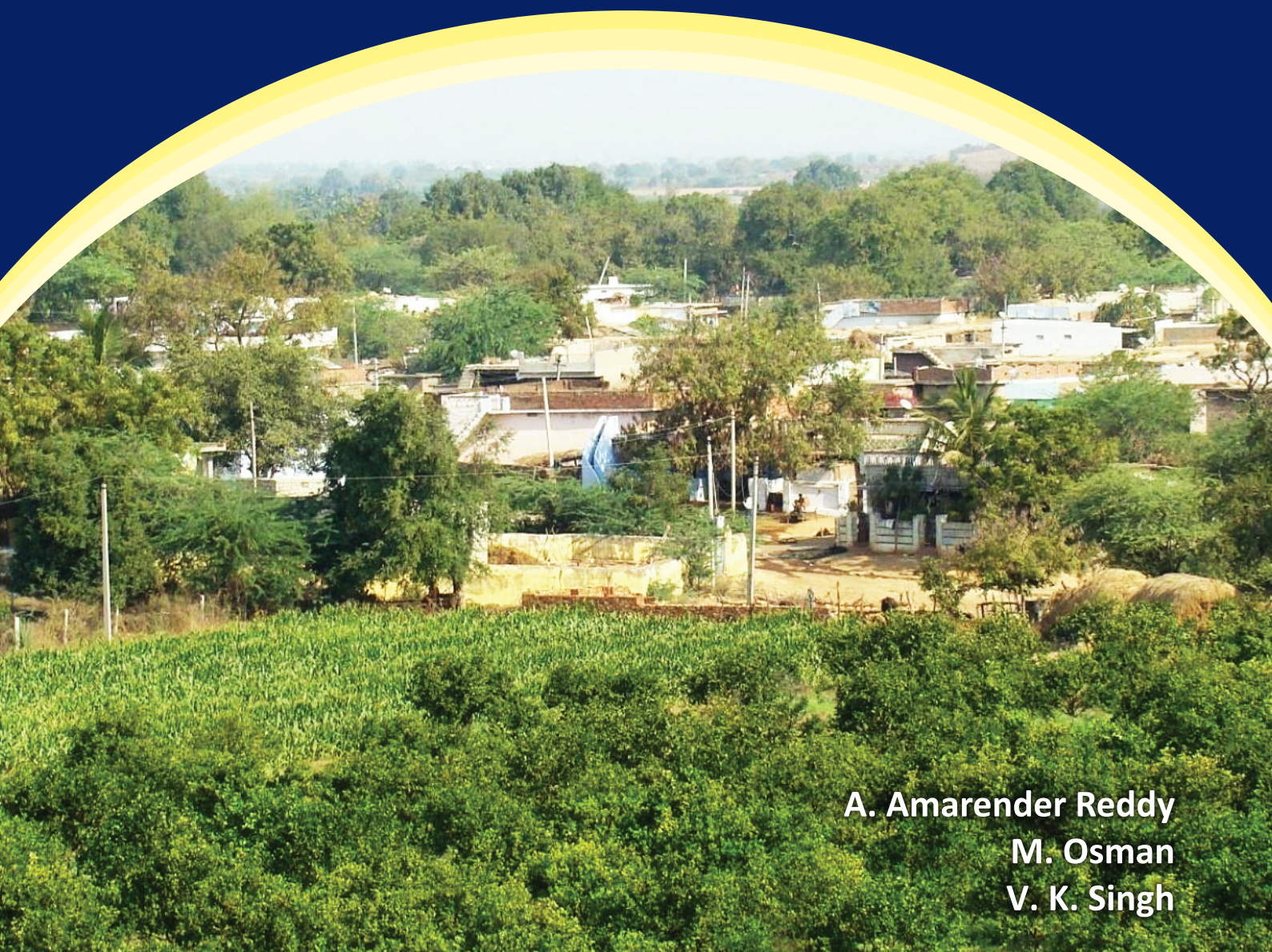


Baseline Survey of SC-Sub Plan Villages for Building Local Capabilities

A Problem-Driven Iterative Adaptation (PDIA) Approach



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FOREWORD

The Scheduled Castes (SCs) are officially designated groups of people in India. The SCs are sometimes referred to as Dalit. The Scheduled Castes comprise about 16.6 per cent of India's population (according to the 2011 census). The Constitution (Scheduled Castes) Order, 1950 lists 1,108 castes across 28 states in its First Schedule. For much of the period of British rule in the Indian subcontinent, they were known as the "Depressed Classes". Since the independence of India, the SCs were given Reservation status, guaranteeing political representation. The Constitution lays down the general principles of positive discrimination for SCs.

The Constitution provides a three-pronged strategy to improve the situation of SCs:

Protective arrangements: Such measures as are required to enforce equality, to provide punitive measures for transgressions, and to eliminate established practices that perpetuate inequities.

Affirmative action: Provide positive treatment in allotment of jobs and access to higher education as a means to accelerate the integration of the SCs with mainstream society.

Development: Provide resources and benefits to bridge the socioeconomic gap between the SCs and other communities. Legislation to improve the socioeconomic situation of SCs because twenty-seven per cent of SC households lived below the poverty line, compared to the mere eleven percent among other households. Additionally, these castes were poorer than other groups in Indian society, and they suffered from higher morbidity and mortality rates as per the National Commission for Scheduled Castes.

However, in spite of planned development and prioritization of scheduled caste households in various development schemes, there are various reports, which pointed out that there is underutilization of funds and intended benefits were not reached to the targeted households. To address the problem of underutilization of the allocated budget for SC upliftment, the Scheduled Caste Sub Plan (SCSP) program was initiated by the Government of India.

The SCSP mandated a planning process for the social, economic and educational development of SCs and improvement in their working and living conditions. It was an umbrella strategy, ensuring the flow of targeted financial and physical benefits from the general sector of development to the Scheduled Castes. It entailed a targeted flow of funds and associated benefits from the annual plan of union government in at least a proportion to the national SC population. Twenty-seven states and UTs with sizable SC populations are implementing the plan.

Objective of the Scheme

The main objective of the **Indian Council of Agricultural Research (ICAR)** - Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad component of the SCSP programme is to identify major problems faced by the SC households in these three villages to come out of poverty and plan, prioritize and implement household-oriented schemes for overall socio-economic development. ICAR-CRIDA will provide resources and technical support to fill the critical gaps and by providing vital

inputs to achieve the target of improved livelihoods, socio-economic development. Since the schemes/ programmes for SCs depends on the local occupational pattern, economic activities and resource endowments, the implementing agencies have been given flexibility in utilizing the funds with the only condition that it should be utilized in conjunction with SCSP and other resources available from various line departments like agricultural and rural development departments, various corporations and financial institution *etc.*

National Institution for Transforming India (NITI) Aayog guidance, ICAR notified Kotapally mandal of Mancherial erstwhile while Adilabad for overall development of scheduled caste households in a time bound manner with specific budget allocation. As in the Kotapally mandal share of SC population in total population was higher at 25 per cent, while in the district their share is only 15 per cent and only 16.6 per cent in India as per the Census 2011. Upon receiving the approval, the study team of ICAR-CRIDA visited the mandal and identified three villages for developmental intervention for intensive development of the SC households.

The CRIDA team adopted a unique approach called “**Problem Driven Iterative Adoption**” where in the team has identified the problems faced by the SC households, diagnosed and dissected these problems and evolved solution in partnership with the local stakeholders, mainly farmers.

This baseline survey is a part of identifying the specific problems of the farmers and identify solutions in partnership with the farmers. The specific approach followed under the PDIA is given below.

Problem Driven Iterative Adaptation (PDIA)

PDIA is a learning by doing approach that helps organizations build capabilities while solving complex problems. There are four main principles of PDIA:



Local Solutions for Local Problems

Transitioning from promoting predetermined solutions to allowing the local nomination, articulation, and prioritization of concrete problems to be solved.



Pushing Problem Driven Positive Deviance

Creating (and protecting) environments within and across organizations that encourage experimentation and positive deviance.



Try, Learn, Iterate, Adapt

Promoting active experiential (and experimental) learning with evidence-driven feedback built into regular management that allows for real-time adaptation.



Scale through Diffusion

Engaging multiple agents across sectors and organizations to ensure reforms are viable, legitimate and relevant.

Source: <https://buildingstatecapability.com/2018/06/29/knowning-through-doing-and-learning/>

We acknowledge NITI Aayog and Indian Council of Agricultural Research for giving us opportunity to work with farmers in these SC-Sub Plan clusters. We thank the Director, ICAR-CRIDA, Hyderabad for constant guidance and support. We thank field survey team led by Dr. D. S. Ramanjul Reddy for their meticulous data collection. We also thank all the faculty, administrative staff and other supporting staff for constant support.

(Authors)

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ACRONYMS

BPL	:	Below Poverty Line
CRIDA	:	Central Research Institute for Dryland Agriculture
DAP	:	Diammonium phosphate
DRDA	:	District Rural Development Authority
DTPA	:	Diethylenetriamine pentaacetate
FC/OC	:	Forward Caste
FYM	:	Farm Yard Manure
GCA	:	Gross Cropped Area
GDP	:	Gross Domestic Product
GIA	:	Gross Irrigated Area
HHs	:	Households
ICAR	:	Indian Council of Agricultural Research
KCC	:	Kisan Credit Card
LIC	:	Life Insurances Corporation
M/SJ&E	:	Ministry of Social Justice & Empowerment
MGNREGA	:	Mahatma Gandhi National Rural Employment Guarantee Act
MoP	:	Muriate of Potash
MT's	:	Metric Tonnes
NCA	:	Net Cropped Area
NH	:	National Highway
NHB	:	National Horticulture Board
NIA	:	Net Irrigated Area
NIRD	:	National Institute for Rural Development
NITI	:	National Institution for Transforming India
OBC	:	Other Backward Caste
FC/OC	:	Other Caste (Forward Caste)
OECD	:	Organisation for Economic Co-operation and Development
PDIA	:	Problem Driven Iterative Adoption
PDS	:	Public Distribution system
PMKSY	:	<i>Pradhan Mantri Krishi Sinchayee Yojana</i>
PRA	:	Participatory Rural Appraisal
PT	:	Percolation Tank
RRBs	:	Reginal Rural Banks
RTC	:	Road Transport Corporation
SC	:	Schedule Caste
SCA	:	Special Central Assistance
SCDB	:	Scheduled Castes Development Bureau
SCP	:	Special Component Plan
SCSP	:	Scheduled Castes Sub-Plan
SH	:	State Highway
SHGs	:	Self Help Groups
ST	:	Scheduled Tribe
UT	:	Union Territory

INTRODUCTION

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The concept of Scheduled Castes Sub Plan (SCSP) was envisaged by the erstwhile Planning Commission of India (now National Institution for Transforming India (NITI) Aayog, New Delhi) at the time of formulation of Sixth Five Year Plan (1980-85) with the objective to ensure adequate benefits under SCSP for socio-economic and educational development of Scheduled Castes (SCs) both in physical and financial terms by providing funds, out of total allocation of the State Plan, at least in proportion to the percentage of SC population in the state (Dushkin, 1967; Planning Commission, 2007; Pattenden, 2011; Bhagavatheeswaran, *et al.*, 2016; Acharya and Sahoo, 2019).

The SCSP is designed to channelize the flow of benefits and outlays from the general sectors in the plan of the states and central ministries for the development of scheduled castes in physical and financial terms.

These plans are envisaged to help poor Scheduled Castes families through composite income generating programmes during the Sixth Plan period (1980-85). Such family-oriented programmes are to cover all the major occupational groups amongst scheduled castes such as agricultural labourers, small and marginal farmers, share-croppers, fishermen, sweepers and scavengers and urban un-organized labourers below the poverty line.

Special Central Assistance (SCA) to Scheduled Castes Sub-Plan (SCSP)

The Ministry of Social Justice & Empowerment (MoSJ & E) is providing 100 per cent grant under the Central Sector Scheme of Special Central Assistance (SCA) to Scheduled Castes Sub-Plan (SCSP) as an additive to SCSP to the States/UTs to fill the critical gaps and vital missing inputs in family-oriented income generating schemes with supporting infrastructure development so as to make the schemes more effective. The objective of the SCA is to provide additional support to Below Poverty Line (BPL) SC families to enhance their productivity and income. SCA could also be utilized for infrastructural development in the blocks having 50 per cent or more of SC population. SCA is released to these States/UTs on the basis of the following weightage criteria:

- (i) SC Population of the States/UTs: 40 per cent
- (ii) Relative backwardness of the States/UTs: 10 per cent
- (iii) Percentage of SC families in the States/UTs covered by Composite economic development programmes in the State Plan to enable them to cross the poverty line: 25 per cent
- (iv) Percentage of SCSP to the Annual Plan as compared to SC population percentage of the States/UTs: 25 per cent

SCSP implemented by ICAR-CRIDA

One of the major problems identified for widespread poverty among SC households is low adoption of modern technologies by the households and consequent low productivity and low household incomes. Considering the potential of agriculture and livelihoods improvements among the SC households, Indian Council of Agricultural Research (ICAR) is implementing SCSP in few selected districts of different states. In each district a mandal or taluka has been identified which is having more than 40 per cent of population of SC Communities. In Telangana state, Kotapally mandal of Mancherial district (erstwhile Adilabad) has been identified for implementation of SC-Sub Plan by ICAR-CRIDA as in the mandal share of SC population in total population was higher at 25 per cent, while their share was only 15 per cent in the Mancherial district, 20 per cent in Telangana state and 16.6 per cent in India.

In this context, ICAR-CRIDA also received SCSP guidelines and funds for implementing SC-Sub Plan and the Institute is implementing this in the identified Kotapally mandal. The plan was started in the last quarter of 2018-19 and is being continued during the current financial year (2021-22). Three villages having more than 40 per cent of SC population have been identified by ICAR-CRIDA in collaboration with Department of Agriculture namely Mallampet, Nagampet and Edagatta for taking interventions related to agriculture, horticulture, poultry and entrepreneurship and small business activities under this plan. Later, the SCSP interventions by ICAR-CRIDA team were extended to the remaining 31 villages in the mandal. The names of the villages covered are Nakkalpalle, Brahmanpalle, Shankarpur, Shetpalle, Pangadisomaram, Kotapalle, Vesonvai, Sarvaipet, Kondampet, Bopparam, Venchapalle, Supak, Jangaon, Algaon, Pullagaon, Sirsa, Edula Bandam, Lingannapet, Pinnaram, Parpalle, Yerraipet, Borampalle, Kawarkothapalle, Annaram, Arjungutta, Rajaram, Rampur, Kollur, Rawalpalle, Dewalwada and Rapanpalle (Table 1.1). Three villages namely Chintakunta, Ayepalle and Adkapalle are with no habitation of population.

Table 1.1: Village wise population in Kotapally mandal (2011 census)

S. No.	Villages	Population	Male	Female	Households	Share (%) of SC population
1	Dewalwada	2,575	1,296	1,279	683	80.0
2	Annaram	1,877	866	1,011	484	34.4
3	Edula Bandam	1,943	992	951	484	56.7
4	Jangaon	1,751	908	843	449	19.0
5	Parpalle	1,628	826	802	440	32.2
6	Algaon	1,643	891	752	433	66.8
7	Kotapalle	1,552	938	614	418	24.7
8	Rapanpalle	1,424	714	710	402	37.5
9	Sirsa	1,313	637	676	350	25.0
10	Shetpalle	1,206	610	596	332	33.1
11	Sarvaipet	1,145	666	479	290	38.7

S. No.	Villages	Population	Male	Female	Households	Share (%) of SC population
12	Rampur	1,059	531	528	285	33.6
13	Kondampet	1,066	538	528	272	58.3
14	Pullagaon	937	456	481	264	33.2
15	Mallampet	1,002	494	508	254	56.7
16	Nakkalpalle	880	411	469	253	12.8
17	Nagampet	966	515	451	241	58.5
18	Venchapalle	874	469	405	235	15.7
19	Kollur	820	543	277	233	45.8
20	Supak	839	429	410	203	22.9
21	Pinnaram	737	386	351	189	25.6
22	Lingannapet	677	331	346	182	42.5
23	Vesonvai	634	301	333	163	37.9
24	Rajaram	646	309	337	157	14.6
25	Pangadisomaram	670	345	325	149	20.6
26	Edagatta	512	260	252	131	49.8
27	Rawalpalle	458	218	240	125	83.1
28	Kawarkothapalle	479	233	246	114	37.7
29	Arjungutta	415	194	221	103	37.7
30	Bopparam	450	245	205	101	23.1
31	Brahmanpalle	360	174	186	94	37.0
32	Borampalle	234	120	114	58	50.0
33	Shankarpur	176	107	69	49	15.0
34	Yerraipet	162	81	81	39	36.5
35	Chintakunta	Uninhabited				
36	Ayepalle	Uninhabited				
37	Adkapalle	Uninhabited				
38	Kotapally mandal total	33,110	17,034	16,076	8,659	37.8

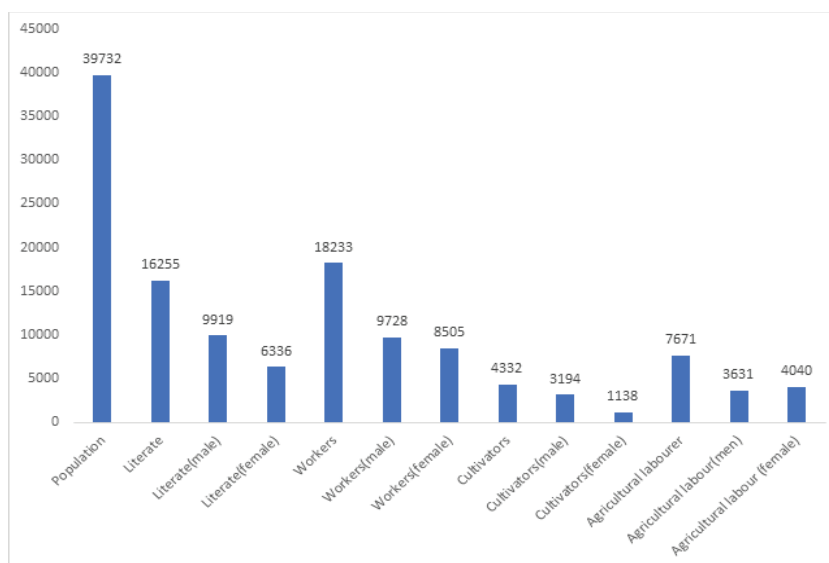


Figure 1.1: Demographic profile of Kotapally mandal (2011 census)

Overall, the main objectives of the SCSP scheme in Kotapally mandal of Mancherial district are

- ▶ Enhancing livelihood and nutritional security through the introduction of improved varieties of suitable crop
- ▶ Demonstration of improved technology/interventions in major fields of agriculture, horticulture and livestock (poultry) for livelihood improvement of SC farmers
- ▶ Development of households based other off-farm activities including backyard farming/ kitchen gardening supported by technological innovations for income diversification
- ▶ Organizing training programmes/exposure visits related to improved technology interventions

Enhancing local capabilities

Local capabilities means the quality of being able to accomplish goals set by local communities. The goals may be increase in crop production, conservation of soil and water etc. Building local capabilities for improving local communities’ capabilities needs constant support to formal (like Panchayat Raj institutions) and informal (like farmers groups, women groups and youth groups) institutions and individuals within and outside of government. Community based approaches and approaches which build trust and relationships within community to take up activities like construction of community ponds is vital for sustainable development of villages. Under the SC-sub plan, one of the important objectives of ICAR-CRIDA is to strengthen local capabilities to take up community wide development programmes for the benefit of each and every one in the community. The table 1.2 provides capability matrix, which indicates the capability levels of different stakeholders in solving the prioritized problems. In the table, green colour indicates the strong capability of individual/organization to solve the problems in specific prioritized area, while red colour indicates weak capability, which needs to be improved through training programmes and skill development.

Table 1.2: Capability matrix: strengths and weakness matrix of stakeholders

Priority area	Individuals/organizations/institutions			
	Individuals	Cooperatives	Commercial banks	Money lenders
Credit	Individuals	Cooperatives	Commercial banks	Money lenders
Agricultural technology	Farmers	ICAR-CRIDA	Department of agriculture	KVK
Kitchen garden	Households	ICAR-CRIDA	Department of horticulture	KVK
Nutrition	Households	Aanganwadis	Integrated Child Development Scheme (ICDS)	ICAR-CRIDA
Soil health	Farmers	ICAR-CRIDA	Department of agriculture	KVK
Water conservation	Farmers	ICAR-CRIDA	District Rural Development Agency (DRDA)	KVK

Note: Red colour indicates weak capability, yellow indicates moderate; green indicates strong;

Source: Focus group interactions with key stakeholders

References

- Acharya, S., & Sahoo, H. (2019). Education among Scheduled caste population in India. *The Indonesian Journal of Geography*, 51(3), 393-405.
- Bhagavatheeswaran, L., Nair, S., Stone, H., Isac, S., Hiremath, T., Raghavendra, T., & Beattie, T. S. (2016). The barriers and enablers to education among scheduled caste and scheduled tribe adolescent girls in northern Karnataka, South India: A qualitative study. *International Journal of Educational Development*, 49, 262-270.
- Dushkin, L. (1967). Scheduled caste policy in India: History, problems, prospects. *Asian Survey*, 626-636.
- Pattenden, J. (2011). Social protection and class relations: Evidence from scheduled caste women's associations in rural South India. *Development and Change*, 42(2), 469-498.
- Planning Commission. (2007). Working Group Report of the Development of Education of SC/ST/ Minorities/Girls and Other Disadvantaged Groups for 11th Five Year Plan (2007-2012).

IMPLEMENTATION STRATEGY AND METHODOLOGY

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A multipronged strategy was followed by involving a multidisciplinary team. Along with ICAR-CRIDA Scientist's, officials from line departments such as department of agriculture and rural development were also involved in the implementation of the scheme. The basic strategy was illustrated in Figure 2.1.

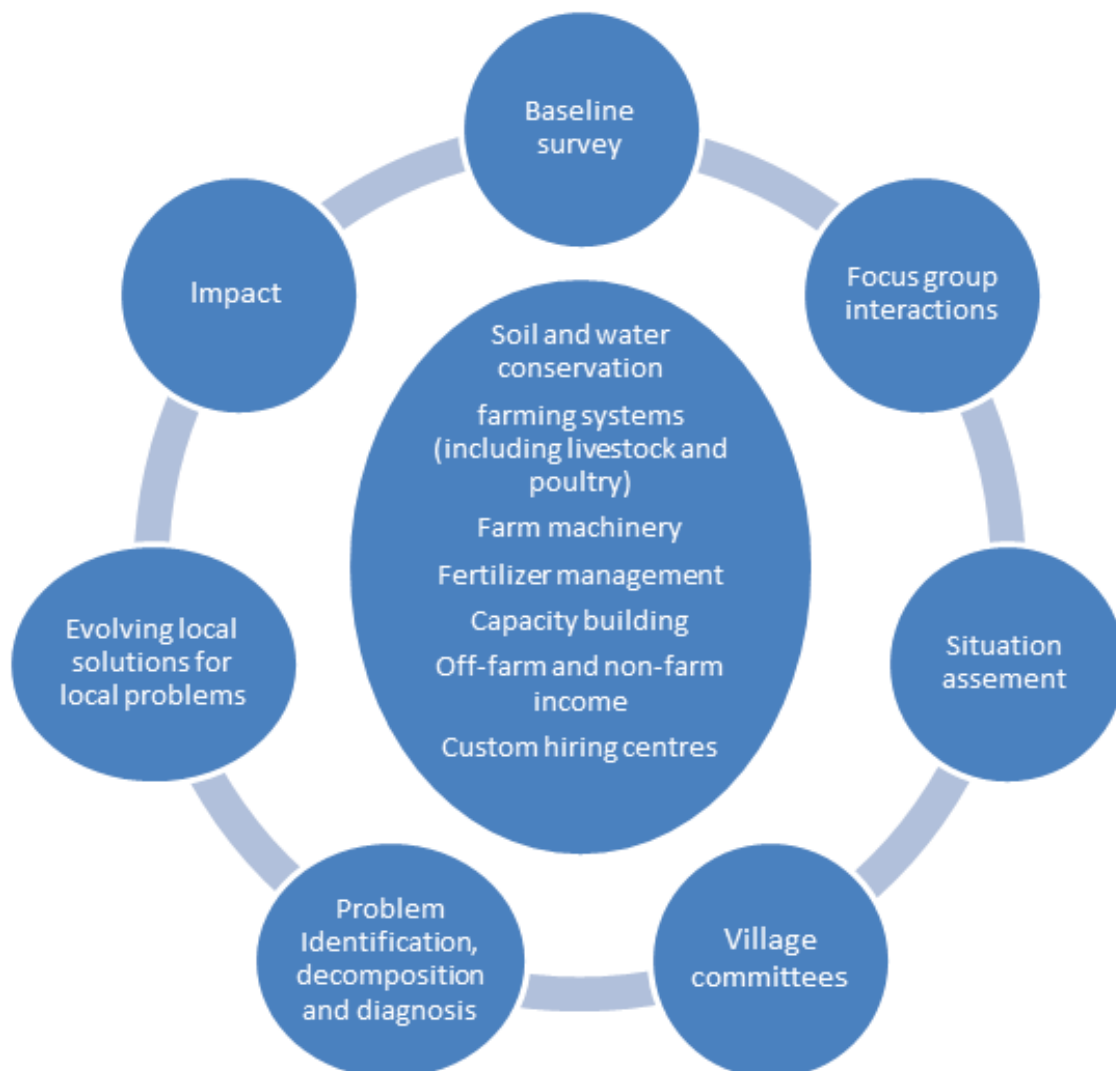


Figure 2.1: Strategies/activities planned for improvement of SC farming community

Entry Point Activities

In order to gain confidence of all the stakeholders, especially among SC farming community, women farmers, women Self-Help Groups (SHGs) and youth, ICAR-CRIDA scientists and project team organized a number of Village wise focus group discussions with each group separately and also in larger group. The main objectives of these focus group interactions are:

- (i) To understand the existing socio-economic condition of the villagers
- (ii) To understand the availability and use of basic amenities and public facilities
- (iii) To assess the livelihoods and cropping pattern of the farmers
- (iv) To understand the problems faced by the farmers in farming and also in adopting various livelihoods strategies
- (v) To assess the technological adoption levels and problems in adoption by the farmers
- (vi) To understand farm, off-farm and non-farm employment and incomes sources
- (vii) To plan and prioritize development pathways

Gram Sabha's and Focus Group Discussions

In order to understand and identify major problems faced by the SC community, SCSP implementation committee organized the Gram Sabha and constituted an advisory committee named “*SC Sankshema Samithi*” in each selected village (Figure 2.2), in this committee there was adequate representation of weaker section of the community within SC households like women farmers, disabled and women-headed households.

These *Samithi* members were active in all activities undertaken like soil and water management measures, distribution of improved varieties of seed, horticultural planting material, procuring and rearing improved breeds of livestock and poultry, starting of custom hiring centre and procurement of farm implements and identification of farmers for training programs *etc.*



Figure 2.2: Gram Sabha's and FGD'S to understand the local problems, prioritise and plan the activities

The overall approach followed by ICAR-CRIDA in the implementation of the SC-Sub Plan in the selected villages is adopted from Problem Driven Iterative Adoption (PDIA) as illustrated in Figure 2.3 (Andrews *et al.*, 2013; Rao, 2014; Andrews *et al.*, 2015).

