes (Table 7.6), which increased with the size of land holding. But here too, other nonfarm sources provided more income than crops. Livestock gave positive returns over variable costs but not substantially, except in the case of medium-farm households. Labor households derived most of their income from agricultural work, which contributed substantially to the incomes of small- and medium-farm households too. Incomes from nonfarm labor, caste

Table 7.5. Sources of household income (Rs per year) in Kanzara, 2001-04.

Class of households	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Labor	244	936	9230	2949	962	282	14714	29317
Small	-4034	1805	12972	3771	2788	350	5972	23624
Medium	-18966	5067	9069	0	1190	1579	14268	12207
Large	59332	12079	1200	0	0	7867	24900	105378
Average	-891	3454	9854	2188	1633	1387	12211	29836

Table 7.6. Sources of household income (Rs per year) in Kinkheda, 2001-04.

Class of households	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Labor	19	288	17648	2038	0	1167	5309	26469
Small	5464	490	9464	262	1286	762	5496	23224
Medium	19727	5889	3494	0	0	0	16438	45548
Large	24324	2574	1606	0	0	2000	34376	64880
Average	9134	1712	9408	624	562	875	11111	33426

occupations and migration were very small. Income from other nonfarm sources contributed substantially to the incomes of all the groups, which varied with the size of holding. Labor households had higher incomes than small-farm households, but medium- and large-farm households recorded far higher incomes than these two groups.

7.1.1 Structure of Household Incomes in Relation to Size of Land Holding

Since land has been traditionally seen as an indicator of wealth and income, landless labor households were believed to be at the bottom of the income ladder and large-farm households at the top, with small- and medium-farm households occupying the rungs in between. But given the decline of crop incomes over the years, it will be interesting to study the present pattern of income distribution in relation to the size of land holding. Even though crop incomes are low, investments made in past years by the richer farm households on their children's education, assets and business may still be keeping them at the top of the income ladder by contributing to income in the form of salaries or profits. At the other end of the ladder, with labor wages going up and employment prospects getting brighter due to the integration of labor markets, labor and small-farm households might have improved their incomes.

Labor-dependent households in the VLS sample had an average income of Rs 26872 (Table 7.7), which was about 82% of the average household income in the VLS villages. The shortfall being only about 18%, there was a fair degree of stability in the incomes of labor households across the VLS villages. Total income for these households lay within a narrow range: from Rs 24312 in Aurepalle to Rs 29317 in Kanzara. These households derived very little income from crop activities. Their biggest earnings came from other nonfarm activities with significant contributions from farm and nonfarm labor. Income from other sources and nonfarm labor together accounted for nearly 50% of their total income. Migration, caste occupations and livestock made supplementary contributions. Agricultural labor provided the single biggest component of total income of these households in Kinkheda and Shirapur, while income from other nonfarm sources was the dominant component in the other four villages. Income from migration was quite prominent in Dokur, while income from nonfarm labor was substantial in Kalman. Thus, labor households were able to earn income in equal measure from traditional farm labor and nontraditional nonfarm work.

On an average, small-farm households incurred a marginal loss from crop activities (Table 7.8), returns to land and management being positive only in Dokur and Kinkheda. Livestock income was substantial in Shirapur, distantly followed by Kalman. Returns over variable costs from livestock were lower than Rs 2000 per household in the other four villages. Small-farm households earned nearly as much as labor households from farm and nonfarm labor and migration. Their highest share of income came from other nonfarm sources, being particularly prominent in Kalman and Shirapur. Income from other nonfarm sources and migration contributed equally to small-farm households in Dokur. Income from agricultural labor formed the single biggest component of income of these

Table 7.7. Income structure (Rs per year) of labor households, 2001-04.

Village	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Aurepalle	65	217	5753	2203	3417	3113	9544	24312
Dokur	-482	0	4197	1997	572	7067	13124	26475
Shirapur	190	5303	10376	3270	1624	874	5871	27508
Kalman	0	1234	4359	5190	2596	538	13235	27152
Kanzara	244	936	9230	2949	962	282	14714	29317
Kinkheda	19	288	17648	2038	0	1167	5309	26469
Average	6	1330	8594	2941	1529	2174	10300	26872

Table 7.8. Income structure (Rs per year) of small-farm households, 2001-04.

Village	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Aurepalle	-1857	1152	8111	4825	2905	2806	1015	18957
Dokur	2780	1208	3989	2962	1802	8662	8835	30238
Shirapur	-662	10253	5065	3196	0	833	21867	40552
Kalman	-2650	4666	5165	3239	1675	738	26553	39386
Kanzara	-4034	1805	12972	3771	2788	350	5972	23624
Kinkheda	5464	490	9464	262	1286	762	5496	23224
Average	-160	3262	7461	3043	1743	2359	11623	29330

households in Kanzara, Kinkheda and Aurepalle. Just as for labor households, income from nonfarm labor and other nonfarm sources together accounted for about half of the total income of small-farm households. Although their average income was higher than that of labor households, there was greater variability across villages, ranging from Rs 18957 in Aurepalle to Rs 40552 in Shirapur. In fact, small-farm households earned less than labor households in three villages, Aurepalle, Kanzara and Kinkheda. This could be due to the increase in wage rates and decline of crop incomes.

Only in Kinkheda and Dokur did medium-sized farm households earn positive and substantial income from crops (Table 7.9). They incurred marginal losses in Aurepalle, moderate losses in Shirapur and quite heavy losses in Kanzara and Kalman. Returns over variable costs from livestock were impressive only in Shirapur and moderate in the other five villages. Other nonfarm activities were the major source of income for these households. Income from this source was quite high in the Solapur VLS villages, moderate in Akola and quite low in Mahbubnagar. Caste occupations provided substantial income to medium-farm households in Aurepalle while migration was important in Dokur. These households participated in the labor market too and earned supplementary incomes from farm and nonfarm labor. There was a high degree of variability in household income across villages. Due to heavy crop losses, total income was lowest (Rs 12207) in Kanzara. At the other extreme, helped by contributions from other nonfarm sources and livestock, it was as high as Rs 65452 in Shirapur. Just as in the case of labor and small-farm households, medium-farm households derived 53% of their income from other nonfarm sources and nonfarm labor.

Even large-farm households derived only a meager income (Rs 534 per household) from crops (Table 7.10). But crop performance in this household group was diverse, ranging from a profit of Rs 59332 in Kanzara to a loss of Rs 48980 in Kalman. Similarly, big farmers earned a profit of Rs 24324 in Kinkheda

Table 7.9. Income structure (Rs per year) of medium-farm households, 2001-04.

Village	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Aurepalle	-340	4112	3637	1634	12370	2636	4359	28408
Dokur	10263	5593	4030	4829	2452	5500	4923	37590
Shirapur	-4263	26093	4401	907	0	1529	36785	65452
Kalman	-13080	6096	6185	2775	500	0	33539	36015
Kanzara	-18966	5067	9069	0	1190	1579	14268	12207
Kinkheda	19727	5889	3494	0	0	0	16438	45548
Average	-1110	8808	5136	1691	2752	1874	18385	37537

Table 7.10. Income structure (Rs per year) of large-farm households, 2001-04.

Village	Crops	Livestock	Labor	Nonfarm work	Caste occupation	Migration	Others	Total
Aurepalle	-3830	5349	2650	711	8735	5372	11859	30846
Dokur	-8185	8956	5565	1717	4131	3525	25926	41635
Shirapur	-19460	18827	1693	800	0	1056	31235	34151
Kalman	-48980	15101	200	779	0	0	1144	-31756
Kanzara	59332	12079	1200	0	0	7867	24900	105378
Kinkheda	24324	2574	1606	0	0	2000	34376	64880
Average	534	10481	2152	668	2144	3303	21573	40856

but incurred a loss of Rs 19460 in Shirapur. In both the Mahbubnagar villages, crop losses were moderate. Returns over variable costs from livestock enterprises were positive in all the villages, but substantial only in Shirapur, Kalman and Kanzara. Even large-farm households depended on other nonfarm sources for the bulk of their income, Kalman being the exception. As was the case with other farm-size groups, 54% of the total household income of these households came from other nonfarm sources and nonfarm labor. Caste occupations and migration were substantial sources of income in Aurepalle, while agricultural labor and livestock were relatively more important in Dokur. Large-farm households in Kalman depended only on farming and did not take up any nonfarm activities. The heavy crop losses sustained in this village could not be compensated by income earned from livestock. As a result, the three farmers belonging to this group returned an average negative income of Rs 31756. In contrast, the five large-farm households in Kanzara had an average household income of Rs 105378 per year. In the other four villages, household incomes ranged from Rs 30846 in Aurepalle to Rs 64880 in Kinkheda.

7.2 Importance of the Nonfarm Sector

Due to the decline in crop incomes in all the VLS villages, farm households have come to be dependent on the nonfarm sector for their livelihood. While they still devote most of their time to farming, one or two members of the family explore opportunities in salaried employment, business, self-employment, contract work, etc. Their investment of money as well as time in these activities was aimed at earning a supplementary income but with crops turning nonviable, these sources have become principal sources of income. For the VLS sample as a whole, nonfarm sources provided 51% of the net household income (Table 7.11) of farm households, comprising 7% from nonfarm labor and 44% from other nonfarm activities. This proportion was highest (80.5%) in Kalman followed by Shirapur, Kanzara, Dokur, Kinkheda and Aurepalle. In Aurepalle, nonfarm sources accounted for about one-third of the household income.

The nonfarm sector has emerged stronger in the Solapur villages while the Akola and Mahbubnagar villages are still exploring it. These nonfarm sector activities were not all capital-intensive; they included business, self-employment options like autorickshaw driving, tailoring, etc, rental incomes from machinery, land and buildings, salaried jobs, interest on savings and money lending, handicrafts, etc.

7.2.1 Changes in Net Household Incomes from 1975-78 to 2001-04

Between 1975-78 and 2001-04, there were drastic changes in the distribution of net incomes in the six VLS villages (Table 7.12). Net crop incomes had been positive in all the villages during 1975-78, their share in the net household incomes ranging from 29.8% in Aurepalle to 46.1% in Dokur. But in 2001-04, net crop incomes were positive only in Kinkheda and Dokur. Their contribution to the net crop income was still significant in Kinkheda at 27.3%, but a mere 4.4% in Dokur. On the other hand, the negative contribution of crop losses

Table 7.11. Income (Rs per year) from nonfarm activities earned by farm households, 2001-04.

Village	Income from nonfarm labor	Income from other nonfarm sources	Total nonfarm income	Total income
Aurepalle	2289 (8.9[1])	6228 (24.1)	8517 (33.0)	25814 (100)
Dokur	2853 (8.7)	12165 (37.2)	15018 (46.0)	32671 (100)
Shirapur	2609 (6.3)	21389 (51.3)	23998 (57.6)	41665 (100)
Kalman	3590 (10.7)	23383 (69.8)	26973 (80.5)	33493 (100)
Kanzara	2188 (7.3)	12211 (40.9)	14399 (48.3)	29836 (100)
Kinkheda	624 (1.9)	11111 (33.2)	11735 (35.1)	33426 (100)
Average	2359 (7.2)	14415 (43.9)	16773 (51.1)	32818 (100)

1. Figures in parentheses are percentages of the row totals.

Table 7.12. Share (%) of different sources of income in net annual income of VLS households, 1975-78 and 2001-04.

Source of income	Aurepalle		Dokur		Shirapur		Kalman		Kanzara		Kinkheda	
	1975-78	2001-04	1975-78	2001-04	1975-78	2001-04	1975-78	2001-04	1975-78	2001-04	1975-78	2001-04
Crops	29.8	-4.5	46.1	4.4	33.7	-5.8	46.0	-14.9	43.9	-3.0	43.4	27.3
Livestock	25.5	10.6	2.0	9.4	15.0	30.4	0.8	12.9	9.0	11.6	13.1	5.1
Farm labor	32.8	19.1	46.3	13.2	42.6	14.5	42.1	14.8	38.7	33.0	40.8	28.1
Nonfarm labor	11.6	8.9	1.1	8.7	0.2	6.3	4.1	10.7	2.6	7.3	5.3	1.9
Caste occupation	_	29.2	_	6.2	0.2	1.0	_	5.0	_	5.5	_	1.7
Migration	_	12.6	_	20.7	_	2.4	_	1.7	_	4.6	_	2.6
Other nonfarm activities	0.3	24.1	4.5	37.2	8.3	51.3	7.0	69.8	5.8	40.9	-2.6	33.2
Total	100	100	100	100	100	100	100	100	100	100	100	100
Absolute level (Rs)	2361	25814	2967	32671	2955	41665	1942	33493	3856	29836	2522	33426
Equivalent level at 2001-04 prices (Rs)	16117	25814	20253	32671	20445	41665	13257	33493	26323	29836	17217	33426

ranged from 3% in Kanzara to 14.9% in Kalman. The share of income from livestock fell in Aurepalle and Kinkheda but increased in the other four villages. The most significant contribution of livestock income was in Shirapur where it accounted for 30.4% of the total household income.

The share of income from farm labor declined in all the villages. The decline was moderate in the Akola villages and drastic in Solapur and Mahbubnagar. The share of nonfarm labor income declined in Aurepalle and Kinkheda but increased in the other four villages. Income from caste occupations and migration were classified under other sources in the 1975-78 survey but listed separately in 2001-04. Their combined share was significant in Aurepalle and Dokur and moderate in Kalman and Kanzara. The biggest increase was noted in income from other nonfarm sources which emerged as the single biggest component of household incomes in 2001-04. Their share exceeded 50% in Kalman and Shirapur; lay between 33% and 50% in Kanzara and Dokur; and 25% and 33% in Kinkheda and Aurepalle.

Total household incomes have increased in all the VLS villages (Table 7.13). When the values of 1975-78 are adjusted for the prices of 2001-04, we see that the increase was marginal in Kanzara (13%) and phenomenal in Kalman (153%). Barring Kanzara, the Maharashtra VLS villages recorded higher increases than the Mahbubnagar villages.

Table 7.13. Household and per capita income (Rs per year), 1975-78 and 2001-04.

Village	Net household income			Per capita income		
	1975-78	2001-04	% increase	1975-78	2001-04	% increase
Aurepalle	16117[1] (2361[2])	25814	60.2	2883	5854	103.0
Dokur	20253 (2967)	32671	61.3	3821	5585	46.1
Shirapur	20445 (2995)	41665	103.8	3038	7802	156.8
Kalman	13257 (1942)	33493	152.6	2163	7126	229.4
Kanzara	26323 (3856)	29836	13.3	4280	5262	22.9
Kinkheda	17217 (2522)	33426	94.1	2780	5314	91.1
Average of VLS villages	18935 (2774)	32818	73.3	3226	6157	90.9

1. Equivalent values at 2001-04 prices.
2. Figures in parentheses are values at 1975-78 prices.

On an average, household incomes in the six villages has increased by 74% during the 16-year period. In per capita terms, growth was even higher (91%), which is attributable to the decline in the average family size. The sharpest increase in per capita income was noted for Kalman followed by Shirapur and Aurepalle. In these three villages, per capita income more than doubled but remained less than 100% in Kanzara, Dokur and Kinkheda.

7.3 Migration of Labor and Income Earned

Labor tends to migrate when there are inadequate employment opportunities locally. Prospects of earning better wages and getting work on a continuous basis also encourage migration, initially seasonal and then permanent. Several mutually interacting factors are causing this phenomenon. While the population and labor force are increasing in villages, land and other resources have been either stagnant or declining due to increased demand for house sites and industrial and community purposes. At the same time, education levels have been improving, and skilled and literate persons are finding salaried jobs in towns and cities. Even nonliterate and nonskilled workers are in constant search of employment security and higher wages. Integration of labor markets has improved real wages in villages as well as towns but the wage differential promotes the movement of labor from villages to towns. Moreover, contractors of large projects such as dams or canals subcontract work packages to labor contractors, who in turn engage labor from rainfed areas on annual contracts and by paying advance money. Labor from Mahbubnagar villages have thus been migrating long distances to work in projects in Gujarat, Maharashtra, Madhya Pradesh, etc. This trend has been increasing and has become an important source of income for many poor families.

7.3.1 Migration of Labor in VLS Villages

Table 7.14 presents data on migration in the six VLS villages including the number of people migrating, the number of days employed and the earnings therefrom. On an average, 0.3 persons per household have migrated from these villages and found employment for 65 days per year. Their earnings per day were Rs 85 and the average distance traveled for work was 39 km. This phenomenon is most strongly seen in Dokur, which has had frequent droughts. On an average, 0.9 persons per household have migrated from this village. The other Mahbubnagar village, Aurepalle comes a distant second. The incidence of migration is seen much less in the Maharashtra villages, but the average earnings per day from migration are higher there than in Andhra Pradesh. Kanzara, which has only 0.2 persons per household migrating, had higher average earnings than Aurepalle, which has 0.4 persons per household migrating. Labor from Dokur travel the longest distance for work when compared to other villages.

Table 7.14. Migration of labor from six VLS villages.

Village	No. of migrants per household	Annual employment (days)	Annual income (Rs)	Earnings per day (Rs)	Distance travelled (km)
Aurepalle	0.4	78	5103	65.4	18
Dokur	0.9	174	11981	68.9	121
Shirapur	0.2	56	5164	92.2	15
Kalman	0.1	16	1777	111.1	9
Kanzara	0.2	40	6327	158.2	22
Kinkheda	0.1	26	2633	101.3	49
Average	0.3	65	5498	84.6	39

7.3.2 Migration of Labor in Relation to Farm-size Group

People from all classes of households migrate, either to find skilled jobs in the informal sector or to find nonskilled work. As the more prosperous households have a better capacity to invest on education, individuals from large- and medium-farm households are more likely to migrate for skilled jobs while those from labor-dependent and small-farm households are more likely to migrate for nonskilled work. It would be interesting to study the patterns of migration in relation to the size of land holding of households across villages.

Migration from labor households was greater in Dokur (Table 7.15). Migrants from this village travelled longer distances and found work for an average of 200 days per year. But average daily earnings were lower in Dokur, as also in Aurepalle and Kalman. Daily earnings were about twice as much in the other three Maharashtra villages, whose migrants tended to work in factories or in urban locations. The average daily earnings of labor households were higher than the average for all groups.

Migration from small-farm households was slightly higher than from labor households (Table 7.16). They found work on more days per year but realized lower average earnings per day. They travelled shorter distances in search of work. Migration from the small-farm group was very low in Kalman and Kinkheda.

Migration was slightly lower in medium-farm households (Table 7.17). They travelled shorter distances and found fewer days of work but recorded the highest earnings per day among all the farm-size groups.

Migration from large-farm households was about the same as for medium-farm households (Table 7.18). They travelled longer distances and worked for a substantial number of days, but earned less per day than migrants from medium-farm households. There was no migration from large-farm households in Kalman. But migration from such households in Kanzara and Kinkheda was much higher than for the other farm-size groups.

Table 7.15. Migration of labor from labor households, 2001-04.

