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9. ABSTRACT
The purpose of the Village Level Studies is to understand the factors affecting the traditional system of farming in different agroclimatic zones. Three districts were selected representing major agro-climatic zones within the semi-arid tropical areas of India. Factors considered for selection of districts were soil types, pattern of rainfall, and relative importance of crops like sorghum, pearl millet, pulses and groundnuts. The availability of a nearby Agricultural University/ Research Station from where planning and logistical assistance could be obtained was also important. The three districts selected were Mahbubnagar, Sholapur, and Akola. The report includes a discussion of the districts and villages selected, resource endowments, and tables showing the characteristics of the districts. It is hoped that the study of these traditional systems may reveal some elements which could be refined and incorporated into the prospective technology packages and highlight physica biological, economic, and institutional constraints which condition the traditional system of farming and may prove detrimental to the spread of prospective technology.

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VILLAGE STUDY METHODOLOGY AND RESOURCE ENDOWMENTS OF THE SELECTED VILLAGES IN ICRISAT'S VILLAGE LEVEL STUDIES

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VILLAGE STUDY METHODOLOGY AND RESOURCE ENDOWMENTS OF THE SELECTED VILLAGES IN ICRISAT'S VILLAGE LEVEL STUDIES†

PART I
METHODOLOGY

1.1 INTRODUCTION:

ICRISAT initiated its Village Level Studies (VLS) at six locations in May, 1975. The VLS project was broadly governed by the assumption that one of the efficient ways to identify and indicate relevant elements for incorporation in the prospective technology generated by ICRISAT was to thoroughly understand the traditional system of farming in Semi-Arid Tropical (SAT) areas. The study of traditional systems as revealed by farm-level resource endowments and their utilization may hopefully: (i) reveal some elements which could be refined and incorporated into the prospective technology packages; (ii) highlight physical, biological, economic, and institutional constraints which condition the traditional system of farming and--unless alleviated--may prove detrimental to the spread of prospective technology. In brief, the VLS are primarily designed to collect relevant farm-level details to assist ICRISAT's research system which is engaged in the task of generating technology suited to the needs and means of SAT farmers. This is achieved through observing and monitoring why farmers do what they do. To properly guide our data-gathering effort, a number of hypotheses, specifically reflecting their focus vis-à-vis the research objectives and strategy of ICRISAT, were framed. These are described elsewhere.[1]

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† This paper is revised and combined version of three earlier papers brought out by the Economics Program of ICRISAT. They are (i) N.S.Jodha and J.G.Ryan, *ICRISAT Study of Traditional Farming Systems in the Semi-Arid Tropics of India : Work Plans and Related Aspects*, January, 1975 (mimeo), (ii) M. Asokan, *ICRISAT Village Level Studies : Introduction to the Selected Villages*, August, 1975 (mimeo), (iii) N.S.Jodha, *Preliminary Report of Activities and Results from Village Level Studies in Semi-Arid Tropical India in 1975-76*, April, 1976 (mimeo). The authors acknowledge their debt to S.S.Badhe, T.Balaramaiah, V. Bhaskar Rao, M.J.Bhende, N.B.Dudhane and K.G.Kshirsagar, the six Investigators currently responsible for the collection of the data in the Village Level Studies.

1 See Binswanger *et al.* (1977).

1.2 SELECTION OF DISTRICTS:

Since the purpose of the VLS was to understand the factors affecting the traditional system of farming in different agroclimatic zones, it was decided to purposefully select three districts representing major agro-climatic zones within the SAT of India. Basic factors considered for selection of districts were soil types, pattern of rainfall, and relative importance of crops like sorghum, pearl millet, pulses and groundnuts--crops in which ICRISAT is primarily interested. District selection was also influenced by the availability of a nearby Agricultural University/Research Station from where planning and logistical assistance could be obtained. Other things being equal, distance from Hyderabad was a factor considered in District selection, as it was felt important that the senior staff of the Economics Program be able to regularly visit and stay in the villages. The three districts selected were Mahbubnagar in Andhra Pradesh and Sholapur and Akola in Maharashtra. Agro-climatically the three districts are vastly different (Table 1).

The Mahbubnagar area, with an annual average rainfall of 713 mm, is characterized by shallow to medium-deep Alfisols. The district reflects the representative conditions of Telangana region. The wide spread phenomenon of traditional tank irrigation (based on run-off collection during the rainy season) is a special feature of this district, which is not so common in the other two districts. Sorghum and pulses, largely grown as mixed crops during the rainy season together with groundnut and castor, are important rainfed crops of Mahbubnagar District. Paddy is an important irrigated crop.

The crops of Sholapur District has deep to medium Vertisols and most crops are grown in the post-rainy season. It has a bi-modal rainfall pattern with an annual average rainfall of 691 mm received during June to September with a long dry spell in mid-season. Rainy season fallowing is widely practiced and sorghum is the most important crop. Millets, groundnuts, and pulses are also grown. The district represents the agro-climatic conditions characterizing the so-called "rabi (post-rainy season) tract" covering large parts of Maharashtra and Karnataka states.

Table 1. Features of selected districts.

Particulars	MAHBUBNAGAR (Andhra Pradesh)	SHOLAPUR (Maharashtra)	AKOLA (Maharashtra)
Soil types	Shallow and medium Alfisols	Deep and medium-deep Vertisols	Medium-deep Vertisols
Rainfall (Annual average)	713mm	691mm (rains received in two phases during rainy season)	817mm (rainfall less variable)
Cropped area irrigated	14.5% (largely tank irrigation)	10.7%	1.5%
Important crops	Sorghum, groundnuts, castor, rainy season pulses (paddy on irrigated lands)	Post-rainy season sorghum, pearl millet, groundnuts, pulses	Sorghum, cotton, groundnuts, rainy season pulse
Broad regions represented	Telangana and other Vertisol tracts of Andhra Pradesh	'Scarcity zone' of Maharashtra and Karnataka	Vidharbha region of Maharashtra and neighbouring parts of Madhya Pradesh and Gujarat
Research Station/ Agricultural University in the district	A.P. Agricultural University, Rajendra Nagar; All-India Coordinated Research Project for Dryland Agriculture.	Agricultural Research Station, Sholapur; AICRPDA	Agricultural University Akola, AICRPDA

Akola District is a relatively assured rainfall area with medium deep Vertisols and rainy season cropping. Annual rainfall averages 817 mm. The important crops of the area are cotton, sorghum, and rainy season pulses. This District represents the agriculturally stable SAT area covering the central parts of India.

1.3 SELECTION OF TALUKAS:

For selection of villages for study, the first step was selection of a taluka in each of the selected districts. There is a real possibility of fairly large inter-taluka[2] differences within a district; these differences often become obscured when district averages are presented. To guard against the consequences of such a possibility and also to take full advantage of availability of taluka-level data, the following procedure was adopted for taluka selection.

Relevant taluka-level details of all the districts adjoining the selected district and/or showing broad similarities to the selected districts were compiled and compared. The taluka within the selected district reflecting the situation of the majority of the talukas in the region (comprising the districts considered) was finally selected. Thus the selected talukas represent the situation of a broad homogeneous region rather than the administrative district in which it happens to be located. (See the following map).

Taluka-wise, details of about 40 different characteristics were collected from district census hand books, district statistical reports, and unpublished records of the Indian Bureau of Economics and Statistics The variables selected broadly represented the natural and man-made resource base and their utilization patterns in the talukas and included density of population, extent of literacy, density (number per hundred hectares of net sown area) of cultivators, agricultural laborers, cattle, buffaloes, sheep and goats, iron and wooden plows, electric pumps plus

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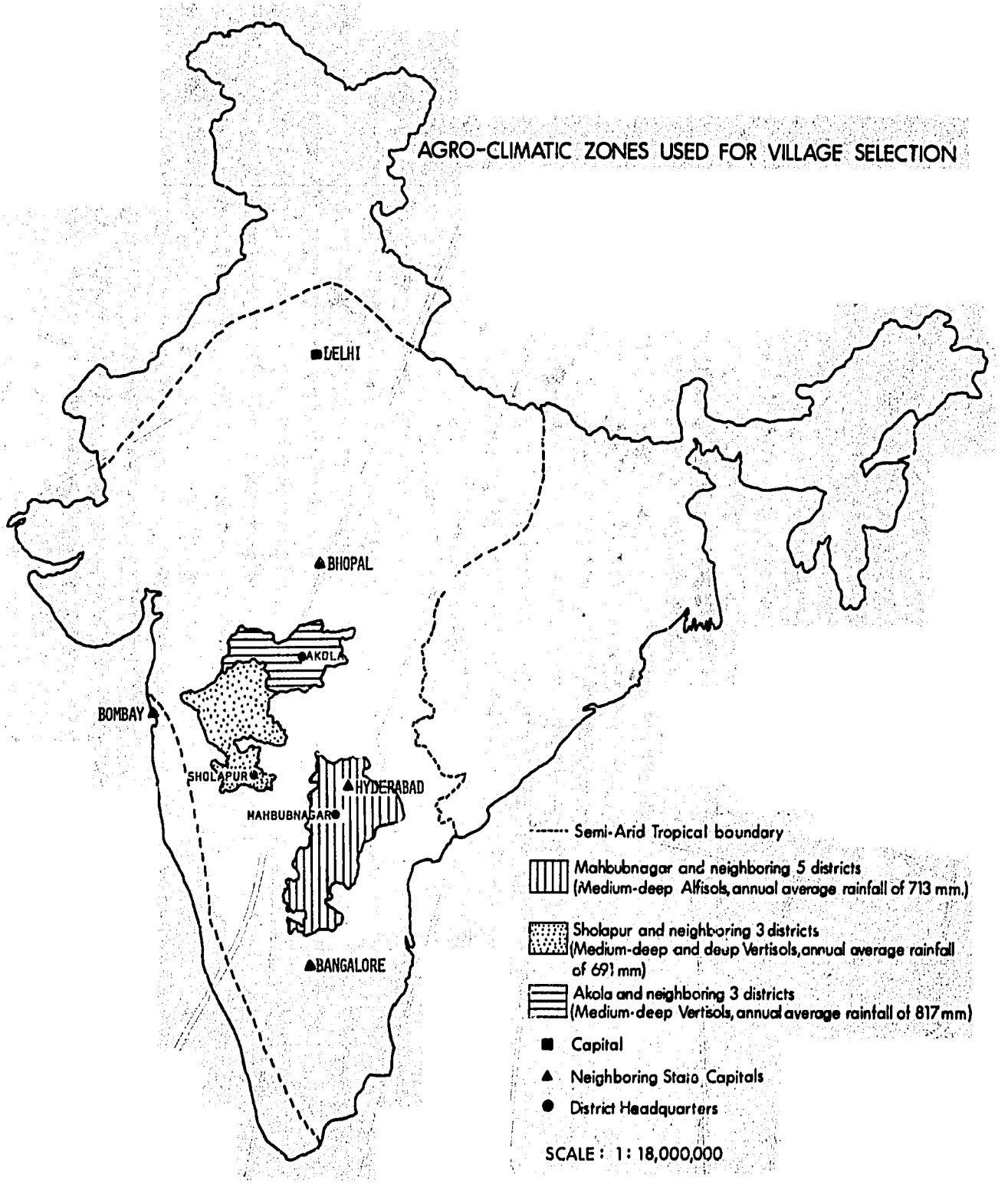
2 Taluka or tahsil is a sub-division of district for purpose of revenue administration.