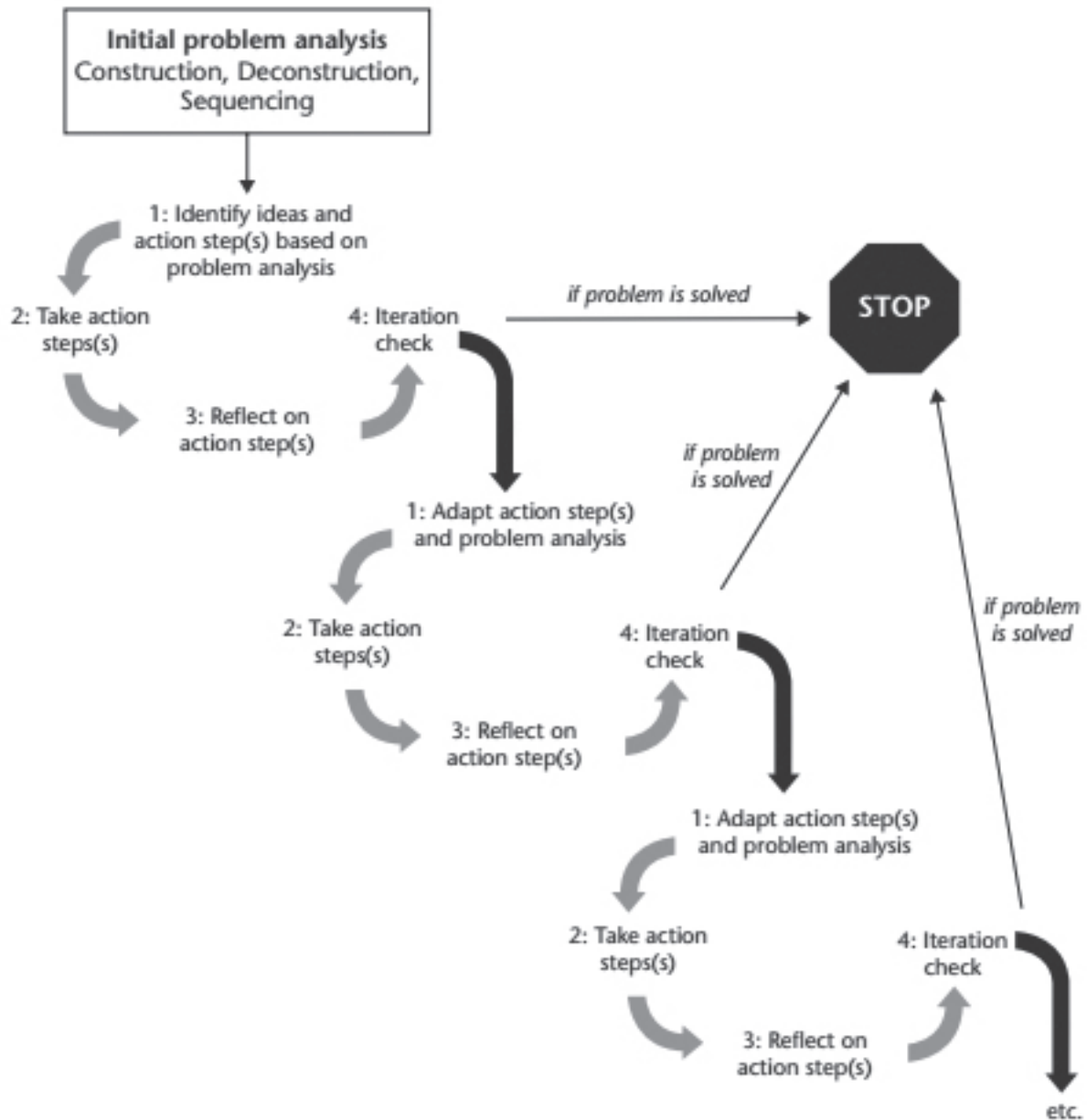


Figure 2.3: Adopted Problem Driven Iterative Adoption (PDIA) approach for implementation of the SC-Sub Plan

Source: <https://buildingstatecapability.com/tag/pdia-course/page/5/>

PDIA emphasizes a problem-driven, iterative approach, which involve essential principles *viz.*, (i) identification of burning problems, solving defined problems through; (ii) creating an environment amenable to experimentation; (iii) creating tight feedback loops and; (iv) engaging a broad set of actors. The Figures 2.3 and 2.4 illustrates the various steps involved in the PDIA approach for development. Past experience shows that successful development schemes have mostly followed PDIA principles,

though these may not have been acknowledged explicitly. The PDIA approach is based on solving a particular performance problem in a specific process. Here the problems are poverty, low agricultural productivity and low farmer's incomes.

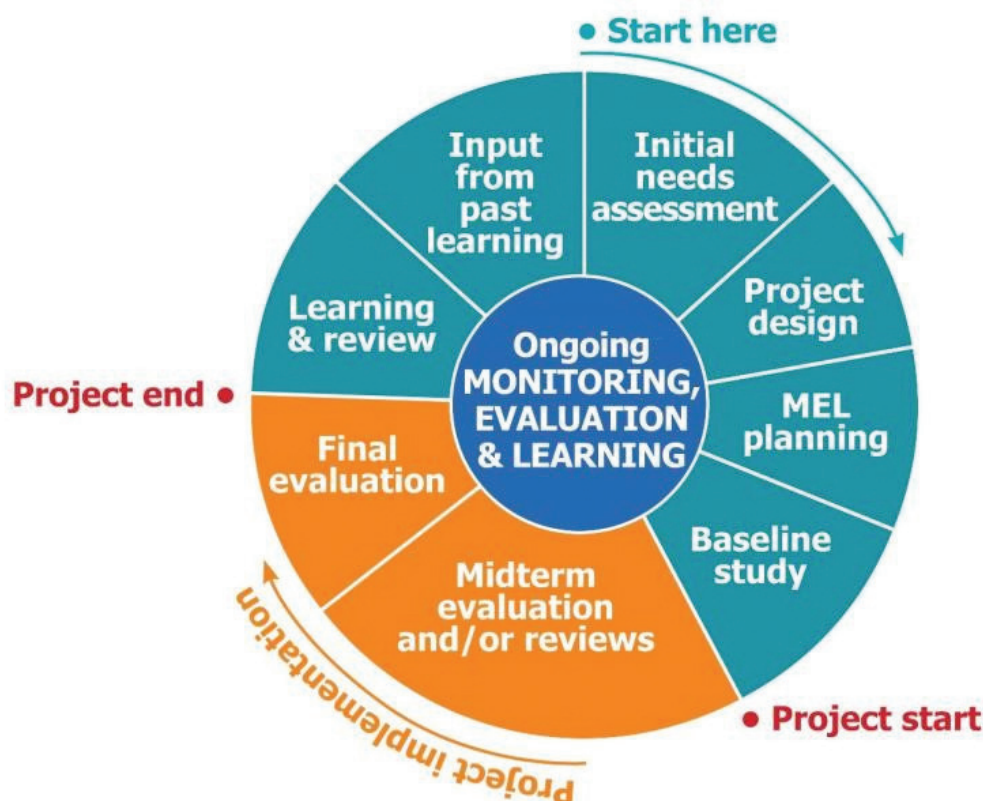


Figure 2.4: Problem Driven Iterative Adoption cycle adopted to SCSP implementation by ICAR-CRIDA

Source: https://www.intdevalliance.scot/application/files/5715/0211/8537/MEL_Support_Package_4th_June.pdf

Methodology of organising the baseline survey

Immediately after the identification of the intervention villages, the study team conducted baseline survey. The baseline survey was carried out in year 2019 for the crop year 2018-19, before any type of intervention. A detailed questionnaire was developed in consultation with all the different subject matter experts to cover all aspects of the farmer's basic-socio-economic and technological status before the implementation of the SC-Sub plan programme in the villages. The questionnaire covered fourteen sections covering (i) location details: farmer-household basic information; (ii) access to basic amenities like bus stand, school, bank *etc.*; (iii) extent of use of public amenities and other government welfare and development schemes like Soil Health Card, *Rythu Bandhu* (direct money transfer based on cropped area); (iv) family details like age, education, occupation, income and employment; source of income and employment pattern (like income from crops, livestock, agricultural labourer, non-farm employment, migration and other sources); (v) landholding pattern like extent of owned land, leased-in land, leased-out land and total operational holding with extent of dryland and wet land; (vi) cropping pattern by season and by irrigation status; (vii) general living standards like owning two wheeler/four wheeler,

mobile, TV, refrigerator, electricity; (viii) type of farm machinery owned including desi plough, seed drill, drip irrigation, sprayers, tractors *etc.*, (ix) ownership of different livestock like bullocks, buffalo, cows, goat and sheep; (x) credit behaviour of the farmers which include amount and source of credit and interest rates both from formal and informal sources; (xi) insurance (awareness about insurance scheme) especially the ongoing crop insurance scheme (*Prime Minister Fasal Bhima Yojana*), (xii) benefits received from the different development and welfare schemes, (xiii) technology adoption in major crops (like improved seed, fertilizer use, use of micro-nutrients, pesticide use, harvest and post-harvest practices), (xiv) technology adoption in livestock sector like owning good shed for livestock, use of concentrated mixture, artificial insemination and vaccination. The questionnaire is attached in *Annexure I*.

The questionnaire was pre-tested in the study villages and rectified for any corrections based on a set of criteria developed by OECD (OECD, 2008) like (i) clear meaning; (ii) data is easily available; (iii) less effort in data collection and does not require expert analysis; (iv) sufficiently representative for the total of the intended results; (v) tangible and observable and; (vi) if difficult to quantify but very important (in this case a proxy indicator was used to capture the approximate value of the intended variable).

A total of ten data collection staff was recruited and trained for data collection. The data collection was done in two month's, later the data was compiled, tabulated and analysed to draw the references and conclusion. There part is prepared which was to be used as ready recknoer for planning intension during the project period of September and October 2019.

References

- Andrews, M., Pritchett, L., & Woolcock, M. (2013). "Escaping capability traps through problem driven iterative adaptation (PDIA)." *World Development*, 51, 234-244.
- Andrews, M., Pritchett, L., Samji, S., & Woolcock, M. (2015). Building capability by delivering results: Putting Problem-Driven Iterative Adaptation (PDIA) principles into practice. *A Governance Practitioner's Notebook*, 123.
- OECD (2008). Handbook on Constructing Composite Indicators: Methodology and User Guide; OECD Publishing: *Paris, France*.
- Rao, S. (2014). Problem-driven iterative approaches and wider governance reform. GSDRC Applied Knowledge Services.

GENERAL PROFILE OF THE STUDY AREA

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The SC Sub Plan programme of Government of India is implemented across all the states by different implementing agencies. As a part of it, ICAR-CRIDA implemented it in Mancherial district of Telangana State as in the district SC population share is significantly higher and most of them are living in below poverty line. In general, backward districts like Mancherial received very little public investment and development expenditure since long in Telangana (Melkote *et al.*, 2010 and Rao, 2014). In this chapter general socio-economic and demographic and agricultural profile of the study area was illustrated.

I. Area

Mancherial district is carved out of erstwhile Adilabad district of Telangana state. It is located in northern Telangana bordering Maharashtra with highest share in forest area and scheduled tribe and scheduled caste population. It is surrounded by Asifabad (Komaram Bheem), Adilabad, Nirmal, Jagtial, Peddapalli, Bhoopalapally districts and the Maharashtra state (Figure 3.1). The district comprises of 18 mandals, two revenue divisions - Mancherial and Bellampalli and 382 villages. The district Headquarters is located at Mancherial town.

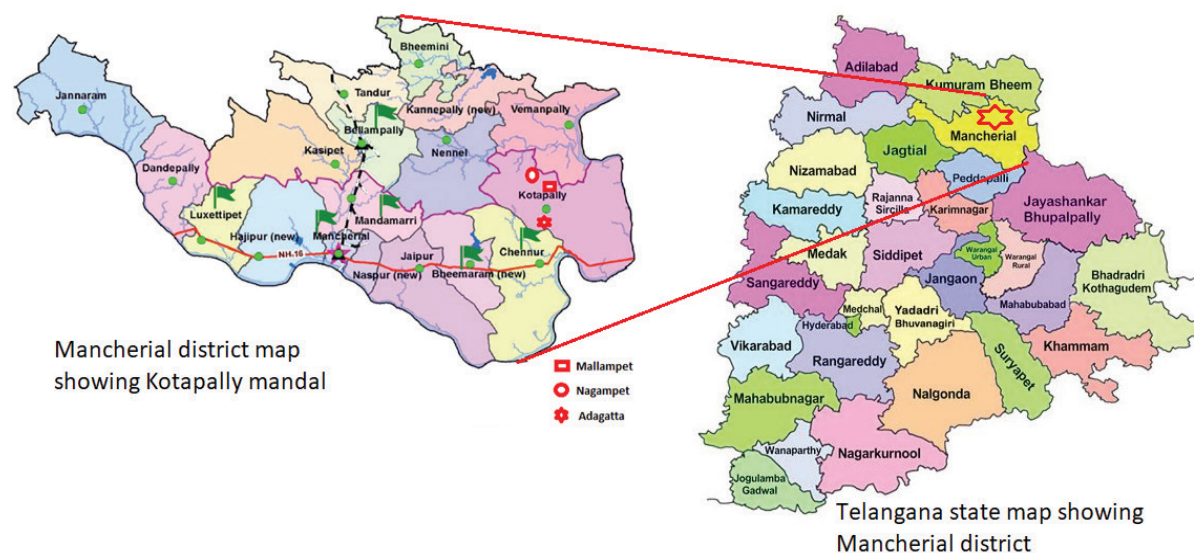


Figure 3.1: Telangana state map with Mancherial district

Mancherial is well connected through its roadways and railways. Mancherial is one of the A category railway stations of Secunderabad division and Bellampalli is also a major railway station in the district (details of the district is given in *Annexure 2*). The state highway (SH1), national highway (NH63) and

Nagpur highways run through the district, making the entire region well linked. It has one State Road Transport Corporation (RTC) bus depot at Mancherial. Rivers Godavari and Pranahita pass through it. Paddy is the major crop in the district, recently cotton area was increased. Housing a precious coal belt, the district is home to Singareni Collieries and Jaipur Thermal Power Plant. It also possesses several private cement manufacturers and ceramics factories. The ceramic pipe industry, which is the largest in the in the country, is definitely an icing on the cake. Mancherial district boasts of the crocodile sanctuary near Chennur and thick forest under a part of the Kawal Tiger Reserve. Gudemgutta Sri Satyanarayana Swami Temple is a noted pilgrim centre in the district (Figure 3.2 and 3.3).

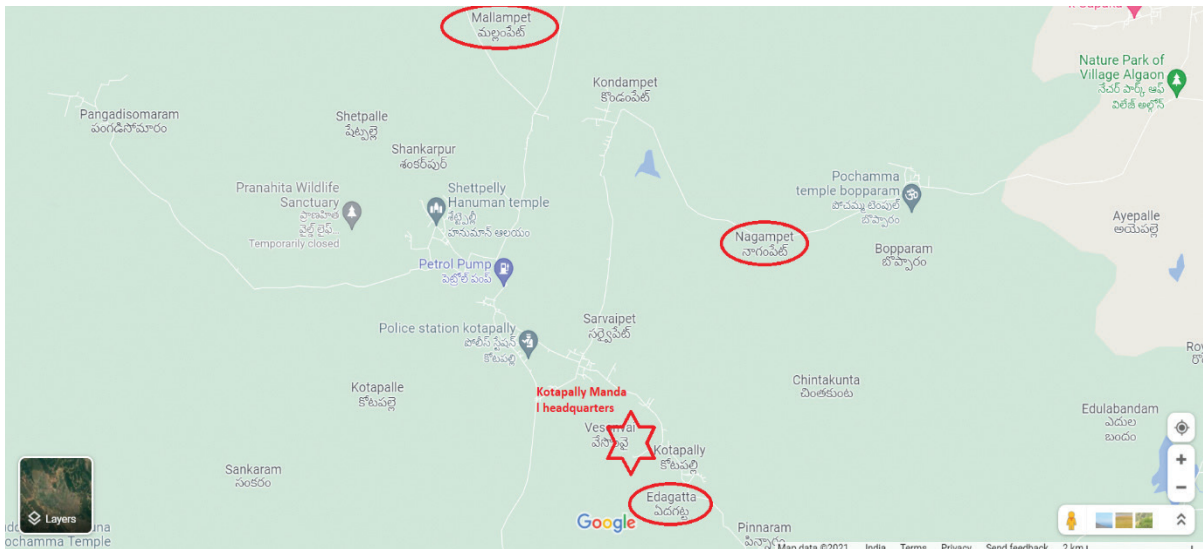


Figure 3.2: Kotapally mandal headquarters with location of three study villages identified for baseline survey demarcated

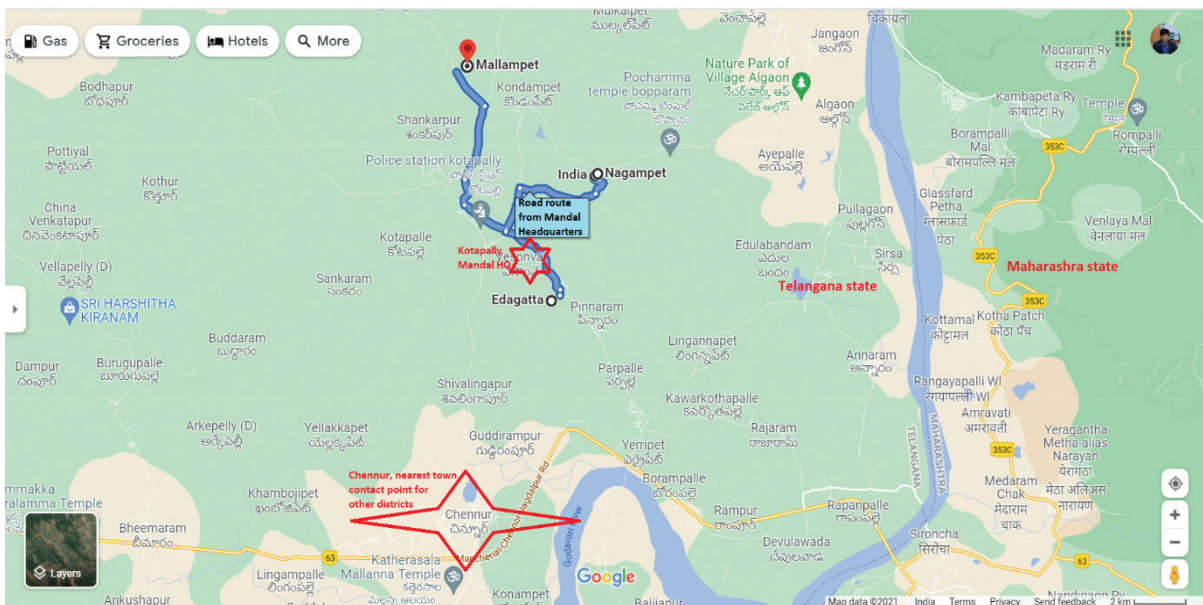


Figure 3.3: Geographical location of villages identified for baseline survey, with demarcation of nearest Chennur town

II. Demography

As per Census 2011, Mancherial district is having a population density of 201/sq. km, as against the state average which is 312/sq. km. The total population of the district is 8,07,037 which accounts for 2.3 per cent of the total population of the State. The rural population accounts for 56 per cent. (4,53,151) of the total population in the district. The total number of households is 2,06,983. So, the average household size is 3.8. The sex ratio (females per 1,000 males) is 977. The total literacy rate is 64 per cent in the district. The female literacy percentage is quite low (55.59 per cent) compared to the male literacy rate (73 per cent) in the district. The share of workers in total population is 43 per cent. Total scheduled caste population is just 15.5 per cent in the state, while their share was 25 per cent in the district. Overall, the Mancherial district is little more urbanised than Telangana state, but having more gender discrimination with lower sex ratio than the state, having more SC population and low density of population (Figure 3.1).

Table 3.1: Demographic profile of Mancherial district (2011 census)

S. No.	Parameter	State	Mancherial
1.	Population as per 2011 Census		
	Total	3,50,03,674	8,07,037
a)	Males	1,76,11,633	4,08,272
b)	Females	1,73,92,041	3,98,765
c)	Sex Ratio (Females per 1,000 Males)	988	977
d)	Rural Population (%)	61.12	56.15
e)	Urban Population (%)	38.88	43.85
2.	Households	83,03,612	2,06,983
3.	Density of Population (per Sq. Km.)	312	201
4.	Literates		
	Total	2,06,96,778	4,71,856
a)	Males	1,17,01,729	2,69,729
b)	Females	89,95,049	2,02,127
5.	Literacy Rate (%)		
	Total	66.54	64.35
a)	Males	75.04	72.96
b)	Females	57.99	55.59
6.	Scheduled Castes Population		
	Total	5,4,08,800	1,99,493
a)	Males	26,93,127	1,00,792
b)	Females	27,15,673	98,701

Source: <https://cdn.s3waas.gov.in/s33dd48ab31d016ffc314df2b3cb9ce/uploads/2020/07/2020071751.pdf>

III. District Agricultural Profile

Climate

Mancherial district falls under agroclimatic zone of Northern Telangana Zone. Normal annual rainfall of this district is 1,065 mm, during South West Monsoon (rainy season spanning from June to September) average rainfall is 953.20 mm, North East Monsoon (October to December) average 69.4 mm, during winter season average rainfall is 7.60 mm and during hot period (summer) average rainfall is 28.9 mm. Average annual temperature on average ranges between maximum 34.9 °C and minimum 22.0 °C with mean hottest temperature 42.6 °C and the average relative humidity varies from 61-90 per cent. The soils are of clayey to gravelly clayey, moderately deep dark brown soils, loamy to clayey skeletal deep reddish-brown soils and shallow loamy to gravelly clay red soils. Many village tanks in the district are renovated under Mission Kakatiya (tank renovation scheme of Telangana state), but still maintenance is not proper (Figure 3.4).



Figure 3.4: Tank in Nagampet village (before renovation) in Mancherial district

Agriculture

Mancherial district is predominantly agrarian based. It has been a home for Gondi people who mainly depend on agricultural activities for their livelihood. Later the district became industrialised by the establishment of coal mines. But still the people engaged with agriculture (cultivation and agricultural labour) make up to 56 per cent of total work population.

(Source: <https://mancherial.telangana.gov.in/documents/>).

Landholding pattern in the district is similar to that of the Telangana state. A large number of populations hold up to 1 ha of land and only 0.39 per cent of the population operates 10 ha and above landholding (Table 3.2).

Table 3.2: General characteristics of Telangana state and Mancherial district

S.No.	Parameters	Telangana state	Mancherial district
1	Land holdings		
	a) Marginal (up to 1 ha)	34,20,202 (62.0)	92,733 (63.8)
	b) Small (1-2 ha)	13,18,390 (23.9)	30,723 (21.1)
	c) Semi-medium (2-4 ha)	5,98,145 (10.8)	16,756 (11.5)
	d) Medium (4-10 ha)	1,65,127 (3.0)	4,654 (3.2)
	e) Large (10 ha and above)	15,647 (0.3)	581 (0.4)
	Total	55,17,511(100)	1,45,447 (100)
2	Cropped area (ha.)		
	a) Gross cropped Area (GCA)	48,93,148	95,568
	b) Net cropped Area (NCA)	41,74,532	84,931
	c) Gross irrigated Area (GIA)	20,27,663	30,698
	d) Net irrigated Area (NIA)	14,86,241	30,698
	e) Cropping intensity (GCA/NCA)*100	117	113
	f) Irrigation intensity (GIA/NIA)*100	136	100
3	Area under different crops (ha.)		
	a) Rice	14,71,710	25,831
	b) Jowar	83,401	1,021
	c) Maize	7,12,981	3,553
	d) Red gram	2,51,121	2,262
	e) Green gram	95,524	1,775
	f) Black gram	31,221	110
	g) Bengal gram	80,766	388
	h) Groundnut	1,77,914	293
	i) Sunflower	17,574	324
	j) Chillies	82,649	721
	k) Sugarcane	34,775	0
	l) Cotton	16,77,492	50,200
	m) Horticulture	6,64,326	23,513
4	Agriculture marketing (Nos.)		
	a) Agriculture market committees	180	5
	b) Rythu bazars		
5	Livestock population		
	a) Cattle	48,80,293	2,11,945
	b) Buffaloes	41,60,419	96,960
	c) Sheep	1,28,35,761	2,96,133
	d) Goats	45,75,695	1,45,376
	e) Others	6,20,723	4,859
	Total	2,70,72,891	7,55,273

S.No.	Parameters	Telangana state	Mancherial district
6	Poultry population	8,07,50,833	4,95,788
7	Veterinary facilities		
	a) Poly clinics	8	0
	b) Hospitals	100	2
	c) Dispensaries	907	27
	d) Mobile clinics	37	1
	e) Rural livestock units	1,102	15
8	Fisheries		
	a) Fish rearing tanks/reservoirs	24,294	707
	Water spread area (ha.)	8,00,269	13,980
	b) Fishermen Coop. Societies	3,867	60
	Members		
	c) Seed released into tanks/reservoirs by Govt	2,65,071	4,885
	Seed released (lakh nos.)	3,824	108
	d) Estimated production 2016-17 (Tonnes)		
	i) Fish	3,43,447	6,315
	ii) Prawn	3,34,952	5,565

Source: Annexure 2

Table 3.2 shows Mancherial district profile in agriculture and allied activities as against Telangana state. The Net Cropped Area (NCA) represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once. The NCA is 84,931 ha in the district, while Gross Cropped Area was 95,568 ha. The GCA represents the total area sown once or more than once in a particular year, *i.e.* the area is counted as many times as there are sowings in a year. This total area is also known as total cropped area or total area sown. The Net Irrigated Area (NIA) is the area irrigated through any source once in a year for a particular crop is 30,698 ha. It means only 36 per cent of NCA is irrigated in the district. The gross irrigated area which is the total area under crops, irrigated once or more than once in a particular year is same as that of NIA in the Mancherial district. Cotton covers the large area in both state and the district followed by rice and horticulture crops. Maize, red gram and green gram are grown by a significant farmer, but on smaller parcel of lands. There is a good scope for crop diversification and intensification by expanding irrigated area in the district as both cropping intensity and irrigation intensity are low. There are 180 agriculture market committees in the state with 5 of them in the Mancherial district. Although there are 36 *Rythu Bazars* (direct farmer to consumer markets) in the state, but don't exist in the district. Relatively cattle and goat population in the district is higher compared to sheep, buffalo and poultry as farmers still use cattle for ploughing and other agricultural activities and also dairy and goat for meat purpose. Veterinary facilities consist of 2 hospital, 1 mobile clinic and 27 dispensaries in the district. Water spread area in the state accounts for 8,00,269 ha with only 1.7 per cent of that water area spread in the Mancherial district. The district is mostly dependent on 707 fish rearing tanks/reservoirs for fishing and also for irrigation.