Village	No. of migrants per household	Annual employment (days)	Annual income (Rs)	Earnings per day (Rs)	Distance travelled (km)
Aurepalle	0.4	87	5084	58	14
Dokur	1.0	200	11609	58	114
Shirapur	0.1	16	2001	125	5
Kalman	0.1	13	896	69	17
Kanzara	0.1	27	4359	161	37
Kinkheda	0.2	32	3939	123	103
Average	0.3	62.5	4648.0	99.2	48.3

Table 7.16. Migration of labor from small-farm households, 2001-04.

Village	No. of migrants per household	Annual employment (days)	Annual income (Rs)	Earnings per day (Rs)	Distance travelled (km)
Aurepalle	0.38	82	5063	62	20
Dokur	1.1	224	15852	71	131
Shirapur	0.2	61	5995	98	15
Kalman	0.04	10	766	77	4
Kanzara	0.2	46	4390	95	24
Kinkheda	0.05	13	1625	125	26
Average	0.33	72.67	5615.17	87.97	36.67

Table 7.17. Migration of labor from medium-farm households, 2001-04.

Village	No. of migrants per household	Annual employment (days)	Annual income (Rs)	Earnings per day (Rs)	Distance travelled (km)
Aurepalle	0.35	68	4757	70	20
Dokur	0.9	123	10641	87	114
Shirapur	0.2	81	5731	71	22
Kalman	0.1	46	7494	163	18
Kanzara	0.1	19	5729	302	5
Kinkheda	0.1	20	556	28	2
Average	0.29	59.50	5818.00	119.91	30.17

Table 7.18. Migration of labor from large-farm households, 2001-04.

Village	No. of migrants per household	Annual employment (days)	Annual income (Rs)	Earnings per day (Rs)	Distance travelled (km)
Aurepalle	0.41	85	5933	70	14
Dokur	0.5	80	5375	67	115
Shirapur	0.3	92	9200	100	37
Kalman	0	0	0	0	0
Kanzara	0.3	112	20867	186	18
Kinkheda	0.25	68	6667	98	89
Average	0.29	72.83	8007.00	86.89	45.50

7.4 Caste Occupations

Traditional caste occupations do contribute to the incomes of village households. Toddy-tapping, pottery, sheep-rearing, carpentry, goldsmithy, basket-making, hair-cutting and laundering are some of the important caste occupations in the villages. Aurepalle has a large number of palmyra trees which yield a sap that is fermented into an alcoholic drink. There are a considerable number of toddy-tappers who collect the sap and sell the fermented drink. In all the other villages, there were a few people who made a living from their traditional caste occupations.

7.4.1 Importance of Income from Caste Occupations in VLS Villages

Caste occupations were relatively more important in the Andhra Pradesh villages than Maharashtra

(Table 7.19). In Aurepalle, they were very important in providing employment and income. On an average, 0.8 persons per household in this village were engaged in caste occupations, which provided 108 days of work per household. Average daily earnings were Rs 73, which compared favorably with the wage rates prevalent in the village. Average earnings from caste occupations in Dokur were about a half of those in Aurepalle. Among the Maharashtra villages, Kanzara drew considerable annual income from caste occupations, with the average being Rs 2349 per household. Neighboring Kinkheda had the least income from caste occupations. Households in the Solapur villages earned moderate incomes from caste occupations.

7.4.2 Importance of Income from Caste Occupations for Different Farm-size Groups

It is believed that caste and class are interlinked in rural India. Some occupations are pursued by specific castes, and their remuneration is influenced by customs. Over the years, some of the oppressive features of the caste system have receded and remuneration for some of the products and services is now more influenced by demand and supply. It would be interesting to study the relative importance of caste occupations to the incomes of the various classes of households in this study.

Table 7.20 gives data on the dependence of labor households on caste occupations for employment and income. None of the labor households in Kinkheda depended on caste occupations. Kalman and Aurepalle had more persons from labor households dependent on caste occupations. While the number of days of employment from caste occupations was higher in Aurepalle, earnings were higher in Kalman due to the higher daily wage rate. In the other three villages (Dokur, Shirapur and Kanzara), annual household earnings from caste occupations ranged from Rs 2000 to Rs 3000.

Table 7.19. Income from caste occupations in VLS villages, 2001-04.

Village	No. of persons per household	No. of days engaged	Annual income earned (Rs)	Earnings per day (Rs)
Aurepalle	0.8	108	7876	72.9
Dokur	0.3	48	3591	74.8
Shirapur	0.06	11	1031	93.7
Kalman	0.1	18	1980	110.0
Kanzara	0.2	29	2349	81.0
Kinkheda	0.05	5.3	562	106.0
Average	0.3	36.6	2898.2	79.3

Table 7.20. Income from caste occupations of labor households, 2001-04.

Village	No. of persons per household	No. of days engaged	Annual income earned (Rs)	Earnings per day (Rs)
Aurepalle	0.3	51	3657	71.7
Dokur	0.2	29	2122	73.2
Shirapur	0.15	35	2927	83.1
Kalman	0.32	37	4309	116.5
Kanzara	0.15	28	1941	69.3
Kinkheda	0	0	0	0
Average	0.2	30	2492.7	83.0

For the entire VLS sample, an average household got 30 days of employment from caste occupations, earning Rs 2493. Average earnings per day were higher for labor households than for the pooled sample as a whole.

Small-farm households' dependence on caste occupations was about the same as for labor households (Table 7.21) but they were engaged for slightly fewer days in these vocations. Average earnings per day were lower and, consequently, their annual income from caste occupations was about 20% lower than that of labor households.

None of the medium-sized farm households from Shirapur, Kalman and Kinkheda depended on caste occupations for their income (Table 7.22). But their dependence was high in Aurepalle, Dokur and Kanzara. In Aurepalle, an average household of this class obtained 193 days of employment and earned an income of Rs 13463 from caste vocations. In Dokur and Kanzara, the earnings ranged from Rs 2000 to Rs 3000. For the entire sample of medium-farm households, 45 days of gainful employment per average household was available with an average income of Rs 3067.

None of the large-farm households in the Maharashtra villages had any income from caste occupations (Table 7.23) but in both the Mahbubnagar villages their dependence was substantial. In Aurepalle, one person per household was engaged in the caste occupation but the total days of employment were only 79. In Dokur, although only 0.5 persons per household depended on caste occupations, as many as 92 days of employment were generated from them. Earnings per day exceeded Rs 100. Substantial earnings per household were recorded in both villages. For the large-farm household sample as a whole, the average income was Rs 2938 per household.

7.5 Consumption Expenditure

Income levels and consumption standards have been consistently improving in India, accompanied

Table 7.21. Income from caste occupations of small-farm households, 2001-04.

Village	No. of persons per household	No. of days engaged	Annual income earned (Rs)	Earnings per day (Rs)
Aurepalle	0.4	51	2959	58.0
Dokur	0.2	37	2189	59.2
Shirapur	0.04	5.0	613.0	122.6
Kalman	0.05	15	1560	104.0
Kanzara	0.2	40	3353	83.8
Kinkheda	0.11	12	1286	107.2
Average	0.2	26.7	1993.3	74.8

Table 7.22. Income from caste occupations of medium-sized farm households, 2001-04.

Village	No. of persons per household	No. of days engaged	Annual income earned (Rs)	Earnings per day (Rs)
Aurepalle	1.4	193	13463	69.8
Dokur	0.4	53	2808	53.0
Shirapur	0	0	0	0
Kalman	0	0	0	0
Kanzara	0.3	25	2131	85.2
Kinkheda	0	0	0	0
Average	0.4	45.2	3067.0	67.9

Table 7.23. Income from caste occupations of large-farm households, 2001-04.

Village	No. of persons per household	No. of days engaged	Annual income earned (Rs)	Earnings per day (Rs)
Aurepalle	1	79	7992	101.2
Dokur	0.5	92	9636	104.7
Shirapur	0	0	0	0
Kalman	0	0	0	0
Kanzara	0	0	0	0
Kinkheda	0	0	0	0
Average	0.3	28.5	2938.0	103.1

by a radical change in the distribution of consumer expenditure, particularly between food and nonfood items. We can expect to see this in rainfed areas too. When the first-generation VLS studies were done during 1975-85, it was found that more money is spent on food than on nonfood items. But it has become evident in recent years that nonfood expenditure has become more prominent since then, almost equalling spending on food. Nonfood expenditure includes investment on education and health. In this section, we analyze the changes in consumption expenditure patterns over the years, at first in each study village and then in relation to the size of land holding.

7.5.1 Consumption Expenditure in VLS Villages

Consumption expenditure is likely to be influenced by income levels. We noted that household incomes vary widely between VLS villages. While year-to-year variability in income was expected to be substantial, we expected consumption expenditure to be more stable. Households are known to save during the good years and borrow during lean years to meet their consumption needs and other household requirements. A study of the broad aggregates of consumption across villages would help in tracing the consumption patterns and assessing the influence of income on them.

The average consumption expenditure per household was Rs 26665 for the VLS sample as a whole (Table 7.24). It was lowest (Rs 22767) in Kinkheda and highest (Rs 30694) in Kalman. While we found much variability in incomes among the villages, there was much less variability in consumption expenditure. In the Mahbubnagar villages, expenditure on food was about 55%. Of the two Akola villages, food expenditure was 50% in Kanzara but 57% in Kinkheda. But in the two Solapur villages, expenditure on nonfood items was about the same as on food in Shirapur and exceeded 55% in Kalman. Expenditure on food-grain exceeded 30% of the total consumption

Table 7.24. Average household consumption expenditure (Rs) in six VLS villages, 2001-04.

Village	Foodgrain	Other food items	Total food expenditure	Nonfood items	Total
Aurepalle	7517 (30.9[1])	5777 (23.7)	13294 (54.6)	11066 (45.4)	24360 (100)
Dokur	8131 (30.8)	6279 (23.8)	14410 (54.5)	12014 (45.5)	26424 (100)
Shirapur	5051 (17.5)	9306 (32.3)	14357 (49.8)	14497 (50.2)	28854 (100)
Kalman	5701 (18.6)	7971 (26.0)	13672 (44.5)	17022 (55.5)	30694 (100)
Kanzara	4994 (18.6)	8468 (31.5)	13462 (50.1)	13426 (49.9)	26888 (100)
Kinkheda	4443 (19.5)	8626 (37.9)	13069 (57.4)	9698 (42.6)	22767 (100)
Average	5973 (22.4)	7738 (29.0)	13711 (51.4)	12954 (48.6)	26665 (100)

1. Figures in parentheses are percentages of the row total.

expenditure in the Mahbubnagar villages but remained at only about 18% in the four villages in Maharashtra. This disparity could possibly be explained by the fact that sorghum, which is the staple foodgrain in the diet of Maharashtra villages, is much cheaper than rice, which is the staple in Mahbubnagar. The Maharashtra villages have a distinct preference for quality foods like milk, meat, edible oils, fruits, vegetables, etc. and accordingly spent much more on food items other than foodgrain, which accounted for 26-38% of the total consumption expenditure. In constrast, expenditure on other food items was much lower (24%) in Andhra Pradesh. But total expenditure on food was highest in Kinkheda followed by Aurepalle and Dokur. It was lowest in Kalman, with Kanzara and Shirapur taking the middle rungs. Nonfood expenditure, on the other hand, had the highest share of consumption expenditure in the Solapur villages. This was lowest in Mahbubnagar followed by Akola.

7.5.2 Consumption Expenditure in Relation to Size of Land Holding

As one moves from landless labor to large-farm households, incomes are likely to increase. One expects a similar relationship between consumption expenditure and size of land holding as well. The distribution of expenditure among the various farm-size groups by villages is discussed below.

Labor-dependent households spent an average of Rs 18851 (Table 7.25) on their consumption requirements, which is about 29% less than the average for the VLS sample as a whole. Expenditure was lowest among the labor households of Kanzara and highest in Dokur. In the latter village, these households spent 25.3% of their consumption expenditure on foodgrain. This proportion was lowest (20.7%) in Shirapur. Expenditure on food items other than foodgrain was very low in the two Mahbubnagar villages and highest in Kinkheda. In comparison with the average of 56.3% for labor households as a whole, food spending was very low (45%) in Dokur and quite high (67%) in Aurepalle.

The average consumption expenditure of small-farm households was about 15% less than that of the pooled VLS sample (Table 7.26). In Dokur and Kinkheda, small farmers spent less than labor-dependent households. Consumption expenditure was very low (Rs 16859) in Aurepalle and quite high (Rs 34417) in Kalman. Small-farm households in Maharashtra spent a very small proportion of their consumption expenditure on foodgrain (16.7%-24.9%) in contrast with the two Andhra Pradesh villages: 38% in Aurepalle and 33% in Dokur. Spending on food items other than foodgrain was highest in Kinkheda and lowest in Kalman. Overall, small-farm households spent about 54.8% of their consumption expenditure on food. This was lowest (39.8%) in Kalman and highest (66%) in Kinkheda.

Medium-sized farm households spent about 42% more than small-farm households. But there was some variability in the consumption expenditure pattern between villages (Table 7.27), with Dokur reporting only Rs 27948 and Shirapur Rs 38071. Expenditure share of foodgrain was only 14.3% in

Table 7.25. Average consumption expenditure (Rs) of labor households, 2001-04.

Village	Foodgrain	Other food items	Total food expenditure	Nonfood items	Total
Aurepalle	5494 (38.2[1])	4162 (28.9)	9656 (67.1)	4745 (32.9)	14401 (100.0)
Dokur	5875 (25.3)	4656 (20.1)	10531 (45.4)	12669 (54.6)	23200 (100.0)
Shirapur	4625 (20.7)	6710 (30.0)	11335 (50.8)	10995 (49.2)	22330 (100.0)
Kalman	4565 (22.9)	6221 (31.2)	10786 (54.0)	9181 (46.0)	19967 (100.0)
Kanzara	3680 (26.1)	5418 (38.5)	9098 (64.6)	4977 (35.4)	14075 (100.0)
Kinkheda	4198 (21.9)	8100 (42.3)	12298 (64.3)	6834 (35.7)	19132 (100.0)
Average	4740 (25.1)	5878 (31.2)	10617 (56.3)	8234 (43.7)	18851 (100.0)

1. Figures in parentheses are percentages of the row total.

Table 7.26. Average consumption expenditure (Rs) of small-farm households, 2001-04.

Village	Foodgrain	Other food items	Total food expenditure	Nonfood items	Total
Aurepalle	6431 (38.1[1])	4159 (24.7)	10590 (62.8)	6269 (37.2)	16859 (100)
Dokur	6669 (33.1)	5281 (26.2)	11950 (59.3)	8191 (40.7)	20141 (100)
Shirapur	4778 (17.8)	9504 (35.4)	14282 (53.2)	12582 (46.8)	26864 (100)
Kalman	5753 (16.7)	7942 (23.1)	13695 (39.8)	20722 (60.2)	34417 (100)
Kanzara	4934 (23.5)	7998 (38.2)	12932 (61.7)	8029 (38.3)	20961 (100)
Kinkheda	4320 (24.9)	7094 (40.9)	11414 (65.8)	5922 (34.2)	17336 (100)
Average	5481 (24.1)	6996 (30.7)	12477 (54.8)	10286 (45.2)	22763 (100)

1. Figures in parentheses are percentages of the row total.

Table 7.27. Average consumption expenditure (Rs) of medium-sized farm households, 2001-04.

Village	Foodgrain	Other food items	Total food expenditure	Nonfood items	Total
Aurepalle	8287 (26.6[1])	6613 (21.2)	14900 (47.8)	16273 (52.2)	31173 (100)
Dokur	8731 (31.2)	6563 (23.5)	15294 (54.7)	12654 (45.3)	27948 (100)
Shirapur	5577 (14.6)	11741 (30.8)	17318 (45.5)	20753 (54.5)	38071 (100)
Kalman	7252 (21.2)	10220 (29.8)	17472 (51.0)	16801 (49.0)	34273 (100)
Kanzara	5387 (16.2)	9473 (28.4)	14860 (44.6)	18464 (55.4)	33324 (100)
Kinkheda	4077 (14.3)	9054 (31.7)	13131 (46.0)	15417 (54.0)	28548 (100)
Average	6552 (20.3)	8944 (27.8)	15496 (48.1)	16727 (51.9)	32223 (100)

1. Figures in parentheses are percentages of the row total.

Kinkheda and 31.2% in Dokur. Spending on food items other than foodgrain also varied between 21.2% in Aurepalle and 31.7% in Kinkheda. Food expenditure varied between 44.6% in Kanzara and 54.7% in Dokur. Kanzara had a very high share of nonfood expenditure (55.4%) while Dokur reported only 45.3%.

Large-farm households spent the highest on consumption (Table 7.28). An average such household in Kanzara spent twice (Rs 65884) as much as one in Aurepalle (Rs 33446). Due to high expenditure and low foodgrain prices, Kanzara households spent only 11.5% of their consumption expenditure on foodgrain. But in the Andhra Pradesh villages, this accounted for more than 30% of the expenditure. Spending on food items other

Table 7.28. Average consumption expenditure (Rs) of large-farm households, 2001-04.

Village	Foodgrain	Other food items	Total food expenditure	Nonfood items	Total
Aurepalle	10156 (30.4[1])	8332 (24.9)	18488 (55.3)	14958 (44.7)	33446 (100)
Dokur	13949 (32.4)	10501 (24.4)	24450 (56.8)	18559 (43.2)	43009 (100)
Shirapur	7085 (17.3)	10505 (25.7)	17590 (43.0)	23344 (57.0)	40934 (100)
Kalman	6648 (19.5)	11982 (35.2)	18630 (54.7)	15420 (45.3)	34050 (100)
Kanzara	7551 (11.5)	15460 (23.5)	23011 (34.9)	42873 (65.1)	65884 (100)
Kinkheda	5913 (14.6)	14403 (35.7)	20316 (50.3)	20069 (49.7)	40385 (100)
Average	8550 (19.9)	11864 (27.6)	20414 (47.5)	22537 (52.5)	42951 (100)

1. Figures in parentheses are percentages of the row total.

than foodgrain varied between 23.5% in Kanzara and 35.7% in Kinkheda. Food expenditure ranged from 34.9% in Kanzara to 56.8% in Dokur. The share of nonfood items in the consumption expenditure was quite low in the Mahbubnagar villages. Large-farm households in Kanzara and Shirapur spent more on nonfood items than those in Kinkheda and Kalman.

7.6 Nutrition Levels

Consumption standards are influenced by income levels, production patterns, tastes and preferences and the historical evolution of consumption patterns. Sorghum is the dominant cereal in the Maharashtra VLS villages while rice is the staple in Andhra Pradesh. Over the inter-VLS time period, cereals lost their dominance in the consumption patterns and noncereals are gradually supplying a larger share of calories. It would be interesting to study the spatial differences and temporal changes relating to nutrition standards. Although the Maharashtra villages have higher household incomes, their expenditures on foodgrain are quite low. As per the first-generation VLS, the average caloric intake was 2040 calories in Maharashtra and 2355 calories in the Andhra Pradesh villages (Chung 1998). These intake patterns, determined by custom and history, are likely to persist in the second-generation surveys.