AGRO-CLIMATIC ZONES USED FOR VILLAGE SELECTION
DELHI
BHOPAL
AKOLA
BOMBAY
SHOLAPUR
HYDERABAD
MAHBUBNAGAR
BANGALORE
Semi-Arid Tropical boundary
Mahbubnagar and neighboring 5 districts (Medium-deep Alfisols, annual average rainfall of 713 mm.)
Sholapur and neighboring 3 districts (Medium-deep and deep Vertisols, annual average rainfall of 691 mm)
Akola and neighboring 3 districts (Medium-deep Vertisols, annual average rainfall of 817 mm)
Capital
Neighboring State Capitals
District Headquarters
SCALE : 1 : 18,000,000

oil engines, number of tractors per 1000 hectares of net sown area, percentage of forest area, barren and uncultivable lands and net sown area to total geographical area, cropping intensity, extent of net sown area irrigated, contribution of different irrigation sources, average rainfall and rainfall intensity, percentage shares of wheat rice, sorghum, pearl millet, chickpea, pigeonpea, cotton, groundnut total cereals and total pulses to the gross cropped area, and proportions of villages of different size.[3]

By looking at the numerical values of each of the characteristics, various class-interval ranges were set up. On the basis of these classifications, frequency distributions of the forty variables across talukas were derived. The frequency-distribution tables were used to determine the modal class ranges wherein the majority of the talukas in the region fell. Talukas of selected districts which fell within the modal range class of values of a particular variable were considered as representative of the region as far as the variable under question was concerned. Talukas were thus examined for their representativeness with respect to each of the considered variables (or characteristics qualifying the majority of the talukas in the region). Two or three talukas which scored the highest (i.e. qualified for maximum number of features characterizing the majority of the talukas in the region were chosen; one of these was then selected as the final choice. Before final selection, it was ensured that the selected talukas qualified on the basis of crucial variables like net sown area, average rainfall, extent of irrigation, and proportions of important crops. When more than one taluka was found to qualify for selection, their position was more closely examined before final selection. In some cases two talukas were selected.[4] The actual position emerging from

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3 Details about average size of land holding were proposed for consideration but the required taluka-level data were not readily available for many talukas and could not be done except for Mahbubnagar and its adjoining districts. Similarly, comparison of talukas in terms of communication and educational facilities, extent of electrification, etc., could not be done for want of comparable data for all the talu

4 Choice of two rather than one taluka was dictated by the procedure used for selection of villages. In cases where two villages satisfying the specific criteria could not be located within the same taluk an additional taluka (of those selected) was chosen to facilitate selection.

the procedure described above is presented in Appendix I. Talukas found to be representative of the particular region were: Atmakur and Kalwakurthi (Mahbubnagar), North Sholapur and Mohol (Sholapur), and Murtizapur (Akola).

1.4 VILLAGE SELECTION:

For selection of villages within the selected taluka/talukas, the predominent characteristics of the latter were kept in mind. In other words, a village (or villages) was chosen to represent typical characteristics of the taluka (in terms of cropping pattern, land-use, irrigation, etc.). In order to select the village truly representing the traditional situation, those having special programs or more than normal support or resource transfers from outside, or those located nearer towns and highways, were not considered. Some 12 to 20 villages were visited for each of the villages finally selected. At this stage, the work of village selection was facilitated by informal cooperation of the AICRPDA research stations at Sholapur attached to Mahatma Phoole Krishi Vidyapeeth, Rahuri, and at Akola, attached to Punjabrao Krishi Vidyapeeth, Akola. The study benefited from the close knowledge of the workers at these stations in regard to the regions. Scientists working in these organizations have been of great help in continuing the village studies; they visiting the investigators and providing jeep transport when required during the rainy season. Officials from the district agricultural departments and Zilla Parishads also assisted during village selection and initiation of field work in the three districts. Villages finally selected for the study are as follows:

State	District	Taluka	Village	Distance from Hyderabad (km)
Andhra Pradesh	Mahbubnagar	Kalwakurthi	Aurepalle	70
Andhra Pradesh	Mahbubnagar	Atmakur	Dokur	122
Maharashtra	Sholapur	Mohol	Shirapur (Sholapur)	336
Maharashtra	Sholapur	North Sholapur	Kalman	348
Maharashtra	Akola	Murtizapur	Kinkheda	523
Maharashtra	Akola	Murtizapur	Kanzara	528

A few important characteristics of the selected villages, talukas, and their respective agro-climatic regions are summarized in Table 2. Detailed information of the selected villages is presented in Appendix II.

1.5 SAMPLING PROCEDURE FOR SELECTION OF HOUSEHOLDS:

At the time of the census round (May, 1975), the total number of households in six selected villages were: Aurepalle, 476; Dokur, 313; Shirapur, 297; Kalman, 423; Kanzara, 169; and Kinkheda, 143. Of these households, a sample of 40 respondents (30 cultivator and 10 labor) households were selected to ensure representation of all categories of households--labor, small farmers, medium farmers, and large farmers

For labor households a random selection was made amongst those who owned less than 0.2 ha of land or no land at all, and hired out as laborers as their main occupation and source of income. In the case of farm households, the purpose was to give proper representation to small, medium, and large farmers. In view of the different land-man ratios, the wide variation in average size of operational landholding, and land-productivity differences among the selected villages, it was not desirable to have a common criterion for classification of farm-size groups in all villages. For instance, the average size of

Table 2. Important characteristics of majority of talukas in the selected regions.

Characteristics	Values of the variables in the case of: Mahbubnagar Region[a]			Sholapur Region[a]			Akola Region[a]	
	Region (58 Talukas)	Kalvakurthy Taluka	Atmakur Taluka	Region (43 Talukas)	Mahol Taluka	Sholapur North Taluka	Region (30 Talukas)	Murtizapur Taluka
1. Density of population (persons/km2)	101-130	85.14	107.22	101-150	101.00	662.00	100-150	131
2. Proportion of literates (%)	16-20	15.02	13.38	26-30	35.18	45.20	40-50	41-61
3. No. of the following per 100 ha of net sown area:								
- Cultivators (No)	15-30	32	29	15-30	22	21	16-25	13
- Agrl. labor (No)	>51	32	29	upto 20	22	29	41-50	42
- Cattle (No)	66-118	98	63	41-80	40	49	61-80	60
- Sheep and Goat (No)	81-150	106	122	31-50	58	47	21-40	26
- Plough (Iron and wooden) (No)	3-25	22	20	3-7	4	6	7-10	8
4. NSA to geographical area[b]	46-60	50.49	62.64	70-80	79.74	75.54	70-80	78.3
5. Net area irrigated to NSA	<6	7.59	4.99	5-10	10.49	9.34	1-3	0.64
6. Normal rainfall (mm)	745-850	681.48	762.00	501-600	635.8	677.7	700-800	818.8
7. Proportion of cropped area:								
- Sorghum (%)	30-45	37.78	41.07	40-60	65.81	73.58	20-35	28.18
- Pearl millet (%)	<7.0	10.72	17.26	upto 5	4.20	2.38	1-2	1.08
- Chickpea (%)	<5.0	0.20	0.08	2-4	2.78	2.58	upto 1	0.94
- Pigeonpea (%)	1-2	2.98	1.96	upto 3	2.42	4.51	2-4	5.00
- Cotton (%)	0	0	0	upto 5	0.55	0.22	30-50	49.62
- Groundnut (%)	<5	1.91	23.51	upto 3	1.42	2.64	2-10	3.16
8. Average landholding size (ha)	4.01-5.00	6.36	5.20	N.A.	N.A.	N.A.	N.A.	N.A.

a For names of districts comprising respective regions and number of talukas out of the total talukas of the region qualifying for the said characteristics, see Appendix I.

b NSA = Net Sown Area.

operational landholding varied from 2.6 ha in Dokur to 10 ha in Kalman. Further, nearly 69 percent of the households in Dokur had landholdings of less than 0.2 ha. The corresponding proportions in Kalman and Kinkheda were 14 and 35 percent, respectively. The proportions of the total operated area accounted for by the above category of landholdings were around 24, 3, and 9 percent in Dokur, Kalman, and Kinkheda respectively. Similarly, households operating 8.1 hectares or more accounted for 6, 44, and 18 percent of the total farm households in the above three villages, respectively. Land operated by these large farmers accounted for 39, 64, and 57 percent of the total operated land area in Dokur, Kalman, and Kinkheda, respectively.