Kotapally Mandal

Kotapally mandal comes under Chennur division of Mancherial district. The distance from mandal headquarters to district headquarters is 52 km. The mandal consists of 37 revenue villages. A revenue village is a small administrative region in India, a village with defined borders. One revenue village may contain many hamlets. Each revenue village is headed by a Village Administrative Officer. The mandal comprises 34 Gram Panchayats (Gram Panchayat is a basic village-governing institute in Indian villages. It is a democratic structure at the grass-roots level in India. It is a political institute, acting as cabinet of the village. The Gram Sabha works as the general body of the Gram Panchayat. Out of 39,428 ha total geographical area, 47.2 per cent is forest area, only 27.1 per cent is cultivable land, but about 25.4 per cent is cultivated. About 70.1 per cent of cultivated area is under rainfed. Cropping intensity is 116, which indicates that only 16 per cent cultivated area was sown twice (Table 3.3 & Figure 3.5 & 3.6).

Table 3.3: Basic information of Kotapally mandal

Basic information about Kotapally mandal	Land use pattern in the mandal
<ul style="list-style-type: none"> • Mandal: Kotapally • Division: Chennur • District: Mancherial • Distance from Mancherial: 52 Km • Number of revenue villages: 37 • Number of deserted villages: 2 • Number of gram panchayats: 31 • Average rainfall: 1,160 mm 	<ul style="list-style-type: none"> • Total geographical area: 39,428 ha • Area under forest cover: 18,624 ha • Total cultivable land: 10,671 ha • Gross sown area: 10,032 ha • Area under cultivation in <i>rabi</i>: 1,602 ha • Area under cultivation in <i>kharif</i>: 10,034 ha • Area under rainfed condition: 7,101 ha • Area under irrigated condition: 2,931 ha

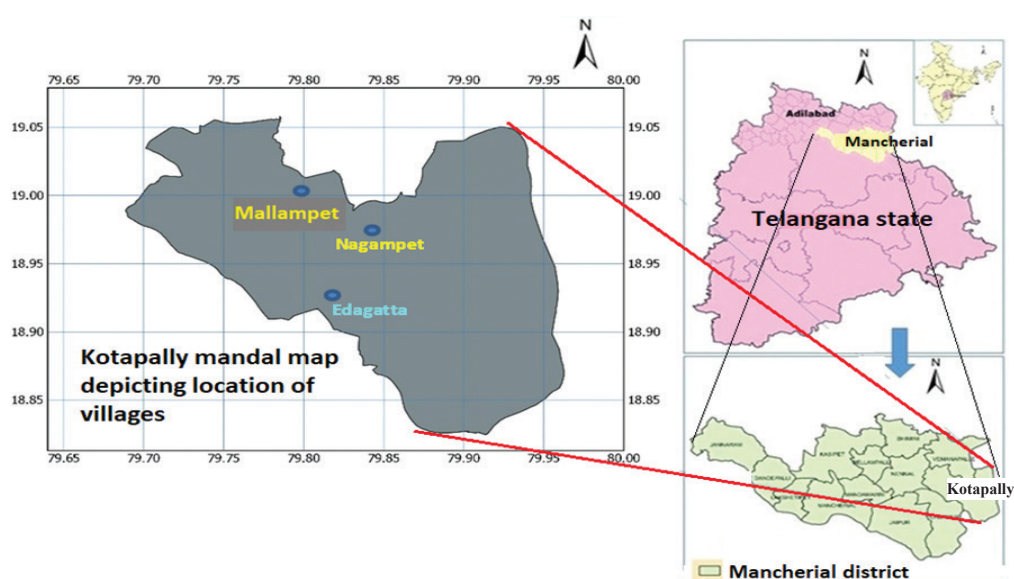


Figure 3.5: Location map of SCSP villages in Kotapally mandal, Mancherial district, Telangana state

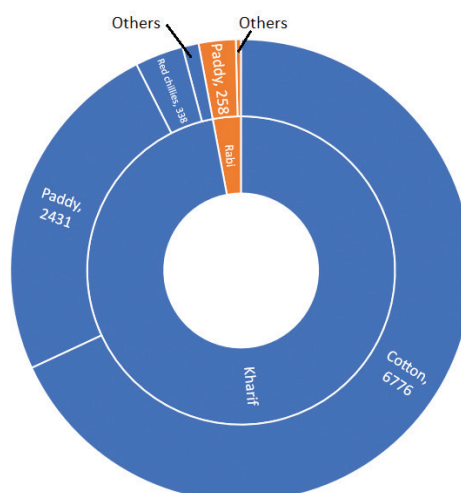


Figure 3.6: Normal cropping pattern in hectares (*Kharif* and *Rabi*) in Kotapally mandal

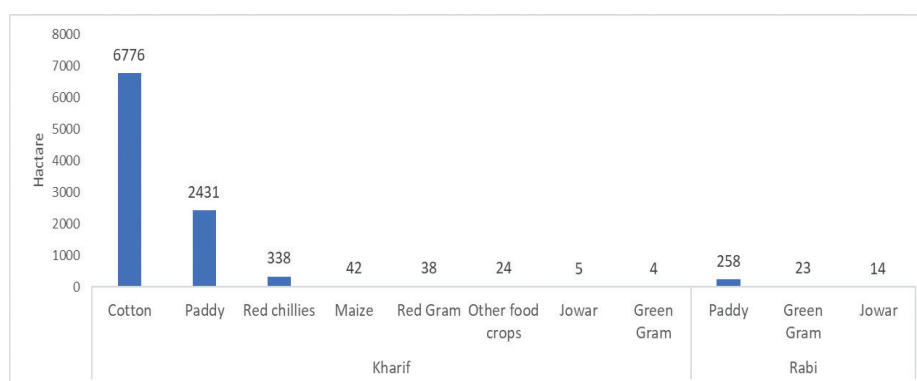


Figure 3.7: Detailed cropping pattern in Kotapally mandal

The cropping pattern in Kotapally mandal is dominated by cotton and paddy in *kharif* season and paddy in *rabi* season. There is a need for crop diversification and expansion of irrigated area, so that the cropped area under pulses and millets can be increased with one or two critical irrigations. (Figure 3.7). The similar domination of cotton and paddy was observed in all three study villages (Table 3.4). As seen from Table 3.4, cotton cropped area is predominant in all villages followed by area under paddy.

Table 3.4: Total cropped area (acre) village wise and dominant crop wise

Village	Cotton	Paddy	Other crops	Total area
Mallampet	545.3	339.3	44.2	928.8
Edagatta	211.1	201.1	21.1	433.3
Nagampet	398.2	364.4	38.1	800.7

References

- Melkote, R. S., Revathi, E., Lalita, K., Sajaya, K., & Suneetha, A. (2010). The movement for Telangana: Myth and reality. *Economic and Political Weekly*, 45(2), 8-11. *Economic and Political Weekly*, 49(9), 10-13.
- Rao, C. H. (2014). The new Telangana state: A perspective for inclusive and sustainable development.

DATA AND SAMPLING FRAME WORK OF THE STUDY**C. A. Rama Rao, A. Amarender Reddy and Cheruku Saipriya***ICAR-Central Research Institute for Dryland Agriculture (CRIDA), Santoshnagar,
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This chapter explains the baseline survey sampling methodology. The study is mostly based on the primary data. Although CRIDA team initially selected three villages namely Mallampet, Nagampet and Edagatta from the Kotapally mandal of Mancherial district in Telangana state for interventions under SCSP plan, later on activities were extended to cover all the remaining 31 villages of the mandal such as Nakkalpalle, Brahmanpalle, Shankarapur, Shetpalle, Pangadisomaram, Kotapally, Vesonvai, Sarvaipet, Kondampet, Bopparam, Venchapalle, Supak, Jangaon, Algaon, Pullagaon, Sirsa, Edula Bandam, Lingannapet, Pinnaram, Parpalle, Yerraipet, Borampalle, Kawarkothapalle, Annaram, Arjungutta, Rajaram, Rampur, Kollur, Rawalpalle, Dewalwada and Rapanpalle. Three villages namely Chintakunta, Ayepalle and Adkapalle are with no habitation of population are not covered under the ICAR-CRIDA SCSP activities. Although, SCSP activities covered 34 villages of the Kotapally mandal, the baseline survey was carried out in only three selected villages to economize on the cost of conducting the survey with proper sampling framework, so that the survey represent all the villages in the mandal. A team of ICAR-CRIDA along with local administration visited all the villages and reviewed the secondary administrative information available with district officials, three villages namely Mallampet, Nagampet and Edagatta are selected for baseline survey as they represent all the agro-ecological and socio-economic conditions of the mandal and also having moderate number of households, it means they are neither too big or too small and represent an average village situation not only in the mandal, but also in the state and as well as the country. The numbers of households are maximum in Mallampet (254), followed by Nagampet (241) and the least in Edagatta (131), which are moderate in size and represents an average village in India. Basic socio-economic profiles of the villages are given in Table 4.1. The study team followed standard census procedure while collecting data from all the selected three villages as it covered all the households in the villages (Pedigo and Buntin, 1993; Singh and Masuku, 2014)

Among the three villages, Mallampet is the largest village with 1,002 population followed by Nagampet (966) and Edagatta (512). The total households in Mallampet are 254, Nagampet are 241 and Edagatta are 131. Sex ratio was highest in Mallampet (1,028), followed by Edagatta (969) and least in Nagampet (876). Overall and female literacy rate was lowest in Mallampet compared to other two villages. STs population was less than 5 per cent in all three villages, but SCs population was above 50 per cent in all three villages with the highest in Nagampet (58.5 per cent) and Mallampet (56.7 per cent). Working population was highest in Mallampet (57.5 per cent) and lowest in Edagatta (45.1 per cent). Overall, the data indicates that Mallampet was educationally backward followed by Nagampet and Edagatta. While, SC and ST population was highest in Nagampet, followed by Mallampet and Edagatta. In all parameters, Edagatta was more developed compared to other two villages.

Table 4.1: Demographic profile of the selected villages

Parameter	Mallampet	Nagampet	Edagatta
Total population	1,002	966	512
Total number of houses	254	241	131
Sex ratio	1,028	876	969
Total literacy rate (%)	45.5 % (456)	58.0 % (560)	56.6 % (290)
Female literacy rate (%)	17.4 % (174)	23.3 % (225)	23.8 % (122)
Scheduled tribes population (%)	2.6 % (26)	4.7 % (45)	0.2 % (1)
Scheduled caste population (%)	56.7 % (568)	58.5 % (565)	49.8 % (255)
Working population (%)	57.5 %	56.1 %	45.1 %
Child (0-6) population, 2011	111	61	51
Sex ratio (among 0-6 years population), 2011	820	488	1125

The baseline survey was carried out by following census method. That is each and every household was surveyed by using pre-tested questionnaire. The questionnaire was canvassed a total of 504 households for the study. From Mallampet village 156 households, from Nagampet village 243 households and from Edagatta 105 households (Figure 4.1). The total household members in the villages are different from census 2011, as many households are migrated out especially from Mallampet. All the data collected was post-classified based on social groups, land holding groups and area groups (village).

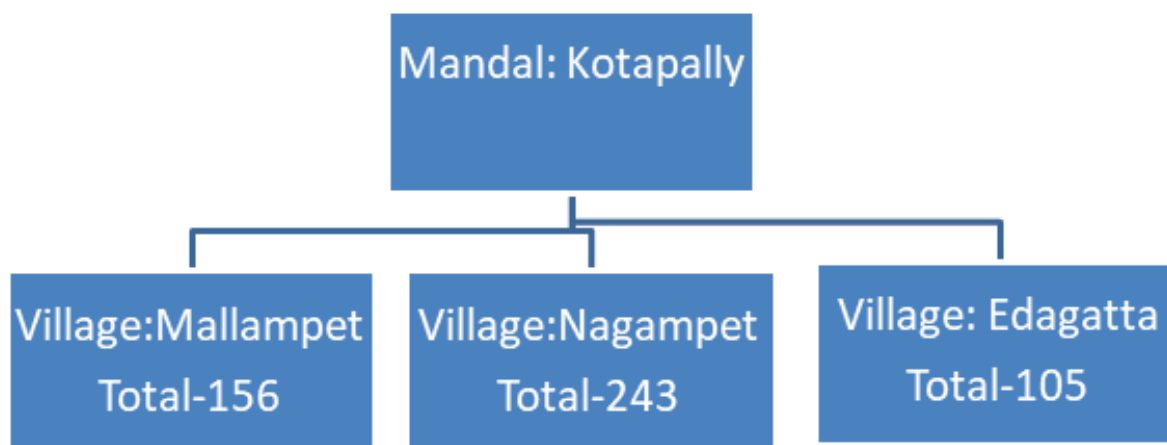


Figure 4.1: Sampling details of selected villages

References

- Pedigo, L. P., & Buntin, G. D. (Eds.). (1993). Handbook of sampling methods for arthropods in agriculture. CRC Press.
- Singh, A. S., & Masuku, M. B. (2014). Sampling techniques & determination of sample size in applied statistics research: An overview. *International Journal of economics, commerce and management*, 2(11), 1-22.

HOUSEHOLD SOCIO-ECONOMIC PROFILE

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The SC-Sub plan programme is implemented in three adopted villages of Kotapally mandal of Mancherial district in Telangana state viz., Edagatta, Mallampet and Nagampet from year 2018-19. This chapter illustrates the socio-economic profile of the households in base line year 2018-19. The socioeconomic profile of the villages is assessed by the following methods:

1. Participatory Rural Appraisal (PRA) tools
2. Focus Group Discussions (FGD)
3. Primary Survey.

1. Participatory Rural Appraisal (PRA): Recently renamed as Participatory Learning for Action (PLA), is a methodological approach that is used to enable farmers to analyse their own situation and to develop a common perspective on natural resource management and agriculture at village level. PRA is an assessment and learning process that empowers farmers to create the information base they need for participatory planning and action. Outsiders contribute facilitation skills and external information and opinions. Many different tools have been developed for use in PRA. There are four main classes: tools used in group and team dynamics; tools for sampling; options for interviews and dialogue; and options for visualization and preparing diagrams. It is a way of learning from and with community members to investigate, analyze and evaluate constraints and opportunities, need assessment and priorities in the field of agriculture and other social and economic development programmes addressed to village developed.

In PRA, seasonal analysis to assess the seasonal trends relating to farming and allied fields and problem identification tools has been used in the present study.

a) Seasonal analysis: This is one of the PRA tools that indicates the specific activities that occur during the different months relating to farming and allied fields. It helps to know about labour requirement, migration, disease and pest incidence, natural calamities that occur and other important relevant events affecting farming activities.

South West monsoon (June to September) is the major source of rain for *kharif* crops in the study villages (Figure 5.1). In the month of May, land preparation activity takes place. In June, sowing of paddy seedlings in nursery along with sowing of cotton commences. In July, the various activities scheduled are paddy transplanting; fertilizer application to cotton; Foot and Mouth disease, Hemorrhagic Septicemia and Black quarter disease incidence in cattle. In August, weeding and pest appearance like stem borer in paddy; pesticide and fertilizer application in cotton at 15 day's time interval twice. In September, pesticide and fertilizer application in cotton at 15 day's time interval take place twice. In October, paddy harvesting and cotton picking commences and there will be high demand for labour. The peak demand for labour is from June to November, after November, up to May there is no much demand

for labour except public works like The Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA). Most of the men are engaged in ploughing, land preparation, spraying of pesticides, while women are engaged in transplanting of paddy, weeding in both paddy and cotton and picking of cotton. Sowing operations are done by both male and female.

Activity	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Livestock rearing	■	■	■	■	■	■	■	■	■	■	■	■
Land preparation (paddy and cotton)					■							
Sowing of paddy seedlings in nursery and sowing of cotton						■						
Paddy transplanting and cotton sowing							■					
Fertilizer application to cotton and paddy							■					
Foot and Mouth disease, Hemorrhagic Septicemia and Black quarter diseases in cattle							■					
Weeding and pest appearance like stem borer in paddy								■				
Pesticide and fertilizer application in cotton at 15 day's time interval								■	■			
Paddy harvesting									■	■		
Cotton picking									■	■	■	■
MGNREGA works		■	■	■								
Migration for construction work	■	■	■	■	■							

Figure 5.1: Seasonal analysis

b) Problem Identification: This method helps in identifying the major problems faced by farmers in farming and allied activities. Accordingly, ten key informants among farmers in each village were selected for recording their responses. The maximum number of key informants pointing to a particular problem was identified as number one ranked problem; the second maximum number of key informants pointing to a problem as second ranked problem *etc.*, was the procedure followed in ranking problems. The problems are listed below:

- i. Low incomes and yields
- ii. Water scarcity
- iii. Lack of knowledge on intercropping, crop rotation
- iv. Low productivity of horticultural crops
- v. Low productivity of kitchen garden
- vi. Low awareness on soil and water conservation activities
- vii. Pest problems in maize
- viii. Lack of mechanization in crops
- ix. Unstable market prices
- x. Problem of wild boar
- xi. Low awareness on alternate sources of women employment

The problem of low yields and incomes is analysed and decomposed into causes and sub-causes as shown in Figure 5.2.

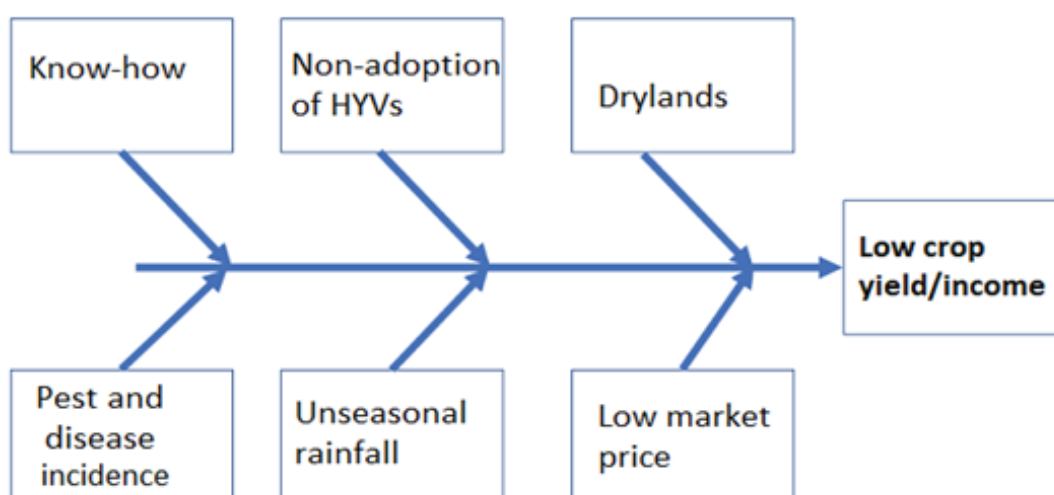


Figure 5.2: Fishbone diagram of problem diagnosis

2. Focus Group Discussions (FGD) were conducted to elicit qualitative data from farmers.

Focus Group Discussions were organized among farmers, agricultural labourer, women groups, youth to identify problems and solutions in a participatory approach. The main problems identified are (i) Low crop yields; (ii) Low income; (iii) Youth unemployment; (iv) Market price fluctuation; (v) Lack of tarpaulins for drying grains between harvest and marketing; (vi) Lack of appropriate farm machinery for pumpsets, sprayers, improved cultivators; (vii) Lack of skills to engage in alternative income sources like livestock rearing and off-farm and non-farm activities; (viii) Improved varieties of crops and livestock breeds, *etc.* (Figure 5.3).

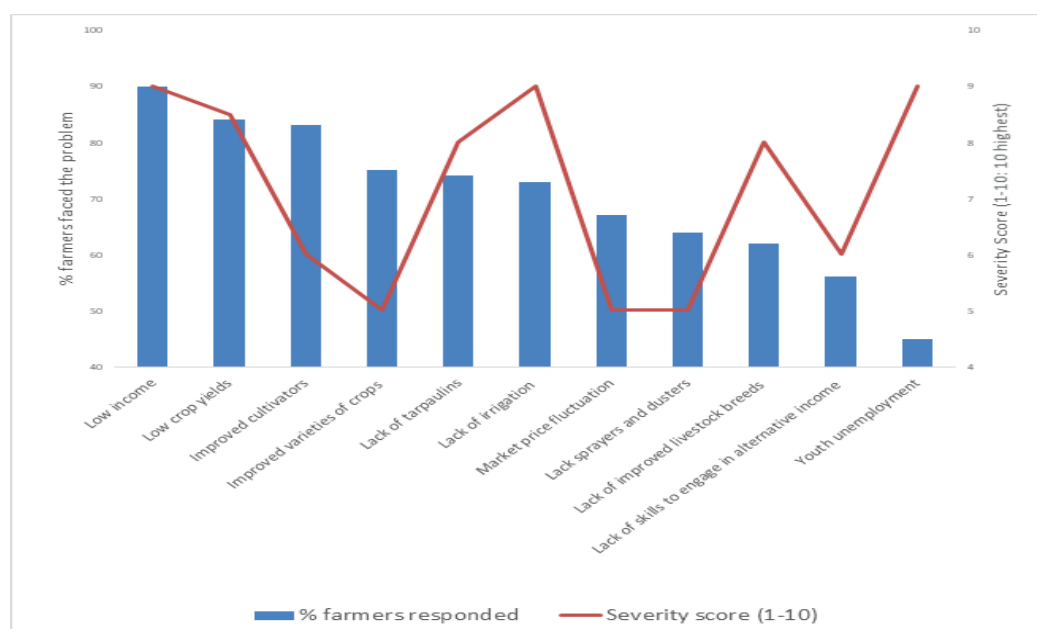


Figure 5.3: Farmer's problems and average score (1-10:10 highest)

3. Primary survey was conducted through interview method to elicit quantitative data from farmers with the help of questionnaire.

A) Social groups (Caste)

The percentage distribution of household samples based on the socio-economic status is illustrated in Chart 1-4. It can be observed from the collected 504 samples that there is a prominence of Scheduled Caste (SC) households' (74 per cent) which is followed by Other Backward Caste (OBC) (20 per cent) and Scheduled Tribe (ST) (6 per cent) (Figure 5.4 & Table 5.1). A majority of the households in each village are from the scheduled caste followed by backward caste and then the scheduled tribes. There is no household belongs to Forward Caste (FC/OC), except Mallampet where only one household is there. Predominance of SC households in these villages are also associated with low level of access to public infrastructure like roads, schools and hospitals due to historical neglect in investments in public infrastructure.

Table 5.1: Distribution of household's by socio-economic groups

Village	SC	ST	OBC	FC/OC	Total
Edagatta	65	11	29		105
Mallampet	135	6	14	1	156
Nagampet	174	12	57		243
Total	374	29	100	1	504

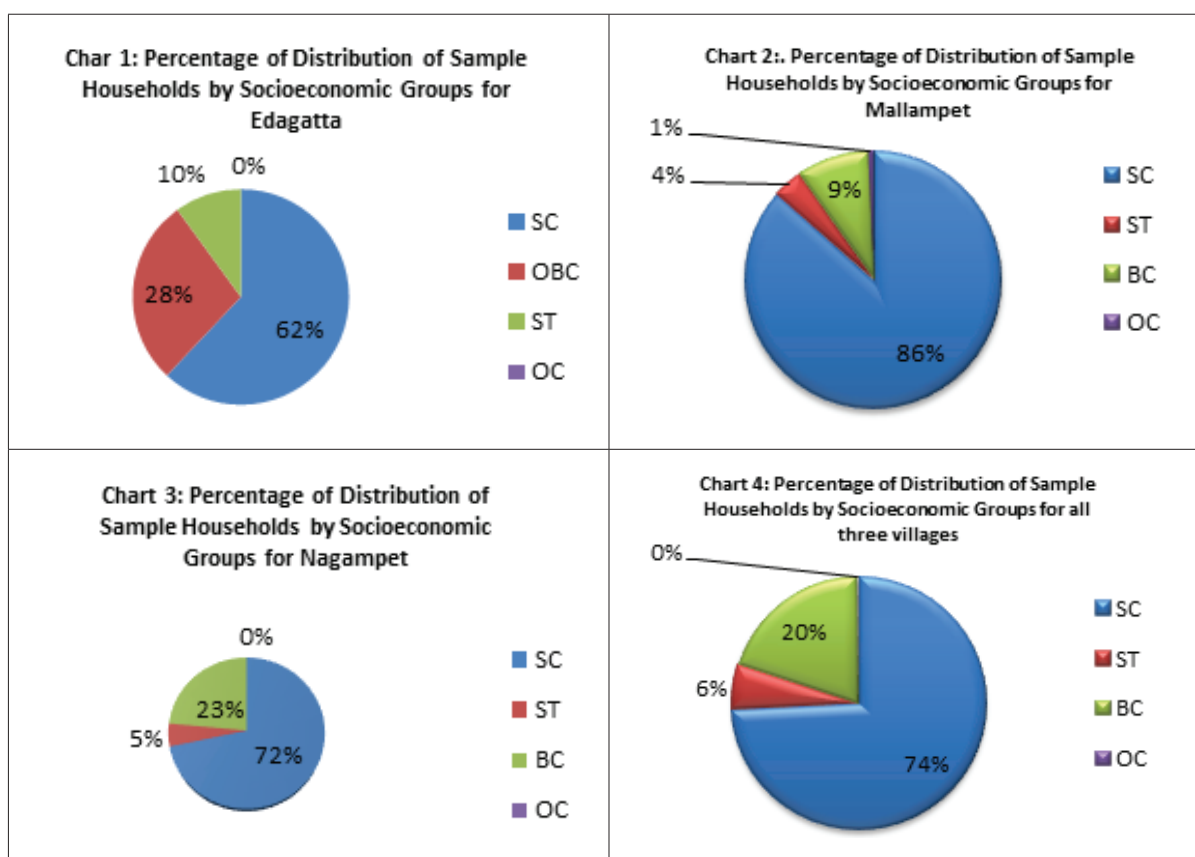


Figure 5.4: Percentage distribution of household's by caste group under each village

B) Land holdings

Historically, land is the only source of income generation in these types of remote villages due to lack of alternative sources of income. Size distribution of land holdings is one of the most important indicators of measuring the income opportunities and economic power structure and interrelations between and among the households, type of technological adoption, profitability and employment within the villages.

Distribution of households in the three villages based on landholding size class is depicted in the Table 5.2. It provides a distinct picture of the high proportion of marginal landholdings (more than 50 per cent with less than 1 ha) akin to the traits of Indian agriculture landholding size. Marginal and small farmers (1-2 ha) together are contributing to about 80 per cent of farmers of sample households in all the three villages. Less than 2 per cent of the landholdings are large size holders with more than 10 ha in the sample.

Table 5.2: Distribution of household's by land holding class by village

Village	Marginal	Small	Medium	Large	Total
Edagatta	63 (60.0 %)	30 (28.6 %)	11 (10.5 %)	1 (1.0 %)	105 (100 %)
Mallampet	77 (49.4 %)	48 (30.8 %)	28 (17.9 %)	3 (1.9 %)	156 (100 %)
Nagampet	116 (47.7 %)	78 (32.1 %)	46 (18.9 %)	3 (1.2 %)	243 (100 %)
Total	256 (50.8 %)	156 (31.0 %)	85 (16.9 %)	7 (1.4 %)	504 (100 %)

The land size classification of sample households among the socioeconomic groups is illustrated in Table 5.3. Noticeably across all the socioeconomic groups the marginal lands stand out in percentage terms over the small, medium and large size land holdings in all the sample villages. The share of marginal landholders was 49 per cent among SCs, 83 per cent among STs, 47 per cent among OBCs and nil among OC (Other/Forward caste) households. The share of large landholders among SCs is one per cent, while among STs 10 per cent and among OBCs two per cent. It shows that among SCs, majority of households belong to small and marginal farmers category, with only one per cent belonging to large farmers category, while among STs and OBCs share of large farmers are little better.