7.6.1 Nutritional Standards of VLS Villages

Table 7.29 gives the caloric and protein intake by sample households in the six VLS villages. It also gives the percentage of households which consume less than 2000 calories and those which take less than 50 g of protein per day. Aurepalle recorded the highest consumption of 2409 calories among the six villages while Kinkheda reported the highest per capita daily protein consumption (52 g). The Andhra Pradesh villages reported much higher levels of calorie consumption than the Maharashtra villages. Among the latter, Kanzara and Shirapur recorded slightly less than 2000 calories of energy, while Kinkheda and Kalman exceeded 2000 calories. Dokur reported the lowest protein consumption of 42 g per capita per day, but intake was of the same level in the other five villages too. Only 39% of the households in Aurepalle consumed less than 2000 calories per day. Dokur and Kalman were the next best with about 43%. Interestingly, Kanzara, where households had better incomes, reported a high level of calorie deficiency, with about 60% of the households consuming less than 2000 calories. Shirapur also had more than 50% of the households deficient in energy consumption. Kalman and Kinkheda reported the prevalence of malnutrition to the extent of 43% and 47% respectively. Protein malnutrition was most rampant in Dokur: more than three-fourths of the households consumed less than 50 g of protein per capita per day. The other Mahbubnagar village, Aurepalle reported 54% of its households as protein deficient. Protein malnutrition was relatively less in the Maharashtra villages due to production of pulses. Kalman reported better nutritional levels and a lower proportion of people who did not get adequate nutrition. The other three Maharashtra villages recorded protein malnutrition between 42% and 52%.

7.6.2 Nutritional Levels Across Farm-size Groups

We have seen that household incomes tend to increase with the size of land holding. It would be

Table 7.29. Nutritional status of households across VLS villages, 2001-04.

	Consumption per day		Malnutrition level (% of households)	
Village	Calories	Protein (g)	<2000 calories per day	<50 g protein per day
Aurepalle	2409	50	39	54
Dokur	2293	42	43	78
Shirapur	1983	48	57	52
Kalman	2143	51	43	37
Kanzara	1973	51	60	48
Kinkheda	2006	52	47	44
Average	2135	49	47	53

interesting to see if this has any bearing on the nutritional levels of the different classes of households. Labor-dependent and small-farm households tend to undertake more strenuous physical work which implies that their calorie requirements are higher and possibly unaffordable given their lower incomes.

Labor households consumed only 2059 calories and 47 g of protein per capita per day (Table 7.30). These levels were about 4% lower than those of the pooled sample. But this difference was not uniform across all the villages: labor households in Dokur and Kinkheda reported slightly better nutrition standards than the pooled sample. In Kanzara and Kalman, the difference in calorie consumption between the pooled and labor household samples was pronounced. The same trend was noticed for protein consumption as well. The proportion of labor households suffering inadequate calorie and protein consumption was high: an average of 56% and 63% respectively.

Small-farm households had about the same nutrition levels as the pooled sample. Aurepalle, Dokur and Kalman recorded calorie intake exceeding 2200 calories per day while the other three villages reported slightly less than 2000 calories (Table 7.31). Small-farm households in the Solapur villages reported slightly better levels of calorie and protein consumption than the pooled sample. This was particularly pronounced in Kalman. But in the other four villages, calorie and protein consumption by small farmers was lower than for the pooled sample. A lower proportion of small-farm households suffered protein malnutrition than the pooled sample.

Medium-sized farm households did no better than small-farm households with respect to nutrition standards (Table 7.32). In fact, a greater proportion of households in this group suffered protein malnutrition than small-farm households. The Mahbubnagar villages recorded higher levels of calorie consumption than the Maharashtra villages.

Table 7.30. Nutritional levels across labor households.

	Consumption per day		Malnutrition level (% of households)	
Village	Calories	Protein (g)	<2000 calories per day	<50 g protein per day
Aurepalle	2363	50	44	64
Dokur	2296	40	45	80
Shirapur	1893	46	68	68
Kalman	1990	48	54	50
Kanzara	1807	47	77	62
Kinkheda	2005	53	63	38
Average	2059	47	56	63

Table 7.31. Nutritional levels across small-farm households.

	Consumption per day		Malnutrition level (% of households)	
Village	Calories	Protein (g)	<2000 calories per day	<50 g protein per day
Aurepalle	2381	47	38	52
Dokur	2204	41	48	81
Shirapur	1998	48	53	47
Kalman	2261	54	32	25
Kanzara	1936	50	65	50
Kinkheda	1988	52	50	43
Average	2128	49	46	47

Table 7.32. Nutritional levels across medium-sized farm households.

	Consumption per day		Malnutrition level (% of households)	
Village	Calories	Protein (g)	<2000 calories per day	<50 g protein per day
Aurepalle	2378	50	35	51
Dokur	2449	44	40	67
Shirapur	1969	49	53	53
Kalman	1957	47	64	57
Kanzara	1923	50	57	50
Kinkheda	1975	47	50	67
Average	2109	48	47	55

Table 7.33. Nutritional levels across large-farm households.

	Consumption per day		Malnutrition level (% of households)	
Village	Calories	Protein (g)	<2000 calories per day	<50 g protein per day
Aurepalle	2576	54	41	47
Dokur	2320	43	29	79
Shirapur	2252	57	50	33
Kalman	2160	51	67	66
Kanzara	2691	68	0	0
Kinkheda	2120	53	0	25
Average	2353	54	33	49

In Dokur medium-sized farm households had better standards of nutrition than large-farm households. But in Dokur and Kinkheda, about two-thirds of the households reported protein malnutrition. Interestingly, Kalman reported a much higher calorie shortfall in medium-farm households.

With the exception of Kalman, large-farm households reported consistently higher levels of consumption than the other classes (Table 7.33). The average consumption levels of large-farm households were about 10% higher than those of the pooled sample with respect to both calorie and protein consumption. Only 33% of the households in this category exhibited calorie undernutrition and less than half showed protein malnutrition. Not a single large-farm household of Kanzara reported either deficiency. This was also true of Kinkheda in terms of calorie intake.

7.7 Estimates of Income Poverty

Poverty can be defined on the basis of either income or consumption expenditure. The World Bank categorizes people who spend less than $2 per day as poor and those who spend less than $1 per day as very poor. As income data is not always reliable, poverty in India is also measured on the basis of expenditure levels. For the purposes of this study, we relied on the income criterion because the surveys generated data on household incomes for each unit in the sample. The Government of India regards households with incomes less than Rs 13000 per annum at 1993-94 prices as living below the poverty line and all such households are eligible to get benefits from rural development programs. The poverty line is roughly equivalent to an income of Rs 20000 per year in 2002-03 (the mid-point of the duration of our study, 2001-04). Hence, all households with an annual income of less than Rs 20000 have been categorized as poor.

7.7.1 Estimates of Income Poverty in VLS Villages

We have seen that the income levels of sample households in the six villages were different. But those were average figures for the entire sample.

The proportion of the poor in the sample depends upon the distribution of incomes within a village. We took a count of all households whose net annual income was less than Rs 20000 in each of the villages to estimate the proportion of poor people in them.

Taking the VLS sample as a whole, 41% of the sample households had an annual income of less than Rs 20000 (Table 7.34). But there was considerable variation among the six villages in terms of poverty. Dokur recorded the lowest incidence of poverty (31%) and Kalman the highest (49%). The two Akola villages, Kanzara and Kinkheda, along with Dokur had poverty levels lower than 40% while Shirapur, Aurepalle and Kalman exceeded 40%.

Table 7.34. Estimates of income poverty across VLS villages.

Village	Number of sample households	Number of poor	Percentage
Aurepalle	100	44	44
Dokur	80	25	31
Shirapur	88	38	43
Kalman	94	46	49
Kanzara	52	18	35
Kinkheda	32	12	38
Total	446	183	41

7.7.2 Estimates of Income Poverty in Relation to Size of Land Holding

Traditionally, poverty has been associated with landlessness or with ownership of small holdings (Table 7.35). But this principle does not seem to be supported by the data from 2001-04. Within the VLS sample, labor-dependent households and medium-sized farm holdings both recorded the lowest incidence of poverty at 38%. Curiously, households with large farm holdings had a slightly higher incidence of poverty at 39%. Small farmers recorded the highest incidence of poverty (45%). These figures suggest that land ownership does not necessarily enable a household in crossing the poverty line. Since most crop enterprises are loss-making, land ownership may actually prove to be a liability rather than an asset. Those who are endowed with more labor seemed to be better off in terms of income. Of course, the larger land owners have more assets but there is no direct one-on-one relationship between assets and income.

Table 7.35. Estimates of income poverty across land-holding classes.

Category	Number of sample households	Number of poor	Percentage
Labor	112	43	38
Small	182	82	45
Medium	103	39	38
Large	49	19	39
Total	446	183	41

7.8 Comparison of Results with Findings of Macro-level Studies

The National Sample Survey Organization (NSSO) conducted a consumer expenditure survey in India in 1999-2000 and reported data on monthly per capita expenditure. Rao et al. (2005) estimated the incidence of household poverty based on consumer expenditure for each district in the country. Data for the three VLS study districts, Mahbubnagar, Akola and Solapur, are presented in Table 7.36 and compared with the proportion of households suffering malnutrition in the study villages falling in these districts.

The district-level estimates based on the consumer expenditure survey conducted by NSSO in 1999-2000 and the sample estimates based on VLS data for the period 2001-04 are comparable. Between 1999-2000 and 2001-04 (average), the monthly per capita expenditure registered an increase in all the three districts and there was a reduction in the incidence of undernutrition/poverty between the two study periods. While there was a greater increase in consumer expenditure in Mahbubnagar, the impact of increased consumer expenditure in terms of reduction in poverty/undernutrition was more in the Maharashtra districts. These results point to a slight improvement in the living conditions of rural households in the study districts.

7.9 Summary and Inferences

During 2001-04, agricultural conditions were subnormal in terms of the quantum and distribu-

Table 7.36. Comparison of NSSO and VLS estimates.

District	Estimate	Monthly per capita expenditure (Rs)	Incidence of poverty/ undernutrition based on consumption levels (%)
Mahbubnagar	District estimate[1]	407.2	60.3
	Sample estimate[2]	629.5	52.5
Akola	District estimate	362.4	63.6
	Sample estimate	418.6	50.6
Solapur	District estimate	418.2	67.2
	Sample estimate	474.9	47.2

1. District estimates are based on NSSO consumer expenditure survey, 1999-2000.
2. Sample estimates are based on VLS data, 2001-04.

tion of rainfall in the entire Deccan plateau where the six VLS villages are located. Net crop incomes were positive in only two of the villages, Kinkheda and Dokur. Crop losses were heaviest in Kalman, followed by Shirapur, Aurepalle and Kanzara. Just as crop income declined, so did income from agricultural labor in all the six villages. This was reflected in the share of agricultural labor income in the total household income. When compared with 1975-78, the share of agricultural labor income declined in all the villages. The share of income from livestock enterprises in the household income declined in Aurepalle and Kinkheda between 1975-78 and 2001-04. In Shirapur, however, this doubled from 15% to 30% during this period. In the other three villages, Kalman, Kanzara and Dokur, this income improved but not substantially. These indicators point to the decline of agriculture and agriculture-based enterprises including employment opportunities for labor in agriculture. As incomes from agricultural enterprises declined, the sample households relied more on nonfarm activities. However, income from nonfarm labor increased only by a small proportion and it has still not emerged as a major source of income for rural households. But other nonfarm activities like business, salaried jobs, rental incomes, interest on savings or money lending and self-employment options emerged as the chief providers of income, accounting for slightly more than 50% of the total net income of the VLS sample households.

There were drastic changes in the relative position of the villages in terms of income levels. During 1975-78, Kalman was the poorest of the villages, but it recorded the highest percentage growth in income between 1975-78 and 2001-04. Although crop performance was the poorest in Kalman in 2001-04, the nonfarm sector helped it to achieve the highest growth in household income during the intervening 26-year period. Aurepalle, which was better off than Kalman in 1975-78, fell behind the latter in 2001-04 to become the poorest village. Kanzara was the most prosperous village in 1975-78 but it became poorer than four villages in 2001-04. It was ahead of only Aurepalle because of its dependence on agriculture where profit margins have eroded very fast. Shirapur took the top place with the help of the dairy and nonfarm sectors. Dokur also suffered many reverses on the agricultural front but it could make up for the losses in the nonfarm sector, migration and livestock. Kinkheda improved its position slightly with the help of better agricultural performance besides contributions from nonfarm, livestock and agricultural labor incomes.

Among the four farm-size groups, labor households showed a substantial improvement between 1975-78 and 2001-04. Although their average household income was still the lowest of the four groups, the distribution of income within this group was more egalitarian than in others. As a result, this group recorded the lowest incidence of poverty, which was an unexpected result. The small-farm group had a higher average household income than labor households but the distribution of income was less equal. In Aurepalle, Kanzara and Kinkheda, the average incomes of small-farm households were much lower than those of labor households. This group also recorded the highest incidence of poverty. Even though medium- and

large-farm households had far higher incomes than labor households, they were no better in terms of poverty. While the incidence of poverty in medium-farm households was about the same as in labor households, large-farm households recorded an even higher level of poverty. Medium-sized farms in Kanzara and Kalman and large-farm households in Kalman incurred heavy losses from crops. During 1975-78, prosperity was directly proportional to land holding. But in 2001-04, ownership of land, even large holdings, did not guarantee higher incomes, mainly due to the nonviability of crops in particular and agricultural enterprises in general. For the large-farm households in Kalman, which were solely dependent upon farming, the losses from crops were so big that their household incomes were negative.

Migration contributed substantial income to households in Dokur followed by Kanzara, Shirapur and Aurepalle. In Dokur, small farmers earned the maximum income from migration while medium-farm households earned the most from migration in Kalman. In the other four villages, it was the large-farm households which earned the highest incomes from migration, mainly from educated migrants earning higher returns per day of employment.

In general, caste occupations provided higher incomes to households in the Mahbubnagar villages than in Maharashtra. Those who earned more from caste occupations tended to belong to labor households in Kanzara, small-farm households in Kalman, medium-farm households in Aurepalle and large-farm households in Dokur.

The large household income variability noted across villages and farm-size groups was not reflected in the consumption expenditure patterns, which are believed to be determined by customs, habits and permanent income. The surpluses and shortfalls noted in household incomes are moderated by savings and borrowings when it comes to consumption expenditure. The average consumption expenditure of Rs 26665 was about 81% of the average household income of Rs 32818. Consumption expenditure was the lowest in Kinkheda and highest in Kalman. Expenditure on foodgrain was more in the Mahbubnagar villages while expenditure on food items other than foodgrain was higher in Maharashtra. Nonfood expenditure was higher in the Solapur villages than in the Akola and Mahbubnagar villages. While consumption expenditure was directly proportional to the size of land holding, there were divergences from this trend. Small-farm households in Dokur and Kinkheda spent less than labor households on consumption. Small-farm households in Kalman spent more than medium- and large-farm households on consumption.

In the Mahbubnagar villages, per capita calorie intake was much higher than in the Maharashtra villages. A similar result had been noted in 1975-78 too. But protein consumption was more in Maharashtra. Overall, 47% of the households suffered energy inadequacy while 53% experienced protein undernutrition. In general, the percentage of households experiencing calorie inadequacy and protein shortfall declined with increase in the size of land holding.

Estimates of poverty drawn from macro-level NSSO data for 1999-2000 and VLS data for 2001-04 were compared to assess the degree of correspondence between them. It was found that monthly consumption expenditure per capita increased over the three-year period in all the three districts where the VLS villages are located. The increase in monthly per capita expenditure was higher in the Mahbubnagar villages but the impact of increased expenditure in reducing undernutrition was found to be more in Maharashtra.

The biggest finding of this VLS study and an issue of concern is the nonviability of crops as reflected by the negative returns to land and management and limited returns over variable costs of livestock enterprises. One reason for this could be that the three years of the study period were subnormal in terms of rainfall quantum and distribution. These three years may be an aberration, but in the context of climate change and increasing frequency of deviations from the normal, one has to be skeptical about the better rainfall years too. The frequency of subnormal years may only increase and cropping periods like 2001-04 may recur more frequently. This has implications for research. Research systems have to evolve better-performing varieties under adverse rainfall conditions such as those witnessed during 2001-04. Research mandates need to be

attuned to present cropping systems in which commercial crops like cotton, soybean, castor, fruits and vegetables are emerging as more important than traditional cereals and pulses. But much of the distress is caused by adverse policies. For instance, input subsidies are heavily loaded in favor of irrigated crops. So are the procurement and public distribution policies, which favor rice and wheat. Investment subsidies and procurement and public distribution policies have to be reoriented to provide a level playing field between farmers who have access to irrigation and those who do not.

Chapter 8: Changes in Labor Market Scenario

Much of the reduction in rural poverty in India is surmised to have resulted from increasing real wages and decreasing real prices of food. In particular, the labor market scenario has changed dramatically over the three decades between the first and second generations of VLS. During the first-generation studies, the market was segmented, with very little movement of labor between villages and towns. Due to the noncertainty of finding work or the prospect of finding only low-wage work, laborers stayed in villages to work as attached servants on annual contracts. But since then labor markets have become interlinked and there is now greater mobility of labor. The practice of attached servants has withered away and labor is now hired on a contractual or casual basis. Real wages have gone up much faster than the incomes of farmers. Nonfarm employment has gained prominence, particularly in villages near towns. A study of the labor market scenario would help in documenting the status of labor and in comparing their conditions with the situation in the past.

8.1 Labor Market Participation by Different Household Classes

In order to sketch the pattern of participation in the labor market, we have to relate labor participation to the size of land holding by households. Moreover, since labor has been finding work in the nonfarm sector too in recent years, it would be useful to segregate farm work from nonfarm work in order to assess the relative importance of either type.

On an average, a participant in the labor market in Aurepalle found 145 days of work per year and earned Rs 4531 at a daily average of Rs 31.25 (Table 8.1). A total of 160 persons participated in the labor market in this village with labor households finding the highest number of days of work per person. But annual earnings were highest for small-farm households. This was because they found more nonfarm work, possibly because they had better skills, awareness or contacts. Labor households did more farm work (145 days per person) than the other land holding classes. Average daily earnings

Table 8.1. Labor market participation in Aurepalle, 2001-04.

Variable	Class of households				Average
	Labor	Small	Medium	Large	
No. of participants	43	50	48	19	-
Farm work					
Work days per person	145	126	108	76	120
Earnings per worker (Rs)	3868	3683	2912	2354	3344
Daily earnings (Rs)	27	29	27	31	28
Nonfarm work					
Workdays per person	21	34	24	14	25
Annual earnings per worker (Rs)	916	1673	1136	654	1187
Daily earnings (Rs)	44	49	47	47	47
Total					
Work days per person	166	160	132	90	145
Earnings per person (Rs)	4784	5356	4048	3008	4531

Table 8.2. Labor market participation in Dokur, 2001-04.