The criteria for defining farm-size categories was determined by the size composition of landholdings in each village. To ensure equal representation of different size groups, the cultivator group was first divided into three size strata with identical number of households and from each strata ten households were selected at random. This implies equal sampling fractions in each size group and for analysis purposes the cultivator sample is a sample with uniform sampling fractions among the three farm-size groups. Stratification was done primarily to reduce the probability of shared samples with respect to size. The ranges of operational landholdings comprising the three size categories in the six villages using above procedure are presented in Table 3. Hence, in each village 30 cultivator households were selected.

1.6 FIELD WORK:

Regular field work for the studies was initiated in June, 1975. Prior to that, persons with a rural background and post-graduate degrees in Agricultural Economics or equivalent experience, and who originating from same linguistic regions where field work was to tak place, were selected as investigators. They received several weeks

Table 3. Operational size[a] categories used to classify farm holdings in the six selected villages.

Villages	Small (ha)	Medium (ha)	Large (ha)
Aurepalle	0.20 - 1.21	1.22 - 3.24	>3.24
Dokur	0.20 - 0.89	0.90 - 2.11	>2.11
Shirapur	0.20 - 2.02	2.03 - 5.26	>5.26
Kalman	0.20 - 3.64	3.65 - 8.50	>8.50
Kanzara	0.20 - 1.82	1.83 - 5.26	>5.26
Kinkheda	0.20 - 2.02	2.03 - 4.45	>4.45

a Operational size was defined as the area of owned land, minus the area leased or sharefarmed to someone else, plus the area leased or sharefarmed from someone else.

training prior to being permanently assigned to selected villages.[5] Their work was supervised through periodical visits by senior ICRISAT economics staff.

Information about various aspects of traditional farming practices and household economies was collected through 11 specifically designed work sheets/schedules. The investigators interviewed sample householders every 15 to 20 days to elicit information for these schedules.[6] The data collected include details of asset position and endowments of the sample household, including land, livestock, farm implements, irrigation equipment, farm buildings, and consumer durables. Cultivation details, covering input-output data for each crop or crop mixture on a sub-plot basis, time allocation and utilization of family labor, details of bullocks utilization, extent of involuntary unemployment and wage employment were included. All household transactions, including income, expenditure, savings, debt, credit, gifts (with partner and place information); village price and wage rates during different months; annual inventory of food grains, fodder and other materials, including inputs; kinship relationship and social exchanges; risk attitude and adjustment to risk; diet, nutrition, and health details, etc., were recorded. Further details of the information obtained are summarized in Appendix III. A manual was prepared to guide investigators in data collection and coding.[7]

5 A total of 10 persons commenced training program, which was also used as a screening method to select most proficient for tasks of interviewing, coding, field observations and measurements, etc.

In some cases, the more literate members of selected households helped in keeping a record of all farm and family transaction details during the period intervening two rounds in note books supplied by ICRISAT. This facilitated the accuracy of data. In one village, a literate person visited illiterates every 2 to 3 days and recorded information in diary form so that investigator could obtain a more accurate picture.

7 See Binswanger and Jodha (1976).

Data on various agro-biological aspects of traditional farming, as required by scientists at ICRISAT, were also collected from farmers' fields. These observations covered areas like the incidence of shootfly, midgefly, Striga, etc., in the case of sorghum; incidence of downy mildew, ergot, and smut in pearl millet; incidence of wilt and sterlity mosaic in pigeonpea; nodule counting on pigeonpea, chickpea, and groundnut; weed counts; crop-rotation information; and crop cutting surveys for yield estimation of major crops of the areas. The scientists concerned trained the investigators to collect this agro-biological information. Farming systems scientists completed detailed surveys of two watersheds, one in the Shirapur deep Vertisols village and one in the Kanzara medium-deep Vertisols village. Details of the above observations are summarized in Appendix IV.[8]

In the case of annual inventories, all macro-economic data were regularly collected on work sheets with intervals of 15 to 20 days. Data on the work sheets were transferred to 80-column coding sheets specifically prepared for each schedule.[9] This reduced the usual time lag between data collection and their presentation in a form convenient for processing by computer.[10]

Collection of agro-biological information from farmers' fields led to a better understanding on the part of the farmers for the purpose of these studies which in turn helped in sustaining their interest in

8 According to the initial plan, the second phase of the VLS (beginning with the third year of field work) would give greater emphasis to small scale diagnostic experimentation in farmers' fields. These would include study of various agro-biological problems and constraints as previously indicated by 2 years of agro-economic investigations.

9 Samples of all worksheets and coding schedules are to be found in the Binswanger and Jodha (1976) manual.

10 Several checks were performed on the data prior to its final acceptance for input into ICRISAT's PDP 11/45 computer. Checks were both for accuracy and integrity.

regular data collection for a period of 3 years.** This also helped strengthen the interdisciplinary approach to research at ICRISAT.

A simple random sample of 10 households from the labor group in each village was selected in addition to the 30 cultivators. Hence, sampling fractions are not the same for laborers as for cultivators. In analysis, this may have to be taken into account. Details of the number of households in each socio-economic category, together with their sampling fractions, are presented in Table 4.

The data collection was continuous; it became possible to add ne item to the enquiry as and when the need was felt by any group of res earchers in order to confirm or quantify certain hypotheses. For instance, issues of an anthropological nature were added to the schem of investigations upon appointment of a social anthropologist to the team of ICRISAT researchers late in 1976. Because of the continuous residence of well trained and qualified investigators in the village, it was easy to record changes in the village economy--in terms of wag work patterns, consumption patterns, crop situations, etc.--during different parts of the year or following particular events such as a mid-season dry spell, elections, untimely heavy showers, opening of a public relief works, and so forth.

A number of measurements--such as area of plots/sub-plots (in all cases), crop yield, weight of fodder bundles, and cart-loads of manure (on a sub-sample)--were collected both on the basis of farmers' report-

Partly to express the institute's gratitude to the selected villagers, who regularly spared time for our interviews, and partly to establish ICRISAT's credentials as a research organization rather than as a data-collecting agency such as those sometimes employed to collect farm level data for agricultural policy purposes, a visit of the sample respondents and others to the ICRISAT Center at Patancheru was arranged during the rainy season of 1975-76. The visitors were greatly impressed by the work being done on the crops, which are prominent in their areas. They presented a number of searching questions about some of the experiments. Farmers' observations were communicated to the appropriate scientists. In the 1976-77 rainy season, ICRISAT helped sponsor visits by sample farmers to agricultural universities and research stations in their respective areas.

Table 4. Total number of households in various categories in the six selected villages.

Details	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Number of Households:						
Laborers	146 (30.7)[a]	76 (24.3)	97 (32.7)	156 (36.9)	54 (32.0)	55 (38.5
Cultivators	322 (67.7)	226 (72.2)	183 (61.6)	211 (49.9)	109 (64.5)	83 (58.0
Others[b]	8 (1.7)	11 (3.5)	17 (5.7)	56 (13.2)	6 (3.6)	5 (3.5
Total	476 (100)	313 (100)	297 (100)	423 (100)	169 (100)	143 (100)
Sampling fractions (%):						
Laborers	6.85	13.16	10.31	6.41	18.52	18.1
Cultivators	9.32	13.27	16.39	14.22	27.52	36.1
Others	0	0	0	0	0	0
Total	8.40	12.78	13.47	9.46	23.67	27.9

a Figures in parentheses are the percentage of households in each category.

b Includes artisans, shopkeepers, traders, etc.

ed values and on the actual measurement. This will help in assessing the possibility of consistent biases in reported data as against measured data

The data are being analysed in the context of hypotheses framed while initiating the VLS.[12] However, to provide background information for subsequent analyses of different hypotheses or problems, details of the resource position of the selected villages and sample farms are presented in Part II.

PART II

RESOURCE ENDOWMENTS

Details of the resource endowments of the regions and Talukas in which the villages are located were presented in preceding tables. In this section, the resource position of the six selected villages is discussed. These data were collected during the census round of the field work and during regular interviews with sample households.[13]

2.1 THE STATISTICAL PROFILE:

The statistical profile of the selected villages (Table 5), indicated different facets of factor endowments of the six villages. Broadly speaking, the density of population (persons/km^2) is relatively higher in the higher rainfall areas. This tendency is also reflected by the fact that drier areas also have the largest average size of operational holding. Average operational holding size is around 8 ha in Kalman (Sholapur), compared to around 2.6 ha in Dokur village (Mahbubnagar), which has the highest proportion of irrigated land (32%).[14]

12 See Binswanger *et al.* (1977).

13 Data about landholding size, irrigated area, etc., of the selected respondents, are as reported during the beginning of the field work (July, 1975). The data often changed when they were recorded plotwise after actual measurement during the course of field work.