Table 5.3: Distribution of household's by land holding class by social group by village

Village	SC					ST				OBC				FC/OC		
	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Total	Marginal	Small	Medium	Large	Total	Medium	Total
Edagatta	62	28	11	0	100	91	9	0	100	45	38	14	3	100	0	0
Mallampet	47	33	17	2	100	100	0	0	100	50	21	29	0	100	100	100
Nagampet	47	32	20	1	100	67	8	25	100	47	37	14	2	100	0	0
Total	49	32	17	1	100	83	7	10	100	47	35	16	2	100	100	100

C) Farm size of the household's

The average farm size of the households by social group is shown in Figure 5.5. In all the three villages, the average farm size is less than 3 acre; however, farm size was slightly higher among STs followed by SCs and OBCs. While for FCs it was 8 acres, but only one household belongs to this caste. Average farm size was less than 3 acres in all three villages, but there is slight variation, Nagampet and Mallampet average farm size was 2.9 acres, while it was only 2.4 acres in Edagatta. In terms of size of the land holdings (Figure 5.6), all the three villages have nearly similar number of marginal, small, medium and large farms. Marginal farmers with average farm size of less than one acre constitute 50 per cent of the farmers, the average size of small farmers is just 3 acres, and their share in the sample farmers is about 30 per cent. Medium farmers constitute about 15 per cent with average farm size of 6.3 acres. While large farmers share is just 5 per cent but the average size of the farms is 11.3 acres. The small farm size, in addition to the low level of adoption of new technologies and no alternative sources of income are the main constraints to come out of poverty for most of the households in the study villages.

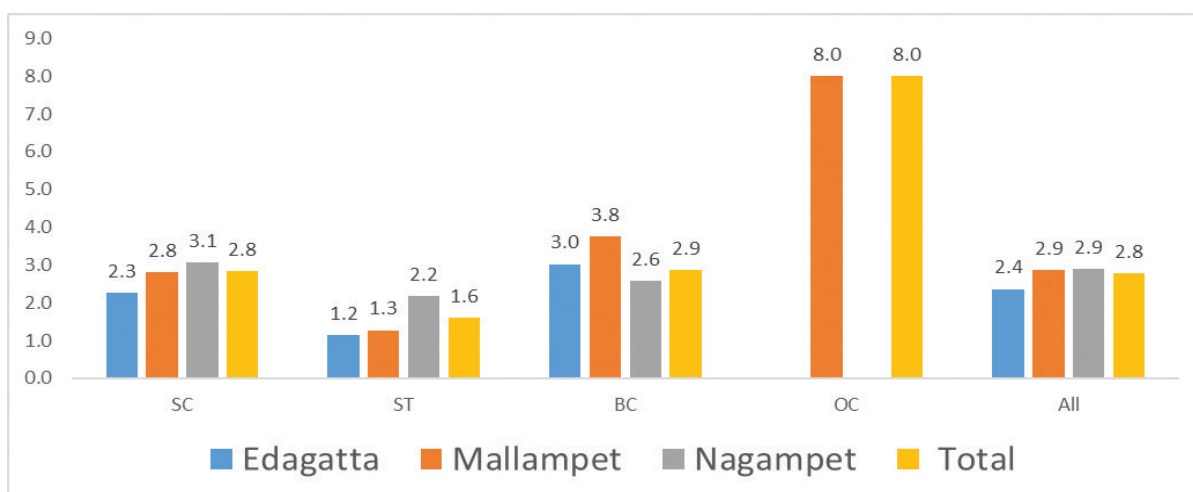


Figure 5.5: Average farm size (in acre) by social group and village

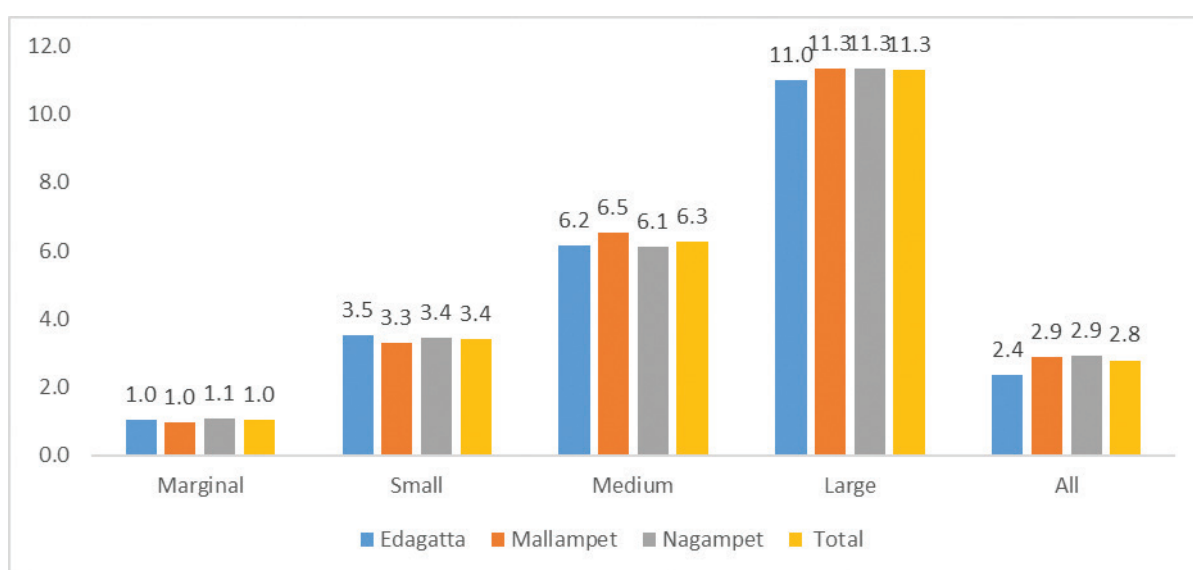


Figure 5.6: Average farm size (in acre) by land size category by village

D) Household composition and education

Educational level and literacy rates enhance the human power in households in multifaceted ways. It generally increases employment and income opportunities within and outside the village, help in adoption of new agricultural technology, getting benefits from different government schemes and also help in overall participation of households in various socio-economic programmes in the village. Average household size (number of family members in the family) getting reduced over the years, with joint families replaced by nuclear families and also with the adoption of family planning. The average household size of the study area is 2.8 which is much lower than the district average (3.8) and state average (4). On average, male population is higher than female population in the villages, which may be true, but sometimes may be due to under reporting of number of women due to the existing local socio-economic conditions. However, in Edagatta, female population was higher than male population, might be due to the outmigration of males to work in nearby towns and urban centres. The higher level of outmigration in the village may be attributed to nearness to the road network which connected to Chennur and farther to district headquarters Mancherial and Hyderabad. The average years of schooling is around 6 years pointing towards the very low level of education among the people. The literacy status of the head of the household is one of important attribute which capture the household's socio-economic status and also ability of the household to adopt new technology. The average literacy rate of the head of the household was 27.2 per cent in the study area which is much lower than the district average of 75.7 per cent. The literacy rate was the highest in Edagatta (43.8 per cent) and lowest in Nagampet (17.3 per cent). The higher level of literacy in Edagatta is also may be one of the reasons for higher migration levels in the village (Table 5.3). The lower literacy rate in the study area may be attributed to higher share of SC and ST in the villages and also remoteness of the villages. There is a vast difference in literacy rate among land size classes and social groups. People with large landholding have highest average years of schooling as well as highest percentage of literate heads in the households among all the other landholding class. It is also to be noted that, large farmers are having bigger family size and also with higher female population compared to other land size classes. The higher female population among large land size class may indicate less discrimination against women mainly due to their higher educational levels and higher literacy rates. Average family size among the SCs and STs are 2.8 and 2.6, which indicates dominance of the nuclear families in the village coupled with out-migration of many family members either due to education or for employment purpose (Table 5.4 & 5.5). During the focus group interactions, many households reported that the aged parents are willing to live separately from their children's families to avoid conflicts among the members and also because of income received from old-age pensions. There is no much difference among SCs, STs and OBCs in terms of education, but only FC families are far better in both average years of schooling and also literacy rate of the head of the family.

Table 5.3: Level of education (years of school education) and literacy rate by villages

Village	Average family size	Male (%)	Female (%)	Average years of schooling	(%) Literate head of hhs
Edagatta	2.6	38.1	61.9	6.7	43.8
Mallampet	2.7	64.3	35.7	6.3	31.4
Nagampet	2.9	62.3	37.7	6.2	17.3
Total	2.8	58.4	41.6	6.3	27.2

Table 5.4: Level of education (years of school education) and literacy rate by landholding class

Land size class	Average family size	Male (%)	Female (%)	Average years of schooling	(%) Literate head of hhs
Marginal	2.5	60.1	39.9	5.5	28.9
Small	2.9	55.8	44.2	6.3	28.2
Medium	3.1	59.1	40.9	8.1	17.6
Large	3.7	53.8	46.2	9.0	57.1
Total	2.8	58.4	41.6	6.3	27.2

Table 5.5: Level of education (years of school education) and literacy rate by social group

Social economic group	Average family size	Male (%)	Female (%)	Average years of schooling	(%) Literate head of hhs
SC	2.8	57.6	42.4	6.4	26.5
ST	2.6	59.2	40.8	5.8	24.1
OBC	2.7	60.7	39.3	6.0	30.0
FC/OC	2.0	70	30	13.5	100.0
Total	2.8	58.4	41.6	6.3	27.2

E) Members participation in farming activities

The average family size of the sample households and their active involvement in farming activities in all the three villages is presented in Table 5.6. Across the sample villages the average family size is 3 out of which about 2 family members are involved in farming on an average and the same trend is also observed across all the socioeconomic groups except for FCs where family size and family members involved in the farming are same (Table 5.6 & Figure 5.7). The data indicates that, irrespective of their age, all the household's members are more or less engaged in agricultural activities, unless and otherwise they are very old and not able to work. Even those old-aged people also participating in some economic activities within their household premises, like involved in backyard poultry, work in backyard gardening by growing vegetable crops, cleaning of grain and drying of grain, *etc.* (Figure 5.8, 5.9, 5.11).



Figure 5.7: Small ruminants grazing after harvest of paddy



Figure 5.8: Family members involved in farming activities (Traditional plough)

Table 5.6: Average members of households involved in farming by socio-economic groups

Village	SC		ST		OBC		FC/OC		Total	
	Family Size	Involved in farming	Family Size	Involved in farming	Family Size	Involved in farming	Family Size	Involved in farming	Family Size	Involved in farming
Edagatta	3	2	2	2	2	2			3	2
Mallampet	3	2	2	2	3	2	2	2	3	2
Nagampet	3	2	3	2	3	2			3	2
Total	3	2	3	2	3	2	2	2	3	2



Figure 5.9: FGD with mango farmers

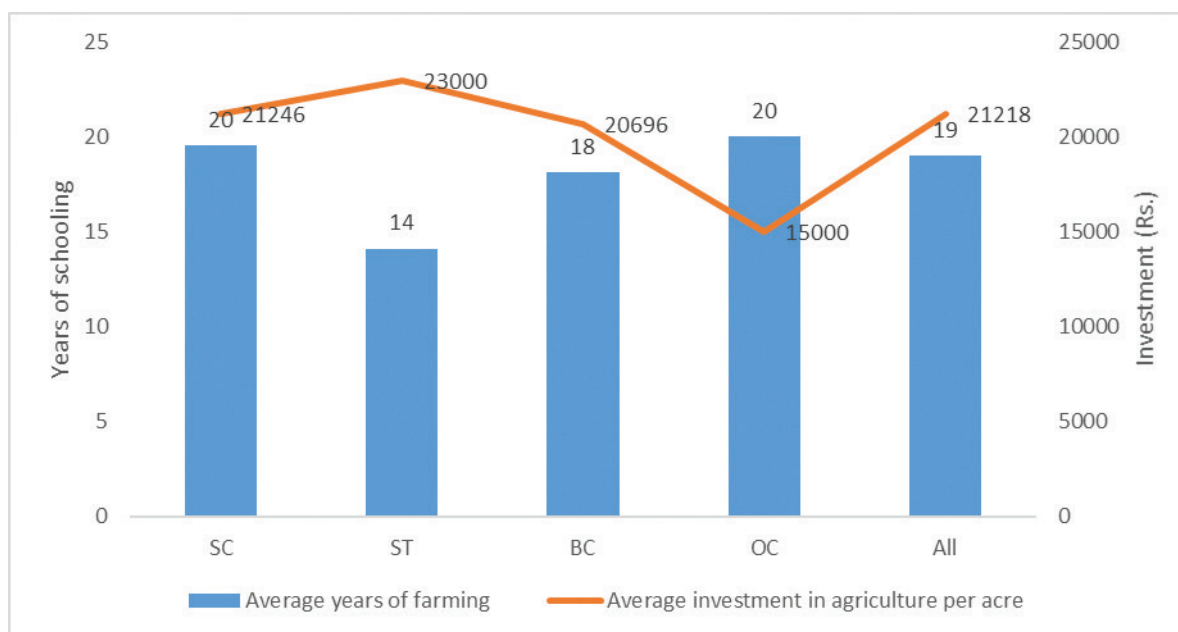


Figure 5.10: Average years of farming and average investment (Rs.) by social group

The average years of farming experience is an important indicator showing whether farmers having necessary experience in maintaining their farms. The past experience shows that about 5-6 years of farming experience is sufficient for almost all agricultural operations in more efficient way, more experience also indicates that perpetuation in old agricultural practices, not inclined for change to new and improved methods of agriculture. Most of the sample households have been involved in agriculture for about 19 years (Figure 5.10), which indicates experience is not a constraint for adopting good agricultural practices. On the other hand, a farmer with more than 15 years of experience habitual to do only old agricultural practices, motivating him to adopt new and improved agricultural practices require more efforts from the extension agencies and scientists. SC farmers on an average have about 20 years of experience, while lowest is among STs with only 14 years of experience. Although farmers are still using old type of ploughs, bullock carts, sickles (single-handed agricultural tool designed with variously curved blades and typically used for harvesting) *etc.*, they are also adopting new technology especially fertilizers, pesticides, crop varieties (especially cotton), if they found useful and simple to use.

Most of the farmers own only drylands with minimal investments in agriculture. The average investment per household was just Rs. 21,218/acre (Figure 5.10). Investment by SC households is little less than all other households. However, there is no significant difference across the social groups in terms of investment per acre. There is significant difference in investment per acre and also years of experience in farming across land size class. The marginal farms are being tilled for 18 years with an average investment of Rs. 20,800 with at least one family member of the sample households and a minimum of two persons are engaged on small and medium farms with an average investment of Rs. 21,400. Whereas, the large farmers are having farming experience of 29 years, with no more than 3 people involved, with average investment per acre Rs. 24,200, which is significantly higher than that of marginal, small and medium farmers (Figure 5.12). It indicates that the large farmers are taking advantage of new technology mostly tractor drawn farm implements like improved plough, cultivator, seed cum fertilizer drill and

harrow *etc.*, and investing a significant amount to overcome the shortage of labour and increased wage rates. Further, paddy crop operations like sowing, transplanting, weeding and harvesting are seasonal, most of the operations are fully mechanized on large farms, but on marginal and small farms, still farmers are doing most of the operations through manual labour, mostly by own-labour or many time exchange of labour among neighboring farmers. The local wage rates are steeply increased after the implementation of The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA: 100 day's guaranteed public work for each household at minimum wage rates) especially for women. Although, large farmers mechanized most of the paddy operations, still they are depending upon wage labour for cotton cultivation mainly for weeding and picking. Especially during the paddy transplanting, weeding and cotton weeding and picking there was huge demand for women wage labour and farmers have to give money intime and also provide other amenities like arranging food, transport *etc.*, during the peak demand for labour. Male labourer are mostly engaged in land preparation, ploughing, inter-cultivation through bullocks, transport of grain, operation of tractor drawn implements like cultivators, operation of sprayers and dusters, *etc.*



Figure 5.11: Women taking care of small ruminants

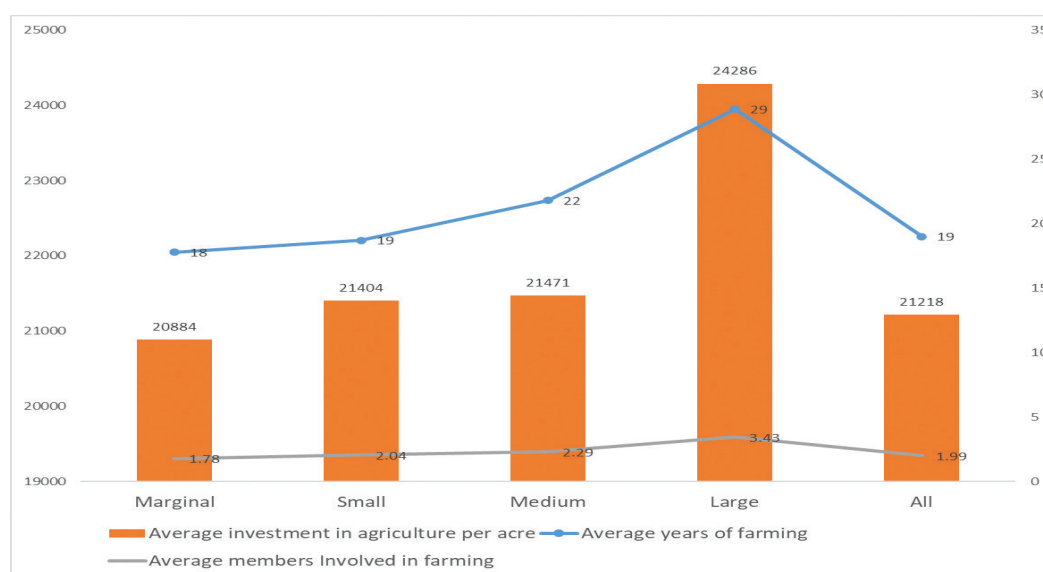


Figure 5.12: Average number of family members involved in farming and investment (Rs.) and number of years in farming by land class

F) Investment capabilities of the households

The average investment in agriculture on acre basis, Figure 5.13, is observed to be made highest by the Scheduled Tribe farmers in the Edagatta village (Rs. 30,000) and the lowest by the FC farmers in Mallampet village (Rs. 15,000). In total sample only one FC household is there, that too, they are actively engaged in non-farm activities. This is half of what a Scheduled tribe farmer of Edagatta village farmer pays. This shows that, slowly, farmers who have capabilities in terms of social contacts, education are slowly investing out of agriculture and trying to settling down in non-agricultural activities either they are petty business or engaged as contractors in construction or any other works related to nearby town. Further, the average agriculture investment is higher in Edagatta village (Rs. 29,000) than the Mallampet (Rs. 19,600) and Nagampet (Rs. 18,800) villages distinguishably. In Nagampet village the average investment difference over the socioeconomic groups is seen to be little. One of the main contributing factor of higher investments in Edagatta is it is well-connected through road networks and easily accessible with all urban amenities. Although, there was significant difference among three villages in terms of investment per acre, that difference don't exists within the village among different land size class farmers (Figure 5.14). That is both the large and marginal farmers in Edagatta invested Rs 30,000 and 29,000, respectively, while large and marginal farmers in Nagampet invested Rs. 22,000 and 18,000 per acre, respectively. The average investment in agriculture for large farms is Rs. 24,000, while among marginal, small and medium farms it is Rs. 21,000.

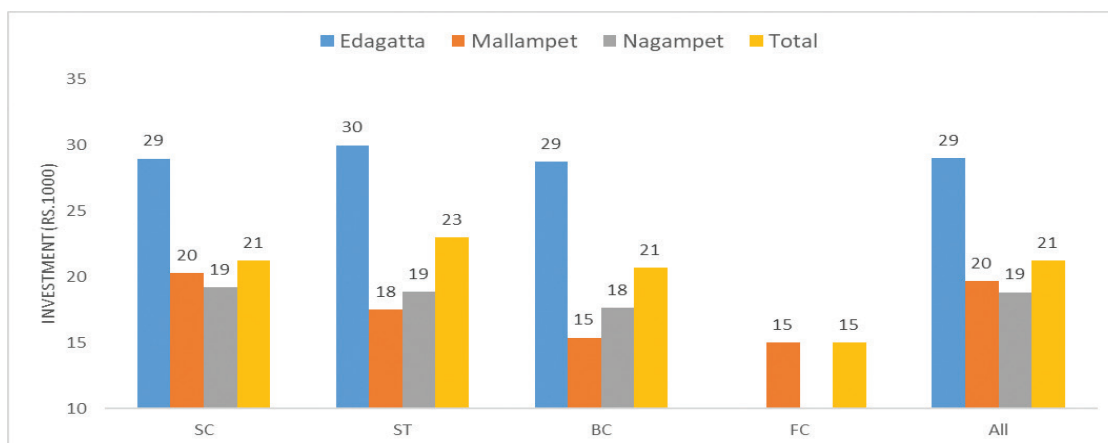


Figure 5.13: Average investment in agriculture per acre by social group (Rs. 1,000/acre)

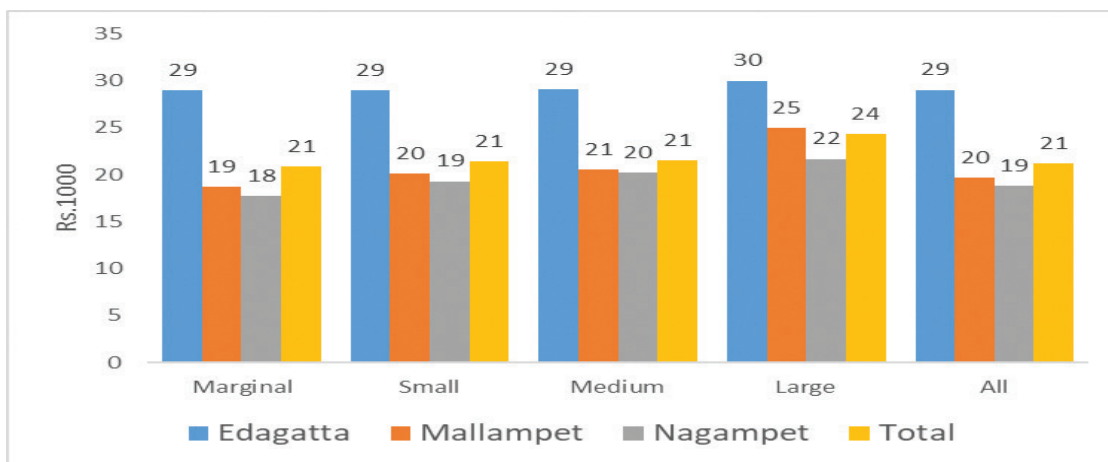


Figure 5.14: Average investment in agriculture per acre by land class (Rs. 1,000/acre)

The above data illustrates that the farmers in these villages are not only deprived of less operational holdings but are also economically backward and are unable to invest enough in agriculture and land development to reap higher returns (as seen from the past studies of Gupta, 2005; Reddy *et al.*, 2014A; Reddy *et al.*, 2014; Pattnaik *et al.*, 2018; Jha *et al.*, 2018). The condition is worst in Nagampet village and in micro level, the FC farmers marginal farmers population are suffering badly, although for different reasons. Being remote is working against Nagampet farmers as they are not well-connected to nearest town and their other sources of income are low, hence they are not able to invest as that of Edagatta, which is closely linked with nearest town. Except, large farmers all other category farmers are having too small land parcels for cultivation, which is not producing enough returns to invest to improve crop yields. Their incomes are hardly sufficient for their consumption needs.

However, the recent government Direct Money Transfer Schemes such as PM-KISAN (*Pradhan Mantri Kisan Samman Nidhi* is an initiative by the government of India in which all farmers will get up to Rs. 6,000 per year as minimum income support) and *Rythu Bandhu* (*Rythu Bandhu* scheme also Farmer's Investment Support Scheme is a welfare program to support farmer's investment for two crops a year by the Government of Telangana. The government is providing Rs. 58.33 lakh farmers Rs. 5,000 per acre per season to support the farm investment, twice a year, for *rabi* and *kharif* seasons) are playing an important role to increase investments in farming by the farmers. Although crop insurance scheme is implemented in the villages, very few are benefited.

References

- Gupta, D. (2005). Whither the Indian village?: Culture and agriculture in 'rural'India. *Review of Development and Change*, 10(1), 1-20.
- Jha, C. K., Gupta, V., Chattopadhyay, U., & Sreeraman, B. A. (2018). Migration as adaptation strategy to cope with climate change: A study of farmers' migration in rural India. *International Journal of Climate Change Strategies and Management*, 10(1), 121-141.
- Pattnaik, I., Lahiri-Dutt, K., Lockie, S., & Pritchard, B. (2018). The feminization of agriculture or the feminization of agrarian distress? Tracking the trajectory of women in agriculture in India. *Journal of the Asia Pacific Economy*, 23(1), 138-155.
- Reddy, D.N., Amarender, R. A., Nagaraj, N., & Bantilan C. (2014A). Rural non-narm Employment and Rural transformation in India: Working Paper Series No. 57. Patancheru 502 324, Telangana, India: *International Crops Research Institute for the Semi-Arid Tropics*, 28.
- Reddy, D.N., Amarender, R. A., Nagaraj, N., & Bantilan C. (2014B). Emerging Trends in Rural Employment Structure and Rural Labor Markets in India, Working Paper Series No. 56. Patancheru-502 324, Telangana, India: *International Crops Research Institute for the Semi-Arid Tropics*, 26.

GENERAL STANDARD OF LIVING

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In this chapter, household's employment and income status, sources of income along with the ownership of household durable consumer goods, assets across socio-economic groups and land size class are discussed. Historically, the villages predominantly habituated by the SC households are generally poor. The employment and income opportunities are not diversified, they mostly depend on agriculture, especially in villages where droughts are recurring phenomenon and agriculture is rainfed (Reddy and Kumar, 2006; Reddy, 2015; Blakeslee, 2020;). The ownership of various household items (durable consumer goods) like having TV, refrigerator, car/bike, *etc.*, will give clear indication of the living standards of the households, which can be comparable both temporally and geographically (Dreze and Srinivasan, 1997; Saccani *et al.*, 2017; Mahapatro *et al.*, 2017). Many households also have permanent assets in terms of agricultural land and household dwellings and some have gold jewellery and bank savings accounts or LIC premium certificates.

A) Source of income

The major source of income in all the three villages for the sample households is agriculture (61.1 per cent), which is followed by wages from Mahatma Gandhi National Rural Employment Guarantee Act, (MGNREGA) (16.8 per cent), off-farm income (5.0 per cent) and non-farm income (4.5 per cent). The livestock contributes to only 3 per cent of total income (Figure 6.1). Other income is 8.4 per cent, which might have included government supported direct money transfer schemes like schemes like old-age pension, *Rythu Bandhu*, PM-KISAN, *etc.* It is noted that migration is also an option for marginal and small land holders, but there is no migration evident among the large farmers from the sample households.