Variable	Class of households				Average
	Labor	Small	Medium	Large	
No. of participants	38	71	42	34	-
Farm work					
Work days per person	69	63	51	64	62
Earnings per worker (Rs)	2088	1758	1554	1613	1753
Daily earnings (Rs)	30	28	30	25	28
Nonfarm work					
Work days per person	23	25	30	14	24
Annual earnings per worker (Rs)	1074	1182	1564	652	1149
Daily earnings (Rs)	47	48	52	47	49
Total					
Work days per person	92	87	82	78	85
Annual earnings per person (Rs)	3162	2940	3119	2265	2902

for the village as a whole were Rs 28 for farm work and Rs 47 for nonfarm work. The latter type of work accounted for only 17% of the total work days but contributed 26% of the average earnings. As can be expected, the number of work days decreased with the size of land holding, perhaps because as the farm size increases, there is more work available on one's own farm and therefore less need to seek work elsewhere.

Compared to Aurepalle, there were limited opportunities of work in Dokur because of persistent drought and fallowing of lands in the command area of the village tank (Table 8.2). A participant in the labor market in Dokur could find only 85 days of work and earn Rs 2902 per year. While nonfarm work opportunities were about equal in both villages, availability of farm work in Dokur was about 50% of that in Aurepalle. Average daily earnings were the same for farm work in both villages but slightly higher for nonfarm work in Dokur. Since many workers, particularly from labor households, migrate long distances for work, participation in the local labor market was lower. Labor households found more farm work than other household classes while medium-sized farm households found nonfarm work for a greater number of days. The number of work days as well as earnings per person declined with increase in the size of land holding. Just as in Aurepalle, average daily earnings in nonfarm work were about 75% higher than in farm work.

Due to the advent of irrigation, work opportunities were better in Shirapur (Table 8.3). There were 139 days of work available per person, promising earnings of Rs 7311 per year. Nonfarm work accounted for only 16% of the total number of work days. Daily earnings in farm work were quite high (Rs 51), about 82% higher than in the two Mahbubnagar villages. The difference in daily earnings from farm and nonfarm work was not as high as in Mahbubnagar. Daily earnings from nonfarm work were only 22% higher than from farm work. The number of work days per participant showed a slightly declining trend with increase in the size of land holding. But earnings per participant were highest in the medium-sized land holding group, closely followed by the large-farm group. This was because these farm-size groups could realize higher earnings per day for farm work than labor or small-farm households. The medium-farm group realized higher daily earnings from nonfarm work too than other groups. Labor households worked for a greater number of days in agriculture and realized the highest earnings from such work. Small- and medium-farm households worked for more days in nonfarm activities. Large-farm households did not do any nonfarm work.

Table 8.3. Labor market participation in Shirapur, 2001-04.

Variable	Class of households				Average
	Labor	Small	Medium	Large	
No. of participants	39	47	11	2	-
Farm work					
Work days per person	136	106	98	112	116
Earnings per worker (Rs)	6352	5622	5715	7888	5906
Daily earnings (Rs)	47	53	58	70	51
Nonfarm work					
Work days per person	18	26	31	0	23
Annual earnings per worker (Rs)	993	1654	2185	0	1405
Daily earnings (Rs)	54	64	71	0	62
Total					
Work days per person	154	132	129	112	139
Annual earnings per person (Rs)	7345	7276	7900	7888	7311

Compared to Shirapur, labor opportunities were lower in Kalman (Table 8.4) with an average of 133 days of work per year available per participant and annual earnings of Rs 6013. Earnings per day were lower for farm work (Rs 41) and nonfarm work (Rs 61). The number of days of farm work was quite high (106) but nonfarm work was available for only 27 days per year. Medium-sized farm households found more days of nonfarm work than the other groups and earned a total of Rs 6054 per person in the labor market. Small-farm households found the highest number of days of farm work but found fewer days of nonfarm work than labor and medium-farm groups. Large-farm households earned only Rs 303 from nonfarm work which was about 50% of what they earned from farm work. Labor households found more days of work than the land-owning groups but their earnings were much less than earnings by small and medium farms.

Kanzara offered the best opportunities for labor market participation among the six VLS villages (Table 8.5) with 168 days of work per person and earnings of Rs 6699 per year. Most of the work was

Table 8.4. Labor market participation in Kalman, 2001-04.

Variable	Class of households				Average
	Labor	Small	Medium	Large	
No. of participants	31	61	19	1	-
Farm work					
Work days per person	107	116	76	10	106
Earnings per worker (Rs)	3757	4980	3564	600	4362
Daily earnings (Rs)	35	43	47	60	41
Nonfarm work					
Work days per person	32	22	36	4	27
Annual earnings per worker (Rs)	2103	1181	2490	303	1650
Daily earnings (Rs)	65	54	69	76	61
Total					
Work days per person	139	138	112	14	133
Earnings per person (Rs)	5861	6161	6054	903	6013

Table 8.5. Labor market participation in Kanzara, 2001-04.

Variable	Class of households				Average
	Labor	Small	Medium	Large	
No. of participants	20	44	26	0	-
Farm work					
Work days per person	188	171	127	0	160
Earnings per worker (Rs)	7440	6589	4632	0	6145
Daily earnings (Rs)	39	39	37	0	38
Nonfarm work					
Work days per person	19	7	0.6	0	8
Annual earnings per worker (Rs)	1523	428	45	0	554
Daily earnings (Rs)	81	59	70	0	71
Total					
Work days per person	207	178	127	0	168
Earnings per person (Rs)	8963	7017	4677	0	6699

in the farm sector. Compared to the Mahbubnagar and Solapur villages, nonfarm work was very limited – only 8 days per person per year. Although farm work opportunities were plenty, daily earnings were much lower than in the Solapur villages. The difference between daily earnings from farm and nonfarm work was quite substantial: the nonfarm sector yielded 87% more income than the farm sector. Medium-farm households found least work – both farm and nonfarm. Labor households found more days of work and earned more than the other household classes.

Kinkheda, on account of its proximity to Kanzara and due to the impact of surface irrigation, offered similar employment opportunities (Table 8.6) with only a shade fewer work days and earnings per year. Nonfarm employment was available for only 7 days but earnings from it were quite high at Rs 86 per day. There was a substantial difference in earnings between farm and nonfarm work: daily earnings from nonfarm work were 146% higher. Interestingly, none from medium- and large-farm households did any nonfarm work in this village. But labor and small-farm households did so and

Table 8.6. Labor market participation in Kinkheda, 2001-04.

Variable	Class of households				Average
	Labor	Small	Medium	Large	
No. of participants	16	25	5	1	-
Farm work					
Work days per person	188	156	112	67	157
Earnings per worker (Rs)	6795	5246	3743	3000	5449
Daily earnings (Rs)	36	34	33	45	35
Nonfarm work					
Work days per person	14	5	0	0	7
Annual earnings per worker (Rs)	1594	160	0	0	615
Daily earnings (Rs)	111	35	0	0	86
Total					
Work days per person	203	160	112	67	164
Earnings per person (Rs)	8389	5406	3743	3000	6064

benefited from it. Labor households found the most work in both farm and nonfarm sectors and earned the highest income. Large-farm households found the least amount of work and earnings among all farm-size groups. Participation as well as earnings from the labor market declined with increase in the size of land holding.

8.2 Labor Market Participation in Relation to Gender and Land Holding

The role of women in agriculture is quite critical. Certain field operations like weeding and transplanting are traditionally performed by them. Similarly, men conventionally carry out operations like plowing, puddling, pesticide application, etc. Some operations are performed by both men and women. However the pattern of employment of male and female labor can be different in different locations. Generally, wage rates for women laborers are lower than for men, possibly because of their shorter working hours, the less strenuous operations carried out by them or due to exploitative practices. It would be interesting to study the differences between employment of male and female labor in terms of participation rates, wages and earnings at different locations.

More women participated in the labor market than men in all farm-size groups in Aurepalle (Table 8.7). Women invariably found more days of farm work than men but the latter found more nonfarm work. Daily wages were invariably higher for men for farm as well as nonfarm work. Overall, male laborers were employed for an average of 91 days in farm work and 48 days in nonfarm work. Female laborers, on the other hand, found 138 days of farm work and 10 days of nonfarm work. Male laborers earned an average of Rs 6374 per year and female laborers Rs 3333 per year. Despite working for 10 days more per year, female laborers' earnings were about 50% of the earnings of male laborers. The overall average earnings per day were Rs 46 for male labor and Rs 23 for female labor. A part of this difference in earnings can be explained by the higher participation of male labor in nonfarm work where wages were higher. The remaining difference can be attributed to differences in working hours, productivity and the convention of valuing male labor higher than female labor. Although government legislations provide for equal wages for men and women, they are practised more in the breach on private farms.

Just as in Aurepalle, more women participated in the labor market than men in all farm-size groups

Table 8.7. Gender pattern of labor market participation in Aurepalle.

Class of households and gender	No. of participants	Farm work			Nonfarm work		
		Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)	Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)
Labor							
Male	13	142	5265	37	41	2363	58
Female	30	147	3263	22	12	288	24
Small							
Male	22	100	4200	42	63	3418	54
Female	28	146	3277	22	12	301	25
Medium							
Male	19	63	2698	43	50	2637	53
Female	30	133	2951	22	7	147	21
Large							
Male	9	54	2665	49	20	1048	52
Female	10	96	2074	22	9	298	33
Total							
Male	63	91	3748	41	48	2626	55
Female	97	138	3081	22	10	252	25

Table 8.8. Gender pattern of labor market participation in Dokur.

Class of households and gender	No. of participants	Farm work			Nonfarm work		
		Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)	Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)
Labor							
Male	16	64	2644	41	33	1914	58
Female	22	73	1683	23	16	463	29
Small							
Male	26	43	1973	46	45	2518	56
Female	45	74	1634	22	13	410	32
Medium							
Male	16	27	1761	65	109	5245	48
Female	26	66	1427	22	12	380	32
Large							
Male	12	73	2214	30	22	1278	58
Female	22	59	1285	22	10	311	31
Total							
Male	70	49	2119	43	42	2389	57
Female	115	69	1530	22	13	394	30

in Dokur (Table 8.8). Large farms were the only exception where men found more days of farm work than women; in all other classes of households, female labor did farm work on more days than men. But in case of nonfarm work, this exception was the rule, with men finding more work days than women in all farm-size groups. Both in farm work as well as nonfarm work, daily wages for men were nearly twice that for women. Overall, days of employment were higher for men than women: Male laborers found an average of 91 work days and female laborers only 82. In the labor and small-farm groups, the number of work days available for female labor was only slightly lower than for male. This difference increased in the medium- and large-farm groups. Average earnings for men were Rs 4508 per year and only Rs 1924 for women. In other words, women laborers' average earnings were 43% of the earnings of a male laborer. Labor earnings in Dokur were much lower than in Aurepalle.

In general, participation of people in the labor market was lower in Shirapur than in the Mahbubnagar villages (Table 8.9). Women participated much less than men. However, they found a few more days of work than men in farm operations although their participation in nonfarm work was again typically much less. No woman from medium- and large-farm households participated in any nonfarm work. A few women from labor and small-farm households did so but for far fewer days than their male counterparts. Interestingly, wages for males were Rs 64 per day in farm work and Rs 65 per day in nonfarm work. But for female labor, daily wages were slightly higher in nonfarm work than in farm work although they continued to be less than 50% of the wages paid to male labor for farm work and slightly more than 50% for nonfarm work. Overall, a male laborer worked for 148 days and earned Rs 9454 per year. In contrast, a female laborer found work for 122 days and earned Rs 3501 per year, or just 37% of the earnings of a male.

Just as in Shirapur, more males participated in the labor market overall than females in Kalman (Table 8.10). But this was not so in labor households, where more women did labor than men, finding 122 days of work as against 86 by their male counterparts. In small-farm households too, female labor found a few more work days in the farm sector than males. But in medium- and large-farm households, male labor did more days of farm work than female. Male laborers' daily wages for farm work were 82% higher than the wages of female laborers. In the nonfarm sector, male labor from all farm-size groups found more days of work than female labor and enjoyed higher daily wages too. Overall, men found an average of 133 days of work and earned Rs 7446 per year as against 129 work days and

Table 8.9. Gender pattern of labor market participation in Shirapur.

Class of households and gender	No. of participants	Farm work			Nonfarm work		
		Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)	Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)
Labor							
Male	24	139	8110	58	26	1510	58
Female	15	130	3539	27	6	167	30
Small							
Male	29	105	7083	67	38	2554	67
Female	18	108	3268	30	6	204	36
Medium							
Male	9	90	6241	69	38	2671	71
Female	3	89	2233	25	0	0	0
Large							
Male	2	93	7259	78	0	0	0
Female	1	38	1258	33	0	0	0
Total							
Male	64	115	7355	64	33	2099	65
Female	36	117	3330	29	5	171	33

Table 8.10. Gender pattern of labor market participation in Kalman.

Class of households and gender	No. of participants	Farm work			Nonfarm work		
		Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)	Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)
Labor							
Male	13	86	4523	53	54	4310	80
Female	18	122	3204	26	16	510	32
Small							
Male	37	115	5917	51	26	1593	61
Female	24	118	3536	30	15	545	36
Medium							
Male	14	87	4339	50	39	2648	68
Female	5	45	1392	31	28	2048	73
Large							
Male	1	10	600	60	4	303	76
Female	0	0	0	0	0	0	0
Total							
Male	66	100	5138	51	33	2308	70
Female	47	112	3181	28	17	691	41

earnings of Rs 3872 for women. Despite working for nearly the same number of days, female labor earned only 52% of the earnings of men.

In Kanzara, women were equal labor market participants in the labor households (Table 8.11) and less than equal participants in small- and medium-farm households. In the large-farm households, neither males nor females participated in the labor market. In the nonfarm sector, female participation was less than male. Women's daily wages were about the same for both farm and nonfarm work. But men realized much better daily wages from nonfarm work than from farm work. On an average, a male worker found 170 days of work and earned Rs 8296 per year while a woman found 166 days of work and earned Rs 4260. Thus, while women worked for about the same number of days as men, their earnings were only 51% of that for a male laborer.

More women participated in the labor market of Kinkheda than men (Table 8.12). In the case of small-farm households, their participation was higher in both farm and nonfarm work. In the labor and medium-sized farm households, female participation was equal in farm work but virtually nil in nonfarm work. Just as in Kanzara, average daily wages for women were equal for both farm and nonfarm work. But for male labor, earnings per day in nonfarm work were higher by 133% than the daily wage rate for farm work. Overall, a male laborer found 171 days of work and earned Rs 8405 per year while a female labor participant worked for 156 days and earned only Rs 3911 per year. Thus, daily earnings were Rs 49 for male labor and Rs 25 for female labor. While a part of this difference can be attributed to differences in working hours, type of work and labor productivity, it can also be ascribed to the tradition of paying less to women.

8.3 Employment Opportunities

Many land-owning households employ family labor to the maximum extent possible. Nevertheless, some members of the family may have to seek employment in the labor market because the family farm is too small or due to the seasonal nature of agricultural employment. Over the years, there have arisen nonfarming employment opportunities in and around villages, apart from work opportunities on others' farms. Some people are also engaged in self-employment enterprises. When

Table 8.11. Gender pattern of labor market participation in Kanzara.

Class of households and gender	No. of participants	Farm work			Nonfarm work		
		Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)	Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)
Labor							
Male	10	191	10045	53	25	2742	110
Female	10	186	4835	26	12	304	25
Small							
Male	28	178	7954	45	9	613	68
Female	16	159	4201	26	4	104	26
Medium							
Male	16	119	5460	46	1	73	69
Female	10	138	3307	24	0	0	0
Large							
Male	0	0	0	0	0	0	0
Female	0	0	0	0	0	0	0
Total							
Male	55	160	7464	47	10	832	88
Female	36	161	4129	26	5	131	26

Table 8.12. Gender pattern of labor market participation in Kinkheda.

Class of households and gender	No. of participants	Farm work			Nonfarm work		
		Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)	Work days per worker	Earnings per worker (Rs)	Daily wage (Rs)
Labor							
Male	8	189	8925	47	29	3188	111
Female	8	187	4665	25	0	0	0
Small							
Male	11	170	7339	43	3	182	61
Female	14	144	3601	25	6	143	25
Medium							
Male	3	79	3558	45	0	0	0
Female	3	107	2681	25	0	0	0
Large							
Male	1	67	3000	45	0	0	0
Female	0	0	0	0	0	0	0
Total							
Male	23	160	7209	45	11	1196	105
Female	25	153	3831	25	3	80	25

employment is scarce in their own village, some villagers migrate long distances in search of work.

A study of the work opportunities available for men and women in the labor market will help us understand the extent of underemployment and prevalent wage patterns in local and distant markets.

In the six VLS villages, there were an average of 571 participants in the local labor market and 149 participants in the distant labor market (Table 8.13). The number participating in the local labor market averaged 1.3 per household, while those participating in the distant labor market averaged 0.3. The participation of women was higher in the local labor market while there were more male workers in the distant labor market. In both markets, male workers found more days of work than female workers. Male workers' daily earnings were about twice that of female workers in the local labor market. In the distant labor market, male workers' earnings per day were about 74% higher than those of female workers. Participation in distant labor markets was much higher in the Mahbubnagar villages than in the Solapur or Akola villages. Daily wages in the local market were higher in the Solapur villages while wages in the distant market were higher for workers from the Akola villages. Overall, there were adequate work opportunities in the local and distant labor markets for workers. But gender inequality relating to daily earnings persists in all the villages.

8.4 Changes in Real Wage Rates

Wage rates reflect the returns to labor endowments. During 1975-78, labor markets were segmented entities. The skill profiles needed for work in one market were different from skills needed in another. Also, there were high transaction costs involved in the mobility of labor. Wage rates were determined by custom and the relative bargaining power of land owners and laborers. The system of year-long contracts was quite dominant for male labor. A part of the wages were paid in kind. But since then, there has been a greater monetization of the economy and wages in kind have been replaced by cash payments. Similarly, casual daily-rated and piece-rate contract systems replaced long-term labor contracts. The bargaining power of land owners has declined and that of laborers has improved. The Union and state governments also periodically

Table 8.13. Employment opportunities in local and distant labor markets in relation to gender, 2001-04.

Village/ gender group	Local market			Distant market		
	No. of workers	Average no. of work days per worker	Average daily earnings (Rs)	No. of workers	Average no. of work days per worker	Average daily earnings (Rs)
Aurepalle						
Male	63	139	46	30	217	77
Female	97	148	23	7	148	35
Dokur						
Male	70	91	50	45	182	84
Female	115	82	23	27	175	57
Shirapur						
Male	64	148	64	16	264	100
Female	36	122	27	2	352	48
Kalman						
Male	66	133	56	8	160	119
Female	47	129	30	1	220	59
Kanzara						
Male	55	170	49	9	182	175
Female	36	166	26	1	345	88
Kinkheda						
Male	23	171	49	3	275	101
Female	25	156	25	0	0	0
Total						
Male	215	142	52	111	204	94
Female	356	134	26	38	185	54

mandate the minimum wages to be paid to agricultural labor, which generally exceed the prevailing market wage rate. Although the official wage rates are implemented only on government farms, they exert an upward pressure on the market rate. As a result of these factors, the real wages of agricultural labor have gone up. Table 8.14 presents a comparison of the real wages of male and female labor in three VLS villages, Aurepalle, Shirapur and Kanzara.