14 For additional details of landholdings and extent of irrigation, see Tables 7 and 10

Table 5. Proportion of land operators and landless households in the selected villages.[a]

District	Mahbubnagar		Sholapur		Akola	
Village	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
1. Population (persons/km^2)	167	100	110	93	156	133
2. Households (No)	476	313	297	423	169	143
3. Landless households (%)	27.52	13.10	23.56	24.11	32.54	40.56
4. Landowners who leased out total land (%)	1.47	7.03	14.82	26.00	2.96	1.40
5. Land operators (%)	71.01	97.87	61.62	49.89	64.50	58.04
6. (4) as % of (4+5)	2.32	8.08	19.38	34.26	4.39	6.74
7. Average size of operational holding (ha)	3.53	2.62	6.53	7.97	6.10	5.76
8. % Irrigable area to total cropped area [b]	12.04	32.28	8.23	9.19	4.45	0.93
9. Average rainfall (at taluka Hq., mm)[c]	681.48 (697.70)	762.00 (973.10)	635.80 (1023.1)	659.70 (417.45)	818.80 (937.8)	818.80 (867.40)
10. Soil types	Deep red Alfisols	Medium Alfisols Gravelly	Medium-deep Vertisols	Meedium-deep Vertisols	Medium-deep Vertisols	Medium-deep Vertisols
11. Important crops of the village	Sorghum Castor Pearl-millet Paddy Pigeonpea	Paddy Groundnut Sorghum Pigeonpea Castor	Rabi-sorghum Pigeonpea Chickpea Wheat Minor-pulses	Rabi-Sorghum pigeonpea Chickpea Wheat Minor-pulses	Cotton Sorghum Mung bean Groundnut Wheat	Cotton Sorghum Mung bean Groundnut Wheat

a These data refer to the entire village and not just the sample households. It is based on data from the Census during May, 1975.

b Main sources of irrigation in Mahbubnagar villages are tanks and wells. In other villages, wells (with highly undependable rechange in the case of Sholapur villages) are the only source of irrigation.

c Figures in parentheses indicate the total rainfall recorded in the villages during calander 1976.

The relatively larger size of operational holding in Sholapur villages i also due to relatively lower proportion (50 to 62%) of households operat ing the land.

The proportion of labor households (which are mostly agricultural labor households) is relatively higher in the Akola villages, largely because of the high labor requirements of cotton, a major crop of the region. Cotton helps sustain landless households in terms of both employment and income. In the Mahbubnagar villages, because of a greater proportion of irrigation and more intensive cropping, landless labor can manage to obtain employment for a more extended period than in areas with less irrigation. In the case of the Sholapur villages, low and highly variable rainfall, together with limited irrigation, make it more difficult for landless laborers to sustain themselves. Yet the proportion of such households is about one-fourth of the total households in Sholapur. This could be the consequence of what may be described as the "process of pauperization" initiated and accentuated by recurrent droughts.[15] Due to loss of bullocks and non-availability of other resources in the years following droughts, people first lease out or mortgage lands and finally sell them. This is clearly indicated by the fact that 19 and 34 percent of cultivator households leased out all of their lands in Shirapur and Kalman, respectively. This contrasts with figures of between 1, 2, and 8 percent in the other villages. Land mortgaging is normally reported as leased-out land by landowners, general ly for reasons such as social prestige. Those who lease out their lands under the pressure of recurrent droughts tend to swell the agricultural labor market. This is partly reflected in Table 6, which gives the dis-

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15 As indicated by the analysis of 30 to 70 years of rainfall data for different SAT districts, the probability of year to year drought as well as mid-season droughts leading to crop failure is highest in Sholapur, when compared to the other two districts. For a study of the impact of drought on the economy of the respondent households, see Jodha (1977a, 1978).

Table 6. Percentage distribution by main source of income of households who leased out total land in Sholapur villages (entire village da

Occupation/Source of Income	Percentage of households in the village who leased out the entire landholding.		
	Shirapur	Kalman	Total
Agricultural labor	45.5[a] (25.6)	23.6 (46.4)	29.9 (40.4)
Non-farm labor	4.5 (5.1)	4. (-)	4.6 (1.5)
Rural crafts	4.5 (-)	2.7 (2.2)	3.3 (1.5)
Profession/Service	2.3 (-)	7.4 (2.1)	5.8 (1.5)
Remittance [b]	36.4 (66.7)	56.4 (42.3)	50.7 (49.3)
Others	6.8 (2.6)	5.4 (7.0)	5.7 (4.4)
Total	100.0 (100.0)	100.0 (100.0)	100.0 (100.0)

a Figures in brackets refer to percentage of households with these occupations/income sources as their first subsidiary occupations.

b Remittance means money sent by members of the families who seasonally/permanently outmigrated for work.

tribution of such households by occupational pattern in the two Sholapur villages. Nearly 35 percent of the households in these two villages stated that farm and/or non-farm labor was their main occupation, and 42 percent gave labor as their principal subsidiary occupation. Remittances from outside constituted the main and principal subsidiary sources of income for nearly half of the households who had leased-out their land. The bulk of such remittances were received from people who had temporarily or seasonally migrated to towns or irrigated farming areas.

2.2 OPERATIONAL LANDHOLDINGS:

For reasons explained above, the proportion of land-operating households to total households varied from around 50 percent in Kalman to around 80 percent in Dokur. Details of the distribution of operational landholdings are presented in Table 7. Even when the average size of landholding differed from village to village and the holding size showed a negative association with rainfall (and irrigation), the intra-village distribution of landholdings showed almost the same degree of skewness as indicated by the fact that in most of the villages only a fifth of the landholders operated more than one-half of the land. Column 8 of Table 7 shows that in most of the villages the share of the largest holdings in the total operated area is 5 to 15 times more than their share of the total number of households operating land. The average size of landholding in the largest size category is between 3 to 13 times higher as compared to the average size of landholding in the respective villages.

2.3 EXTENT OF BUNDING:

Bunding for the control of soil erosion is an important feature of the land-resource base in the Maharashtra village, in contrast to the Andhra villages. The bulk of the lands in three Maharashtra villages have bunding. More details about bunding, including type and effectiveness, will be available only after data contained in the Plot and Crop Rotation Schedule are analyzed. The census round data presented in Table 8, however, indicate that in Mahbubnagar (Alfisols) villages, 94

Table 7. Percentage distribution of operational landholdings by size in selected villages.[a]

Villages	% of households falling in the following size (ha) groups							Average land-holding size in largest size group (ha)
	Up to 2.0	2.1 - 4.0	4.1 - 6.1	6.2 - 8.1	8.2 - 12.1	12.2 - 16.2	above 16.2	
Aurepalle	54.74 (16.27)[b]	23.37 (20.48)	6.80 (10.27)	5.33 (10.22)	3.55 (9.10)	3.55 (13.95)	2.66 (19.71)	26.32
Dokur	68.80 (23.74)	16.00 (17.28)	4.00 (7.65)	4.80 (12.58)	4.40 (16.38)	0.80 (4.38)	1.20 (17.99)	39.27
Shirapur	38.75 (7.52)	18.03 (9.12)	13.12 (10.25)	10.38 (11.82)	16.38 (17.33)	3.28 (7.11)	6.56 (36.85)	36.84
Kalman	13.74 (2.60)	24.65 (9.12)	12.32 (8.04)	15.17 (13.59)	16.59 (20.89)	7.58 (13.72)	9.95 (31.24)	25.10
Kanzara	37.61 (8.13)	22.02 (11.11)	14.68 (12.47)	7.34 (8.83)	8.26 (14.19)	4.59 (11.90)	5.50 (33.37)	36.84
Kinkheda	34.94 (9.13)	27.71 (14.72)	16.87 (15.16)	2.41 (2.79)	6.02 (11.44)	4.82 (12.88)	7.23 (33.88)	27.13

a Data relate to all households operating land in the entire village as of May, 1975.

b Figures in parentheses indicate the proportion (%) of total area falling in each category.

Table 8. Distribution of farm households in the selected villages according to the extent of their land having bunding (entire village data).

Percentage of area bunded	Cultivator households in villages					
	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
	(No)					
NIL	314 (97.52)[a]	185 (81.86)	102 (55.74)	16 (7.58)	7 (6.42)	6 (7.23)
up to 10%	3 (0.93)	-	1 (0.55)	-	-	-
11 to 30%	2 (0.62)	5 (2.21)	4 (2.19)	1 (0.47)	2 (1.83)	- -
31 to 50%	3 (0.62)	10 (4.42)	14 (7.65)	3 (1.42)	2 (1.83)	1 (1.20)
51 to 70%	1 (0.31)	5 (2.21)	9 (4.92)	7 (3.32)	2 (1.83)	2 (2.41)
71 to 90%	-	11 (4.87)	7 (3.83)	7 (3.32)	3 (2.75)	-
91 to 100%		10 (4.42)	46 (25.14)	177 (83.89)	93 (85.32)	74 (89.16)
Total	322	226	183	211	109	83

a Figures in parentheses indicate the percentage of households in all villages.

to 98 percent of the cultivator households do not have bunding on their lands. On the other hand, in three of the villages in Maharashtra--a leading state as far as the bunding program is concerned--84 to 89 percent of the households have 90 to 100 percent of their lands covered by bunding. Shirapur village, where more than 55 percent of the households have no bunding on their land is an exception. This is because in Shirapur most of the agricultural area consists of deep Vertisols; bunding tends to damage crops and bunds are difficult to keep intact due to cracking of the clay soils. Bunding in deep Vertisols is neither recommended nor encouraged by the Soil Conservation Department.

2.4 IRRIGATION:

Besides bunding, irrigation potential is another feature of the land-resource base in which significant village-to-village differences exist (Table 5). Detailed information relating to the sample cultivators is presented in Table 9. Accordingly, the broad pattern of irrigation in the sample households is similar to that of the villages as a whole, as suggested by Table 5. In Dokur village, not only is the overall extent of irrigable area relatively high, but it is consistently the case for all categories of landholdings. In four of the six villages small farms have a higher proportion of irrigable land than do the medium-size farms. These high proportions, being evident only on very small holdings, may in an absolute sense not mean much. Owing to the likelihood of a more assured crop offered by irrigation, even on a small fraction of the landholding, the irrigable area helps stabilize the economy of small farmers. However, the actual area irrigated during different years is subject to fluctuation in the supplies of water from tanks and wells--the sources of irrigation in these villages. In Mahbubnagar villages, tanks and wells are the primary sources of irrigation. Tank water is mostly used for irrigating paddy (rice) crops. During the post-rainy season, once tanks are empty, the tank beds are generally cropped. Small temporary wells are often dug within the tank beds after they are dry to irrigate the crops in the

Table 9. Average size of operational landholding and extent of irrigable area on different operational size groups of sample farms in the selected villages.