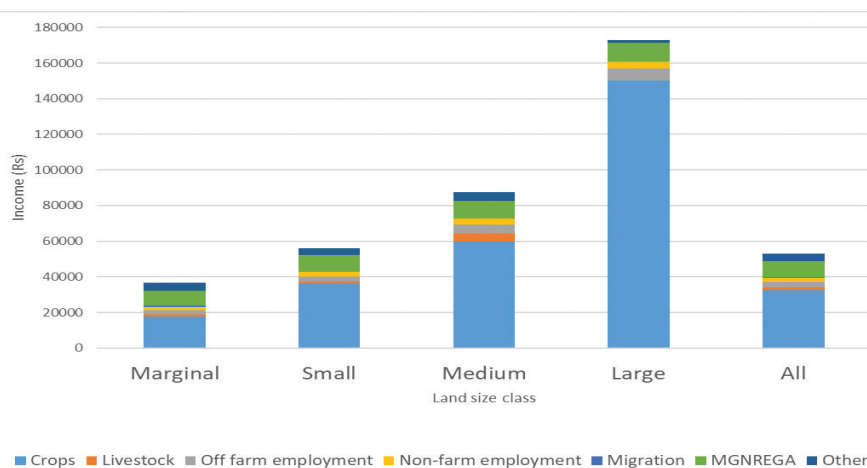


Figure 6.1: Sources of income of households by land size class

Among marginal farmers, because of the low agricultural employment and income, especially during the post-rainy and summer season, MGNREGA became a considerable source of income, contributing about 22.7 per cent of total income. Whereas, for large farmers its share is just 6.2 per cent of their total earning, while they earn a major chunk (about 86 per cent) from agriculture. Livestock rearing is more prevalent in medium size farmers with 5 per cent of their income, while its contribution is almost negligible among large farmers. Income and employment diversification among marginal farmers are higher especially towards public works under MGNREGA, off-farm and non-farm activities. Income diversification is also picking up even among small and medium farmer's (Table 6.1 and Figure 6.2).

Table 6.1: Household income per annum from all sources by farm size category

Land size class	Percentage of total annual income							Average household income (Rs.)
	Crops	Livestock	Off farm employment	Non-farm employment	Migration	MGNREGA	Others	
Marginal	48.3	2.9	6.5	5.3	1.6	22.7	12.7	36,773 (100)
Small	65.1	1.8	4.6	4.8	0.2	16.7	6.8	55,946 (100)
Medium	68.5	5	5.8	3.5	0	11.3	5.9	87,624 (100)
Large	86.8	0	4.1	2.1	0	6.2	0.8	1,72,857 (100)
Total	61.1	3	5.6	4.5	0.6	16.8	8.4	53,174 (100)



Figure 6.2: Sheep rearing in the village

Average income of STs was the lowest, followed by OBC, SC and highest among FCs (Figure 6.3). However, income gap among social groups is less than the gap between marginal and large land-class. It indicates that, the social group as an indicator of economic status is losing relevance, while landholding size playing a major role in higher incomes.

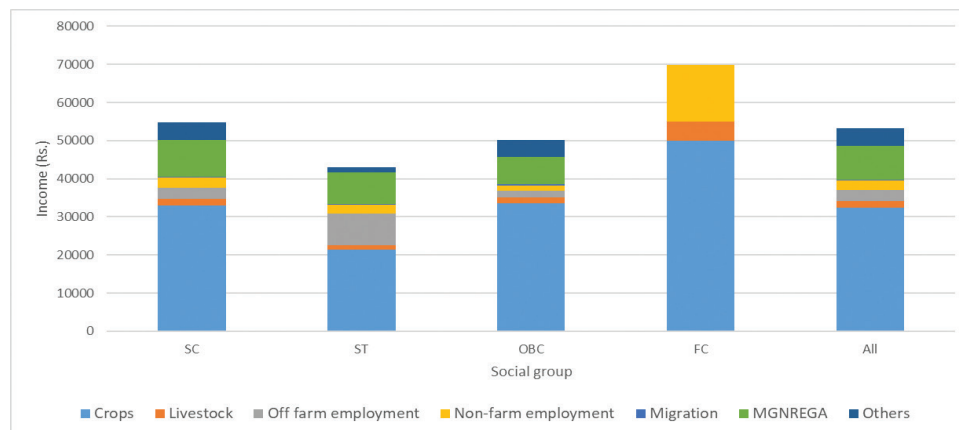


Figure 6.3: Sources of income by social group

Among all social groups, ST households received the lowest share of income from agriculture (49.8 per cent of total income), which was followed by SCs (60.4 per cent of total income) as against the 71.4 per cent for FC households. Also, income from the livestock rearing is higher in the other caste group at 7.1 per cent and is the lowest for scheduled tribe at 2.8 per cent.

Although agriculture is main source of income (71 per cent) for only FC/OC household present in the sample, a good chunk of income is also coming from non-farm employment, which is highest among the all the groups (21.4 per cent of total income). While non-farm incomes not crossed even 5 per cent for all other social groups with lowest for the backward class at 2.8 per cent and for scheduled castes at 4.8 per cent. The large chunk from non-farm income for FC household, may be due to their higher level of education and also assets and capabilities to start and build non-farm income sources like petty business or engagement in contracts, *etc.* Whereas, the SCs, STs and OBCs lack those networks, capabilities like initial human and physical capital to take advantage of non-farm employment. Almost 20 per cent of the earnings of STs and SCs are received from MGNREGA. Off farm income is significant among STs (off-farm income encompasses all agriculture-related activities that occur beyond the farm. Examples of off-farm income and enterprise include processing, packaging, storage, transportation distribution, and retail sale). Apart from STs and SCs, MGNREGA contributes to the income of OBCs significantly at 14.3 per cent. However, involvement of FCs in MGNREGA activities is limited (Table 6.2).

Table 6.2: Household income per annum from all sources by social group

Social group	Percentage of total annual income							Average household income (Rs.)
	Crops	Livestock	Off farm employment	Non-farm employment	Migration	MGNREGA	Others	
SC	60.4	3	5.3	4.8	0.6	17.4	8.6	54,746
ST	49.8	2.8	19.3	5.2	0.8	19.3	2.8	42,931
BC	66.9	3	3.5	2.8	0.7	14.3	8.9	50,095
FC/OC	71.4	7.1	0	21.4	0	0	0	70,000
Total	61.1	3	5.6	4.5	0.6	16.8	8.4	53,174

Table 6.3 illustrates the percentage of income through different sources for the sample villages. After agriculture as the main source of income is public works under MGNREGA in all the three villages. In Edagatta village, 32.2 per cent of income of the residents and 15 per cent in Mallampet and Nagampet is through MGNREGA. Among all the villages, Edagatta is having very low average income per household, whereas Mallampet and Nagampet are little better off. The main reason for low incomes in Edagatta village is low-income diversification; there is almost no income from livestock, off-farm and non-farm employment and also migration. Majority of the households in the village are just depending on crop production, in the off-season like summer and post-rainy seasons they are engaged in public works of MGNREGA. Although, average income of households in Mallampet village was highest, the share coming from agriculture is only 53.2 per cent. There is significant income from off-farm and non-farm employment (Figure 6.3, 6.4, 6.5 and Table 6.3). Hence, in Mallampet, there is a need for increasing agricultural incomes along with livestock incomes. In Nagampet income sources are more diversified than other two villages.

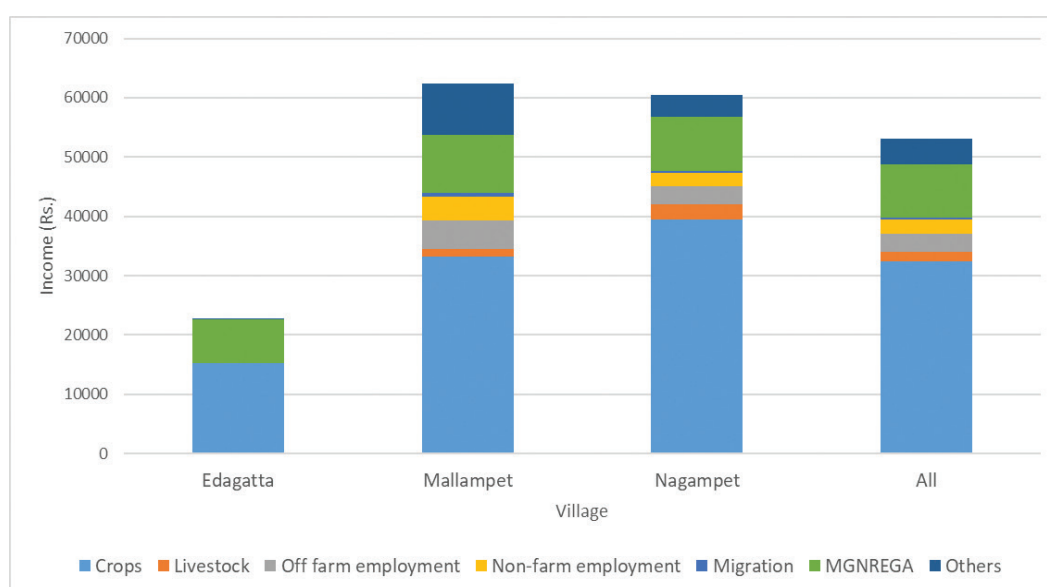


Figure 6.4: Average income by villages

Table 6.3: Household income per annum from all sources by village

Village	Percentage of total annual income							Average household income (Rs.)
	Crops	Livestock	Off farm employment	Non-farm employment	Migration	MGNREGA	Others	
Edagatta	67.6	0	0.1	0	0	32.2	0.2	22,629
Mallampet	53.2	2	7.7	6.6	0.9	15.7	14	62,378
Nagampet	65.4	4.1	5	3.8	0.5	15.2	6	60,463
Total	61.1	3	5.6	4.5	0.6	16.8	8.4	53,174



Figure 6.5: Backyard poultry by traditional methods

B) Durable consumer goods

The ownership of household durable consumer goods like electricity, mobile, TV, car/bike and refrigerator by the sample households by village, social group and land class are provided in Figure 6.7 to 6.9. Typically 25 per cent of the households in Edagatta, Mallampet and Nagampet villages are having either car/bike (mostly two wheelers) and the smart mobile phone is less popular among the population as it is used by only 40 per cent of the households. Despite 95 per cent or more households having electricity facility, only 10.7 per cent of the households have a refrigerator whereas television is being viewed by exceedingly over half the households of the three villages and a maximum in Mallampet at 74 per cent. About 70 per cent of the households have ordinary phones, in which most of the communication is from WhatsApp group messages, video stream relating to agricultural technology cannot be accessible. Overall, there is no significant difference between the villages in ownership of household durables, still a slightly lower use in Edagatta and more use in Mallampet and Nagampet were observed.



Figure 6.6: Traditional multipurpose shelter for livestock

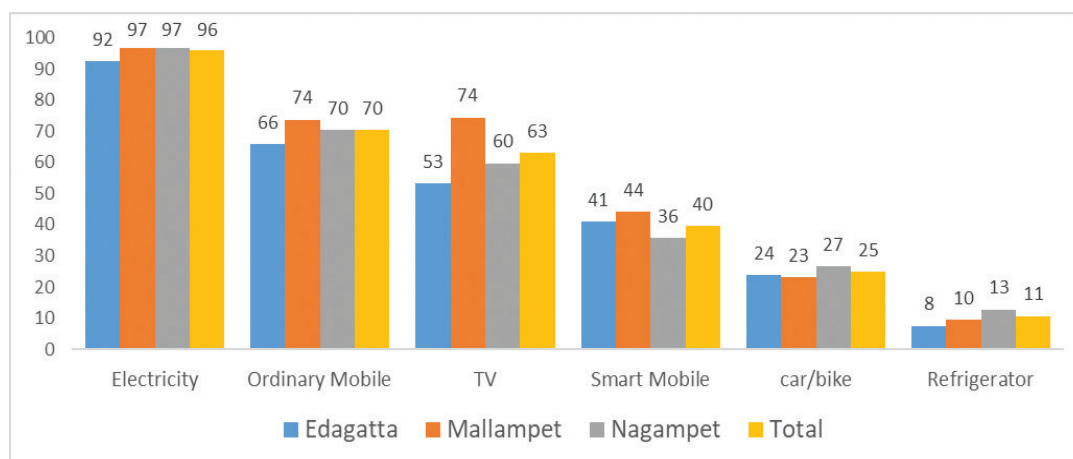


Figure 6.7: General living standards of households (Percentage of households having different amenities) by village

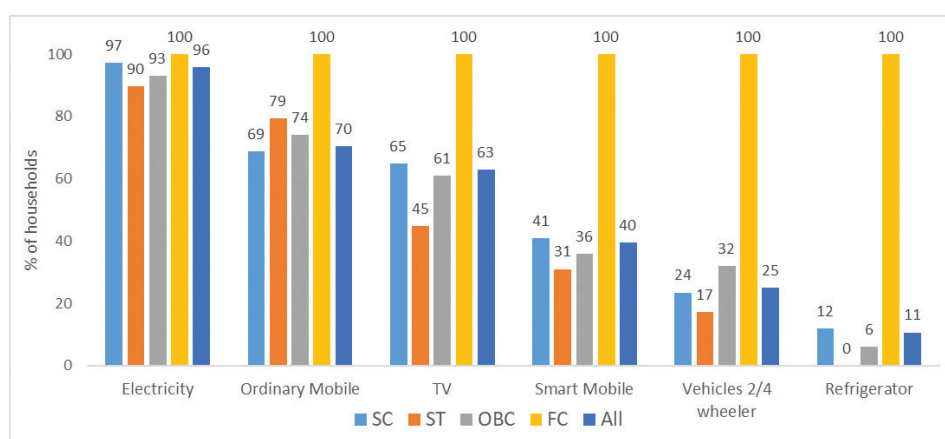


Figure 6.8: General living standards of households (Percentage of households having different amenities) by socio-economic groups

From the Figure 6.8, it is clear that accessibility to electricity reached more than 90 per cent in all social groups, but still 10 per cent of STs 7 per cent of OBCs and 3 per cent of SCs are not yet accessing the electricity, which is a basic necessity in modern life. In most of the goods, TV, smart phone, two-wheeler and also in case of refrigerator ST households are worse off than even SC households. In the sample villages, only one household belongs to FC and they have access to all the modern household durable items. All though, accessibility to electricity and ordinary mobile phone are more or less uniform across social group and also land class (Figure 6.8 and 6.9), there is significant difference in accessing the TV, smart mobile, two-wheeler and refrigerator, this difference is much higher among land class group (between large and marginal farmers), then between social groups (between ST and FC households).

Noticing through the land holding class and social group, with the existing adequate electricity facilities, refrigerator is not a popular durable good when compared to news/entertainment/communication goods such as television/mobile phone.

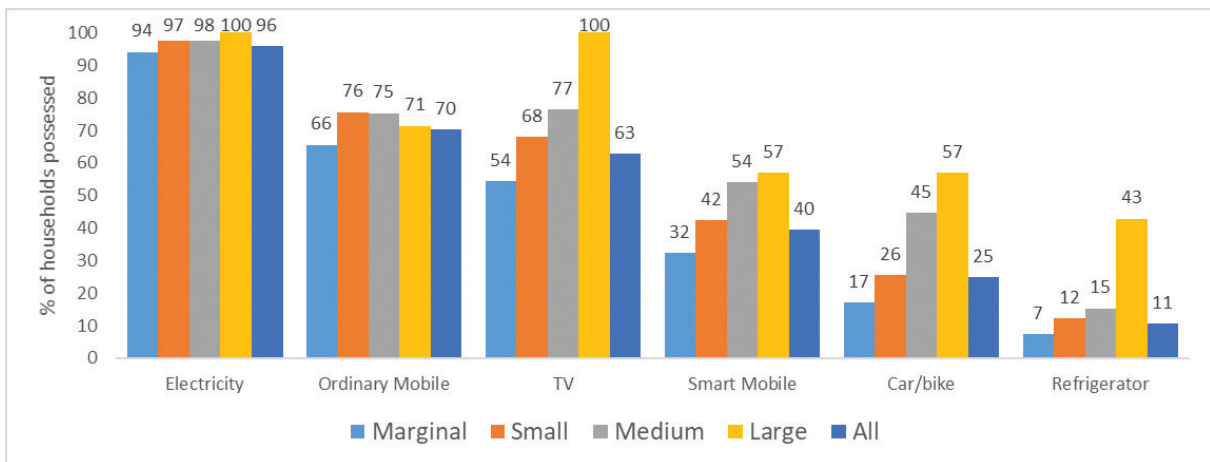


Figure 6.9: General living standards of households (Percentage of households having different amenities) by land size class



Figure 6.10: Mode of transport into the village



Figure 6.11: Participatory Rural Appraisal in the study village

Overall, the income levels (the annual income of Rs. 53,174 translating in to monthly income of Rs. 4,431) are very low in the study villages compared to the income levels (Rs.10,218 per month) of the recent nationally representative sample from the National Sample Survey Organization (NSSO) almost of the same period of 2018-19. The low incomes compounded with low level of social networks being dominated by SC and ST households reduce their capabilities to earn higher income. Even though most of the households having access to electricity, they don't have other modern amenities like TV/smart phone, which indicates their lower living standards which needs to be increased through enhancing incomes from not only agriculture but also from livestock, off-farm and non-farm activities (Figure 6.10 and 6.11).

References

- Blakeslee, D., Fishman, R., & Srinivasan, V. (2020). Way down in the hole: Adaptation to long-term water loss in rural India. *American Economic Review*, 110(1), 200-224.
- Dreze, J., & Srinivasan, P. V. (1997). Widowhood and poverty in rural India: Some inferences from household survey data. *Journal of Development Economics*, 54(2), 217-234.
- Mahapatro, S., Bailey, A., James, K. S., & Hutter, I. (2017). Remittances and household expenditure patterns in India and selected states. *Migration and Development*, 6(1), 83-101.
- Reddy, A. A., and Kumar, P. (2006). Occupational structure of workers in rural Andhra Pradesh. *Journal of Indian School of Political Economy*, 77-91.
- Reddy, A. A., (2015). Growth, structural change and wage rates in rural India. *Economic and Political Weekly*, 50(2), 56-65.
- Saccani, N., Perona, M., & Bacchetti, A. (2017). The total cost of ownership of durable consumer goods: A conceptual model and an empirical application. *International Journal of Production Economics*, 183, 1-13.

SOCIO-ECONOMIC INFRASTRUCTURE AND GOVERNMENT SCHEMES

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The provision of public goods by the government is one of the best strategies of poverty alleviation (Chhibber *et al.*, 2004; Benerjee and Somanathan, 2007; Roy 2021). The access to basic amenities like electricity, gas connection for cooking, sanitation, potable water for drinking, ration shop to get subsidized food under Public Distribution System (PDS), school, nearest bus stand for accessing public transport, market for selling the agricultural produce and purchase of inputs and other necessary household items, Primary Health Centre (hospital) to consult doctor and bank for financial services like saving *etc.*, are indicators of getting access to public goods and also indicates efficiency of local government in provision of public goods to the citizens (Reddy *et al.*, 2016; Ansary and Da, 2018). This chapter examined the access to public amenities and also public goods by the households in the SC-Sub plan villages.

A) Access to basic and essential amenities

The basic amenities such as drinking water, electricity, sanitation, housing, drainage and others are very crucial for a secure, dignified and healthy human life. The existing status and access to such amenities reflects standard of living, and poverty levels, especially in rural areas. In all the villages, access to electricity and cooking gas connection is almost saturated, except a few gaps, like still 7 per cent households in Mallampet don't have access to electricity, while about 10 per cent don't have access to gas connection. Access to sanitation and tap water is uneven among the villages, mostly not reached to the poorest of the poor like disabled, old-aged and households with no earning member. Among the three villages, Nagampet village is badly placed in terms of basic both sanitation and potable water. In Edagatta village, more than 90 per cent of the households have access to all the amenities mainly its proximity to Kotapally mandal headquarters, whereas, about 40 per cent households in Mallampet village do not have access to potable water. In Nagampet village, only 36 per cent households have access to potable water and about 54 per cent have sanitation facility (Figure 7.1).

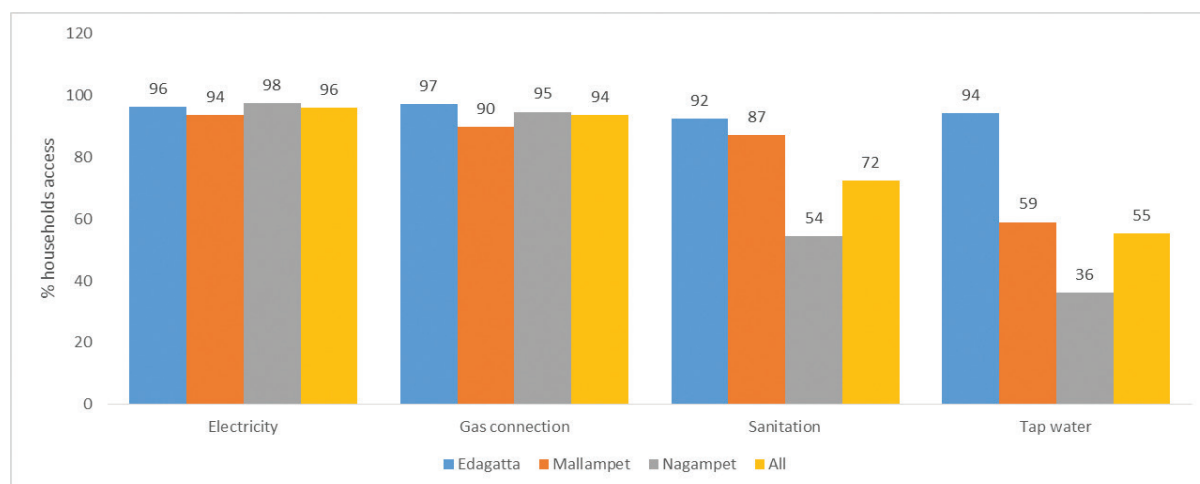


Figure 7.1: Percentage of households having essential amenities by village

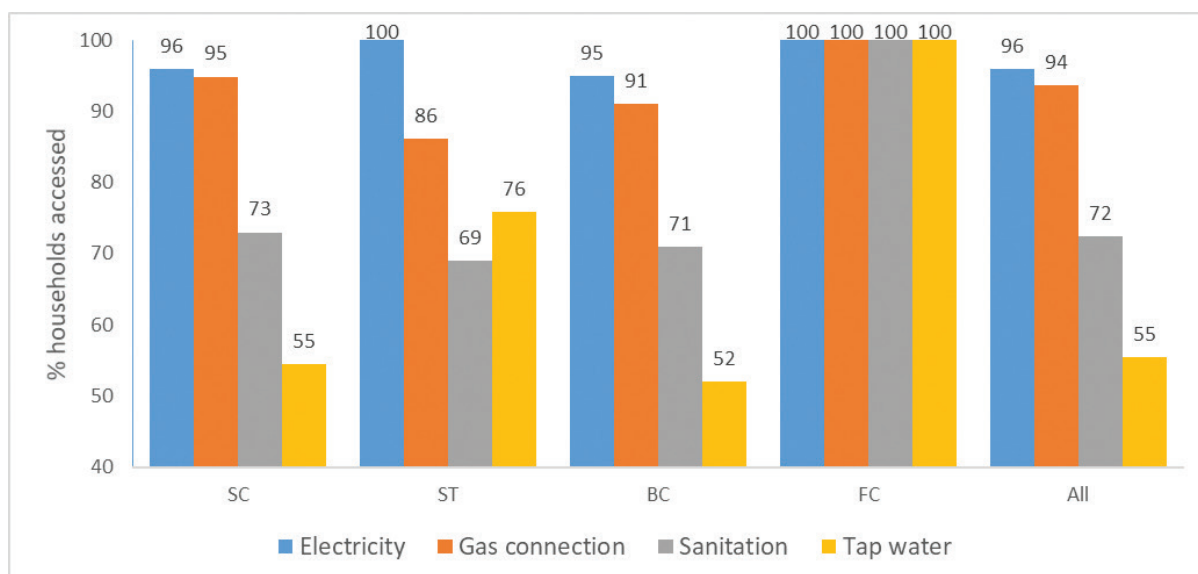


Figure 7.2: Percentage of households having essential amenities by social group

But among the social groups, except forward caste households, access to sanitation and potable water is poor, it is especially serious in case of potable water. Among, SC, ST and BC households, ST households are slightly better placed with regard to potable water as the community firmly represented their issues through their elected representatives and secured government funded potable pipeline connections under Mission Bhagiratha (Figure 7.2).

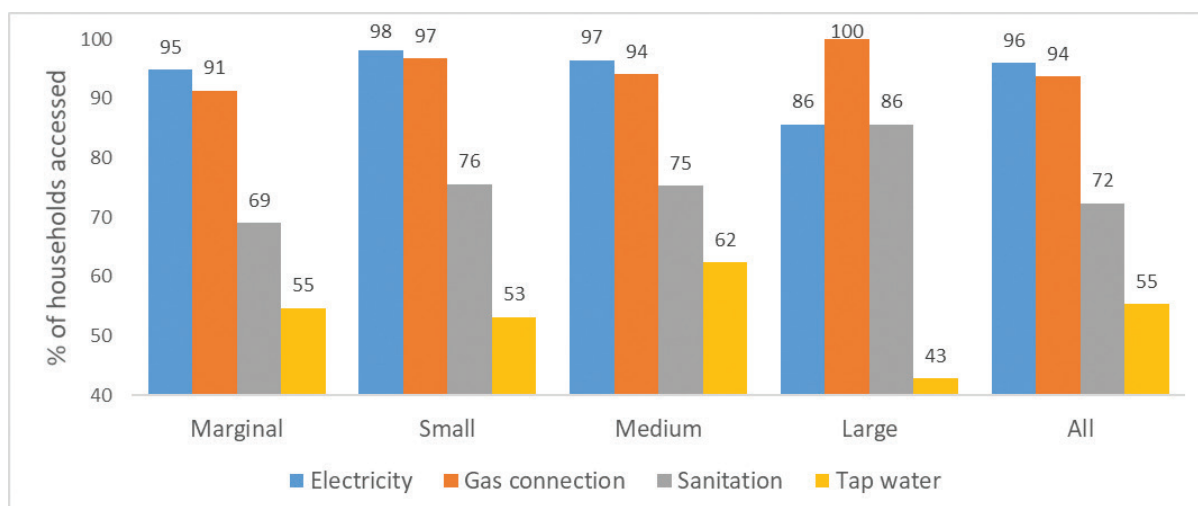


Figure 7.3: Percentage of households having essential amenities by land size class

Again, irrespective of the land-holding size, access to potable water is a major problem. Even among large farmers who are in general better access to all these amenities, only 86 per cent having sanitation facilities in their house, the remaining 14 per cent households not having access to sanitation, which needs to be bridged (Figure 7.3) and access among marginal farmers is just 69 per cent. One positive aspect is, across social as well as landholding groups, electricity and gas connection amenities are available to almost all the households. So, overall it is clear that the study area is deprived of the most important essential amenities like tap water and also sanitation which are an indication of overall

backwardness, this is in spite of running of special programmes like *Swachh Bharat Mission (SBM)/ Total Sanitation Campaign (TSC)* for sanitation improvement and also state government programmes like *Mission Bhagiratha*, which aimed at providing drinking water to each household in the villages (Dandabathula *et al.*, 2019; Srinivasan and Joy, 2019). During the focus group discussions, villagers mentioned that the work is under progress and will be completed within one or two years mostly funded by the government.