In real terms, wages for male labor have increased by an average of 138% between 1975-78 and 2001-04. Growth in wage rates for female labor (98%) has been relatively slower. Male labor wage rates have risen most rapidly in Aurepalle (187%), closely followed by Shirapur (181%). They rose slowest in Kanzara (69%). Wage rates for women rose fastest (123%) in Shirapur. In Aurepalle, the growth rate (97%) was around the sample average (98%). As was the case with male labor, growth in real wages for female labor was slowest in Kanzara. However, wage rates for female labor increased slightly faster than male labor wage rates in Kanzara.

8.5 Comparison of Wage Rates in VLS Villages and Respective Districts

We compared the wage rates paid in the three VLS villages with the average wage rates prevailing in the districts in which they are located. The district wage rates were gathered from secondary sources. Wage rates for male labor are reported in periodic publications of the Government of India. These rates were averaged for the study years and compared with the male labor rates in vogue in Aurepalle, Shirapur and Kanzara (Table 8.15)

During 1975-78, wage rates in Aurepalle and Shirapur were lower than the district average; in

Table 8.14. Comparison of current daily wage rates (Rs) with base-year wages at current prices.

Village	Wage rates in 1975-78	Wage rates in 1975-78 at 2001-04 prices	Wage rates in 2001-04	Percentage increase between 1975-78 and 2001-04
Aurepalle				
Male	2.7	18.1	52.0	187
Female	1.8	11.7	23.0	97
Shirapur				
Male	3.4	22.5	63.3	181
Female	1.8	12.1	27.0	123
Kanzara				
Male	4.1	27.5	46.6	69
Female	2.1	14.0	25.0	79
Average				
Male	3.4	22.7	54.0	138
Female	1.9	12.6	25.0	98

Table 8.15. Comparison of male wage rates in VLS villages and respective districts.

Year	VLS village	Male wage (Rs per day)	District	Male wage (Rs per day)
1975-78	Aurepalle	2.7	Mahbubnagar	3.7
	Shirapur	3.4	Solapur	3.8
	Kanzara	4.1	Akola	3.5
2001-04	Aurepalle	52.0	Mahbubnagar	43.3
	Shirapur	62.3	Solapur	49.1[1]
	Kanzara	46.6	Akola	40.3[1]

1. Figures pertain to three-year average of 1996-99.

Kanzara, they were higher. Secondary data are available for Mahbubnagar district up to 2004, but for Solapur and Akola districts only up to 1999. During 2001-04, the male wage rates prevalent in Aurepalle were higher than the district average. In Shirapur and Kanzara too, the male wage rates for 2001-04 were higher than those reported for 1996-99 (average) for the respective districts. But the male wage rates in the three VLS villages and the district average wage rates moved in a similar fashion.

As we noted earlier, wages for male labor in real terms increased substantially between 1975-78 and 2001-04. The same trend was seen for male wage rates at the district level (Table 8.16). Growth rates of male wages in real terms were highest in Akola district followed by Solapur for the period (1975-1999). In Mahbubnagar district, the growth rate was slower at 3.15% per annum. All the growth-rate equations were statistically significant at a high level of probability.

Table 8.16. Growth rates of daily wages for male labor in real terms in Mahbubnagar, Solapur and Akola districts.

District	Period	Growth rate in real wages of male labor (Percent per annum)
Mahbubnagar	1975-2004	3.15*
Solapur	1975-1999	3.80*
Akola	1975-1999	4.64*

** Significant at 1% probability level.*

8.6 Summary and Inferences

There was substantial participation of VLS sample households in the labor market. Of the two Mahbubnagar villages, there was more work

available in Aurepalle than in Dokur. Due to the decline of tank irrigation in Dokur, a laborer in that village could find only 50% of the days of work that his counterpart in Aurepalle did. But opportunities for nonfarm work were slightly better in Dokur. The Akola villages (Kanzara and Kinkheda), which have a better rainfall regime and enjoy the support of surface irrigation in the postrainy season, recorded very high number of days of farm employment. In Solapur district, Shirapur, which has partial support of irrigation, had more days of farm employment than Kalman, which depends more on rainfed agriculture. Work opportunities in the nonfarm sector were better in the Solapur villages than in the Mahbubnagar and Akola villages. Wage rates for farm work were higher in Solapur, where the wage differential between farm and nonfarm work was less too. While the number of days of employment in nonfarm work was quite limited in the Akola villages, wage rates for nonfarm work were substantially higher than those for farm work. Participation in the labor market was spread across all farm-size groups in the Andhra Pradesh villages, while it declined with size of land holding in the Maharashtra villages. In general, the presence of labor households was greater in farm work while small- and medium-farm households were more prominent in nonfarm work.

In the Andhra Pradesh villages (Aurepalle and Dokur), women participated more than men in farm work. In the Solapur villages, they participated less. Similarly, their participation was higher in Kinkheda while men were prominent in the labor market in Kanzara. In general, participation of female labor was largely confined to farm work and quite limited in nonfarm work. Daily wages were much lower for women than for men, both for farm as well as nonfarm work. Overall earnings for women ranged from 33% to 50% of the earnings of men.

On an average, there were 571 participants in the local labor market in the VLS villages and 149 participants in the distant labor market, an average of 1.3 persons per household in the local labor market and 0.3 per household in the distant labor market. Participation of women was higher in the local market while men were more prominent in the distant labor market. In both markets, male workers found more days of work than their female counterparts. Their daily earnings too were about twice that of female workers in the local labor market, and in the distant labor market about 74% higher. Participation of labor in the distant markets was much higher in the Mahbubnagar villages when compared with the Solapur and Akola villages. Earnings per day in the local market were higher for workers of Solapur villages while Akola villagers earned the highest from the distant markets. Overall, there were adequate opportunities in the local and distant labor markets for those in search of work. But gender inequality in terms of earnings per day persisted in all the villages.

On an average, wages for male labor increased by 138% in real terms between 1975-78 and 2001-04. Relatively, wages for female labor grew by only 98%. The increase in the wage rate of male labor was most rapid in Aurepalle (187%). For female labor, the biggest increase of 123% was recorded in Shirapur. Real wages of female labor increased slightly faster than those of male labor in Kanzara.

The increase in real wages noted in three VLS villages was reflected in the growth of real wages of male labor at the district level. The growth in real wages was faster in the Maharashtra villages than in Andhra Pradesh. The nominal wages in VLS villages and the average wages in the districts where they are located moved in a parallel manner. The real wages of male labor in the study districts increased at compound growth rates ranging from 3.15% to 4.64% per annum.

The integration of labor markets has created work opportunities both in the farm and nonfarm sectors as well as in local and distant markets. Real wages increased substantially in all three VLS villages and in the districts where they are located. While returns to land have decreased, returns to labor have increased substantially. This has a significant implication for reduction of inequalities between labor and land-owning households. A sure development pathway is to have more workers participating in the labor market. The higher the literacy and skill levels, the greater are the earning opportunities for labor, particularly in the nonfarm sector.

Chapter 9: Investment for Development of Natural Resources

There is a general perception that population pressure, frequent droughts and reduced use of organic manure have accelerated the degradation of natural resources. Depletion of ground water is also contributing to this process. Practices such as crop rotation and legume cultivation, which can arrest this phenomenon, have been shrinking. Soil erosion is known to erode the top soil and nutrients, thereby affecting the texture, structure and fertility of the soil. This chapter is devoted to investments made by farmers to curb soil erosion and explore for ground water.

9.1 Soil Characteristics of VLS Villages

The soils in the two Mahbubnagar VLS villages, Aurepalle and Dokur, are of five major types: dubba, yerra, nalla, regadi and bette. Dubba is a mixture of soil and sand with a higher proportion of the latter than is found in the other types. Yerra (red) soils have lower sand content and are harder and stickier. Nalla are shallow black soils with about 60 cm depth. Regadi soils are deeper black soils and are very hard when dry and sticky when wet. When dry, 5-45 cm cracks develop in them. Bette are shallow, pebbly, white soils containing limestone, which imparts 'coolness' to the soil, allowing crops to survive longer during drought.

The soils in the Solapur villages, Shirapur and Kalman, are of six types: kali, karal, morwandi, barad, 'problem' soils and specialty soils. Kali, morwandi and karal are common, deep, black, heavy clays with only a subtle distinction between them. Kali soils are the ideal black soil: deep and fertile with good tilth and moisture storage capacity. Karal soils are distinguished by their hardness. They are difficult to cultivate and have a low water infiltration rate. Morwandi soils are relatively shallower. Barad are also black or black-gray soils, but compared to the kali group, they may be shallow, rocky or infertile. The 'problem' soils include morrum, malachi and chicken. Morrum soils are whitish yellow and consist of about 50% rock. Malachi soils are usually brown or black, but only 7.5 to 10 cm deep. Chicken soils are extremely hard and sticky reddish black soils. Specialty soils include marul and tambadi. Marul is a term used for irrigated fields, river bed plots or material removed from the river bed and applied to other soils to lend them fertility. Tambadi is the red material which lies below the top soil in many types of soils. Though not fertile, it is considered a valuable soil amendment.

The major soil groups in the two Akola villages, Kanzara and Kinkheda, are bhari kali, madhyam kali and halki. Bhari kali soils are deep black soils of 90 to 180 cm depth. Madhyam kali are shallower soils of 48 to 90 cm feet depth. Halki soils are even shallower with depth less than 48 cm.

9.1.1 Aurepalle

In Aurepalle, 27 farmers had fields with nalla (black and regadi) soil; 25 had red soil and 23 sandy (dubba) soil. Three farmers had murram fields and two had saline soil. In terms of depth, most of the farmers' fields (49 out of 80) had shallow soil, 24 had medium-deep soil, and only 7 had deep soil. In terms of inclination, 39 farmers had level plots with a slope of less than 1%. Inclination was medium (1-3%) for 28 farmers and steep (3-10%) for 5 farmers. Forty-four farmers felt that the fertility of their soil was good while 34 felt theirs was poor. One farmer each categorized his soil fertility as very good and very poor. Sixty-one farmers did not see soil degradation as a major problem; 16 felt soil erosion was indeed a problem. Two farmers said their soils faced nutrient depletion while one felt he had a serious problem of salinity/alkalinity.

9.1.2 Dokur

The dominant soil type in Dokur is sandy, with 32 out of 65 farmers saying that their soil fell in this category; 14 of them reported medium-deep black soil, 3 had deep black soil, 8 red soil and 7 saline. A lone farmer said his soil was murram. Just as in Aurepalle, a majority (34 out of 65) of the farmers

had shallow soil; 27 farmers reported medium-deep soil and 4 had deep soil. Thirty-five farmers characterized their land as level (less than 1% slope) fields; 28 reported having land with a gentle slope, while 2 had slopes exceeding 3%. Thirty-two farmers felt that their lands were of poor fertility while one described the fertility of his land as very poor; 29 of them perceived their soil fertility to be good and 3 felt that it was very good. Fifty-five of the farmers said soil degradation was not a problem on their farms. Two of them cited erosion as a problem; 1 faced nutrient depletion; 4 farmers reported salinity/alkalinity and 3 faced water-logging.

9.1.3 Shirapur

Of the 67 farmers interviewed in Shirapur, 26 reported deep black soil; 23 had medium-deep black soil, 13 murram soil, 3 sandy soil and 2 shallow soil. In terms of depth, 17 farmers had very deep soil, 16 had deep soil, 7 medium deep soil, 23 medium soil, 3 had shallow medium soil and 1 had shallow soil. Nineteen of the farmers categorized their soil fertility as very good while 36 described it as good; 8 farmers reported poor soil fertility while another 4 said it was very poor. Thirty-nine farmers had level fields while 23 noticed a slight slope. Two farmers reported a medium slope and 3 a very steep slope. Fifty-one farmers said they had not noticed any degradation of their soil; 13 reported erosion. Three farmers complained of salinity/alkalinity and 2 faced waterlogging.

9.1.4 Kalman

Fifty-eight out of 71 farmers in Kalman reported having black soil while 13 had murram fields. In terms of depth, six farmers had very deep soil and 30 deep soil. Twenty-six farmers reported medium-deep soils while 9 farmers had shallow soil. Only six farmers said their soil fertility was very good while 49 described it as good. Fourteen farmers felt that their soil fertility was poor while the remaining two said it was very poor. Thirty-six farmers had leveled lands while 31 farmers reported a slight slope. Three farmers had moderately sloping land while one reported a steep slope. Forty-eight farmers saw no problem of soil degradation while 13 cited erosion and 3 reported waterlogging or soil salinity/alkalinity.

9.1.5 Kanzara

The most common soil type in this village is medium black, and 22 out of the 41 farmers interviewed had such fields. Only four farmers had fields with deep black soil. The other types of soil are distributed as follows: shallow black (3 farmers), murram (9), red (2) and sandy (1). Twenty-two farmers categorized their soil fertility as good while three others felt it was very good. Five farmers rated their soil fertility as medium while 11 rated it as poor. Thirty-five farmers had slightly sloping land while six had level fields. Fourteen farmers reported no problem of soil degradation and 19 said they faced soil erosion. Six farmers reported waterlogging while two faced soil salinity/alkalinity.

9.1.6 Kinkheda

Twenty of the 25 farmers in Kinkheda had fields with black soil of varying depth: 8 had deep soil, 11 had medium-deep soil and 1 shallow soil. Five farmers had murram fields. Nineteen farmers rated their soil fertility as good and one farmer as very good. Four farmers reported poor soil fertility and another medium fertility. Five farmers had level fields while 19 reported a slight slope. Only one had land with a moderate slope. Twelve farmers saw no soil degradation while an equal number reported soil erosion. Only one complained of waterlogging.

9.2 Investment on Soil Conservation Measures in VLS Villages

With a large number of farmers acknowledging soil erosion as a major problem, one would expect that they invest in controlling it. The central and state government runs several schemes to encourage farmers to take up soil conservation work on a cost-sharing basis. Some of these schemes have built-in incentives for farmers. The watershed development programs that have been taken up in many villages of the country also support farmers who take up soil conservation investment. But farmers' ability to make such investments is severely limited by the profits they make from agriculture. In this chapter we analyze investment by VLS sample households on soil conservation activities.

Nearly 66% of the total soil conservation investments made during 1985-2004 were for strengthening field bunds (Table 9.1). Soil conservation normally requires either contour or graded bunds. But such bunds do not correspond to farmers' property boundaries. As a second-best alternative, farmers tend to invest on strengthening existing field bunds which correspond to property boundaries. Another 21% of the investment was spent on land-leveling work. This activity is particularly taken up in the irrigation plots of farmers. Only 5% of the total investments were made on building contour bunds, which are recommended for erosion control. The remaining 8% was spent on other types of work to check soil erosion. Among the VLS villages, the biggest investments were made in the two Solapur villages, Kalman and Shirapur. Soil conservation investments were very low in the Akola villages and a bit better in the two Andhra Pradesh villages. There were heavier investments in Dokur than in Aurepalle; in Kalman than in Shirapur; and in Kanzara than in Kinkheda. Farmers incurred 64% of the total investment in Aurepalle but only 24% in Dokur, where substantial watershed development work was taken up. Hardly 3% of the investments made in Shirapur was borne by the farmers. This was less than 1% in Kalman. Farmers' share of the investments were low in Kanzara and Kinkheda too: 6% and about 13% respectively. In other words, there was more support for soil conservation by the Maharashtra state government than its Andhra Pradesh counterpart. For the six VLS villages as a whole, farmers tended to spend as much on the annual maintenance of soil conservation structures as they invested on the effort over the last two decades. However, in Andhra Pradesh, these annual maintenance costs were a small fraction of the investment while they constituted a relatively larger fraction of the investment in the Maharashtra villages.

Most of the investments made on soil conservation works were on small farmers' fields (Table 9.2),

Table 9.1. Investment (Rs) on soil conservation in VLS villages, 1985-2004.

	Soil conservation work						
Village	Land leveling	Field bunds	Contour bunds	Others	Total	Farmers' share	Maintenance cost per year
Aurepalle	21500	7000	24000	2160	54660	34900	6713
Dokur	39300	13500	3800	60500	117100	27600	2411
Shirapur	182500	218000	50493	9000	459993	13870	12200
Kalman	59150	752890	0	41400	853440	6900	44500
Kanzara	18950	5900	3650	0	28500	1800	14551
Kinkheda	100	3900	0	0	4000	500	2350
Total	321500	1001190	81943	113060	1517693	85570	82725

Table 9.2. Investment (Rs) on soil conservation in relation to size of land holding, 1985-2004.

	Soil conservation work						
Class of households	Land leveling	Field bunds	Contour bunds	Others	Total	Farmers' share	Maintenance cost per year
Labor	350	0	0	0	350	200	0
Small	166450	753090	51643	15400	986583	22920	19370
Medium	94150	167450	24500	2160	288260	32950	46730
Large	60550	80650	5800	95500	242500	29500	16625
Total	321500	1001190	81943	113060	1517693	85570	82725

Table 9.3. Number of sample households perceiving benefits from soil conservation investments in six VLS villages.

Village	Reduction in soil erosion	Increase in soil fertility	Increase in crop productivity
Aurepalle	18 (22.5[1])	18 (22.5)	17 (21.2)
Dokur	15 (23.1)	15 (23.1)	15 (23.1)
Shirapur	59 (88.1)	59 (88.1)	59 (88.1)
Kalman	59 (83.1)	59 (83.1)	59 (83.1)
Kanzara	34 (82.9)	34 (82.9)	33 (80.5)
Kinkheda	12 (48.0)	12 (48.0)	12 (48.0)
Total	197 (44.2)	197 (44.2)	195 (43.7)

1. Figures in parentheses are percentages of the total sample of farmers in the respective villages.

perhaps because those households are felt to be needing more support from the Government than medium- and large-farm households. Since labor households possess very little land, soil conservation investments on their land were meager and restricted to land leveling. Field bunds took the lion's share of the investment in case of small- and medium-sized farms. Large farmers incurred relatively higher expenditure on projects other than leveling, field and contour bunds. Small farmers incurred only 2% of the total investment while the medium- and large-sized farms bore 11%-12% of the total investment. Medium-sized farm households spent relatively more on annual maintenance than small- and large-farm households.

9.3 Perceived Benefits from Soil Conservation Projects

The number of farmers who perceived a benefit from soil conservation investments depended on the type of soil and the level of investment. In the Solapur VLS villages, where farmers have deep black soils and where relatively heavier investments have been made, a greater proportion of the sample farmers perceived benefits from the investment, such as reduction in soil erosion, improvement in soil fertility and increase in crop productivity (Table 9.3). In the Akola villages, where the soils are black and medium in depth and where relatively lower investments were made, more than 66% of the sample farmers perceived all those benefits. In Mahbubnagar, where there is a predominance of red and shallow soils, less than 25% of the sample perceived benefits from soil conservation investments. Although investments were relatively higher in Dokur than in Aurepalle, about the same proportion of farmers perceived benefits from soil conservation investments.

Only 33% of the land-owning labor households perceived benefits from soil and water conservation efforts (Table 9.4), which perhaps explains why these households tend to invest little in such activities. More than 65% of the large-farm households and about 56% of the small- and medium-sized farm households perceived benefits

Table 9.4. Number of households from different farm-size groups perceiving benefits from soil conservation investments.