Farm-size groups[a]	Villages					
	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
Small farms	0.83 (4.88)[b]	0.61 (75.27)	1.39 (10.34)	2.85 (11.35)	1.42 (17.04)	2.39 (1.73)
Medium farms	2.25 (10.79)	1.72 (53.29)	4.53 (5.36)	6.49 (7.80)	3.94 (2.05)	4.26 (3.81)
Large farms	4.88 (12.90)	2.41 (39.34)	7.29 (10.17)	8.04 (10.99)	5.79 (4.52)	6.43 (1.25)
All farms	2.64 (13.01)	1.56 (38.31)	4.45 (10.11)	5.80 (11.12)	3.70 (4.51)	4.36 (2.10)

a As mentioned in the section dealing with sampling design, ranges of farm size categories differ from village to village as indicated in Table 3. Data are as reported at the beginning of field work (July 1975).

b Figures in parentheses indicate % extent of irrigable land.

beds. This helps reduce losses due to submersion of land under the tanks. As Dokur observations show, the cost of small temporary wells does not exceed Rs.25/- per well. These can be used to grow 0.08 to 0.12 ha of paddy.

Wells are an important source of irrigation water in all villages. Depending upon the availability of water in wells, the important crops irrigated in Mahbubnagar are paddy, groundnut, finger millets, wheat, and vegetable crops. In the Sholapur villages, wheat, sugarcane, vegetable crops, and sorghum (in the event of inadequate water in wells are most common. In Akola cotton, groundnut, vegetables, and wheat are usually the crops irrigated from wells.[16]

2.5 UNUTILIZED WELLS:

An important problem relating to well irrigation is that a large number of wells found to be out of use, particularly in the Maharashtra villages. Table 10 presents the details of wells--their cost of construction, depth, area irrigated, etc.--in five of the six villages.

In Maharashtra villages 48 to 57 percent of the wells were reported to be out of use. The extent of unused wells was much less (12.5%) in Dokur. Eighty percent of the owners of unused wells indicated that lack of finance was the principal reason for non-use. As most of these wells were either dry or did not have enough recharge, their commissioning or recommissioning would involve additional investment.

Lack of sufficient depth of wells, resulting in their non-use, is partly supported by the details presented in Table 10, 11, and 12. By and large, wells in use have a greater depth than those out of use. As the depth of ground water in the SAT of southern India is always uncertain, many farmers give up digging wells once they suspect that

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16 For details of irrigated and rainfed crops and their place in the cropping patterns of the villages, see Jodha (1977).

Table 10. Details of wells owned by sample cultivators in selected villages.

Details of wells	Villages [a]				
	Aurepalle	Dokur	Kalman	Kanzara	Kinkheda
Total Wells (No)	14	16	23	15	7
Wells in use (No)	10	14	12	7	3
Wells out of use (%)	29	13	48	53	57
Average depth of unused wells(m)	12.27	13.41	6.88	5.85	5.79
Average cost of unused wells(Rs.)	6,875	6,000	8,572	1,013	7,53
Average depth of wells in use(m)	12.07	14.63	9.96	9.32	7.93
Average cost of wells in use(Rs.)	8,700	8,000	7,020	6,757	4,797
Average area irrigated by wells (ha)	1.51	2.18	0.61	1.26	0.53
Type of lifting device					
- Electric motors (No)	6	8	6	4	1
- Oil Engines (No)	1	4	-	-	-
- Motes (no)	4	2	6	3	2

a Complete details for Shirapur village are not available at present. All costs are in terms of 1974-75 rupees.

Table 11. Distribution of unused wells according to cost of construction and depth. [a]

Details	% of wells	Average cost	Average depth
		(Rs.)	(m)
Range of cost (Rs.)			
Up to 1000	22.7	522	5.27
1001 - 5000	40.9	3466	8.02
5001 - 10000	18.2	6376	10.52
Above 10000	18.2	15070	10.30
Mean		5436	8.26
Range of depth (m)			
Up to 4.57	22.7	1884	4.33
4.58 - 7.62	36.4	5211	6.34
7.63 - 10.67	18.2	4414	10.75
Above 10.67	22.7	10164	13.54
Mean		5434	8.27

a Data are for sample households from five villages and costs are in 1974-75 rupee equivalent values. Costs exclude lifting devices.

Table 12. Details of wells in use according to cost of construction and depth.

Details	% of wells	Average cost	Average depth	Average area irrigated
		(Rs.)	(m)	(ha)
Range of cost (Rs.)				
Up to 4500	17.5	3286	8.14	0.54
4501 - 6000	30.0	5241	10.21	1.32
6001 - 10000	35.0	7932	13.72	1.92
Above 10000	17.5	15162	13.45	2.08
Mean		7577	11.65	1.53
Range of depth (m)				
Up to 7.62	20.0	5682	6.33	0.73
7.63 - 10.67	25.0	4925	8.90	0.87
10.68 - 13.72	32.5	9604	12.76	2.10
Above 13.72	22.5	9280	17.82	2.14
Mean		7577	11.65	1.53

a Data are from sample households from five villages; costs are in 1974-75 rupee equivalent values. Costs exclude lifting devices.

water is not likely to be found. In other cases, resources become exhausted before the well is fully constructed.[17] The cost of construction and depth of wells usually shows a positive association except when there are significant differences in geology and well-construction technology. Not only does the depth of wells and the costs of construction move together, but the area irrigated by wells increases with costs and depths of wells, as shown in Table 12. This supports the view that capital is one of the major constraints to further exploitation of groundwater in SAT areas. On the other hand, unused wells represent preemption of a large amount of scarce capital resources, particularly with wells which are fully constructed. Table 11 shows the average capital value of these to be Rs.5,500. This is a huge sum, when compared to the resource position of the average farmer in these villages.

In a few cases, non-use of wells resulted from lack of lifting devices and bullocks rather than adequate water. This was particularly so in Kalman village. Hence, while in the majority of cases additional funds for deepening wells poses a problem, in yet other cases additional resources for lifting devices are essential to activate already-invested capital.

The principal modes for lifting water included traditional motes, oil engines, and electric motors (Table 10). The selected villages are electrified, but power connections (except in the case of affluent villagers) are used only for wells, village shops, or grinding mills, etc.; in most cases, the use of electricity for home consumption is still treated as a luxury.

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17 A few years ago, in the Sholapur villages under the so-called Jhavery Scheme, substantial funds were advanced by the Government for well digging as a permanent remedy against recurrent droughts. Farmers diverted most of the funds for other uses and many wells have remained incomplete since then.

2.6 FARM ASSETS:

Farm equipment investment is relatively higher (Rs. 324 and Rs. 582 per ha) in the Mahbubnagar villages, mainly because of the high proportion of irrigation equipment in use there.

Because of recurrent droughts the number of bullocks per hundred hectares is lowest (15 and 20) in the Sholapur villages. On the other hand, in the Mahbubnagar villages, which have more irrigation and more intensive cultivation, the corresponding number of bullocks is more than double that of Sholapur villages. The situation in the Akola villages lies in between. However, if looked at in terms of investment in bullocks per acre of operated land, the Sholapur villages show a much higher amount than the number of bullocks per acre would suggest. This again is largely due to the high bullock prices in post-drought years, as well as predominance of the better breed (Khillar) in the area. The value of the bullocks per household is still disproportionately higher in the Sholapur villages, when compared to others. The value of other livestock per household ranges between Rs.343 in Kanzara (Akola) to more than Rs.2,000 in Shirapur (Sholapur). The relatively regular facility for marketing fluid milk through private agencies available in Aurepalle, Dokur and Shirapur villages could be one reason for the high investment in milch stock; the investment dominates total livestock value (Table 13).

2.7 LABOR RESOURCES:

In view of the practice of hiring labor, family labor alone may not give a complete picture of the labor availability at the farm level, but it helps in obtaining a comparative picture of the labor intensity on different sizes of farms in different villages (Table 14). The number of family workers per 100 ha ranges from 42 in Kalman to 124 in Dokur. The land per worker varies from 2.35 ha in Kalman to about 0.81 ha in Dokur. Land area per worker on small farms varies from about 0.20 ha in Aurepalle to more than 0.81 ha in Kalman and Kinkheda. The land area per worker

Table 13. Number of bullocks per hundred hectares of operated area and value of investment per ha on sample farms as of July, 1975.

Farm-size groups	Villages					
	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
	(Bullocks/100 ha)					
Small	47	32	37	35	2	40
Medium	35	35	17	12	22	22
Large	37	62	20	22	30	25
Total	40	52	20	15	25	25
Value of bullocks[a]	185 (903)	314 (757)	198 (883)	154 (1239)	154 (888)	119 (769)
Value of farm equipment[a]	325 (1582)	596 (1403)	175 (787)	129 (985)	125 (724)	71 (454)
Value of other livestock	349 (1699)	565 (1360)	470 (2099)	87 (696)	59 (343)	110 (708)

[a] Value in Rs. per ha of operated land. Farm equipment includes irrigation equipment as well as minor implements. Figures in parentheses indicate the average value of respective items per household. Labor households are excluded.

Table 14. Number of family workers, by number per 100 ha of operated land, on sample farms as of July 1975.