B) Access to other public amenities

Access and nearness to public amenities like ration shop, school, bus stand, market, hospital and bank make life easy for rural dwellers saves time for daily commuting to avail facilities for these daily essentials (Figure 7.4). Ration shop and school are within 1-2 km from their house for all the sample households in three villages. Bus stand also less than 2 km, except in Edagatta village. While, distance to market, hospital and bank is higher at about 3-6 km from home. (Figure 7.5 to 7.7). Mallampet village has all the service facilities within 3.5 km, whereas, for Edagatta and Nagampet villages the Hospital and Bank are far-off (more than 5 km away from the village).



Figure 7.4: Nearest public school

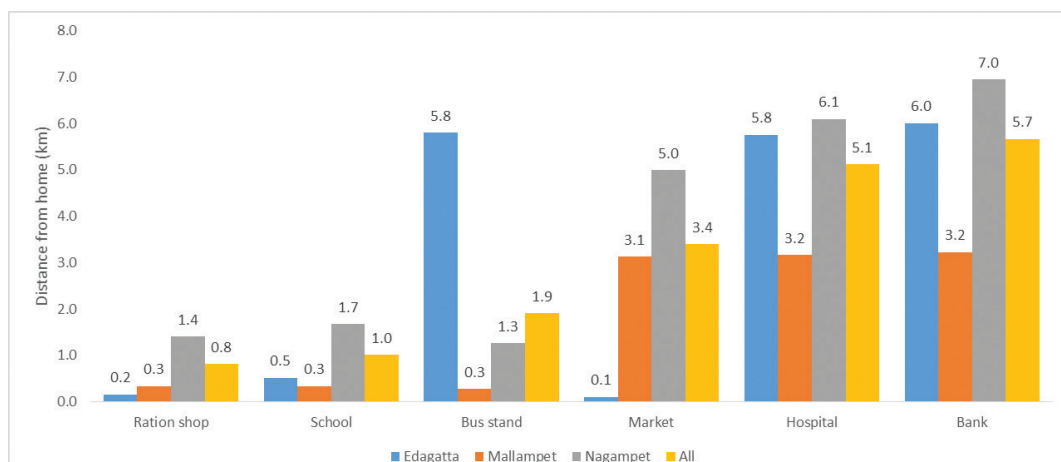


Figure 7.5: Average distance to access the amenities (km) by village

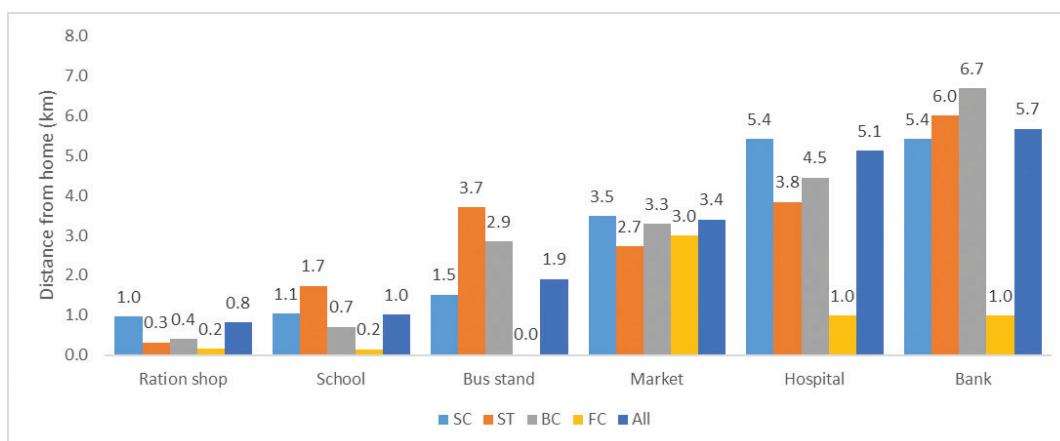


Figure 7.6: Average distance to access the amenities (km) from house by social group

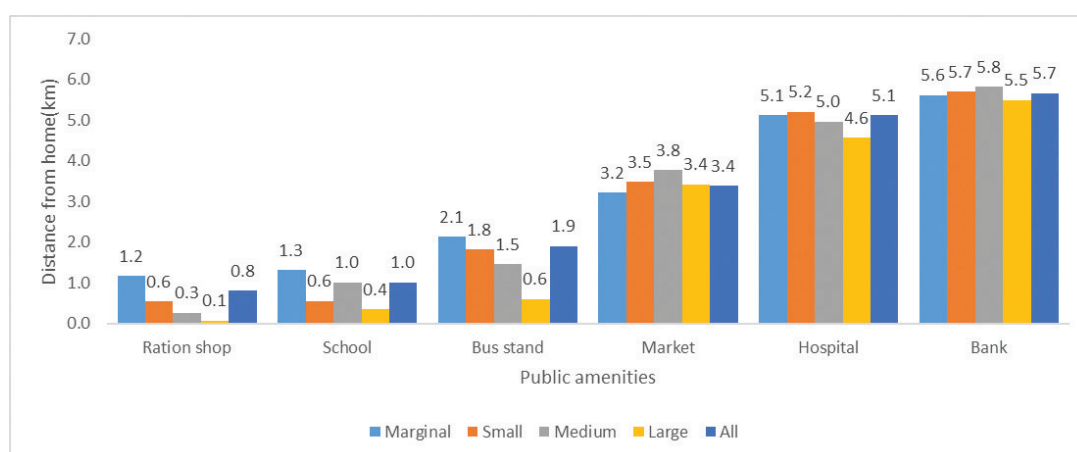


Figure 7.7: Average distance to access the amenities (km) by land size class

Figure 7.6 and 7.7 shows that bus stand, school, and ration shop are within 2 km of reach for all social groups as well as the land holding groups. But the hospital, market and bank are distantly placed and people need to travel to access these facilities. But it is apparently noted that the households of FC community have a very easy access to all the facilities as these are quite nearer to them in comparison to the other social groups. This scenario also corresponds to the better access in terms of nearness to basic amenities for large farmers compared to marginal, small and medium farmers. But disparities in accessing and nearness to basic amenities are larger among social groups than on the basis of land class size.

C) Access of various government schemes

The villagers are mostly poor when compared to urban areas not only in the study area, but also across India. The governments (central, state and local governments) have planned and running various development schemes since independence with varied success rates. In line with this, there are various ongoing government schemes in the study area among which Bank account (*JanDhan: Pradhan Mantri Jan Dhan Yojana* is a financial inclusion programme of the Government of India open to Indian citizens, that aims to expand affordable access to financial services such as bank accounts, remittances, credit,

insurance and pensions) (Figure 7.8), ration card (ration cards offer identification as well entitle the holder to a ration of food, fuel, or other goods issued by the Government of India), MGNREGA card (The Mahatma Gandhi Employment Guarantee Act 2005), is an Indian labour law and social security measure that aims to guarantee the ‘right to work’. This act was passed in 23 August 2005, which guarantees 100 days of employment in their own locality on demand), Aarogyasri card (Aarogyasri Scheme is a unique Community Health Insurance Scheme being implemented in State. The scheme provides financial protection to families living below poverty line upto Rs. 2 lakhs in a year for the treatment of serious ailments requiring hospitalization and surgery), membership in SHG (A SHG is a community-based group with 10-25 members. Members are usually women from similar social and economic backgrounds; all voluntarily coming together to save small sums of money, on a regular basis and use saved money for productive purpose like dairy. *Rythu Bandhu* scheme is also helping farmers to meet their cash expenses in agriculture like purchase of seed and fertilizers. Under the scheme, Telangana government is directly transferring cash to Rs. 58.33 lakh farmer’s bank accounts at the rate of Rs. 5,000 per acre per season for both *rabi* and *kharif* seasons at the beginning of crop season. Another important schemes is the Kisan Credit Card (KCC) scheme, which is a Government of India scheme which provides farmers with timely access to credit. The KCC scheme was launched in year 1998 with the aim of providing short-term formal credit to farmers and was created by NABARD (National Bank for Agriculture and Rural Development). The KCC scheme was introduced to ensure that the credit requirements for farmers in the agriculture, fisheries and animal husbandry sector are met. This was done by helping them avail short-term loans and provide them with a credit limit to purchase equipment and for their other expenses as well. Moreover, with the help of KCC, farmers are exempted from the high interest rates of the regular loans offered by banks as the interest rate for KCC starts as low as 2 per cent and averages at 4 per cent. Under this scheme, farmers can repay their loans depending on the harvesting period of their crop for which the loan was given. some other welfare schemes primarily targeted to weaker sections are old-aged, widowed are *Aasara pension* schemes. It is a welfare scheme of pensions to old people, widows, Goud community, elephantiasis patients, AIDS afflicted people, physically disabled and beedi workers. Each person is getting Rs.1,000 per month, now it is revised to Rs. 2,000 per month, All these schemes are important and having significant popularity among the villagers. There are two aspects to the actual benefits received from the schemes. One is having eligibility and essential eligibility card and another is whether the households are really getting the benefits by using the eligibility.



Figure 7.8: Nearest Bank (Regional Rural bank)

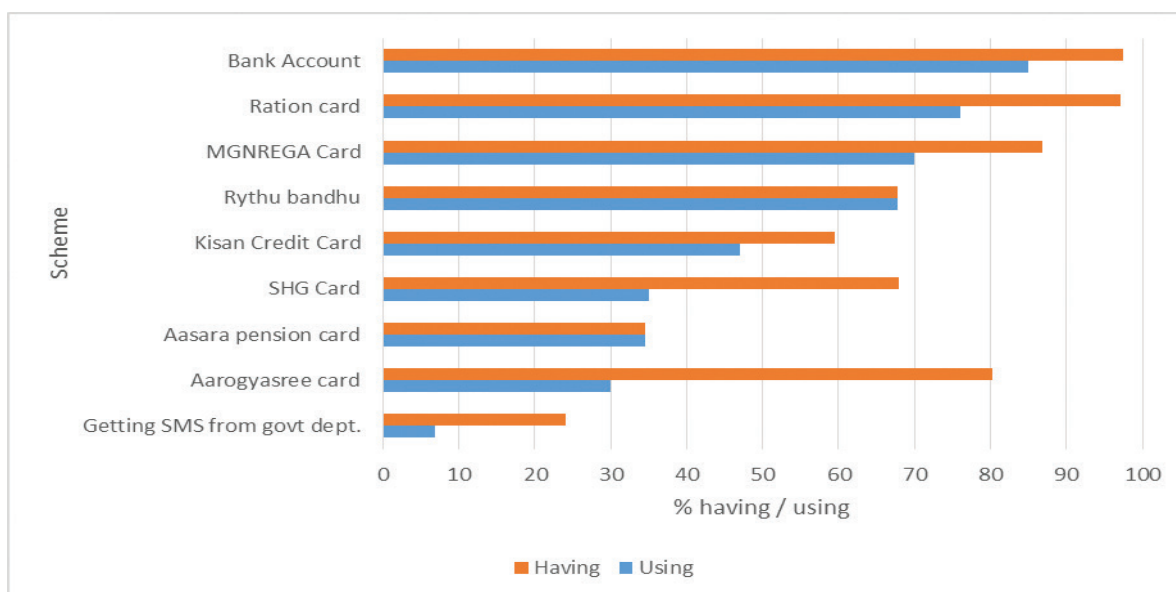


Figure 7.9: Percentage of households having different eligibility cards and use of different government schemes

Figure 7.9 presents scheme wise beneficiary households in the sample villages. Overall, many households are actually benefited from bank account under Jan Dhan Yojana, ration card, MGNREGA works, *Rythu Bandhu*. While, benefits from getting Subject Matter Specialist (SMS) from government departments, aarogyasri, *Aasara pensions* are less. However, popularity of Aarogyasri and SHGs are on par with more popular schemes like ration card and MGNREGA.

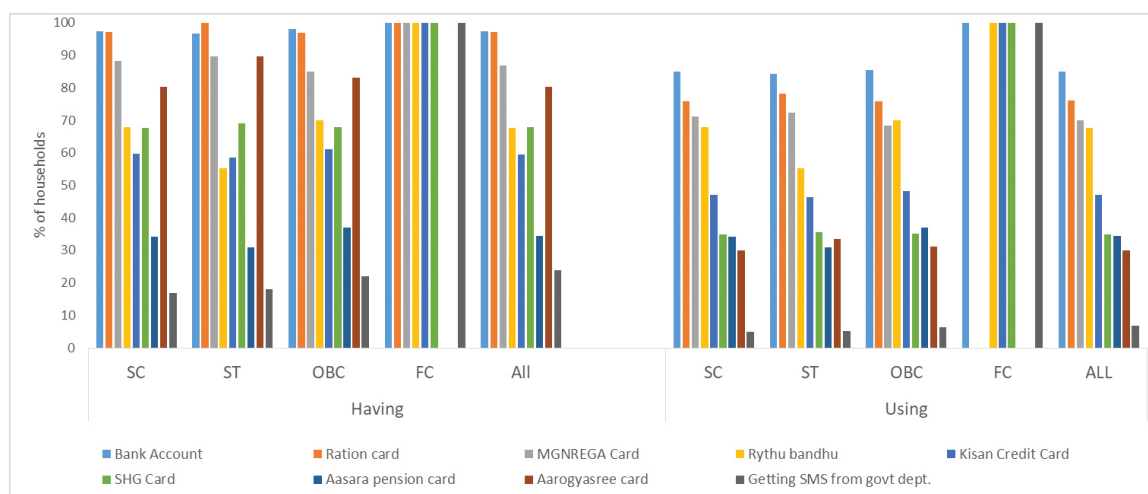


Figure 7.10: Scheme wise beneficiaries by social group

Figure 7.10 and 7.11 depicts benefits and uses for households from various government scheme by social group and land holding class. The Figures shows that irrespective of the social group and land holding groups over 90 per cent of the sample households possess ration cards and bank accounts. However, utilization of these are little bit less. Also, there is a good coverage of MGNREGA card and Aarogyasri cards; however utilization of former is more than the later. *Aasara pensions* are also popular among the old-aged, but still some are not able to get due to lack of proper age certificate or residence certificate. And it is very surprising to see that most of the people except large land holders and FC

households are unable to get the access to the information from various departments through SMS, which is very important to create awareness and intimating the households about various developmental information. The government officials are recently using WhatsApp messages for sending messages, that too not all households, as officials are having contact numbers of only progressive farmers.

Overall, there is almost universal access to some public amenities like electricity, ration card, MGNREGA works, and bank accounts, however, they are not all using and getting benefits from them. Although many farmers have SHC cards and Aarogyasri cards, their utilization is less. While the SMS sent to citizens regarding government schemes are less and their utilization for decision making is still lower, hence there is a need for increasing awareness of importance of SMS in dissemination of information.

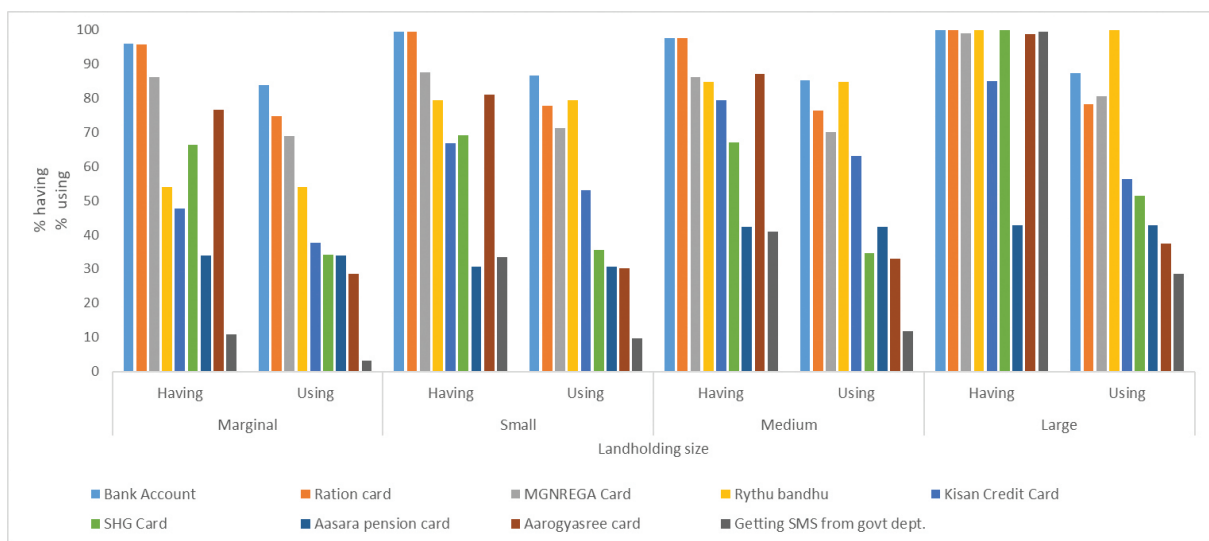


Figure 7.11: Percentage of households using government schemes by farm size

References

- Ansary, R., & Das, B. (2018). Regional patterns of deprivation in India: An assessment based on household characteristics, basic amenities and asset possession. *Social Change*, 48(3), 367-383.
- Banerjee, A., & Somanathan, R. (2007). The political economy of public goods: Some evidence from India. *Journal of Development Economics*, 82(2), 287-314.
- Chhibber, P., Shastri, S., & Sisson, R. (2004). Federal arrangements and the provision of public goods in India. *Asian Survey*, 44(3), 339-352.
- Dandabathula, G., Bhardwaj, P., Burra, M., Rao, P. V. P., & Rao, S. S. (2019). Impact assessment of India's Swachh Bharat Mission–Clean India Campaign on acute diarrheal disease outbreaks: Yes, there is a positive change. *Journal, of Family Medicine and Primary Care*, 8(3), 1202.
- Reddy, A. A., Rani, C.R., Cadman, T., Reddy, T.P., Battarai, M., & Reddy, A.N. (2016). Rural transformation of a village in Telangana, A Study of Dokur since 1970s. *International Journal of Rural Management*. 2016;12(2):143-178. doi:10.1177/0973005216665944.
- Roy Chowdhury, J. (2021). Elite status, market linkages, and contributions to collective goods: Evidence from a Survey and Public Goods Experiments. *The Journal of Development Studies*, 1-17.
- Srinivasan, V., & Joy, K. J. (2019). Transitioning to sustainable development goals for water. *Economic and Political Weekly*, 54(11), 16-19.

FARM MECHANIZATION

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Use of farm machinery and equipment play a greater role in agricultural incomes. Farm equipment and machinery play a vital role in enhancing agricultural productivity and improving income. Therefore, lack of access to agricultural equipment can be a limiting factor for the agricultural development of the farm households. Use of appropriate farm machinery will save time and increase labour productivity and also reduces drudgery. This will allow men and women to have more time for doing other ancillary works (Ball *et al.*, 1997; Rada and Fugie, 2019). In India farm mechanization picked up steeply since last two decades in all activities like land preparation, inter-cultivation, weeding, harvesting and threshing. But the adoption levels are uneven with higher mechanization in some crops like wheat, chickpea, cotton, *etc.* (Singh, 2005; Mehta *et al.*, 2019).

In study villages, still modern farm machinery and farm implements are not popular. They are mostly using desi plough (iron/wood) for land preparation, bullock cart for transport, manual sprayers and dusters and blade hoe for weeding, *etc.* A significant number of farmers are using tractors for land preparation mainly on hired basis. About 10 per cent of the households are having power sprayers. Less than 2 per cent of the households have sprinkler set or drip irrigation, pumpset, fertilizer cum seed drill, modern plough, BBF planter, blade harrow, chaff cutter, *etc.* The below Figure indicate that, in terms of farm machinery the villages are backward (Figure 8.1). Our focus group discussions indicate that, there is a need for pumpsets, power sprayers and dusters, modern ploughs, sprinklers and dusters with the increased acreage under cotton.

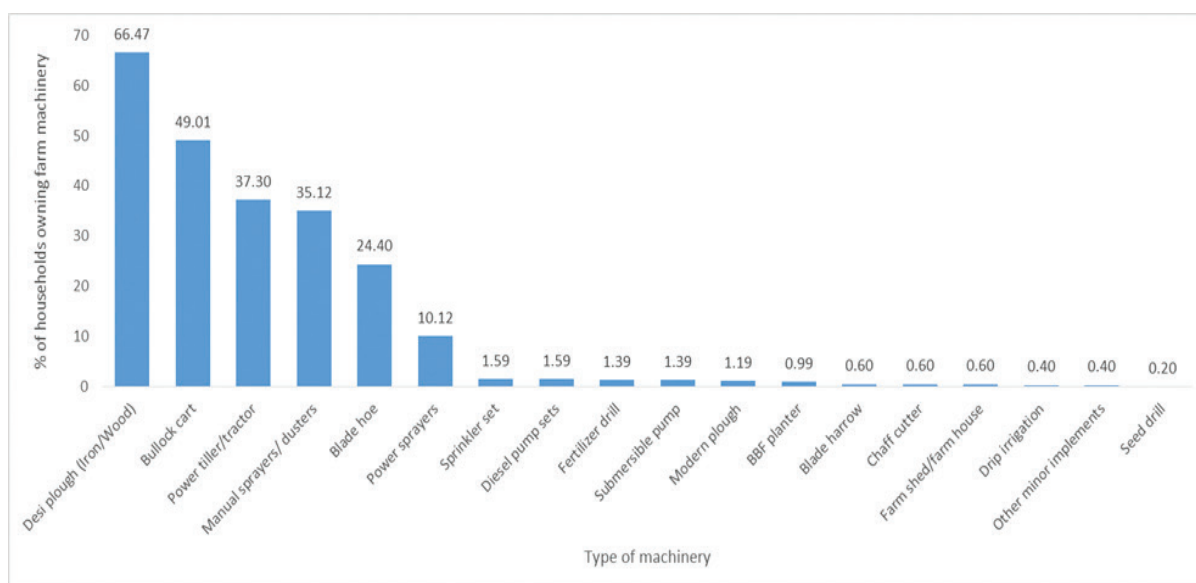


Figure 8.1: Percentage of farmers using different types of farm machinery

Use of farm machinery and equipment in three villages and among varied classes of social groups and land size groups in the sample villages are presented in Tables 8.1 to 8.3 and Figures 8.2 to 8.4 respectively. Among the three villages, farm mechanization is more or less same, but little more in Edagatta compared to other two villages. In Edagatta, tractorization and use of power sprayers and sprinkler sets was higher, where as in Nagampet and Mallampet many are still using bullock carts and desi plough.

Table 8.1: Percentage of farmers using different types of farm machinery by villages

Type of farm implement	Edagatta	Mallampet	Nagampet
Desi plough (Iron/Wood)	63.8	65.4	68.3
Bullock cart	34.3	49.4	55.1
Power tiller/tractor	50.5	48.7	24.3
Manual sprayers/dusters	17.1	48.1	34.6
Blade hoe	1.9	23.7	34.6
Power sprayers	31.4	9.0	1.6
Sprinkler set	6.7	0.6	0.0
Diesel pump sets	2.9	3.2	0.0
Fertilizer drill	1.0	1.9	1.2
Submersible pump	2.9	1.3	0.8
Modern plough	1.0	2.6	0.4
BBF planter	0.0	1.3	1.2
Blade harrow	0.0	1.3	0.4
Chaff cutter	1.0	0.6	0.4
Farm shed/farm house	0.0	1.9	0.0
Drip irrigation	1.0	0.0	0.4
Other minor implements	0.0	1.3	0.0
Seed drill	0.0	0.0	0.4

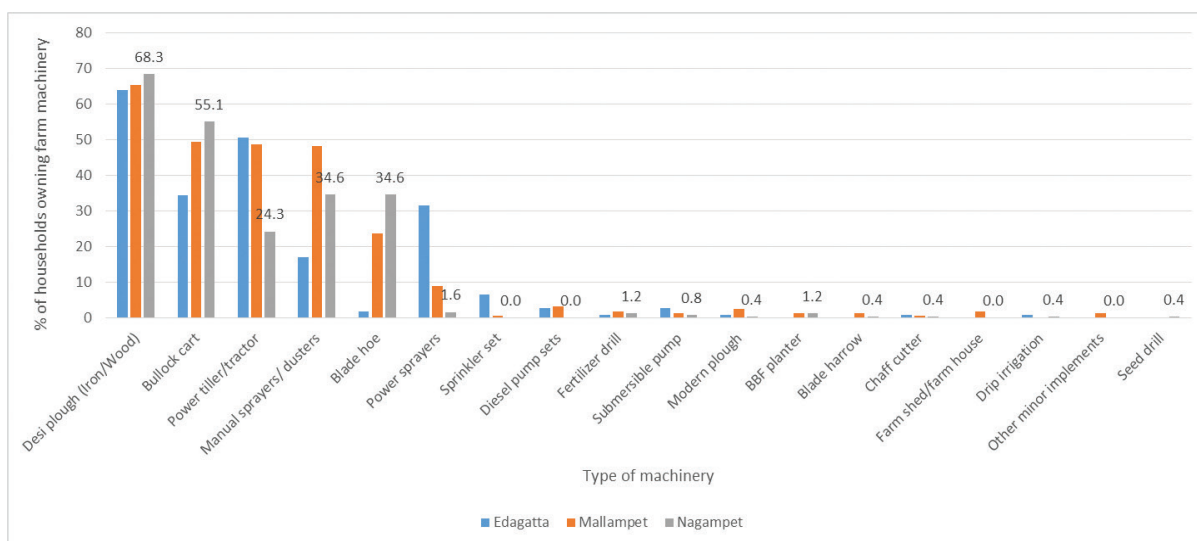


Figure 8.2: Ownership of farm machinery by village

The farm mechanization across social groups shows that, desi plough, bullock cart, tractors power sprayers are most commonly used by SC households, the use of small implements was observed only in few households. Farm mechanization was quite low among ST households mainly due to their agricultural practices are more traditional compared to other households.