Farm-size group	Reduction in soil erosion	Increase in soil fertility	Increase in crop productivity
Labor	4 (33.3[1])	4 (33.3)	4 (33.3)
Small	103 (56.6)	103 (56.6)	103 (56.6)
Medium	57 (55.3)	57 (55.3)	56 (54.4)
Large	33 (67.3)	33 (67.3)	32 (65.3)
Total	197 (44.2)	197 (44.2)	195 (43.7)

1. Figures in parentheses are percentages of the total sample of farmers in the respective groups.

from soil conservation investments. Although small-farm households made relatively high investments in soil conservation, their perception of benefits from them was not high enough relative to medium- and large-farm households.

9.4 Investments on Water Exploration in VLS Villages

In Aurepalle, during the early part of the period 1985-2004, seven farmers invested in digging open dug wells (Table 9.5). Six of these seven attempts were successful, with the average cost of a successful well amounting to Rs 15000. In addition, five farmers made a total of nine attempts to deepen their existing dug wells by an average depth of 8 feet. Four of these attempts were successful. But as the ground water level receded, most of the open dug wells dried up, leaving only two still in use. The investment on these two open dug wells still in use works out to Rs 45000 each. A total of 53 farmers invested in bore wells and four others tried to drill bore holes in their existing open dug wells. A total of 110 attempts were made to drill new bore wells or bore holes in existing open dug wells. Only 47 of them were successful at that time. The cost of drilling a successful bore well to an average depth of 322 feet was Rs 23405, while the cost of drilling a bore hole in an existing well was Rs 10000. But over the years, 11 of the 43 new bore wells and one of the four in-well bores dried up, leaving only 32 bore wells and 3 in-well bores in use. This takes the cost of a bore well still in use to Rs 31450 and that of a still-in-use in-well bore to Rs 13333. The weighted average cost of an irrigation source presently in use in Aurepalle averaged Rs 32876. A sample farmer in this village, on an average, invested Rs 15205 on water exploration efforts during 1985-2004. The average number of open dug wells still in use per farmer was negligible at 0.025. However, the number of functional bore wells per farmer averaged 0.44.

As in Aurepalle, six farmers of Dokur invested in digging seven open dug wells in the early part of the study period, 1985-2004, resulting in four successful wells (Table 9.6). As the large village tank was then getting filled regularly, the water table in the village was high and it cost an average of only Rs 10000 to dig a successful well. Four other farmers made a total of 12 attempts to deepen their existing open wells by 12 feet, but only two of these attempts succeeded. Due to the low rate of success, the cost of successfully deepening a well was even higher, Rs 15500. Presently, none of the four successful dug wells and only one of the two deepened wells is functional. As the village tank has not been filled for several years, the water table has receded and only one of the six dug or deepened wells is presently in use. In addition to the open dug wells, 39 farmers made 100 attempts to drill new bore wells down to an average depth of 377 feet, but only 32 of those attempts succeeded. Nine other farmers dug 12 bore holes to a depth of 72 feet in their existing wells, out of which only seven were successful in striking water. The investment on a successful bore well worked out to Rs 32461 and Rs 11571 for a successful in-well bore. But gradually nine of the new bore wells and five of the in-well bores dried up, leaving only 23 bore wells and two

Table 9.5. Investments on water exploration in Aurepalle, 1985-2004.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	7	5	53	4	69
Number of attempts	7	9	101	9	126
Average depth of attempt (ft)	88	8	322	44	267
Successful attempts	6	4	43	4	57
Presently in use	2	0	32	3	37
Total amount spent (Rs)	90000	80000	1006400	40000	1216400
Cost per successful attempt (Rs)	15000	20000	23405	10000	21340
Cost of sources still in use (Rs)	45000	Very high	31450	13333	32876
Investment per sample land owner (Rs)	1125	1000	12580	500	15205

Table 9.6. Investments on water exploration in Dokur, 1985-2004.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	6	4	39	9	58
Number of attempts	7	12	100	12	131
Average depth of attempt (ft)	21	12	377	72	297
Successful attempts	4	2	32	7	45
Presently in use	0	1	23	2	26
Total amount spent (Rs)	40000	31000	1038750	81000	1190750
Cost per successful attempt (Rs)	10000	15500	32461	11571	26461
Cost of sources still in use (Rs)	Very high	31000	45163	40500	45798
Investment per sample land owner (Rs)	615	477	15981	1246	18319

in-well bores functional. The investment cost on a still-functional bore well worked out to Rs 45163 and that on a functional in-well bore to Rs 40500. These average investments on functional wells, bore wells and in-well bores in Dokur were much higher than in Aurepalle, pointing to an acute water crisis in Dokur. The average investment on a functional water source in Dokur was Rs 45798 as against Rs 32876 in Aurepalle. A sample farmer in Dokur invested Rs 18319 on water exploration during this period. A sample farmer, on an average, owned 0.38 functional bore wells, which was much less than what was reported for Aurepalle.

Shirapur started receiving surface irrigation from the mid 1990s but then the supply stopped. An aqueduct had to be built on the Seina river to improve the water supply to an extent. Fourteen farmers in this village dug 17 new open dug wells to a depth of 31 feet out of which 12 attempts succeeded (Table 9.7). Twenty-six farmers made 30 attempts to deepen their existing wells by another 19 feet and 18 of these attempts were successful. Although the wells were not very deep, they had to be lined with cement structures due to the deep soils prevalent in the village. The cost of digging a successful well was Rs 56417, which further went up to Rs 67700 after two of the wells dried up. The cost of deepening the existing wells was Rs 13639 per successful attempt. Since all of them are functional; the investment cost for deepening the wells remained the same. Twelve farmers made 31 attempts to sink in-well bores to a depth of 187 feet in their existing dug wells. But only six of the 31 attempts yielded water at an average investment cost of Rs 14833. Twenty-six farmers made 32

Table 9.7. Investments on water exploration in Shirapur, 1985-2004.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	14	26	26	12	78
Number of attempts	17	30	32	31	110
Average depth of attempt (ft)	31	19	527	187	216
Successful attempts	12	18	23	6	59
Presently in use	10	18	20	5	53
Total amount spent (Rs)	677000	245500	521400	89000	1532900
Cost per successful attempt (Rs)	56417	13639	22666	14833	25981
Cost of sources still in use (Rs)	67700	13639	26070	17800	28923
Investment per sample land owner (Rs)	10104	3664	7782	1328	22879

attempts to drill bore wells to a depth of 527 feet, and 23 of these attempts succeeded in striking water. Despite the great depth, the cost per successful bore well was only Rs 22666 because of the loose nature of the soil and subsoil. Over the years, three of the bore wells and one of the in-well bores dried up. In 2004, 28 dug wells, 20 bore wells and 5 in-well bores were functional. The average investment on a functional water source in Shirapur was Rs 28923, much lower than in the Mahbubnagar villages. Similarly, the average investment made by a sample farmer on water exploration was lower at Rs 22879. On an average, a sample farmer possessed 0.42 dug wells and 0.37 bore wells in Shirapur.

Kalman had been the poorest village in terms of household and per capita income during 1975-1984. But since then there has been considerable investment on irrigation. Twenty-six farmers made 28 attempts to dig open wells to a depth of 21 feet (Table 9.8). Twenty-four of these attempts were successful, at an average cost of Rs 39083, much less than in Shirapur. Although the yield of water in these wells declined due to drought conditions, only three of them dried up. The investment cost on a functional well thus increased to Rs 44667. Thirty-five farmers made 42 attempts to deepen their existing wells by 11 feet, and 37 of the attempts were fruitful. But nine of the deepened wells dried up later. At the time of deepening, the cost of a successful well was Rs 15569, which increased to Rs 20573 after the well dried up. Relative to open wells, investment on digging new bore wells and drilling bore holes in existing wells was lower in Kalman. Only nine farmers drilled bore wells up to an average depth of 284 feet, and eight of them succeeded in striking water. Investment on functional bore wells averaged Rs 26125. Nine farmers made 20 attempts to drill bore holes in existing wells, and only nine of those attempts were successful. However, three of those in-well bores dried up later. Investment on a successful in-well bore was Rs 8778, which increased to Rs 13167 for a functional in-well bore after some of them dried up. The average investment on a functional water source was Rs 28604. Investment on water exploration by a sample land owner in Kalman was Rs 25381. In 2004, there were 49 wells and 14 bore wells functioning. A sample farmer in this village owned 0.69 dug wells and 0.20 bore wells.

In Kanzara, where rainfall is fairly high and generally assured, the need for irrigation is rather less. The focus remains on open wells. During the period 1985-2004, nine farmers made 19 attempts to dig open wells to a depth of 12 feet (Table 9.9). Nine of these wells were successful. The average investment on these open wells was Rs 27178. But two of these nine wells dried up later, raising the cost of each functional well to Rs 34943. Nine other farmers made 20 attempts to deepen their existing wells by 14 feet, but only seven of them yielded water, at an average investment of Rs 20786. Later, two of these deepened wells dried up. Owing to the failure of two of these wells, the average investment cost of the still-functional deepened wells increased to Rs 29100. Three farmers made seven attempts to drill bore wells up to a depth of 61 feet but only two of them were successful. The investment on a

Table 9.8. Investments on water exploration in Kalman, 1985-2004.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	26	35	9	9	79
Number of attempts	28	42	9	20	99
Average depth of attempt (ft)	21	11	284	68	50
Successful attempts	24	37	8	9	78
Presently in use	21	28	8	6	63
Total amount spent (Rs)	938000	576050	209000	79000	1802050
Cost per successful attempt (Rs)	39083	15569	26125	8778	23103
Cost of sources still in use (Rs)	44667	20573	26125	13167	28604
Investment per sample land owner (Rs)	13211	8113	2944	1113	25381

Table 9.9. Investments on water exploration in Kanzara, 1985-2004.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	9	9	3	4	25
Number of attempts	19	20	7	11	57
Average depth of attempt (feet)	12	14	61	9	18
Successful attempts	9	7	2	3	21
Presently in use	7	5	2	2	16
Total amount spent (Rs)	244600	145500	40000	59200	489300
Cost per successful attempt (Rs)	27178	20786	20000	19733	23300
Cost of sources still in use (Rs)	34943	29100	20000	29600	30581
Investment per sample land owner (Rs)	5966	3549	976	1444	11934

successful bore well averaged Rs 20000. Four other farmers made 11 attempts to dig bore holes in existing wells. Three of them were successful initially but one of them dried up subsequently. The average investment on a successful in-well bore was Rs 19733. The cost of the still-functional in-well bore worked out to Rs 29600. The average investment on a functional water source in Kanzara was Rs 30581, and the investment made by a sample land owner on water exploration was Rs 11934. There were only 12 open wells and 4 bore wells functioning in the village in 2004. A sample land owner owned only 0.30 open wells and 0.10 bore wells in Kanzara.

Although Kinkheda lies only 10 km from Kanzara, its water potential and the investment capacity of its farmers are much lower. Four farmers in this village made as many as 22 attempts to dig wells up to a depth of 7 feet (Table 9.10). Only three of them yielded water at that time but they all dried up later. The investment cost on a successful dug well was Rs 7267. But since all of them dried up later, the cost of a functional open dug well has become infinitely high. Four other farmers deepened their wells by 5 feet, and two of them succeeded in getting water. But one of the two deepened wells dried up later. The investment cost of a successful deepened well worked out to Rs 5100; after one of the two wells dried up, the investment cost on the lone functional well increased to Rs 10200. A lone farmer dug a bore well up to a depth of 60 feet but it cost him Rs 56000. Another farmer attempted to dig a bore hole up to 8 feet in his existing well by investing Rs 4000, but was unsuccessful in getting water. There are only two functional water sources among the 25 sample farmers in Kinkheda. The average investment on a functional water source was as high as Rs 46000. But the average investment made by a sample land owner on water exploration was Rs 3680, which was the lowest investment on water exploration among the six VLS villages.

Table 9.10. Investments on water exploration in Kinkheda, 1985-2004.

Vaiable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	4	4	1	1	10
Number of attempts	22	4	1	1	28
Average depth of attempt (feet)	7	5	60	8	9
Successful attempts	3	2	1	0	6
Presently in use	0	1	1	0	2
Total amount spent (Rs)	21800	10200	56000	4000	92000
Cost per successful attempt (Rs)	7267	5100	56000	Very high	15333
Cost of sources still in use (Rs)	Very high	10200	56000	Very high	46000
Investment per sample land owner (Rs)	872	408	2240	160	3680

Only 12 out of the 112 labor households in the VLS sample possessed land. Although their holdings were small, they nevertheless made some investments on water exploration. Three of these households made 13 attempts at digging new open dug wells up to a depth of 42 feet, but only three of these attempts were successful (Table 9.11). Two of these three wells dried up later, leaving only one that was still functional in 2004. The average investment cost of a successful well was Rs 24333 but this increased to Rs 73000 when all but one of the successful wells dried up. There was no investment by labor households on deepening any of their existing wells. Five such farmers, however, made 13 attempts to dig bore wells up to a depth of 159 feet but only four of these attempts proved successful. The investment cost of a successful attempt thus was Rs 32500. After two of these four bore wells went dry, the average investment cost of a functional bore well went up to Rs 65000. In addition, four farmers in this category made five attempts to sink bore holes in existing wells but only three of these attempts yielded water. The investment cost of a successful in-well bore was Rs 7000. As two of these three in-well bores dried up, the investment cost of the lone functional in-well bore rose to Rs 21000. Land-owning labor households had only four functional water sources and the average investment on each was as high as Rs 56000. The average investment made by these labor households on water exploration was Rs 18667. Average ownership of water resources was as low as 0.08 dug wells and 0.25 bore wells.

During the period 1985-2004, thirty-seven small-farm households made 48 attempts to dig new open dug wells down to an average depth of 12 feet (Table 9.12). Thirty of these attempts were successful,

Table 9.11. Investments on water exploration by labor households.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	3	0	5	4	12
Number of attempts	13	0	13	5	31
Average depth of attempt (ft)	42	0	159	45	92
Successful attempts	3	0	4	3	10
Presently in use	1	0	2	1	4
Total amount spent (Rs)	73000	0	130000	21000	224000
Cost per successful attempt (Rs)	24333	0	32500	7000	22400
Cost of sources still in use (Rs)	73000	0	65000	21000	56000
Investment per sample land owner (Rs)	6083	0	10833	1750	18667

Table 9.12. Investments on water exploration by small-farm households.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	37	44	32	20	133
Number of attempts	48	54	40	21	163
Average depth of attempt (ft)	12	4	131	21	40
Successful attempts	30	41	25	16	112
Presently in use	23	31	20	11	85
Total amount spent (Rs)	1330800	549150	640110	199500	2719560
Cost per successful attempt (Rs)	44360	13394	25604	12469	24282
Cost of sources still in use (Rs)	57861	17715	32005	18136	31995
Investment per sample land owner (Rs)	7312	3017	3517	1096	14942

but later seven of these successful wells dried up. The average cost of digging a new open dug well was Rs 44360. But the cost of a functional dug well increased to Rs 57861 with the drying up of some of the wells. Forty-four small farmers made 54 attempts to deepen their existing wells to a depth of 4 feet, out of which 41 attempts were successful. The average cost of deepening a well was Rs 13394, which went up to Rs 17715 after 10 of the deepened wells dried up. Thirty-two farmers of the small land-owning category made 40 attempts to drill new bore wells up to a depth of 131 feet. Only 25 of these new bore wells were successful in striking water, costing Rs 25604 per bore well. Later, five of these bore wells went dry, raising the cost of a functional bore well to Rs 32005. Twenty farmers drilled 21 in-well bores up to a depth of 21 feet, but only 16 of these attempts succeeded. The average investment on an in-well bore was Rs 12469 which went up further to Rs 18136 after five of these in-well bores dried up. In 2004, 54 open dug wells and 31 bore wells belonging to small farmers were functioning in the six VLS villages. The average investment on a functional water source was Rs 31995. Small-farm households invested an average of Rs 14942 each on water exploration between 1985 and 2004. The average number of functional dug wells and bore wells were 0.30 and 0.17 per small-farm household respectively.

Nineteen of the medium-sized farm households in the VLS sample made 31 attempts to dig new open dug wells up to a depth of 13 feet, out of which 18 were successful (Table 9.13). But later 8 of these wells went dry. The average cost of a successful open dug well had been Rs 25867 but in 2004 this went up to Rs 46560 per functional open dug well. In addition 23 farmers belonging to this land-holding class invested on deepening 28 existing wells by 8 feet but only 18 of those attempts yielded water. The cost per successful deepened well was Rs 17984 but when three of them dried up, this went up further to Rs 21473. Fifty-eight of these medium-sized farmers invested on drilling 105 bore wells up to an average depth of 144 feet. But the success rate was quite low with only 51 bore wells yielding water. The cost per successful bore well thus works out to Rs 22308, which further went up to Rs 29939 after 13 of the bore wells dried up. Further, eight farmers in this household category made 30 attempts to drill bore wells in their existing wells to a depth of 55 feet. Only five of these attempts were successful in striking water. In 2004, only three of these were still functional as the other two had dried up. The average cost of a successful in-well bore well was as high as Rs 17140, which rose to Rs 28567 with the drying up of two of the in-well bores. Medium-sized farm households in the sample owned 25 open dug wells and 41 bore wells that were still functional in 2004. The average investment on each functional water source worked out to Rs 30471. These households on an average owned 0.24 dug wells and 0.40 bore wells. The average investment on water exploration by a medium-farm household was Rs 19525.

Large-farm households invested more on bore wells than on open dug wells. Seven of them made eight attempts to dig new wells up to a depth of 18 feet (Table 9.14). Only one of these attempts failed

Table 9.13. Investments on water exploration by medium-farm households.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	19	23	58	8	108
Number of attempts	31	28	105	30	194
Average depth of attempt (ft)	13	8	144	55	90
Successful attempts	18	18	51	5	92
Presently in use	10	15	38	3	66
Total amount spent (Rs)	465600	322100	1137690	85700	2011090
Cost per successful attempt (Rs)	25867	17984	22308	17140	21860
Cost of sources still in use (Rs)	46560	21473	29939	28567	30471
Investment per sample land owner (Rs)	4520	3127	11046	832	19525

Table 9.14. Investments on water exploration by large-farm households.

Variable	New open dug wells	Deepening of wells	New bore wells	In-well bores	Total
Number of farmers	7	16	36	7	66
Number of attempts	8	35	92	28	163
Average depth of attempt (ft)	18	8	100	9	61
Successful attempts	7	11	29	5	52
Presently in use	6	6	26	4	42
Total amount spent (Rs)	142000	217000	963750	46000	1368750
Cost per successful attempt (Rs)	20286	19727	33227	9200	26322
Cost of sources still in use (Rs)	23667	36167	37060	11500	32589
Investment per sample land owner (Rs)	2898	4429	19665	939	27934

to yield water and only one of the successful dug wells subsequently went dry. The average investment on a successful dug well was Rs 20286 and that on a functional dug well Rs 23667. Similarly, 16 farmers made 35 attempts to deepen their existing wells by 8 feet. The success rate was very low: only 11 of these attempts yielded water. However, five of the successful deepened wells went dry later. Because of the low success rate and the high subsequent failure rate, the investment on successfully deepening an existing well (Rs 19727) was nearly as high as the cost of digging a new one. The investment cost on a functional deepened well (Rs 36167) too was much higher than that of a functional new dug well. Thirty-six farmers made 92 attempts to dig new bore wells up to a depth of 100 feet and only 29 of these attempts yielded water. Three of these bore wells went dry later. Due to the low success rate, the cost of a successful bore well went up to Rs 33227 and the cost of a functional bore well increased to Rs 37060. Seven farmers made as many as 28 attempts to drill in-well bores to a depth of 9 feet. But only five of the attempts were successful. The investment cost per successful in-well bore was Rs 9200 which went up to Rs 11500 after one of the in-well bores went dry. Large-farm households together owned 12 functional open wells and 30 bore wells. The average number of wells and bore wells per household was 0.24 and 0.61 respectively. Because of low success rates, the average investment on a functional water source worked out to Rs 32589 and the average investment of a large-farm household on water exploration was Rs 27934.