Farm-size groups	Family workers on farms in					
	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
	(Workers/100 ha)					
Small	469 (0.21)[a]	314 (0.32)	203 (0.50)	116 (0.87)	331 (0.30)	106 (0.94)
Medium	183 (0.54)	193 (0.52)	99 (1.01)	42 (2.40)	148 (0.68)	72 (1.42)
Large	35 (2.82)	79 (1.25)	47 (2.08)	47 (2.10)	44 (2.30)	30 (3.43)
Total	79 (1.26)	124 (0.80)	82 (1.23)	42 (2.34)	91 (1.11)	47 (2.10)

a Figures in parentheses indicate the area per family worker in hectares.

on large farms varies from about 1.21 ha in Dokur to about 3.44 ha in Kinkheda. The availability of land per family member will be less than these figures, as the total number of members of a family are generally more than the number of persons reported as workers. With such a low availability of land and meagre and unstable yields in view of frequent droughts, especially in Sholapur and to some extent in Mahbubnagar, most of the households (particularly those of small farmers) find it difficult to sustain themselves from the land alone. Diversification of resource use, particularly family labor use, is one of the ways in which returns from land are supplemented. As shown in Table 15, the majority of households in most of the villages have more than one occupation or source of income. In each village the proportion of households (excluding labor households) depending on a single source of income increases as the size of landholding increases. As a natural corollary to this, in most cases the proportion of households depending on two sources of income declines as landholding size increases. Details concerning sources of income and occupations are presented in Table 15, which records the distribution of households by main and principal subsidiary occupation. Of course, there are considerable differences among different categories of households. Table 16 summarizes details for all households taken together. With this qualification, the bulk of the households reported cultivation and agricultural labor as the main and principal subsidiary sources of income, respectively. Regarding other sources of income the relative importance varied from village to village. An important fact revealed by Table 16 is that in the Sholapur villages a significant proportion of the people depend on remittances from outside as their main source or principal subsidiary source of income.

2.8 ADJUSTMENT IN PRACTICES TO FIT RESOURCE AVAILABILITY:

What has been described above gives a quantitative and rather static picture of resource availabilities in the selected villages. The intra-year and intra-seasonal spread of various employment acti-

Table 15. Distribution of households of different categories according to number of sources of income in the selected villages.

Categories of households	% of households[a] with number of sources of income																	
	Aurepalle[b]			Dokur			Shirapur			Kalman			Kanzara			Kinkheda		
	1[c]	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Total landholding leased out	29	71	—	23	73	5	11	86	2	12	75	14	20	60	20	—	100	—
Labor	65	33	1	57	39	5	76	21	3	81	18	1	82	18	—	91	9	—
Small farmer	7	79	14	12	83	5	4	91	4	22	69	8	11	58	31	14	86	—
Medium farmer	19	68	12	36	58	5	23	75	2	42	50	8	26	61	13	8	22	78
Large farmer	53	42	5	48	44	8	48	43	10	52	43	5	4	23	6	5	52	45
Total	37	55	8	36	58	6	34	61	4	42	51	7	50	39	11	54	46	1

a Data relate to all households in the villages as of May, 1975.

b Village.

c Number of sources.

Table 16. Percentage distribution of households by main and principal subsidiary occupation/source of income.

Occupation	Villages[a]					
	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Cultivation	42.2 (36.5)[b]	53.4 (45.0)	39.7 (32.8)	43.3 (11.3)	49.1 (27.4)	42.0 (34.8)
Agricultural labor	27.9 (29.8)	24.0 (28.0)	42.8 (37.0)	25.8 (53.6)	37.9 (44.0)	48.3 (42.4)
Animal husbandry	2.1 (5.0)	5.1 (2.5)	1.0 (3.2)	0.2 (4.0)	-- (9.5)	--
Trading/shopkeeping	14.7 (21.7)	4.5 (5.0)	1.7 (5.3)	1.9 (3.2)	1.8 (2.4)	2.8 (12.1)
Rural crafts	6.1 (1.0)	2.2 (2.0)	1.3 (-)	2.6 (1.6)	3.6 (1.2)	2.1 (1.5)
Profession/service	2.7 (5.0)	3.2 (4.5)	4.0 (3.7)	6.4 (3.2)	5.3 (8.3)	1.4 (3.0)
Remittances	--	--	5.4 (13.8)	14.7 (16.5)	1.8 (3.6)	0.7 (3.0)
Others	4.3 (1.0)	7.6 (13.0)	4.1 (4.2)	5.1 (6.6)	0.5 (3.6)	2.7 (3.2)
Total	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)

a Data relate to all households in the villages as of May, 1975.

b Figures in parentheses refer to the percentage of households with these occupation/income sources as their principal subsidiary occupations.

vities and their related income contributions will be available once "VLS-K : Labor, Bullock, and Machinery Utilization" data are analyzed. These processes and their time spread inject a significant degree of flexibility in labor resource use and determine the extent of resource availabilities at different periods of the year. Moreover, the seasonal pattern of resource availabilities at farm level resulting from month to month adjustment to family circumstances is not specific to labor alone, but extends to other farm resources also. For instance, labor contracts (within and outside the village) seasonal migration of labor to irrigated regions, inter-season and intra-season sale and purchase transactions in bullocks and other livestock, and the inter-season (and in some cases intra-season) land leasing and share cropping transactions all indicate that the traditional village economy in SAT areas, normally described as stagnant or stationary, is not really so. It has its own dynamics which provide the mechanism which, in turn, helps SAT farmers negotiate the hazards posed by the harsh agro-climatic conditions in these areas.

The features mentioned above have significant implications for technology generation and for approaches to development of these areas. The effective availabilities of farm-level resources at different points of time need to be taken into account while evolving a technology or development strategy which seeks to utilize local resources.

In the context of traditional technology, temporal variabilities of farm-level resource availabilities act as a source of periodical resource constraints and influence the adoption of traditional cultural practices by different farmers. This is illustrated by the extent and intensity with which weeding, thinning, and post-harvest plowing/harrowing are undertaken. The precise quantitative details about these phenomena will be available through other papers on traditional farm practices. However, we have been able to make the following observations through some ad hoc surveys in the villages.

For instance, practically every farmer knows the value of post-harvest plowing of fields to kill weeds, to utilize bullocks without requiring concentrates in the immediate post-harvest period, and to enhance the moisture absorption capacity of the soil. However, in view of the higher earning opportunities for bullocks through transport activities and increased hire charges for bullocks for post-harvest plowing, not many small farmers can afford to undertake post-harvest plowing. Consequently only well-endowed farmers in the six villages were able to undertake post-harvest plowing within 4 weeks of harvest of the crop. However, as time passes and bullock (and also labor) availability improves, more and more farmers undertake post-harvest plowing.

Furthermore, most farmers did harrowing rather than plowing in the post-harvest operation period. Non-availability of bullocks was given as the principal reason for this preference, as harrowing involved relatively less intensive use of bullocks per unit of area. This is the farmers' way of adjusting to one particular resource constraint.

A number of other adjustments in farm operations are made to obtain some resource saving. They include selective weeding where only big weeds or the weeds considered more dangerous by the farmers (rather than every weed) is removed; removal of weeds or undertaking of other operations like inter-culturing only in parts of the plot (where the crop looks promising or the crop would, in the farmer's view, definitely respond to the treatment) rather than in the whole plot; postponement of non-time specific farm operations such as harvesting of byproducts (fodder) and threshing of main product to that part of the crop season when labor is more available; completing farm operations through a variety of labor-contracts as well as piece-wage rather than time-wage arrangements, etc. These adjustments are considerably facilitated by the diversified cropping pattern which permits a more even spread of labor requirements for crops. In some cases, particularly on small farms, the adjustment takes place by completly ignoring some of the farm operations with the exception of sowing and

harvesting of the crop. During the period intervening these two operations, they offer their services to other farmers in the village or outside, as in their view, wage earnings during the peak periods tend to more than compensate the losses suffered due to neglected crops. The data collected in VLS-M (Price and Marketing Schedule) show that during peak labor periods of the crop season, wage rates are twice to thrice non-peak wage rates. The wage rates in neighboring irrigated areas can be four to five times higher than local wage rates. This induces labor to seasonally migrate to these areas.

2.9 FARMERS' INNOVATIVENESS:

A few cases of farmers doing experimentation with various farming practices were observed. These included shaking and bending pigeonpea plants during the cloudy season to avoid insect attack; replacing cotton with sorghum in cotton-pigeonpea mixed cropping, with increased rows of sorghum to minimize the incidence of pigeonpea wilt; avoid raising pigeonpea on plots with hard pan to minimize incidence of wilt; raising black-seeded low-priced but supposedly wilt-resistant pigeonpea at least in parts of the fields; mixing coriander with sorghum crop to minimize the incidence of Striga; cutting off leaves of sorghum affected by shootfly to facilitate vigorous re-growth of new shoots; dry seeding of crops; lopping of branches of young chickpea plants to facilitate better branching; using wide-row spacing of rabi sorghum and sowing chickpea in between when sorghum is about 20 days old; ratooning of sorghum (mainly for fodder); and on some farms land shaping for better conservation and utilization of moisture. Most farmers are aware of such practices, which are generally followed by a few innovative farmers in the villages, and they have seen the productive results of these and other practices. However, the unanimous answer--when questioned about non-adoption--of many of them was generally that they do not have enough resources (money, bullocks, labor, etc.) to adopt or to face the risk involved in some of the practices.

Distribution of talukas in the selected districts and their surrounding regions qualifying for relevant characteristics.

A. MAHBUBNAGAR

Characteristics qualifying the majority of talukas in the region (comprising Mahbubnagar, Medak, Hyderabad, Nalgonda, Kurnool and Anantapur Districts)	No. of talukas qualifying for 1 in the Region (58) [b]	Mahbubnagar dist. (12)[b]	Kalvakurthy taluka (Actual values)	Atmakur taluka
1. Density of population (persons/km^2) (101-130)[a]	21	6	85.14	107.22
2. % of literacy (16-20)	19	3	15.02	13.38
3. Cultivators (No/100 ha) of NSA (15-30)[d]	22	4	32.00	29.00
4. No. of agricultural laborers per 100 ha of NSA (51 and above)	22	3	32.00	29.00
5. No. of cattle per 100 ha of NSA (66-118)	22	3	98.00	63.00
6. No. of buffaloes per 100 ha of NSA (less than 35)	34	10	26.00	15.00
7. No. of sheep and goats per 100 ha of NSA (81-150)	24	8	106.00	122.00
8. No. of ploughs (iron/wooden) per 100 ha of NSA (3-25)	33	7	22.00	20.00
9. No. of oil and electric pumps per 100 ha of NSA (less than 1)	28	6	2.00	2.00
10. No. of tractors per 1000 ha of NSA (0.1-0.5)	26	5	0.09	0.14
11. % of forest area to geographical area (3-6)	17	4	4.97	1.92

(Appendix I.A contd.)