Table 8.2: Percentage of farmers using different types of farm machinery by social groups

Type of machinery	SC	ST	OBC	FC/OC
Desi plough (Iron/Wood)	70.1	41.4	60.0	100.0
Bullock cart	52.7	17.2	45.0	0.0
Power tiller/tractor	45.2	3.4	18.0	0.0
Manual sprayers/ dusters	37.4	10.3	34.0	0.0
Blade hoe	23.0	10.3	34.0	0.0
Power sprayers	12.0	3.4	5.0	0.0
Sprinkler set	2.1	0.0	0.0	0.0
Diesel pump sets	1.9	0.0	1.0	0.0
Fertilizer drill	1.9	0.0	0.0	0.0
Submersible pump	1.3	0.0	2.0	0.0
Modern plough	1.6	0.0	0.0	0.0
BBF planter	0.5	0.0	3.0	0.0
Blade harrow	0.5	0.0	1.0	0.0
Chaff cutter	0.5	0.0	1.0	0.0
Farm shed/farm house	0.8	0.0	0.0	0.0
Drip irrigation	0.5	0.0	0.0	0.0
Other minor implements	0.5	0.0	0.0	0.0
Seed drill	0.3	0.0	0.0	0.0

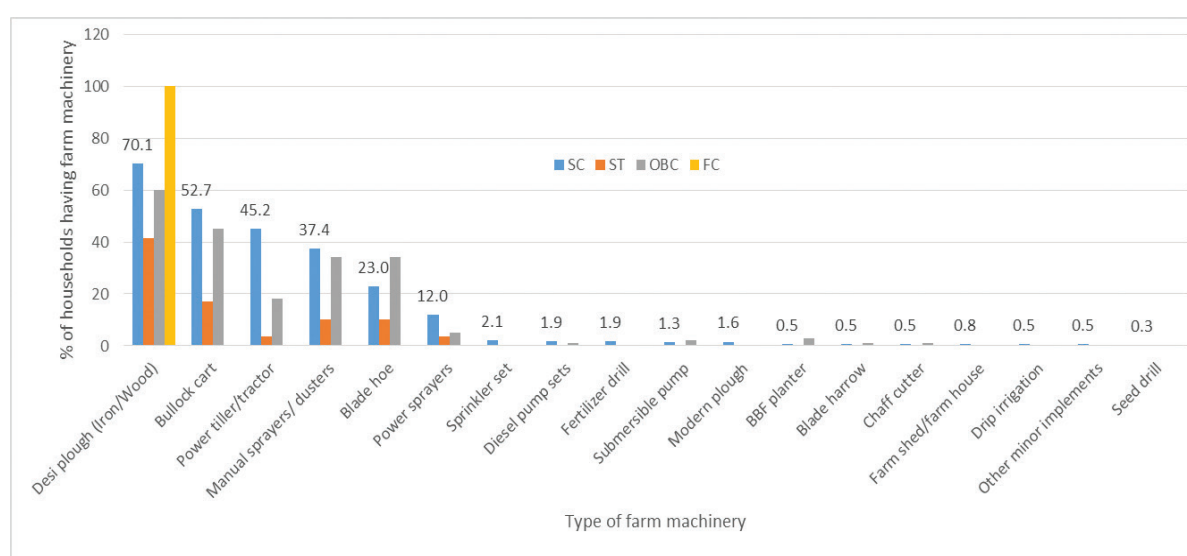


Figure 8.3: Ownership of farm machinery by social group

Pattern of farm mechanization by land class was presented in Table 8.3 and Figure 8.4. In general, farm mechanization and ownership of different modern farm implements increased from marginal farmers to large farmers. Except the large farmers, there is a negligible use of power tiller and tractor. However, the bullock cart is being used not only by many of the marginal farmers but also most of the small, medium and large farmers. Even though with the change in times, ownership of tractors increased, the use of bullock carts is not decreased in the villages, may be due to the ready availability of draft animals in the village.

Table 8.3: Percentage of farmers using different types of farm machinery by land size class groups

Type of machinery	Marginal	Small	Medium	Large
Desi plough (Iron/Wood)	49.2	75.0	75.2	85.0
Bullock cart	33.5	50.8	58.9	73.3
Power tiller/tractor	24.6	43.5	45.0	48.3
Manual sprayers/dusters	24.1	33.9	42.6	56.7
Blade hoe	23.0	21.8	27.9	26.7
Power sprayers	5.8	10.5	12.4	18.3
Sprinkler set	1.0	2.4	1.6	1.7
Diesel pump sets	0.5	0.8	3.9	1.7
Fertilizer drill	0.0	3.2	1.6	1.7
Submersible pump	1.0	0.8	1.6	3.3
Modern plough	1.0	0.0	2.3	1.7
BBF planter	1.6	0.0	0.0	3.3
Blade harrow	0.0	1.6	0.8	0.0
Chaff cutter	0.0	0.8	1.6	0.0
Farm shed/farm house	0.0	0.8	0.8	1.7
Drip irrigation	0.0	0.8	0.8	0.0
Other minor implements	0.5	0.0	0.0	1.7
Seed drill	0.0	0.8	0.0	0.0

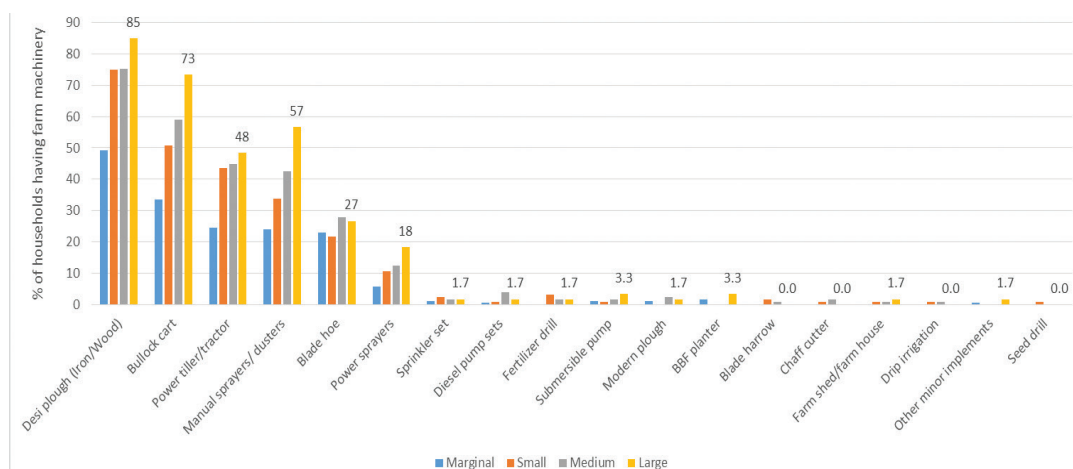


Figure 8.4: Percentage of farmers using different types of farm machinery by farm size category

The overall analysis shows that there is a significant increase in farm mechanization with the increase in farm size, although there are no perceptible differences in farm mechanization across the social groups, ST farmers are lagging behind in adoption of modern farm implements (Figures 8.5 and 8.6). Edagatta village farmers are adopting more modern farm machinery due to their nearness to town and more accessibility and exposure to outer world. Still majority are using desi plough, bullock cart, and manual sprayers. Among modern farm machinery, tractor is more popular across all social groups and also land categories, as hiring of tractor is scale neutral.



Figure 8.5: Traditional bullock cart still used for transport of fertilizer *and other activities*



Figure 8.6: Shed used for keeping of farm machinery and livestock

References

- Ball, V. E., Bureau, J. C., Nehring, R., & Somwaru, A. (1997). Agricultural productivity revisited. *American Journal of Agricultural Economics*, 79(4), 1045-1063.
- Mehta, C. R., Chandel, N. S., Jena, P. C., & Jha, A. (2019). Indian agriculture counting on farm mechanization. *Agricultural Mechanization in Asia, Africa and Latin America*, 50(1), 84-89.
- Rada, N. E., & Fuglie, K. O. (2019). New perspectives on farm size and productivity. *Food Policy*, 84, 147-152.
- Singh, J. (2005). Scope, progress and constraints of farm mechanization in India. *Status of Farm Mechanization in India*, 48-56.

SOIL FERTILITY STATUS

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Historically, soils play very important role in formation of human civilization and still paying a major role in agricultural dependent economies. The dynamics of agricultural growth, employment and long run sustainability depends on soil fertility and management. Soil fertility is one of the important factors that determines the productivity and profitability of crops, cropping and farming systems. In simple terms soil fertility is the ability of the soil to provide all essential nutrients required for plant growth in a proper proportion. In order to achieve higher productivity and profitability, every farmer should realize that fertility levels must be measured as these measurements can then be used to manage soil fertility in terms of choosing appropriate cropping pattern and fertilizer use. As a part of baseline survey, a team of scientists from ICAR-CRIDA collected soil samples and analysed them in ICAR-CRIDA soil test lab and based on the results recommended the appropriate crops and crop rotations and also recommended appropriate fertilizers and micro-nutrients for higher yields and profitability.

Currently the tools available for measuring the fertility levels of the fields are: a) Indigenous knowledge; b) Plant/Tissue analysis; c) Visual diagnosis; d) Remote sensing; e) Soil testing/analysis; f) Greenhouse pot experiments and; g) Biological tests, of all these tools, soil analysis is widely used for measuring the fertility status of the soils as this technique is simple, rapid, cost-effective, accurate, universal, and works for all kinds of soils.

Soil testing and its importance: Soil analysis is generally defined as any chemical, physical and biological measurement that is made on the soil. Whereas, soil testing represents a programme that includes soil sample collection, method of analysis, interpretation of results, evaluations, fertilizer and amendment recommendations based on soil analysis and on several other considerations (Reddy, 2019; Purakayastha *et al.*, 2019; Joshi *et al.*, 2019). The objective of soil testing are to: a) accurately determine the available nutrient status of soils; b) clearly indicate to the farmer the seriousness of any deficiency or excess that may exist in terms of the various crops; d) express the results in such way that they permit an economic evaluation of the suggested fertilizer recommendations and; e) to identify the type and degree of soil-related constraints like acidity, salinity and alkalinity and to recommend the amount of lime or gypsum to be added for reclaiming acid and sodic soils, respectively.

A sound soil-testing programme requires an enormous amount of background research. This background research should determine, the significant chemical forms of the available nutrients in the soils of the area, the extractants most suitable for extracting all or part of the available nutrient forms, the relative productive capacity of the soils of various crops, the differential response of the various rates and methods of fertilizer applications for different crops, field sampling techniques, test procedures and methodologies. The soundness of the required interpretive judgments will depend on the thoroughness and quality of these background studies and it is aptly said that the success of soil testing is directly proportional to its research backing.

Soil fertility assessment in Kotapally mandal

Assessment of soil health and its management can help in enhancing the profitability of the resource-poor farmers of rainfed areas. Hence, efforts were made to assess the initial soil fertility status and also to identify the soil related constraints affecting the crop production in Kotapally mandal of Mancherial district, Telangana state under SCSP programme.

For assessing the soil fertility status 100 random soil samples from the farmer's fields of three villages viz., Mallampet, Nagampet and Eddagatta of Kotapally mandal were collected during March 2020. The collected soil samples after air-drying were analyzed for major and micro-nutrients by following standard methods. The results of the analysis of the soil samples are presented below:

a) Organic carbon status: Analysis of the soil samples for organic carbon status revealed (Table 9.1) that about 83 per cent of the soil samples in Mallampet are classified as low or deficient in available nitrogen, whereas, in Nagampet and Edagatta about 64 and 55 per cent of the soils, respectively are deficient in available nitrogen. It could also be seen that only 17 per cent of the samples in Mallampet are classified either as medium or high in organic carbon status. Overall, about 70 per cent of the samples in Kotapally mandal are classified as low in organic carbon status indicating that the soils of the mandal are deficient in available nitrogen.

Table 9.1: Village wise soil health (soil organic carbon) status

Village	Number/ percentage of soil samples testing under different category for organic carbon status			
	Low	Medium	High	All
Mallampet	34 (83)	4 (10)	3 (7)	41 (100)
Nagampet	25 (64)	13 (33)	1 (3)	39 (100)
Edagatta	11 (55)	6 (30)	3 (15)	20 (100)
Overall	70 (70)	23 (23)	7 (7)	100 (100)

Figures in the parentheses indicate per cent of samples

Available phosphorus status: Data in the Table 9.2 reveals that about 39, 51 and 45 per cent of the soil samples tested for available phosphorus in Mallampet, Nagampet and Edagatta villages, respectively were low /deficient in available phosphorus. Overall, about 45 per cent of the soils of three villages are deficient in available phosphorus and about 55 per cent of the soils tested medium to high for available phosphorus.

Table 9.2: Village wise available phosphorus status

Village	Number/ percentage of soil samples testing under different category for available phosphorus			
	Low	Medium	High	All
Mallampet	16 (39)	15 (37)	10 (24)	41 (100)
Nagampet	20 (51)	15 (39)	4 (10)	39 (100)
Edagatta	9 (45)	4 (20)	7 (10)	20 (100)
Overall	45 (45)	34 (34)	21 (21)	100 (100)

Note: Figures in the parentheses indicate per cent of samples

b) Available potassium: Data in the Table 9.3 reveal that soils of the three villages would supply adequate quantities of potassium to crops as evident from the high percentage of soils samples (54 per cent) were classified as high. Only about 7 per cent of the soil samples in the three villages were low in available potassium.

Table 9.3: Village wise available potassium status

Village	Number/ percentage of soil samples testing under different category for available potassium			
	Low	Medium	High	All
Mallampet	2 (5)	16 (39)	23 (56)	41 (100)
Nagampet	3 (8)	14 (36)	22 (56)	39 (100)
Edagatta	2 (10)	7 (35)	9 (45)	20 (100)
Overall	7 (7)	37 (37)	54 (54)	100 (100)

Note: Figures in the parentheses indicate per cent of samples

c) Available DTPA extractable micro-nutrients: The results of the soil analysis with respect to DTPA extractable micro-nutrients such as iron, copper and manganese revealed that the soils of the three villages can supply adequate quantities of these micro-nutrients (Table 9.4). However, with respect to available zinc more than 90 per cent of the samples were deficient in available zinc.

Table 9.4: Village wise available zinc status

Village	Number of soil samples testing		
	Deficient	Adequate	All
Mallampet	34 (83)	7 (17)	41 (100)
Nagampet	39 (100)	0 (0)	39 (100)
Edagatta	17 (85)	3 (15)	20 (100)
Overall	90 (90)	10 (10)	100 (100)

Note: Figures in the parentheses indicate per cent of samples

Conclusion

In general, Indian soils are deficient in soil organic carbon status, in line with the national soil conditions, soils in the villages are low in soil carbon (70 per cent), and only 7 per cent of soil tests are indicated high status. On the other hand, soil available phosphorus is moderate in general with only 45 per cent of the samples with low status, 34 per cent medium and 21 per cent high status. When compared to available phosphorus, available potassium was high in the soils, with 54 per cent reported high, 37 per cent reported medium and only 7 per cent reported low. But the disturbing issue is most of the soils (90 per cent) are deficient in micro-nutrient like zinc. Overall, based on the results, the farmers have to focus on potassium deficiency in soils in addition to severe deficiency of zinc and soil carbon.

References

- Joshi, P. K., Kishore, A., Pandey, D., & Wani, S. (2019). Helping farmers to use optimal inputs: lessons from soil health cards in Bhoochetana experiment. In *Agricultural Extension Reforms in South Asia. Academic Press*, 167-176.
- Purakayastha, T. J., Pathak, H., Kumari, S., Biswas, S., Chakrabarty, B., Padaria, R. N., & Singh, A. (2019). Soil health card development for efficient soil management in Haryana, India. *Soil and Tillage Research*, 191, 294-305.
- Reddy, A. A. (2019). The soil health card Scheme in India: Lessons learned and challenges for replication in other developing countries. *Journal of Natural Resources Policy Research*, 9(2), 124-156.

WATER RESOURCES AND UTILIZATION

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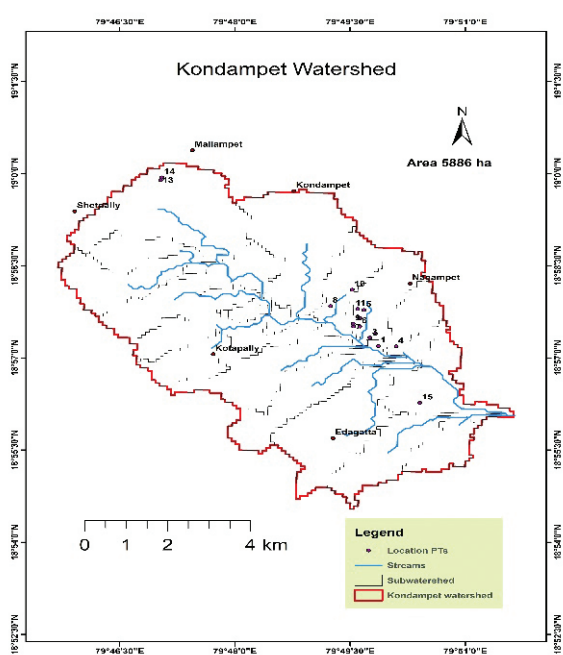
Managing water is vital for not only agriculture, but also animal husbandry and also for human livelihoods. Importance of water management is still more important in predominantly rainfed areas (Reddy *et al.*, Hope, 2007). Godavari zone of Telangana (Adilabad district) has been classified as Agro Ecological Sub Regions (7.3) and is characterised by semiarid climate with farming situation of vertisols/alfisols and 1,150 mm precipitation and the major cropping pattern of cotton followed by rice during *kharif* season and rice fallows during *rabi*. Agriculture is the major source of livelihood of the people in this region. However, agricultural productivity in the region is very poor due to lack of water resources during the terminal drought situation in spite of good annual average rainfall. Therefore, the habitats of the region are one of the poorest farmers in India and mostly belongs scheduled caste families. In view of this, the present study initiated with the following objectives.

In the study area, rainy season duration is four months from June to September with average rainfall of 1,100 mm; this rain water needs to be stored used for crop production in the remaining months. Hence, water conservation and harvesting and reusing are crucial for overall development of rainfed areas. Kotapally mandal in the Mancherial district has Integrated Watershed Management Program implemented by District Rural Development Authority (DRDA), Govt. of Telangana with the assistance of *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY), Govt. of India. The watershed consists of several villages with focus on treatment of soil and water conservation measures.

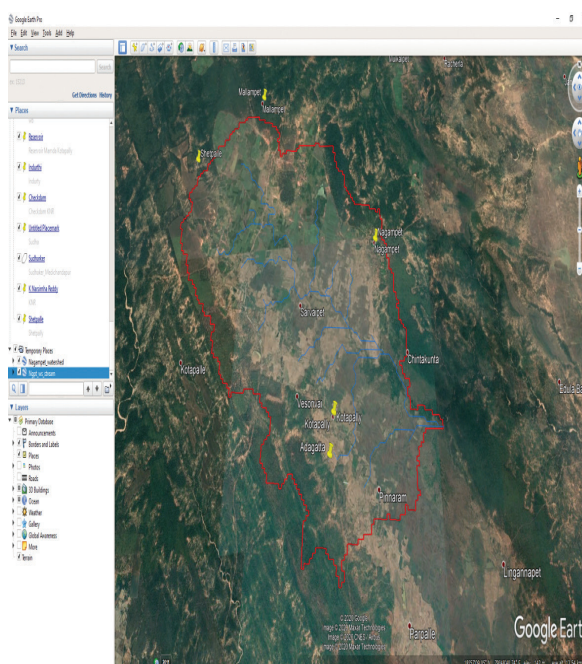
The basic infrastructure developed in the watershed for water resource development were percolation tanks in the form of earthen dams constructed for rainwater harvesting in the farmer's fields (Kerr, 2002; Datta, 2015). Water harvesting structures like Percolation tanks and dug out ponds both as community structures and on individual land holdings is a key intervention in most land and water conservation program. Two types of soil, alfisols and vertisols are more prominent in dryland regions. The vertisols having high clay content and higher water retention capacity causes low permeability and thus has higher runoff potential. Whereas, alfisols is light textured soils which have low moisture holding capacity but high water intake and thus has low runoff potential. Many watershed programs in this region, mostly emphasized to increase the water table in the vicinity through activity involving surface water harvesting and utilization. The water harvesting mostly achieved in small percolation tanks and farm ponds, the harvested rainwater was recycled as lifesaving irrigation/supplemental irrigation to attain sufficient soil moisture for successful crop production.

According to Mohanty *et al.*, 2014, under on farm research study, the water harvesting structures were constructed in farmers' field on a participatory basis in which farmers contributed to a part of the expenditure. Multiple use of water was done from the water harvesting ponds to develop them as integrated farming system models along with imparting adequate trainings and exposure visit to the farmers. The results indicated that there was substantial improvement in the livelihood of the rainfed farmers due to the technological interventions. Water harvesting is an ancient tradition and has been used for millennia in most dry lands of the world; many different techniques have been developed. However, the same techniques sometimes have different names in different (Oweis 2004). The on-farm runoff collection into farm ponds and recycling through supplemental irrigation can increase and stabilize the crop production. There is an abundant scope and opportunity for harvesting excess runoff in the rainfed region in different states of the country (Wani, *et al.*, 2003, Sharma *et al.*, 2009).

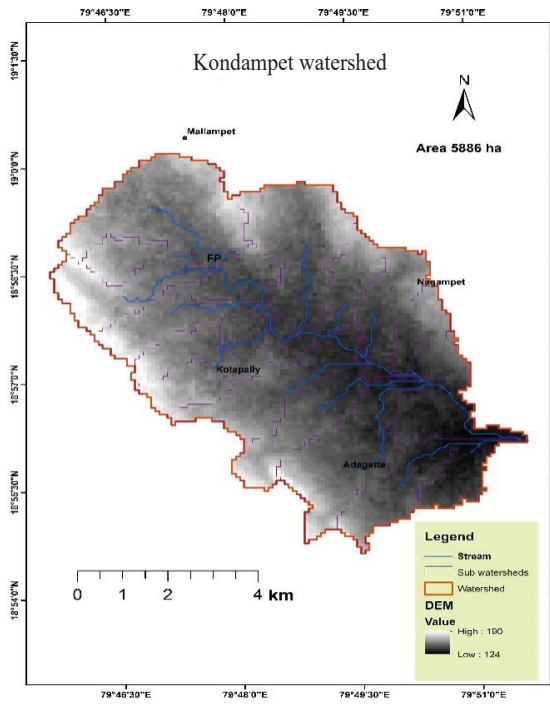
About 400 (Percolation tanks) structures were created for water storage and use for irrigation to paddy down word side of the structures. Since, the runoff potential is high with annual average rainfall of the watershed is about 1,100 mm. The soils are medium to deep vertisols in 90 per cent of the watershed and the rest sandy loam where horticulture crops are grown particularly mango. The study area in Kotapally mandal has been delineated in to Kondampet watershed with a drainage area of 5,886 ha covering the villages and part of Nagampet, Kondampet, Mallampet, Edagatta, Sarvaipet, Pinnaram and Shetpally. The flow direction varies from Northwest to Southeast, the elevation difference varies from 124-190 MSL, and major land use is crop lands, followed by forest and drylands. The soils are mainly vertisols with ISDA class of Vp20-3a-3866 and the major slope is gentle topography (0-2 per cent). The thematic maps of watershed, Digital Elevation Model (DEM), Land use/Land cover(LULC), soils and slope were shown in Figure 10.1.



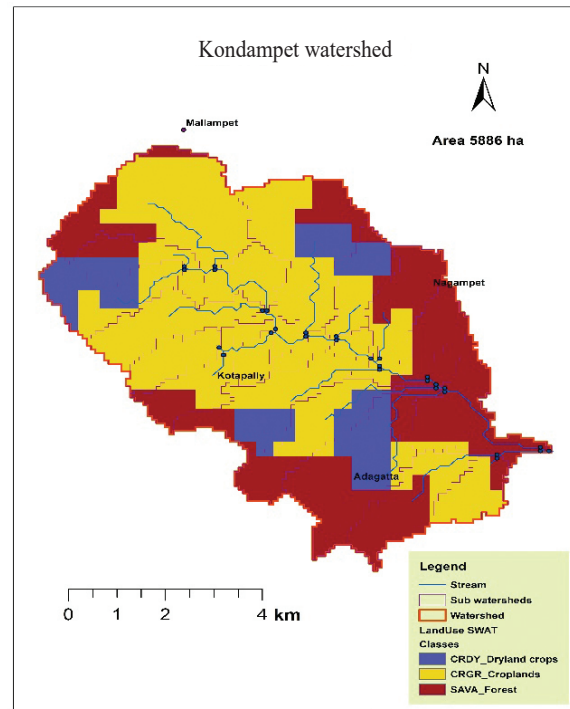
Kondampet watershed



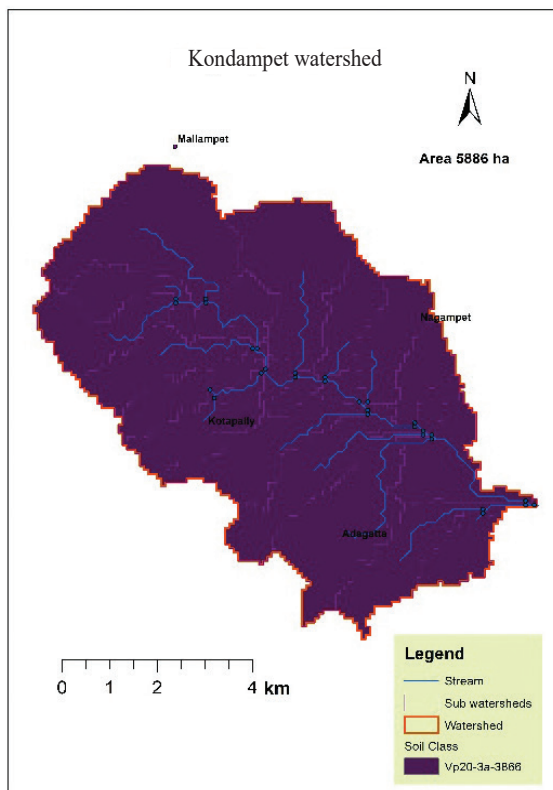
Google earth view of KWS



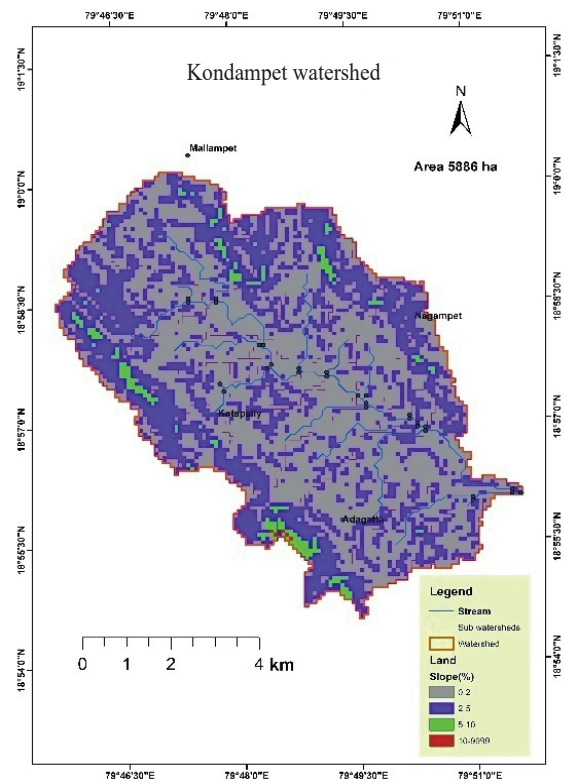
Digital Elevation Map



LULC map of KWS



Soil map of KWS



Slope map of KWS

Figure 10.1: Digital maps of Kondampet watershed

Hydrogeology of erstwhile Adilabad district

The southern part of district is mainly underlain by pink and grey granites and gneisses with dolerite dykes as intrusions. The shale, limestone and sandstone of Penganga formations overlie granites/gneisses and occur in north of Adilabad and Asifabad area and between Mancherial and Asifabad town. The Sullavai formation comprising grits, conglomerates and sandstone rest over Penganga formations in Mancherial, Sipur-Kagaznagar area. The Gondwana formations consisting of sandstone, which occupies the eastern part of the district in Sirpur, Asifabad, Mancherial, Chennur and Yemanpalle area. The Deccan traps are represented by both vesicular and massive basalt and occupy the central and western part of the district. Sub recent alluvium consisting of laterite occurs as capping over Deccan traps in Utnoor Taluk. Recent alluvium consisting of sand, silt and clay occur along the river courses. The Granite, gneiss, schist, limestone, dolerite and basalt rocks are grouped under consolidated formation. The Gondwana formations comprising sandstones, shales, limestones, *etc.*, form a thick sequence of sediments and are grouped under Semi-consolidated formations. The Unconsolidated formations consist of laterites and recent alluvium [Central Ground Water Board (CGWB) report 2012-13].