9.5 Irrigation Sources and Coverage

Traditionally, these six VLS villages used to depend on community irrigation sources like village tanks. Subsequently, some of them began to receive support from surface irrigation projects. Kanzara, Kinkheda and Shirapur received such support during the last ten years. Nevertheless, most of the irrigated area in the VLS villages is served by private sources like open wells and bore wells. Open wells continue to be important sources of irrigation in the Maharashtra villages but in Mahbubnagar they have almost become nonfunctional. It would be interesting to study the pattern of coverage by different sources of irrigation in the VLS villages.

The proportion of cropped area receiving irrigation support (Table 9.15) was the lowest in Kalman (15.6%) and highest in Shirapur (49.2%). Although these two villages are only 30 km apart, Shirapur has a better irrigation regime because it receives partial support of surface irrigation. The two Akola villages (Kanzara and Kinkheda) have better irrigation coverage of about 40% while the two Mahbubnagar villages (Aurepalle and Dokur) have only 22%. The average irrigated area for the six villages as a whole was about 29%. The command area per irrigation source was more than 2.2 ha for the Akola villages. Shirapur had a slightly higher command area per irrigation source than the average for the six villages. Kalman, Aurepalle and Dokur had less command area than 1.4 ha per irrigation source. The command area per well was slightly higher than that per bore well.

Table 9.15. Irrigation sources and unit command areas in VLS villages.

Village	Total cropped area (ha)	Irrigated area (ha)				Irrigated area (%)	Command area (ha) per		
		Wells	Bore wells	Others	Total		Well	Bore well	Irrigation source
Aurepalle	156.3	1.4	20.6	7.8	29.8	19.05	1.4	1.4	1.4
Dokur	59.2	1.5	9.8	4.3	15.6	26.31	1.5	1.2	1.3
Shirapur	125.2	30.6	24.5	6.5	61.6	49.20	1.9	1.9	1.9
Kalman	221.2	23.2	7.3	4.0	34.5	15.62	1.4	1.5	1.4
Kanzara	146.1	31.2	8.4	19.9	59.5	40.74	2.8	2.1	2.6
Kinkheda	68.6	9.3	3.7	14.2	27.2	39.64	2.3	1.9	2.2
Total	776.6	97.2	74.3	56.7	228.2	29.39	1.9	1.6	1.8

9.5.1 Irrigation Sources and Coverage in Relation to Farm-size Group

The relative position of the three land-owning household classes with respect to irrigation coverage and unit command area is summarized in Table 9.16. Irrigation coverage was relatively higher in the case of small-farm households. In fact, the proportion of irrigated area varied inversely with the size of land holding. Unit command areas per well and bore well were similar across the farm-size groups. Large-farm households had a slightly higher command area per open well and a slightly lower command area per bore well.

9.6 Returns from Investment on Water Exploration

Substantial investments were made by farmers to develop private sources of irrigation like open wells and bore wells. In order to assess the rates of return on these investments, the returns per hectare of irrigated area were worked out in the first stage. These were obtained by subtracting the returns from rainfed crops from those of irrigated crops in each of the villages. The returns per hectare from irrigation were multiplied with the average command area per private irrigation source in that village. Table 9.17 shows the annual returns on investments made on private irrigation sources. The average rate of return on investments made on irrigation sources for the entire VLS sample worked out to 10.5% per annum. This return was the highest in Shirapur. In all the other villages, the rate of return was below 10% per annum. This shows that under the current scenario of crop-husbandry in the semi-arid tropics, even returns to investments on irrigation are not very high.

During the first generation of VLS, no returns were assessed for investment on private sources of irrigation. Engelhardt (1985) calculated that irrigated area increased by 2 ha due to each successful in-well bore. Compared to that, the increased irrigated area per functional irrigation source (including open wells, bore wells and in-well bores) worked out to 1.8 ha. This showed that the area commanded per irrigation source has declined to some extent over the three-decade period.

Table 9.16. Irrigation sources and unit command areas of different farm-size groups.

Class of households	Total cropped area (ha)	Irrigated area (ha)				Irrigated area (%)	Command area (ha) per		
		Wells	Bore wells	Others	Total		Well	Bore well	Irrigation source
Small	223.1	47.2	25.7	16.1	89.0	39.9	1.8	1.7	1.8
Medium	267.3	27.4	28.2	19.2	74.8	28.0	1.8	1.7	1.8
Large	255.1	22.6	20.4	21.4	64.4	25.0	2.2	1.6	1.9
Total	745.5	97.2	74.3	56.7	228.2	30.6	1.9	1.7	1.8

Table 9.17. Rates of return (Rs) on investment on private irrigation sources.

Village	Investment on private irrigation source	Returns per ha of irrigated area	Returns per private irrigation source	Rate of return on investment on private irrigation source (%)
Aurepalle	32876	2109	2953	9.0
Dokur	45798	2849	3704	8.1
Shirapur	28923	3917	7442	25.7
Kalman	28604	1612	2257	7.9
Kanzara	30581	1110	2886	9.4
Kinkheda	46000	1402	3084	6.7
Average	35464	2167	3723	10.5

9.7 Comparison with Results from Watershed Programs of ICRISAT

We undertook baseline surveys in three APRLP watersheds covering four villages during 2002-03. The rates of return from investments on private irrigation sources in these villages are presented in Table 9.18.

In the ICRISAT watershed villages too the rate of return on investment on private irrigation sources worked out to 10% per annum, in comparison with 10.5% in the VLS villages. So returns on investment on irrigation sources in VLS villages and watershed villages are comparable.

9.8 Summary and Policy Implications

Soil types vary across the VLS villages. The Mahbubnagar villages have mainly red soils (Alfisols) followed by black soils. Deep black soils dominate the Solapur villages with some areas under murram and shallow Vertisols. The soils are medium deep in the Akola villages. In all the VLS villages, farmers faced the problem of soil erosion, nutrient depletion, waterlogging and salinity/alkalinity in about 15%-20% of the plots owned by them. Nearly 50% of the plots were not fertile. About 10% of the plots had medium or steep slopes.

Very little investment was made on soil conservation. Most of the investments made were for strengthening field bunds and leveling fields. Very few investments were made on the recommended practices of contour/graded bunding. Relatively higher investments were made in the Maharashtra villages on soil conservation than in the Mahbubnagar villages. The Solapur villages attracted higher investments relative to the Akola villages. Among the different farm-size groups, small farmers made more investments on soil conservation work. In Maharashtra, most of the investments were met by government subsidies. In the Mahbubnagar villages, nearly 66% of the investments were made by farmers in Aurepalle while in Dokur the share of farmers was only about 25%. Farmers spent about the same amount on annual maintenance as they

Table 9.18. Rates of return (Rs) on investments in ICRISAT watershed villages.

Village	Investment on private irrigation source	Returns per ha of irrigated area	Returns per private irrigation source	Rate of return on investment on private irrigation source (%)
Nemmikal	58605	1731	1679	2.8
Isthalapuram	46240	5730	7908	17.1
Sripuram	62261	3515	3516	5.6
Karivemula	39889	1914	7656	19.1
Average	51749	3222	5190	10.0

contributed to soil conservation works. Only some farmers perceived the benefits from soil and water conservation work. In the Solapur villages, where investments on soil conservation projects were higher and where deep black soils predominate, a greater proportion of the sample farmers perceived benefits in terms of reduced soil erosion, improved soil fertility and increased productivity. In the Akola villages also, a good proportion of farmers perceived benefits despite their low investments. This was because of their medium deep black soils. In the Mahbubnagar villages where red soils predominate, a relatively smaller proportion of farmers perceived benefits from soil conservation work. About the same proportion of farmers perceived benefits in both Aurepalle, where investments were low, and in Dokur, where the investments were relatively higher.

Farmers invested substantially on water exploration. In the Mahbubnagar villages, most of the investments that were made during 1985-2004 were on bore wells and in-well bores. Investments on new open dug wells and deepening of wells continued to dominate in the Maharashtra villages. Investments on water exploration by a farmer were the lowest in the Akola villages. Investments per farmer in the Solapur villages were higher than those in the Mahbubnagar villages. Investment on a functional water source were the highest (about Rs 46000) in Kinkheda and Dokur. In the other four villages, it averaged around Rs 30000. Even land-owning labor households invested around Rs 18000 on water exploration. In the case of land owners, investment on water exploration increased with the size of land holding. While small farmers owned a relatively greater number of open wells, medium- and large-farm households owned more bore wells per farm. The average command area per functional water source in the VLS villages was 1.8 ha. The returns to investments on irrigation were around 10% per year both in the VLS villages as well as in ICRISAT watershed villages. Since the returns to irrigation are just around the bank rate, an average investor on irrigation was just able to earn a normal return on irrigation investments. Those farmers who had high success rates in irrigation investments were better off and those who faced very low success rates were unable to pay back the loans taken for the purpose.

It was found that farmers were not in a position to make necessary investments on soil conservation unless the government subsidizes up to 80% to 90% of the cost. It was also found that farmers were making too many infructuous investments on water exploration in the absence of scientific information on underground water sources. The Government should make the services of geohydrologists available to farmers to assess water availability in the villages. It should also devise an insurance scheme to protect farmers from failures in water exploration.

Chapter 10: Government Interventions and Strategies for Coping with Droughts

Variability in rainfall and periodic droughts are characteristic of the SAT. In recent years there have been signs of rainfall variability increasing. Some analysts characterize this as a result of climate change. Many farmers also perceive a change in climatic patterns. However, the India Meteorological Department (IMD) denies there has been any significant departure from the normal rainfall pattern at the all-India level. Farmers' perceptions may be influenced by their recall of only the good rainfall years and not the bad. Since the population is growing at about 2% per year, the water needs of the people are increasing and rural people may be finding the available water insufficient, even though there is no change in the quantum of rainfall received. Therefore, the perceptions of the people may not match the data on weather parameters in a given area. This survey conducted in 2002-03 elicited the perceptions of VLS sample households on different aspects of the climate.

10.1 Perceptions of Respondent Households in VLS Villages

The study villages fall in three different agroclimatic regions in the SAT. Their rainfall regimes and soil types are different. The perceptions of respondent households on climatic factors are presented in Table 10.1. Most of the respondents in all the villages felt that weather parameters and water availability changed dramatically between 1985 and 2002. About 96% of them said the quantum of rainfall has decreased over time and 63.3% felt its distribution has become highly erratic. About 85% believed that the onset of the monsoon was getting later. About the same proportion felt that water availability in wells and bore wells has decreased over the years. About 78% opined that water availability in irrigation tanks too has decreased. More than 75% sensed that both winter and summer temperatures have increased. There were very little differences among the six VLS villages relating to the households' perceptions on changes in rainfall, temperature and water availability.

The respondents' perceptions on climatic parameters are presented according to the size of their land holding in Table 10.2. Relative to labor-dependent households, land-owning households were more apprehensive about climatic changes. In comparison with labor and small-farm households, a greater proportion of medium-sized and large-farm households felt that the total quantum of rainfall has decreased over the years. A higher proportion of medium-farm households than other farm-size groups felt that the distribution of

Table 10.1. VLS households' perception[1] of climatic parameters in six villages, 2002.

Climatic parameter	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda	Average
Decrease in quantum of rainfall	87.6	99.4	99.4	99.2	87.7	99.6	95.5
Highly erratic distribution of rainfall	73.7	79.2	53.6	61.4	54.8	57.2	63.3
Late onset of monsoons	71.6	86.0	97.7	91.1	79.8	82.7	84.8
Decreased water availability in wells and bore wells	86.3	93.0	94.6	69.8	86.1	91.0	86.8
Decreased water availability in irrigation tanks	76.7	90.9	67.2	63.7	77.4	94.1	78.3
Increase in winter temperatures	86.5	90.2	81.5	67.4	62.8	82.9	78.6
Increase in summer temperatures	74.7	78.1	85.6	79.1	63.8	73.5	75.8

1. Figures are percentages of households agreeing with the proposition.

Table 10.2. Perception[1] of climatic parameters by different land-holding classes in six villages, 2002.

Climatic parameter	Class of households				Average
	Labor	Small	Medium	Large	
Decrease in quantum of rainfall	93.9	94.2	96.3	97.5	95.5
Highly erratic distribution of rainfall	62.7	61.3	68.5	60.8	63.3
Late onset of monsoons	79.4	87.9	82.6	89.3	84.8
Decreased water availability in wells and bore wells	83.1	88.6	86.3	89.4	86.8
Decreased water availability in irrigation tanks	72.4	80.4	76.4	84.1	78.3
Increase in winter temperatures	72.1	82.4	76.4	83.3	78.6
Increase in summer temperatures	68.2	78.7	74.4	81.9	75.8

1. Figures are percentages of households agreeing with the proposition.

rainfall has become more erratic. Less than 80% of the labor households said the monsoons were getting delayed while 89% of the large-farm households felt so. More than 80% of the respondents in all farm-size groups said water availability in wells and bore wells has gone down. Only 72% of the labor households believed that water availability in tanks has decreased while a greater proportion of respondents from other farm-size groups shared the same concern. Relative to other size groups, a smaller proportion of labor households felt that temperatures have increased both in winter and summer.

10.2 Impact of Droughts and Coping Mechanisms

There was a severe drought in India in 2002-03 and a special survey was carried out to study its impact on the village economies. The responses of the sample households in Aurepalle and Dokur are presented in Table 10.3. The villagers of Aurepalle felt that there had been four drought years during the last 10 years while the people of Dokur felt there had been six. Aurepalle villagers estimated that the drought had curbed their income by about 45% while Dokur estimated it at 56%. About 75% of the households in Aurepalle and 88% in Dokur adopted coping strategies to tide over the drought. While more households in Aurepalle than Dokur borrowed money and took up nonfarm work and caste occupations, Dokur resorted to more migration and sale of draft animals. The other coping strategies were drawing upon savings and reducing consumption expenditure.

The impact of droughts on the economies of the Maharashtra VLS villages is summarized in Table

Table 10.3. Impact of droughts on the economies of Aurepalle and Dokur, 2002-03.

Parameter/coping strategy	Mahbubnagar		Average
	Aurepalle	Dokur	
Number of drought years in the last 10 years	4.00	6.00	5.00
Average shortfall in income due to drought (%)	44.50	55.70	50.10
Farmers adopting coping strategies (%)	74.70	88.30	81.50
Farmers adopting different coping strategies (%)			
Shift to nonfarm labor	30.40	28.30	29.40
Borrowing	42.90	32.10	37.50
Sale of draft animals/land	5.40	9.40	7.40
Shift to dairy, toddy-tapping, etc.	8.90	9.40	9.15
Migration	3.60	11.30	7.45
Drawing upon old savings	3.60	3.80	3.70
Reduced consumption expenditure	5.20	5.70	5.45

Table 10.4. Impact of droughts on the economies of Maharashtra VLS villages, 2002-03.

Parameter/coping strategy	Solapur		Akola		Average
	Shirapur	Kalman	Kanzara	Kinkheda	
Number of drought years in the last 10 years	3.00	3.00	2.00	2.00	2.50
Average shortfall in income due to drought (%)	20.00	21.68	20.00	30.00	22.92
Farmers adopting coping strategies (%)	30.30	72.90	15.40	25.00	35.90
Farmers adopting different coping strategies (%)					
Cutting down expenditure	11.80	11.80	50.00	33.33	26.73
Participating in labor market	0.00	0.00	16.67	50.00	16.67
Changes in cropping pattern	9.80	9.80	16.67	0.00	9.07
Reducing input use	3.90	3.90	16.67	16.67	10.28
Participation in employment guarantee scheme	74.50	74.50	0.00	0.00	37.25

10.4. Villagers of the two Solapur villages, Shirapur and Kalman, said they had had three drought years during the last 10 years. But in the two Akola villages, Kanzara and Kinkheda, the respondents said there had been only two. On an average, respondents in the four Maharashtra villages estimated the loss in income due to droughts at 23%. Only 36% of the households adopted one or other coping mechanism. About 37% of these households participated in employment guarantee schemes while 17% turned to the local labor market and about 27% reduced their consumption expenditure. The other coping mechanisms followed were changing the cropping pattern and reducing input use.

10.3 Participation in and Benefits from Government Programs

The union and state governments operate several developmental and welfare programs in the rural areas. Some of these are redistributive in nature: landless households are given land to cultivate or build houses upon; some are given cement concrete houses; and some are given assistance to build toilets. The government provides pensions to needy old people, handicapped persons and destitute people. *Anganwadis* provide food to preschool children and school-going children are given midday meals. The Public Distribution System supplies essential goods to households below the poverty line at subsidized prices. During droughts, governments provide some relief and supply essential inputs like seeds and fertilizers at cheaper prices. Employment opportunities are provided to needy people during droughts and in the off-season.

VLS sample households were asked questions regarding their participation in welfare programs and the benefits they received from them during the period 1985-2004. This data is analyzed and discussed in this section.

During the 16-year period 1985-2001, the two Solapur villages, Shirapur and Kalman, received the maximum benefits with Kalman accessing more than Shirapur (Table 10.5). The Mahbubnagar villages, Aurepalle and Dokur, also accessed considerable benefits from government programs, the former more than the latter. The two Akola villages, Kanzara and Kinkheda, in that order, gained the least. On an average, a sample household in the VLS villages accessed benefits worth Rs 4441 during 1985-2001.

The intensity of developmental and welfare programs increased during 2001-04. Within this period of three years, an average household in the VLS sample accessed benefits worth Rs 7617. The Solapur villages continued to lead others in accessing benefits, the Mahbubnagar villages retaining their middle position and the Akola villages their bottom position. Benefits per household ranged from Rs 4009 in Kinkheda to Rs 14876 in Kalman.

The benefits received by households of different farm-size groups are presented in Table 10.6. During 1985-2001, the highest benefits per

Table 10.5. Benefits received (Rs) by respondent VLS households from government welfare programs during 1985-2004.