1	2	3	4	5
12. % of barren and uncultivated land to geo. area (4-6)	25	7	16.65	5.92
13. % of NSA to geographical area (46-60)	20	3	50.49	62.64
14. Cropping intensity (1.01-1.02)	16	6	1.00	1.01
15. % net area irrigated to NSA (below 6)	19	6	7.59	4.99
16. % area irrigated by government canals to NAI (nil)[e]	18	7	NIL	11.69
17. % area irrigated by private canals to NAI (nil)	54	12	NIL	NIL
18. % area irrigated by tanks to NAI (below 7)	19	3	5.90	14.58
19. % of area irrigated by wells to NAI (26-50)	17	5	93.13	44.54
20. % of area irrigated by other sources to NAI (0.01-1.00)	17	4	0.97	29.19
21. Normal rainfall (745-850 mm)	18	6	681.48	762.00
22. % rice area to GCA (4-11)[f]	25	8	6.70	4.59
23. % wheat area to GCA (below 0.1)	22	7	0.22	0
24. % jowar area to GCA (30-45)	27	0	37.78	41.07
25. % bajra area to GCA (below 7.0)	42	8	10.72	17.26
26. % total cereals to GCA (below 8)	26	8	6.92	4.59
27. % gram to GCA (below 5)	34	9	0.20	0.08
28. % tur area to GCA (1-2)	21	4	2.98	1.96
29. % total pulses area to GCA (4-10)	23	6	4.86	5.42
30. % cotton area to GCA (nil)	22	6	0	0
31. % groundnut area to GCA (below 5)	21	2	1.91	23.51
32. No. of villages with population less than 200 (4-7)	19	6	6.00	4.00
33. No. of villages with population 200-499 (17-25)	17	8	18.00	23.00

(Appendix I.A contd.)

1	2	3	4	5
34. No. of villages with population 500-999 (16-30)	17	3	46.00	48.00
35. No. of villages with population 1000-1999 (below 30)	21	2	41.00	36.00
36. No. of villages with population 2000-4999 (13-19)	16	5	30.00	7.00
37. No. of villages with population 5000-9999 (.01-1)	21	5	2.00	1.00
38. No. of villages with population 10000 and above (nil)	44	12	NIL	NIL
39. Average land holding size (4.01-5.00 ha)	19	8	6.36	5.20
40. % distribution of villages according to pre-dominant soil type. (For Telangana region only, excluding Hyderabad urban)				
A. Black soil (Regur)-(below 6)	14	5	3.00	6.00
B. Red soil (Chalka & Dubba)-(95 and above)	11	4	97.00	94.00

See footnotes at end of Appendix I.C

APPENDIX I (CONTD.)

B. SHOLAPUR REGION

Characteristics qualifying the majority of talukas in the region (comprising Sholapur, Ahmednagar, Aurangabad, and Bhir Districts)	No. of talukas qualifying for 1 in the Region (43)[b]	Sholapur district (11)[b]	Sholapur north (Actual values)[b]	Mohol (Actual values)[b]
1	2	3	4	5
1. Density of population per sq. km. (101-150)[a]	23	6	562.00	101.00
2. % of literacy (26-30)	16	6	45.20	35.18
3. No. of cultivators per 100 ha of NSA (15-30)[d]	21	9	21	22
4. No. of agricultural laborers per 100 ha of NSA (up to 20)	22	5	29	22
5. No. of cattle per 100 ha of NSA (41-80)	33	6	49	40
6. No. of buffaloes per 100 ha of NSA (6-10)	18	3	26	12
7. No. of sheep and goats per 100 ha of NSA (31-50)	21	4	47	58
8. No. of ploughs (iron/wooden) per 100 ha of NSA (3-7)	35	1	6	4
9. No. of pumps (oil/elec. pumps) per 100 ha of NSA (2-4)	18	8	3	2
0. No. of tractors per 1000 ha of NSA (up to .05)	15	5	0.27	0.01
1. % of forest area to geographical area (1-5)	22	9	1.82	2.96
12. % of barren and uncultivated land to geographical area (1-5)	26	7	1.73	3.79
13. % of NSA to geographical area (70-80)	17	5	75.54	79.74
14. Cropping intensity (1.01-1.03)	14	5	1.02	1.03
15. % of net area irrigated to NSA (5-10)	18	5	9.34	10.49
16. % of area irrigated by govt. canals to NAI (up to 1)[e]	10	5	28.42	1.79

(Appendix I.B contd.)

1	2	3	4	5
17. % of area irrigated by private canals to NAI (nil)	42	10	NIL	NIL
18. % of area irrigated by tanks to NAI (nil)	34	7	NIL	NIL
19. % of area irrigated by wells to NAI (80 and above)	29	7	70.44	98.21
20. Average number of rainy days (16-30)	21	7	28	26
21. Normal rainfall (501-600 mm)	11	5	677.7	635.8
22. Rainfall intensity (15.1-30.00 mm)	18	4	24.2	24.45
23. % of rice area to GCA(.01-0.5)[f]	31	8	0.59	0.43
24. % of wheat area to GCA (2-5)	17	9	2.80	2.94
25. % of jowar area to GCA (40-60)	12	4	73.58	65.81
26. % of bajra area to GCA (up to 5)	14	7	2.38	4.20
27. % of total cereals area to GCA (70-80)	18	6	80.11	74.88
28. % of gram area to GCA (2-4)	16	7	2.58	2.78
29. % of tur area to GCA (up to 3)	32	7	4.51	2.42
30. % of total pulses area to GCA (5-10)	17	5	8.68	13.22
31. % of cotton area to GCA (up to 5)	30	11	0.22	0.55
32. % of groundnut area to GCA (up to 3)	30	7	2.64	1.42
33. No. of villages with population less than 200 (1-5)	17	5	NIL	1
34. No. of villages with population 200-499 (6-15)	13	6	3	12
35. No. of villages with population 500-999 (21-80)	20	7	8	27
36. No. of villages with population 1000-1999 (31-50)	21	5	16	28
37. No. of villages with population 2000-4999 (6-15)	21	3	14	17
38. No. of villages with population 5000-9999 (1-5)	26	9	2	3

See footnotes at end of Appendix I.C.

APPENDIX I (CONTD.)

C. AKOLA REGION

Characteristics qualifying the majority of talukas in the region (comprising Akola, Buldhana, Amaravati and Jagaon districts)	No. of talukas qualifying for 1 in the		Murtizapur taluka (Actual values) [c]
	Region (30)[b]	Akola Dt. (6)[b]	
1	2	3	4
1. Density of population per sq. km. (100-150)[a]	12	4	131
2. % of literacy (40-50)	17	4	41.61
3. No. of cultivators per 100 ha of NSA (16-25)[d]	11	5	13
4. No. of agricultural laborers per 100 ha of NSA (41-50)	15	5	42
5. No. of cattle per 100 ha of NSA (61-80)	18	3	60
6. No. of buffaloes per 100 ha of NSA (5-10)	11	3	9
7. No. of sheep and goats per 100 ha of NSA (21-40)	9	4	26
8. No.of ploughs (iron and wooden) per 100 ha of NSA (7-10)	12	2	8
9. No. of oil and elec. pumps per 100 ha of NSA (1-3)	22	4	1
10. No. of tractors per 1000 ha of NSA (0.1-0.3)	13	3	0.30
11. % of forest area to total geographical area (5-15)	16	3	5.64
12. % of barren and uncultivated land to geographical area (up to 2)	12	3	1.46
13. % of NSA to geographical area (70-80)	13	4	78.30
14. Cropping intensity (1.001-1.09)	25	6	1.01
15. % of net area irrigated to NSA (1-3)	12	3	0.64
16. % of area irrigated by government canals to NAI (nil)[e]	18	5	NIL
17. % of area irrigated by private canals to NAI (nil)	29	5	NIL

(Appendix I.C contd.)

1	2	3	4
18. % of area irrigated by tanks to NAI (nil)	27	4	6.45
19. % of area irrigated by wells to NAI (90 and above)	23	5	90.45
20. Average number of rainy days (31-40)	14	2	35
21. Normal rainfall (700-800 mm)		0	818.8
22. Rainfall intensity (15.01-25.00 mm)		4	23.39
23. % of rice area to GCA (up to 1)[f]		5	0.31
24. % of wheat area to GCA (2-5)		2	4.41
25. % of jowar area to GCA (20-35)		4	28.18
26. % of bajra area to GCA (1-2)		3	1.08
27. % of total cereals area to GCA (40-		4	33.99
28. % of gram area to GCA (up to 1)	22	3	0.94
29. % of tur area to GCA (2-4)	13	3	5.00
30. % of total pulses area to GCA (10-30)	19	5	10.86
31. % of cotton area to GCA (30-50)	15	5	49.62
32. % of groundnut area to GCA (2-10)	20	5	3.16
33. No. of villages with population less than 200 (31-50)	7	2	57
34. No. of villages with population 200-499 (51-80)	9	2	93
35. No. of villages with population 500-999 (51-80)	10	3	80
36. No. of villages with population 1000-1999 (11-20)	9	1	19
37. No. of villages with population 2000-4999 (11-15)	11	3	11
38. No. of villages with population 5000-9999 (1-2)	16	5	1
39. No. of villages with population 10000 and above (nil)	21	4	NIL

a Figures in parentheses in this column represent the modal range of the statistics concerned using all talukas in the regions.

b Figures in the parentheses at the top cols. 2 and 3 indicate the total number of the talukas in the regions and the selected districts respectively.

c. Cols. 4 & 5 give actual values of each of the variables in the case of selected talukas.

(contd.....)

d NSA : Net Sown Area

e NAI : Net Area Irrigated

f GCA : Gross Cropped Area

Sources of data for Mahbubnagar region:

District Census Hand Book (1971) for concerned districts; Perspective Plans for Telangana (vol.I), and Rayalaseema Region (vol.III), Planning and Cooperation Department, Government of Andhra Pradesh, Records of Bureau of Economics and Statistics, Government of Andhra Pradesh.

Sources for Sholapur region:

Socio-Economic Review and District Statistical Abstract of 1972-73 concerned Districts (Directorate of Economics and Statistics, Government of Maharashtra, (mimeo).

Sources for Akola region:

Socio-Economic Review and District Statistical Abstract 1972-73 for concerned Districts, Directorate of Economics and Statistics, Government of Maharashtra, (mimeo).

APPENDIX II

General information on the selected villages

Details	Village name					
	Aurepalle	Dokur	Shirapur (Sholapur)	Kalman	Kanzara	Kinkheda
Location code number	40 [a]	42 [a]	54 [b]	3 [b]	42 [c]	130 [c]
Area in sq. miles	6.28 [a]	4.55 [c]	5.70 [b]	9.90 [b]	2.30 [c]	2.00 [c]
Total number of households	476	313	297	423	169	143
Total population	2711	1783	1615	2368	930	687
Percentage of literacy	15 [a]	15.81 [a]	17.17 [b]	13.3 [b]	33.68 [c]	28.64 [c]
No. of landless labor households	131	41	70	102	55	58
No. of land owners completely leased-out or rented-out	7	22	44	110	5	2
No. of operational holding households	338	250	183	211	109	83
Area operated in hectares	1193.93	655.87	1195.55	1682.6	664.78	478.14
Average size of landholding in hectares	3.53	2.62	6.53	7.97	6.1	5.76
Percentage of irrigable area to total operated area	12.04	32.28	8.23	9.19	4.45	0.93
Distance from nearest town/marketing center (km)	8	5	8	35	8	13
Distance from taluka headquarters/block	21	45	8	35	8	13
Distance from nearest pucca road	8	3	2.4	5	7	0.4
Distance from nearest railway station	70	5.6	6.4	37	4	0.4
Distance from nearest bus stand	0	5	2.4	35	0.2	0.4
Distance from nearest sub-post office	2	0	0	0	0	0
Road connection (all weather, fair weather, no road)	All weather	All weather	Fair weather	All weather	All weather	Fair weather
Frequency of bus services (per day)	4	3	NIL	3	5	10
Education facilities	UP	UP	H	H	UP	P
Medical facilities	NIL	PM	NIL	PHC	NIL	PM
Veterinary facilities	NIL	NIL	NIL	Veterinary Hospital	NIL	NIL
Drinking water facilities	Well	Well	Well	Well	Well	Well
Electrified?	Yes	Yes	Yes	Yes	Yes	Yes
Weekly market	NIL	Devarkadra	NIL	Kalman	Murtizapur	Murtizapur
No. of shops	8	10	3	9	5	3
No. of tea shops	1	7	2	4	1	NIL
No. of cooperatives	2	NIL	1	1	1	1
No. of radios	25	42	16	35	32	11
No. of newspaper facilities	3	2	1	2	1	NIL
No. of electric pumpsets	120-150	28	22	32	26	3
No. of oil engines	11	31	4	21	1	4
No. of grinding mills	2	1	3	3	2	1
Type of soils (with % of area)	Red soil 23% Sandy soil 28% Shallow black 15% Gravelly soil 19% Alkaline/problem soil 15%	Shallow red 55% Deep red 10% Medium black 30% Deep black 5%	Deep black 50% Medium black 20% Shallow black 30%	Deep black 25% Medium black 50% Shallow black 25%	Shallow black 15% Medium black 75% Deep black 10%	Shallow black 30% Medium black 50% Deep black 10% Shallow red 10%

a District Census Hand Book, Census 1971, Mahbubnagar District, Directorate of Census Operation, Andhra Pradesh.

b District Census Hand Book, Census of India 1961, Sholapur, The Maharashtra Census Office, Bombay.

c District Census Hand Book, Census of India 1961, Akola, The Maharashtra Census Office, Bombay.

P = Primary school; UP = Upper Primary school; H = High school; PM = Private Medical Practitioner: PHC = Primary Health Center.

APPENDIX III

Details of the schedules used for collecting agro-economic data.

Type of schedule	Year and Frequency	Completed[1] (Apprx.No.)	Remarks
1	2	3	4
1. Household Census	May, 1975 Once	1820	For all resident households; demographic, occupational, land-holding and livestock possession detail.
2. Household Member	July, 1975 July, 1976	480	More details of above type for sample households; details about each member.
3. Plot and crop rotation	July, 1975 July, 1976 updated during each crop season.	380	Records physical and ownership status of farm plots; use status (fallow, cropped, double cropped, crop rotation) during different seasons.
4. Animal Inventory	July, 1975 July, 1976	480	Records sample households' resource position in terms of fixed assets.
5. Farm Implement inventory	-do-	480	
6. Farm Building inventory	-do-	480	
7. Cultivation	Since July 1975 every 15-20 days up to 30th June, 1977	Over 4600	Records plotwise input-output details for each crop for each season.
8. Labor, draft animal and machinery utilization	-do-	Over 6900	Records actual utilization of these resources on the day preceding the interview; number of wage employment days, days of involuntary unemployment (for family labor and bullocks) durin the period since last interview.
9. Household transactions	-do-	Over 6900	Records type and value of every transaction involving inflow and outflow of cash, goods and services for sample households.

(Appendix III contd.)

1	2	3	4
10. Price and wage	July 1975 to June 1976; once a month	80	Records wage rates for labor and bullocks and price details of major items transacted by villagers in their village or outside for every month.
11. Stock inventory credit and debt	July, 1975 and July 1976; once a year	480	Records inventory of stocks of foodgrains, fodder, consumer durables; savings, deposits; debt and credit position of sample households.
12. Kinship and social-exchange	Since December 1976 every 15-20 days	2400	Records details on the social networks behind exchange for sample households. (Incorporated with household transactions schedule).
13. Risk investigations	August 1976 to April 1977	320	Records farmers' preferences with respect to suggested decision alternatives with varying degrees of gains and uncertainty of prospects; actual decision and actions about farming; adjustment devices to meet consequences of drought etc. for sample households.
14. Risk attitude experimentation	April to May 1977	295	Records farmers actual choices resulting from their participation in 'risk game' designed for the purpose.
15. Time-allocation studies	Since October 1976 Once ever season.	144 (winter & summer seasons only)	Records actual pattern of activities by all members of households of a sub-sample by constant observation for one day in each of the seasonal rounds.
16. Diet survey	-do-	480	Records through actual measurement and observation the items consumed by each member of the sample households.
17. Health status	-do-	3036* (for all members of sample households)	Records the nutrition-deficiencies disease symptoms and other issues related to health status using methods suggested by health and nutrition experts.

1 Completed upto the May, 1977.

* This excludes the schedules of all school going children in the villages for whom similar details were collected.

APPENDIX IV

Details of agro-biological and related data collected through Village Level Studies in each village during the crop years 1975-76 and 1976-77.

Crop	Description	Minimum no. of plots covered (with 3-5 replicates in each) during each year	Frequency of observations each year	Crop years covered	Information user[a]
1	2	3	4	5	6
Sorghum	1. Shootfly incidence	6	1	Both Years	Entomologists
	2. Stem borer count	6	1	"	"
	3. Midgefly and pre-harvest assessment	6	1	"	"
	4. Grain mould counts	6	1	"	Cereal Pathologists
	5. Striga assessment	6	1	1975-76	Sorghum breede
	6. Leaf disease incidence	6	1	1976-77	Cereal Patholo gists
Pigeonpea	1. Wilt and Sterility mosaic	5	3	Both Years	Pulse Pathologists
	2. Pod borer counts	0	2	"	Entomologists
	3. Nodule counting	5	2	1976-77	Micro-biologis
	4. Crop rotation (with pigeonpea)	0	1	1975-76	Pulse Physiologists and Farming Systems.
Chickpea	1. Wilt incidence	5	3	Both Years	Pulse Pathologists
	2. Pod borer counts	0	2	"	Entomologists
	3. Germination/Crop stand	5	2	1976-77	Pulse Physiologists
	4. Nodule counting	5	3	"	Microbiologist

(Appendix IV contd.)

1	2	3	4	5	6
Pearl millet	1. Incidence of Downy Mildew	5	1	1976-77	Cereal Pathologists
	2. Incidence of Ergot	5	1	"	"
	3. Incidence of Smutt	5	1	"	"
	4. Incidence of Rust	5	1	"	"
Groundnut	1. Nodule counting	5	3		Micro-biologists
All major crops of the area [c]	1. Weed counts	5 (Per crop)	1		Farming Systems
	2. Cropping patterns and crop rotations	30[b]	1		"
	3. Crop cutting	18	1		Economics
	4. Direction of crop planting	30[b]	1	1975-76	Pulse Physiologists
	5. Post-harvest farming practices	30[b]	1	"	Farming Systems, Economics.
	6. Rainfall induced delays in farm operations	30[b]	1	"	Farming Systems, Economics

a Instructions and proformae for collecting observations were supplied by the respective scientists who are potential users of these data. They also trained the investigators for collecting the observations.

b Number of households, and not plots.

c Besides the said observations, measurement of plots and sub-plots, weighment of fodder bundles, cart loads of manure etc. were done on sample basis.

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