	1985-2001		2001-04	
Village	Total	Per household	Total	Per household
Aurepalle	383000	3830	430341	4303
Dokur	250130	3127	457983	5725
Shirapur	496094	5637	677851	7703
Kalman	623872	6637	1398432	14877
Kanzara	185450	3566	296040	5693
Kinkheda	42000	1313	136323	4260
Average	330091	4441	566162	7617

household were accessed by labor households followed by small-farm households. This is expected since a majority of welfare programs are targeted at the poorer households. The benefits accruing to medium- and large-farm households were much lower, and more or less equal to each other. But the picture changed during the period 2001-04. The highest quantum of benefits per household was received by large-farm households, followed by small-farm households. The benefits received by labor households were only slightly higher than those received by medium-farm households. This indicates that the programs were wrongly targeted during this period. It also indicates that perhaps the focus of government programs has shifted from welfare to development in recent years.

10.4 Summary and Conclusions

Variability in rainfall is characteristic of the SAT. Some analysts have argued that rainfall variability has increased in recent years due to the El Nino effect. Some have even characterized this as a symptom of climate change. However, IMD data do not support such a hypothesis as far as India is concerned. But the VLS sample households did perceive a change in climate. A great majority of them believe that the quantum of annual rainfall has decreased and that rainfall variability has increased. They also believe that the onset of monsoon is getting delayed. Similarly, they perceive that summer and winter temperatures are increasing. They are also experiencing a lower availability of irrigation water from wells, bore wells and tanks. These perceptions hold across all the six VLS villages and across the four farm-size groups.

A survey conducted during the drought year of 2002-03 revealed that there has been a drought once in two years in the Andhra Pradesh villages while the frequency was once in four years in Maharashtra. Income losses due to droughts were also much higher in Andhra Pradesh than Maharashtra. A greater proportion of households in Andhra Pradesh followed strategies to cope with droughts. The major coping strategies were borrowing,

Table 10.6. Welfare and development benefits received (Rs) by respondent households belonging to different farm-size groups, 1985-2004.

	1985-2001		2001-04	
Farm-size group	Total	Per household	Total	Per household
Labor	107849	963	127029	1134.2
Small	163555	899	243955	1340.4
Medium	39220	381	111085	1078.5
Large	19467	397	84093	1716.2
Average	82523	740	141541	1269.4

shifting to nonfarm labor, finding work in government employment schemes, drawing upon old savings, reducing consumption expenditure and changing cropping patterns and management practices.

Developmental and welfare programs run by the government in the VLS villages provided supplementary income to the households. During 1985-2001, an average household gained Rs 4441 from government programs. Households in Kalman received the highest benefits per household while those in Kinkheda accessed the lowest. Labor and small-farm households received much more help than medium- and large-farm households. The intensity of government programs has increased over the years with more benefits available to an average household during 2001-04 than during 1985-2001. The two Solapur villages accessed the highest benefits, followed by the Mahbubnagar and Akola villages. Large-farm households received relatively higher benefits followed by small-farm households during 2001-04. Labor households fared only slightly better than the medium-farm category. The benefits accessed by a household during 2001-04 worked out to Rs 2539 per annum, or 7.7% of the average annual household income in the VLS sample (Rs 32818). This proportion could be much higher in case of the actual beneficiaries. Although government programs may not have made a major dent on poverty, they do help in maintaining minimum consumption requirements under adverse circumstances.

Chapter 11: Policy Implications and Future Scenario of Agriculture in the Semi-Arid Tropics

The tabular analyses presented in this publication of different facets of household economies in the semi-arid tropics highlighted certain bright spots as well as several disturbing features. While there has been improvement in incomes, consumption standards, literacy levels, infrastructure and social mobility, the agricultural sector seems to be bleeding. Investments on crop and livestock enterprises are not paying off. Returns to investment on soil conservation and water exploration have been quite low. In such an environment, one can expect a flight of capital and labor from the rural areas to the urban and from the agricultural to the nonagricultural sector.

11.1 Synthesis of the Study

This study brought out the fact that joint families, which had been dominant during 1975-84, have given way to nucleated families, bringing down the average family size from 8.37 in 1975-78 to 5.38 in 2001-04. Family size showed a direct relationship with the size of land holding, with labor households having smaller families and large-farm households the biggest families. Literacy levels too increased with the size of land holding. But among younger groups there was hardly any such differentiation of literacy. This fact points to the potential of education as a means of bringing about socioeconomic equity.

Most of the households in the VLS sample of 1975-78 depended on farming as their major occupation. But the occupational structure became more diversified in 2001-04, particularly in the Andhra Pradesh villages, which are more prone to droughts and water scarcity. As crop and livestock enterprises failed to provide enough income for sustenance, households owning less land looked for alternative occupations that can give them a more reliable income. Some of the better educated households in Maharashtra could earn a major chunk of their family income from the service sector. Still, those who owned more land tended to depend on farming as a major source of income. Smaller family size, better literacy rates and more diversified occupational patterns have placed households in VLS villages in a position to attain rapid development along many more pathways than were available two and a half decades ago.

The households had less land to operate in 2001-04 than in 1975-78 but irrigation made a big difference to their fortunes. The Maharashtra villages improved their position by virtue of having better access to surface irrigation while the Andhra Pradesh villages were rendered much worse off by setbacks in irrigation. Higher asset values helped the VLS households in investing in education or business after disposing of a part of their land. For the poorer households, the only development pathway lay in seizing opportunities in the labor markets.

Cropping patterns have undergone drastic changes over the last three decades, with cash crops becoming more important in all the VLS villages. The share of sole crops of foodgrains in the total area under sole crops came down from about 75% to about 35%. In case of intercrops; there was a steeper decline in the share of foodgrain crops.

Productivity levels varied across regions and crops. Either due to better soils or irrigation support, Aurepalle recorded better yields than Dokur; Shirapur fared better than Kalman; and Kanzara performed better than Kinkheda. While the yield levels in 2001-04 were better than they had been in 1975-78, they were still lower than the yields recorded under irrigation. Drought remained the most dominant constraint for crop production. Pests, diseases, weeds and excess rains also constrained the performance of selective crops. Progressive farmers, relatives and friends remained the most important sources of information for farmers, particularly relating to agronomic practices. Input dealers hold sway over farmers in providing information relating to improved seeds and plant protection chemicals. Extension officers had a prominent role in supplying information about technology only in the Solapur villages.

Most of the produce is sold in the market at the time of the harvest, even in the case of landless labor households and small-farm households. Lack of storage facilities or an immediate need for cash might be the reasons why farmers are forced to sell at the time of harvest. However, the integration of markets and reduction in transaction costs have given farmers a market orientation rather than a subsistence orientation, which had been the case three decades ago.

Due to steadily increasing production costs and stagnant product prices, crop production has become nonremunerative despite a moderate increase in productivity. Propped up by high input subsidies, the predominantly irrigated crops are still profitable, but a majority of rainfed crops have become nonremunerative. Crop profitability improved with the size of land holding. Variability in crop performance between seasons was quite high. Farmers made profits in less than 33% of the plots and did not recover even variable costs in more than 33%.

The livestock sector is believed to have a stabilizing effect on farmers' incomes in dryland areas. But the economics of livestock enterprises in the VLS villages did not support this belief. Even when only variable costs were considered, many of the enterprises were either loss-making or gave paltry returns over variable costs. Rearing buffaloes was more profitable than rearing cows. Perhaps because of a limited number of draft animals, the returns to maintenance of draft animals appear to be attractive. The rearing of small ruminants was profitable in all the study villages due to the rapid increase in meat prices. Thus both crop and livestock enterprises are not very profitable in the VLS villages. The households therefore constantly search for alternatives to move out of crop and livestock enterprises. Farmers also try to reduce their dependence on rainfed crops by investing on water exploration to capture the input subsidies associated with irrigation and thereby stay afloat.

As incomes from agricultural enterprises declined, the sample households relied more on nonfarm activities to generate income. Nonfarm labor income increased only by a small proportion and has still not emerged as a major prop for rural households. But other nonfarm activities like business, salaried jobs, rental income, interest from savings or lending and self-employment options emerged as the chief sources of income, accounting for slightly more than 50% of the total net income of the VLS sample households. The average annual income of the households increased by 103% between 1975-78 and 2001-04. The increase was even sharper at 120% in terms of per capita income. The relative position of the six VLS villages has undergone a major change with the Solapur villages surging forward and the Akola and Mahbubnagar villages remaining stagnant. The gap between labor households and land-holding households narrowed down and poverty levels were much lower in the former.

The large variability in household incomes noted across villages and farm-size groups was not evident in consumption expenditure. Consumption expenditures are believed to be influenced by customs, habits and permanent income. The surpluses and shortfalls noted in the incomes of households were moderated by savings and borrowings when it came to consumption expenditure. The average consumption expenditure of Rs 26665 accounted for about 81% of the average household income of Rs 32818. Overall, 47% of the households suffered energy inadequacy while 53% experienced protein malnutrition. In general, the percentage of households experiencing calorie inadequacy and protein shortfall declined with increase in the size of land holding. Estimates of poverty from macro-level NSSO data for 1999-2000 and VLS data for 2001-04 were compared to see the degree of correspondence between them. It was found that monthly consumption expenditure per capita increased over the three-year period in all the three districts in which the VLS villages are located.

Participation in the village labor market, particularly by women, was higher in the Andhra Pradesh VLS villages than in Maharashtra. Women in general and those from labor households in particular participated more in agricultural work while men, particularly from land-owning groups, participated more in nonagricultural work. The average earnings of women participants varied between 33% and 50% of those of male labor. Overall, there were adequate work opportunities both in local and distant labor markets. On an average, the real wages of male labor increased by 138% between 1975-78

and 2001-04. The real wages of female labor increased (98%) more slowly than those of male labor. The integration of labor markets has created work opportunities both in farm and nonfarm activities and in local as well as distant markets. Real wages increased substantially in three VLS villages and the districts where they are located. While the returns to land have decreased, returns to labor have increased substantially. This has a significant implication for reducing the inequalities between labor and land-owning households.

Soil conservation has attracted very little investment in the VLS villages. Most of the investments made have been for strengthening field bunds and leveling fields; the recommended practices of contour/graded bunding received little support. The Maharashtra villages made relatively more investments on soil conservation than the Mahbubnagar villages because they received higher support of subsidies. Farmers spent about the same amount on annual maintenance as they contributed to soil conservation projects. A greater proportion of farmers owning fields with black soils perceived benefits from soil conservation than those owning fields with red soils. Farmers invested substantially on water exploration, with emphasis on bore wells in Andhra Pradesh and open dug wells in Maharashtra. The average command area per functional water source was 1.8 ha. The returns to investments on irrigation were around 10% per year.

Most of the respondents felt that the quantum rainfall has decreased over the years and that temperatures have increased. But IMD data do not support these perceptions. Perceptions of the frequency of droughts and estimates of the losses associated with them were greater in the Andhra Pradesh villages than Maharashtra. The coping mechanisms followed by the households include borrowing, drawing from old savings, finding work in nonfarm activities, migration, etc. Government programs contributed benefits worth about 8% of the annual average household income. While these programs have intensified over time, their targeting has worsened.

11.2 Policy Implications

Results from the VLS surveys done during 2001-04 show that cropping patterns have changed drastically and that crop and livestock enterprises have become nonviable. Household incomes and per capita incomes have increased, but it was on account of the nonfarm sector and other miscellaneous sources. Research institutions with a regional mandate like the Regional Agricultural Research Station (RARS), Palem, Mahbubnagar district, the Dryland Research Station, Solapur, and Punjab Rao Krishi Vidya Peeth (PKV), Akola, should focus their research on new cropping systems to increase productivity. Our study found that crop enterprises have become nonviable even though the yield levels of dryland crops have gone up. This was because input prices and wages have risen faster than the prices of outputs. Crop nonviability owes much to the policy bias in favor of irrigated agriculture. Most of the subsidies on fertilizer, irrigation and electricity accrue to those who have access to irrigation, lowering their private costs of production. But for rainfed crops, the incidence of subsidy is quite meager and there is very little divergence between private and social costs of production. Discrimination in fixing the minimum support prices for predominantly irrigated crops like rice, wheat, sugarcane, etc. and predominantly rainfed crops like coarse cereals and then backing them up with procurement has also contributed to the nonviability of rainfed crops. Subsidized supply of rice and wheat through the Public Distribution System has hastened the process of substitution of coarse cereals in consumption by superior cereals, thereby reducing the market demand and prices of coarse cereals. Because of the low success rate and high costs of exploration of ground water, investments in ground water exploration are giving low returns. While farmers continue to invest in water exploration, they are also diversifying their investments into education and health of family members and on nonagricultural occupations like business and contracts.

The nonviability of agriculture calls for several policy changes to put rainfed agriculture on an

even keel with irrigated agriculture. There is a realization in the Government of India that farmer indebtedness is quite heavy and serious in the predominantly rainfed districts of peninsular India. The Government has granted a package of Rs 16,000 crore to assist farmers in 26 districts in Maharashtra, Andhra Pradesh and Karnataka where some farmer suicides have been reported. The state governments are using these funds to provide interest relief to indebted farmers. The National Rural Employment Guarantee Act is providing sustenance to those who are dependent on wage labor, although it is putting an upward pressure on market wages and causing further problems to the viability of crop enterprises. Such measures are helping farmers and landless labor to some extent but there are not adequate to create a positive impact on the viability of agriculture in predominantly rainfed areas. Much more needs to be done in the areas of credit and insurance to rescue dryland farmers, besides bringing about the needed policy changes.

11.3 Future Scenario of SAT Agriculture

These results have endorsed the conclusions of Walker and Ryan (1990) that the prospects for dryland agricultural growth are considerably bleak in the Mahbubnagar and Solapur regions. They predicted that the pace of technical change in the Akola region would outstrip the rate of natural increase in population. Although, the economics of crop enterprises are slightly better in the Akola villages when compared to Mahbubnagar and Solapur, the profit margins are under pressure even there. Unless there are great advances in technology and policy changes favoring rainfed agriculture are brought in along with considerable investment on developing infrastructure and natural resources, we do not see much hope for agriculture in general and rainfed agriculture in particular in the SAT of India. The only silver lining is that governments are increasingly becoming conscious about the yawning disparities between irrigated and rainfed regions.

11.4 Future Research Questions and Proposals

Agriculture research questions will continue to hinge on the viability of rainfed agriculture and the growing indebtedness of SAT farmers. More emphasis has to be placed on the pay-offs to investment in education, the nonfarm sector, infrastructure and value addition activities in the SAT. We shall soon be analyzing the data collected from the intensive rounds of the VLS survey for a closer comparison between the old and new VLS. As we have collected data for six years and hope to do so for the next couple of years either by the high frequency method or by annual surveys, we will have as long a dataset as the first-generation VLS. It will facilitate the examination of trends in different parameters during the first decade of the 21st century.

Bibliography

Bidinger PD, Walker TS, Sarkar B, Ram Murthy A and **Babu P.** 1990. Economics, health and nutritional consequences of the mid-1980s drought on a tank-irrigated Deccan village in South India. Resource Management Program, Economics Group Progress Report no. 98. Patancheru, Andhra Pradesh 502 324, India: International Crops Research Institute for the Semi-Arid Tropics. 74 pp.

Bingswanger HP, Ryan JG, von Oppen M and **associates**. 1974. Hypothesis and priorities from the village level studies in the semi-arid tropics of India. Mimeo. Agricultural Economics Department. Patancheru: ICRISAT. 30 pp.

Chung KR. 1998. The contribution of ICRISAT's mandate crops to household food security: A case study of four rural villages in the Indian Semi-arid Tropics. Information Bulletin no. 52, Socio-economics and Policy Division, Patancheru, Andhra Pradesh 502324, India: International Crops Research Institute for the Semi-Arid Tropics. 36 pp.

Dvorak Karen Ann. 1988. Indigenous soil classification in semi-arid tropical India. Resource Management Program, Economic Group, Progress Report - 84, ICRISAT, Patancheru 502 324. 38 pp.

Engelhardt T. 1985. Assessing risk in drilling in-well bores: Evidence from a watershed in South Peninsular India. Economics Program Progress Report no. 70. Patancheru, Andhra Pradesh 502 324, India: International Crops Research Institute for the Semi-Arid Tropics. 12 pp.

Jodha NS. 1997. Resource base as a determinant of cropping patterns. Occasional paper 14, Economics Program, ICRISAT, Patancheru 502 324. 58 pp.

Lipton M. 1983a. Poverty, undernutrition, and hunger. World Bank staff working paper no. 597. Washington D.C., USA: The World Bank. 108 pp.

Lipton M. 1983b. Labor and poverty. World Bank staff working paper no. 616. Washington D.C., USA: The World Bank. 148 pp.

Moore M, Connell J and **Lambert CM.** 1976. Village studies: Data analysis and bibliography. Vol.1, India 1950-75. Sussex: Bowker.

Rao KPC, **MCS Bantilan, Katar singh S, Subrahmanyam, Priya Deshingkar, P Parthasarathy Rao** and **Bekele Shiferaw**. 2005. Overcoming poverty in rural India: Focus on rainfed Semi-arid Tropics. Global Theme on Institutions, Markets, Policy and Impacts, ICRISAT, Patancheru 502324. 92 pp.

Schofield S. 1974. Seasonal factors affecting nutrition in different age groups and especially preschool children. Journal of Development studies 11 (1):22-40.

Singh RP, Asokan M and **Walker TS.** 1982. Size, composition and other aspects of rural income in the semi-arid tropics of India. Economics Program Progress Report no. 33. Patancheru, Andhra Pradesh 502 324, India: International Crops Research Institute for the Semi-Arid Tropics. 28 pp.

Walker TS and **Ryan JG.** 1990. Village and household economies in India's semi-arid tropics. Baltimore, USA: Johns Hopkins University Press. 394 pp.

About ICRISAT®

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

Contact Information

ICRISAT-Patancheru (Headquarters)
Patancheru 502 324
Andhra Pradesh, India
Tel +91 40 30713071
Fax +91 40 30713074
icrisat@cgiar.org

ICRISAT Liaison Office
CG Centers Block
NASC Complex
Dev Prakash Shastri Marg
New Delhi 110 012, India
Tel +91 11 32472306 to 08
Fax +91 11 25841294

ICRISAT-Nairobi (Regional hub ESA)
PO Box 39063, Nairobi, Kenya
Tel +254 20 7224550
Fax +254 20 7224001
icrisat-nairobi@cgiar.org

ICRISAT-Niamey (Regional hub WCA)
BP 12404
Niamey, Niger (Via Paris)
Tel +227 20722529, 20722725
Fax +227 20734329
icrisatsc@cgiar.org

ICRISAT-Bamako
BP 320
Bamako, Mali
Tel +223 2223375
Fax +223 2228683
icrisat-w-mali@cgiar.org

ICRISAT-Bulawayo
Matopos Research Station
PO Box 776,
Bulawayo, Zimbabwe
Tel +263 83 8311 to 15
Fax +263 83 8253/8307
icrisatzw@cgiar.org

ICRISAT-Lilongwe
Chitedze Agricultural Research Station
PO Box 1096
Lilongwe, Malawi
Tel +265 1 707297/071/067/057
Fax +265 1 707298
icrisat-malawi@cgiar.org

ICRISAT-Maputo
c/o IIAM, Av. das FPLM No 2698
Caixa Postal 1906
Maputo, Mozambique
Tel +258 21 461657
Fax +258 21 461581
icrisatmoz@panintra.com

Visit us at www.icrisat.org

ISBN 978-92-9066-507-6 RBE 021 390-2007