Occurrence and movement of ground water

Climate, distribution and intensity of rainfall, topography, geological formations, aquifer matrix such as weathering, joints, fractures, fissures, bedding planes, recharge conditions, transmissivity and storage conditions of the aquifers, *etc.*, play an important role in occurrence and movement of ground water. Hydrogeological map along with area recommended for artificial recharge of the district is in Figure 10.2.

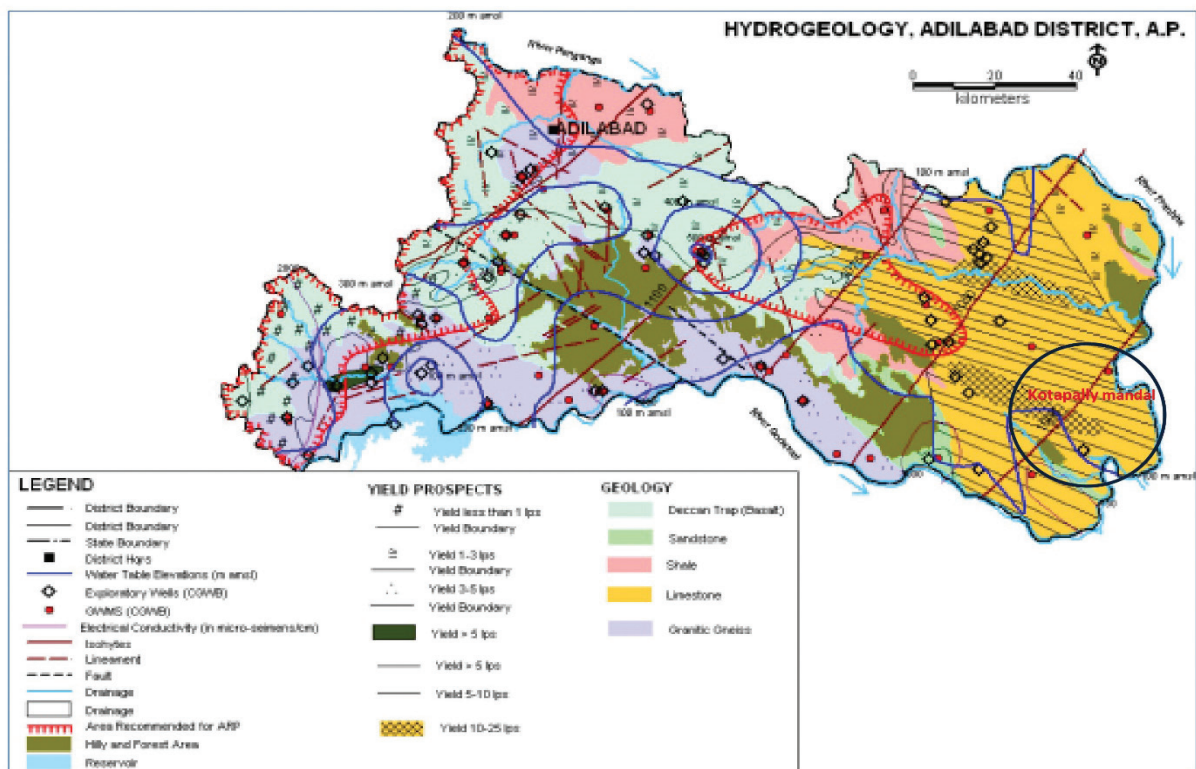


Figure 10.2: Hydrogeology map of erstwhile Adilabad district, Kotapally mandal shown in black circle

But, the geology of some parts of villages viz., Nagampet, Edagatta, Kondampet and Mallampet of watershed area is with lime stone layer to a depth of 1 to 2 m. Lime stone underlying the black soil will have very low recharge potential due to low seepage rate and were shown in Figure10.1. Because of these reasons, the bore wells are not functional but there is a scope for shallow open wells. However, the farmers draw the water from percolation tanks/earthen dams through pipe outlet of 4 to 6” (10 to 15 cm dia) for irrigating the paddy fields. The initial capacity of these structures varied from 800 to 3,500 m³ and silted over the years thus reducing the capacity of the structures by 20 per cent to 5 per cent. There are about 50 per cent SC farmers having these structures in Kotapally mandal in different villages.

Based on the discussion with farmers in the above villages, farmers constructed percolation tanks in 0.5 acre area to 1.0 acre area and sparing even half of the land holdings for water harvesting. This practice of water harvesting was found even from their ancestors. The existing PTs were not in proper shape, leaving a big hump in middle and there were no provision of spillways/waste weirs for disposal of surplus water and several time the bunds were breached due lack of these waste weirs. Keeping in view of groundwater recharges restrictions due to limestone layers and improper construction of PTs. It was decided to rejuvenate the existing PTs into on farm reservoirs (OFRs), 18 PTs have been selected from 18 farmers for renovation of their existing PTs.

The first set of 18 SC farmers of Nagampet, Mallampet and Edagatta were selected for rejuvenation of these structure for desliting as well as for enhanced capacity ranging from 2,300 to 5,600 m³ capacity so that cropping intensity could be increased under these structures along with enhanced water productivity. The total expenditure incurred from SCSP budget was Rs.32 lakhs for rejuvenation of these earthen dams with enhanced capacity. The farmers were trained on the rainwater harvesting and utilization through sprinklers with irrigation pipes which were already distributed to SC farmers in the area. The rejuvenation program was implemented in convergence with DRDA through MoU with Commissioner, PR & RD, Govt. of Telangana. The list of the farmers is given in Table 10.1 and the pictures of the structure before rejuvenation are given in Figure 10.3 to 10.6.



Figure 10.3: Local on farm reservoir before rejuvenation



Before

During

After renovation

Figure 10.4: Renovation of PT of Sri Durgam Rajaiah from 1,200-2,950 m³ with additional water resources created to 1,750 m³



Figure 10.5: Interaction with farmer Mr. Kavera Bakkaiah during rejuvenation at Nagampet



Water filled in OFR of Sri N Ammakka



Water filled in OFR of Sri Dhandu Banaiah



Water filled in OFR of Sri Agadi Bondhakka



Water filled in OFR of Sri Kaveri Rajam

Figure 10.6: OFR after renovation

Table 10.1: Estimate for proposed water resource development activities under SC-Sub Plan

S. No.	Object ID	Village	Caste of the farmers	Type of harvesting structure	Initial capacity (m ³)	Capacity (m ³)	Water resources created (m ³)	Survey No.	longitude (Decimal degree)	latitude (Decimal degree)	Estimated cost (Rs.)
1	Talla Mallaih	Nagampet	SC	PT with surplus weir	1,150	3,300	2,150	230	79.83	18.95	2,29,264
2	Kamera Durgaiah	Nagampet	SC	PT with surplus weir	1,150	3,100	1,950	2,37/6	79.83	18.95	2,11,837
3	Borukunta Ankulu	Nagampet	SC	PT with surplus weir	900	2,500	1,600	237/7	79.82	18.95	1,65,968
4	Sangem Rajakka	Nagampet	SC	PT with surplus weir	1,200	3,500	2,300	212	79.83	18.95	2,16,862
5	Kaveri Ellaiah	Nagampet	SC	PT with surplus weir	800	3,100	2,300	277/1/A	79.82	18.96	2,19,536
6	Durgam Mallaiah	Nagampet	SC	PT with surplus weir	900	2,700	1,800		79.82	18.96	1,86,068
7	Kaveri Bakkaiah	Nagampet	SC	PT with surplus weir	1,100	2,800	1,700		79.82	18.95	1,84,039
8	Agadi Pardesi	Nagampet	SC	PT with surplus weir	1,100	2,900	1,800	281/2	79.82	18.96	1,91,415
9	Durgam Rajaiah	Nagampet	SC	PT with surplus weir	1,200	2,950	1,750		79.82	18.95	1,87,727
10	Eerla Madhunaiah	Nagampet	SC	PT with surplus weir	900	2,300	1,400		79.83	18.96	1,45,868
11	Dandu Banaiah	Nagampet	SC	PT with surplus weir	1,200	3,050	1,850		79.82	18.96	1,97,777
12	Kavera Rajam	Nagampet	SC	PT with surplus weir	1,150	2,950	1,800		79.82	18.96	1,92,752
13	Danthula Mabdhhu	Nagampet	SC	PT with surplus weir	1,300	3,170	1,870		79.82	18.96	1,99,787
14	Odnala Chandraiah	Mallampet	SC	PT with surplus weir	3,500	5,600	2,100	238	79.78	18.99	2,45,627
15	Katralla Padma	Mallampet	SC	PT with surplus weir	1,400	3,400	2,000	226	79.78	18.99	2,30,230
16	Dongiri Mallesh	Edagatta	SC	PT with surplus weir	1,400	3,500	2,100	84/4	79.84	18.93	2,26,912
17	Agadi Bandakka	Nagampet	SC	PT with SW	1,500	2,500	1,000		79.78	18.83	1,52,000
18	Neerati Ammakka	Nagampet	SC	Pt with SW	1,900	2,600	700		79.34	18.43	56,000

Conclusion

The rainfed areas are prone to frequent droughts delayed onset of monsoons and early withdrawal of monsoons. With the climate change the frequency of these weather aberrations is increasing (Amadu *et al.*, 2020; Blakeslee *et al.*, 2020). The three study villages are also predominantly rainfed areas with large area under rainfed cultivation. These villages were treated under watershed schemes since two-three decades, but the constructed check dams, farm ponds are not properly maintained. Under SCSP program, the ICAR-CRIDA team in collaboration with DRDA Mancherial, Telangana Government are planning to renovate these farm ponds for not only recharging the ground water but also to provide supplementary irrigation to save crops during the dry spells. There is also a scope for second crop by utilizing the residual moisture, and a chance to go for relay cropping in the impounded area of On Farm Reservoirs (OFRs).

References

- Amadu, F. O., McNamara, P. E., & Miller, D. C. (2020). Understanding the adoption of climate-smart agriculture: A farm-level typology with empirical evidence from southern Malawi. *World Development*, 126, 104692. Amadu, F. O., McNamara, P. E., & Miller, D. C. (2020). Understanding the adoption of climate-smart agriculture: A farm-level typology with empirical evidence from southern Malawi. *World Development*, 126, 104692.
- Blakeslee, D., Fishman, R., & Srinivasan, V. (2020). Way down in the hole: Adaptation to long-term water loss in rural India. *American Economic Review*, 110(1), 200-224.
- Datta, N. (2015). Evaluating impacts of watershed development program on agricultural productivity, income, and livelihood in bhalki watershed of Bardhaman district, West Bengal. *World Development*, 66, 443-456.
- Hope, R. A. (2007). Evaluating social impacts of watershed development in India. *World Development*, 35(8), 1436-1449.
- Kerr, J. (2002). Watershed development, environmental services, and poverty alleviation in India. *World Development*, 30(8), 1387-1400.
- Madhunre Pandith. (2013). Groundwater brochure Adilabad district Andhra Pradesh (AAP 2012-13). Pub. Central Ground Water Board, MoW, Southern Region, Hyderabad, 27.
- Mohanty, S., Mohanty, R. K., Mandal, K. G., Rautaray, S. K., Ghosh, S., Panigrahy, P., & Kumar, A. (2014). Water resources development in rainfed areas and livelihood improvement of farmers. Bulletin No.-66. Directorate of Water management, Indian Council of Agricultural Research, Chandrasekharapur, Bhubaneswar, India, 25.
- Oweis, T., & H.A.M. (2004). Improving water productivity in the dry areas of West Asia and North Africa, in: *Water Productivity in Agril Limits and Opportunities for Improvement*, 179-0198.
- Reddy, K. S., Ricart, S., Maruthi, V., Pankaj, P. K., Krishna, T. S., & Reddy, A. A. (2020). Economic assessment of water harvesting plus supplemental irrigation for improving water productivity of a pulse-cotton based integrated farming system in Telangana, India. *Irrigation and Drainage*, 69(1), 25-37.
- Wani, S. P., Pathak, P., Sreedevi, T. K., Singh, H. P., & Singh, P. (2003). Efficient management of rainwater for increased productivity and groundwater recharge in Asia. Book chapter in *Water Productivity in Agriculture: Limits and Opportunities for Improvement* edited by Kijne, *et al.*, 2003. CABI publishing, Cambridge, USA.

CROPPING SYSTEMS: COTTON AND PADDY

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The yield, cost of cultivation and technologies adopted are important determinants of sustainability and profitability of the farmers (Reddy, 2014). Technology adoption and profitability depends on various factors including local agro-ecology, resource endowments, awareness, landholding size and irrigation (Palanisami *et al.*, 2015; Pandey and Diwan, 2021). Keeping in view this chapter assessed the above aspects village wise, social groups wise and land class wise. In the study villages only two crops cotton and paddy are major crops occupying more than 90 per cent of the area. Hence, this chapter covers all aspects of technologies, input use, prices received and profitability of these two crops.

Adoption of technology is not uniform in these two crops. Even for the same crop, some technologies are already reached saturation level, while some other technologies are not even reached 20-30 per cent of the farmers. For example, use of fertilizers and pesticide is almost saturated among both cotton and paddy farmers, while use of Farm Yard Manure (FYM) and micro-nutrients have not yet reached even 20 per cent in cotton, while their adoption is just about 30-35 per cent in case of paddy. Only 34 per cent of the cotton farmers are irrigating their crop, while it was about 60 per cent in case of paddy (Table 11.1).

Table 11.1: Comparison of technology adoption level in cotton and paddy among farmers

Technology adoption level	(% Farmers adopted)		Mean (Only for users)		Mean (Including non-users)	
	Cotton	Paddy	Cotton	Paddy	Cotton	Paddy
Seed (bags/acre)	96.8	99.3	2.16	1.85	2.17	1.84
Urea (bags/acre)	100	100	3.37	2.92	3.37	2.91
DAP (bags/acre)	98	100	2.74	2.31	2.81	2.25
MoP/Complex fertilizers (bags/acre)	82	81	2.59	2.25	2.02	1.82
FYM (bullock cart load/acre)	19.4	36.8	3.25	2.68	0.58	0.93
Micro-nutrients (packets/acre)	17.7	31.3	3.45	2.47	0.58	0.70
Irrigation (nos)	34	59	3.70	3.80	1.35	2.28
Pesticide (nos)	93.5	89.6	3.47	3.34	3.19	2.91
Productivity (q/acre)					9.7	15.9
Price (Rs/q)					4,997	1,731
Gross returns (Rs/acre)					48,471	27,523

Note: The recommended dose of seed rate is one bag/acre for both cotton and paddy. One cotton seed bag contains 450 gm in case of hybrids and 3 kg in case of varieties, while paddy seed bag contains 10 kg. Generally, one bag is recommended per one acre in both cotton and paddy case. 1 bag Urea contain 45 kg, 1 bag DAP and MoP/complex fertilizers contain 50 kg each.

This chapter is divided into two sections dealing separately with the technological adoption in cotton and paddy separately.

1) Cotton

A) Cropping pattern

The largest commercial crop in the entire Mancheril district is cotton. The cotton crop cultivation detailing is presented in Table 11.2 to 11.4. Cotton crop is being cultivated on an average of 695.5 acres of the land in three villages collectively, of which 310 acres of Nagampet, 255 acres of Mallampet and 129 acres of Edagatta are included. About 30 per cent of cotton cultivated land area is under irrigation with an average yield of 9.7 quintals per acre which was sold at Rs. 4,997 per quintal, which comes to gross return of Rs. 48,471 per acre. Although, there is a significant difference in irrigated area among three villages (with Edagatta highest and Nagampet the lowest), the average yield and average price of the produce is almost similar across the three villages.

Table 11.2: Area and production of cotton by village

Village	Total area (acre)	Average area (acre) per household	Percentage of rainfed area	Average of yield (q/acre)	Average price (per q)	Gross returns (Rs/acre)
Edagatta	129.7	1.24	93.7	10.1	5,042	50,924
Mallampet	255.8	1.64	79.3	9.9	4,989	49,391
Nagampet	310.1	1.28	52.2	9.5	4,984	47,348
All	695.5	1.38	69.9	9.7	4,997	48,471

Table 11.3: Area and production of cotton by social group

Socio-economic groups	Cropped area (acre)	Average area (acre) per household	Percentage of rainfed area	Average of yield (Per acre q/acre)	Average price (per q)	Gross returns (Rs/acre)
SC	518.2	1.39	77.2	9.4	4,997	46,972
ST	19.7	0.68	49.3	11.7	5,089	59,541
BC	154.6	1.55	49.2	10.5	4,983	52,322
FC/OC	3.0	3.00	0	10.0	5,000	50,000
All	695.5	1.38	69.9	9.7	4,997	48,471

Table 11.4: Cotton crop details by land class

Land size class	Cropped area (acre)	Average area (acre)	Percentage of rainfed area	Average of yield (q per acre)	Average price (per q)	Gross returns (Rs/acre)
Marginal	88.7	1.04	76.9	10.2	5,018	51,184
Small	286.4	1.12	70.8	9.3	4,968	46,202
Medium	277.2	1.78	62	10.2	5,042	51,428
Large	43.2	6.17	100	6.4	4,829	30,906
All	695.5	1.38	69.9	9.7	4,997	48,471

The cotton crop is mostly grown as rainfed crop by SC farmer's whereas, cotton area under irrigation was about 50 per cent in case of ST and OBC farmers. Consequently, average yield among SC farmers is less than the other farmers. The SC farmers are getting less gross revenue (Rs. 46,972 per acre) compared to ST farmers (Rs. 59,541 per acre) and OBC farmers (Rs. 52,322 per acre).

Average area under cotton was 6.17 acre among large farmers, while only 1.04 acre among marginal farmers. Percentage of rainfed area was higher among large farmers and consequently yields are less among them and also gross returns also less (only Rs. 30,906 per acre) compared to medium farmers (Rs. 51,428 per acre).



Figure 11.1: Group farming by village youth (cotton)

A few youths in the village taken about 40 acres on lease and cultivating cotton by pooling land and other resources. Figures 11.1 and 11.2 are showing the Figures of these pooled land cultivation.



Figure 11.2: Cotton crop cultivation by youth

B) Technology

The Tables 11.5 and 11.6 and Figure 11.3 shows the technology adoption for growing cotton crop by villages, social groups and land holding classes, respectively. On an average farmer used 2.03 bags of seed per acre, with slightly higher seed rate in Mallampet. Urea (Nitrogenous) fertilizer is mostly used by the farmers and on average they used 3.17 bags per acre, while use of DAP is 2.53 bags and MoP/Complex fertilizers is only 2 bags per acre. The use of FYM and micro-nutrients is less than the recommended level and also only few farmers practice it. On an average farmers irrigated crop just 1.29 times, as most of them cultivated the crop as rainfed. All the farmers harvested their crop (cotton picking) by manually engaging mostly women labour both family and hired labour. SC farmers used higher seed rate, urea and DAP compared to other farmers. An examination of technology adoption by land class size shows that, small and medium farmers used more fertilizer compared to both marginal and large farmers, indicating inverted “U” shaped relationship between fertilizer use and farm size.

Overall, the data indicate that farmers are using more nitrogenous fertilizers than the recommended, but use of micro-nutrients and FYM is less than the recommended. The use of irrigation water is also less than the recommended due to predominance of rainfed area.

Table 11.5: Technology adoption in cotton crop cultivation by village

Technology	Edagatta	Mallampet	Nagampet	All
Seed (bags/acre)	1.92	2.41	1.55	2.03
Urea (bags/acre)	2.92	3.50	2.82	3.17
DAP (bags/acre)	1.33	3.06	2.41	2.53
MoP/Complex fertilizers (bags/acre)	2.50	2.22	1.41	2.00
FYM (bullock cart load/acre)	0.00	0.56	0.95	0.59
Micro-nutrients (packets/acre)	0.00	0.44	1.09	0.58
Number of irrigations	4.42	0.63	0.55	1.29
Number of fertilizer applications	4.08	3.00	2.55	3.05
Percentage of farmers by harvest method				
Manual harvesting (%)	100	100	100	100
Machine harvesting (%)	0	0	0	0

Note: As in Table 11.1



Figure 11.3: Technology adoption in cotton crop cultivation by social group

Table 11.6: Technology adoption in cotton crop cultivation by land class

Technology Category	Marginal	Small	Medium	Large	Total
Seed (bags/acre)	2.70	1.80	2.13	2.00	2.17
Urea (bags/acre)	3.00	3.00	3.79	2.75	3.37
DAP (bags/acre)	2.50	2.40	3.25	2.00	2.81
MoP/Complex fertilizers (bags/acre)	1.70	2.40	1.96	2.25	2.02
FYM (bullock cart load/acre)	0.20	0.70	0.71	0.50	0.58
Micro-nutrients (packets/acre)	0.30	0.80	0.63	0.50	0.58
Number of irrigations	1.40	2.50	0.58	3.00	1.35
Number of times pesticides application	3.60	3.20	2.87	4.00	3.19
Percentage of farmers by harvest method					
Manual harvesting (%)	100	100	100		100
Machine harvesting (%)	0	0	0		0

Note: As in Table 11.1

2) Paddy

A) Cropping pattern

Paddy is the next major crop after cotton, earlier it used to occupy more area than cotton, but recent years its area reduced with the farmers shifting to cotton from other dryland crops. Paddy crop cultivation characteristics by villages, social group and farm sizes category are presented in Tables 11.7 to 11.9. Being the *kharif* crop Paddy is taken up on a total area of 647.9 acres in three sample villages. In the study area paddy was grown as irrigated crop, but mostly as rainfed crop and also based on stored water in the farm ponds and other water harvesting structures. The average yields vary from 14.3 quintal in Nagampet to 21 quintals in Edagatta. It is important to note that though Nagampet village was having maximum area under paddy cultivation, its yields are less in the village. The average price realization was ranging from Rs. 1,695 to 1,752 per quintal. Most of the paddy production is procured through government at Minimum Support Price (MSP), hence there is no much price variation among the villages. The gross returns per acre ranged from Rs. 25,055 to Rs. 35,601, which are comparatively less than cotton.

Table 11.7: Paddy crop details by village (Kharif)

Village	Cropped area (acre)	Average area (acre)	Percentage of rainfed area	Average yield (Per acre)	Average price (per q)	Gross returns (Rs./acre)
Edagatta	108.8	1.04	91.0	21.0	1,695.3	35,601
Mallampet	167.4	1.07	63.3	15.1	1,718.4	25,948
Nagampet	371.7	1.53	61.9	14.3	1,752.1	25,055
Total	647.9	1.29	67.2	15.9	1,731.6	27,532

The average paddy area per farmer in the village was 1.29 acre. On an average SC farmers grow paddy on 1.27 acre, while area is little less among STs (0.92 acre), but more among BC (1.41 acre) and FC farmers (6 acre). More area was under rainfed among SC farmers than other social groups. On an average yields are lower among SC and ST farmers than OBC and FC farmers. The gross returns are higher among FC (Rs. 30,400/acre) and lowest among ST (Rs. 23,983/acre). These figures shows nearly similar findings as that of the national picture as per the recent cost of production statistics of Government of India (Table 11.8).

Table 11.8: Paddy crop details by social group (Kharif)

Socio-economic groups	Cropped area (acre)	Average area (acre)	Percentage of rainfed area	Average of yield (Per acre)	Average price (per q)	Gross returns (Rs./acre)
SC	475.7	1.27	69.6	15.9	1,726.2	27,447
ST	26.6	0.92	58.3	13.7	1,750.6	23,983
BC	140.6	1.41	63.1	16.6	1,743.5	28,942
FC/OC	5.0	5.00	0	16.0	1,900.0	30,400
Total	647.9	1.29	67.2	15.9	1,731.6	27,532

Unlike cotton, the total paddy area among the large and medium farms is higher than marginal and small category. This is mainly due to its less labour requirement compared to cotton. It is also more mechanized friendly crop except in transplanting and weeding operations. Per cent rainfed area was less among small and medium farmers compared to marginal and large farmers. Average yields are little higher among large and medium farmers compared to marginal and small farmers. Hence, overall, gross returns are better among large and medium farmers than small and marginal farmers. Overall, it indicates that large farmers are preferring paddy, while marginal and small farmers prefer cotton cultivation.

Table 11.9: Paddy crop details by land size category (Kharif)

Land size class	Cropped area (acre)	Average area (acre)	Percentage of rainfed area	Average of yield (Per acre)	Average price (per q)	Gross return (Rs./acre)
Marginal	25	0.9	100	15	1,738	25,547
Small	224	1.4	57	14	1,752	25,056
Medium	226	2.0	67	16	1,718	27,316
Large	174	3.6	76	17	1,732	29,262
Total	648	1.3	67	16	1,735	27,532

B) Technology

Table 11.10 to 11.12 shows the technology adoption in paddy crop by village, social group and land class in the study villages. The seed rate (1.81 bags/acre) is little higher than the recommended practice by the research station, with no significant difference between villages. Similar to cotton, overall, farmers are using more fertilizers than the recommended doses especially nitrogenous fertilizers. On an average the use of Urea (2.86 bags/acre) is higher than the DAP (2.26 bags/acre) and MoP/Complex fertilizers (1.79 bags/acre). At the same time use of micro-nutrients and FYM was less than the recommended dose. On average number of irrigations given are 2.25 times during the crop season, ranging from 1.32 times in Nagampet and 4.8 times in Edagatta. About 60 per cent of the farmers harvested their crop by using manual labour, while remaining 40 per cent using through machine. But slowly farmers are moving to mechanical harvesting. One of the reason for using the manual harvesting is, it is more convenient for harvesting paddy straw which can be used for animal fodder.

The results shows that the fertilizer consumption (Urea, DAP and MoP/Complex fertilizers) and mechanization of harvesting operations were directly proportional to the farm size in case of paddy, while there is no significant influence of difference in case of other technologies. The technology adoption across social groups in paddy shows that, SC farmers use less MoP/Complex fertilizers, a smaller number of irrigations and also less mechanized compared to other farmers. Mechanization was much higher in paddy harvesting among OBC famers than both SC and ST farmers. Harvesting methods vary across socio-economic and land size category of farmers (Figure 11.4) even now farmers are using indigenous traditional storage structures to store the harvested grain (Figure 11.5).

Table 11.10: Technology adoption in paddy crop cultivation by village

Technology Category	Edagatta	Mallampet	Nagampet	All
Seed (bags/acre)	1.97	1.82	1.74	1.81
Urea (bags/acre)	3.06	2.89	2.75	2.86
DAP (bags/acre)	1.23	2.36	2.68	2.26
MoP/Complex fertilizers (bags/acre)	2.17	1.67	1.67	1.79
FYM (bullock cart load/acre)	0.26	0.58	1.47	0.97
Micro-nutrients (packets/acre)	0.00	0.44	1.25	0.76
Number of irrigations	4.80	1.75	1.32	2.25
Number of pesticide applications	3.57	2.89	2.66	2.93

Note: As in Table 11.1

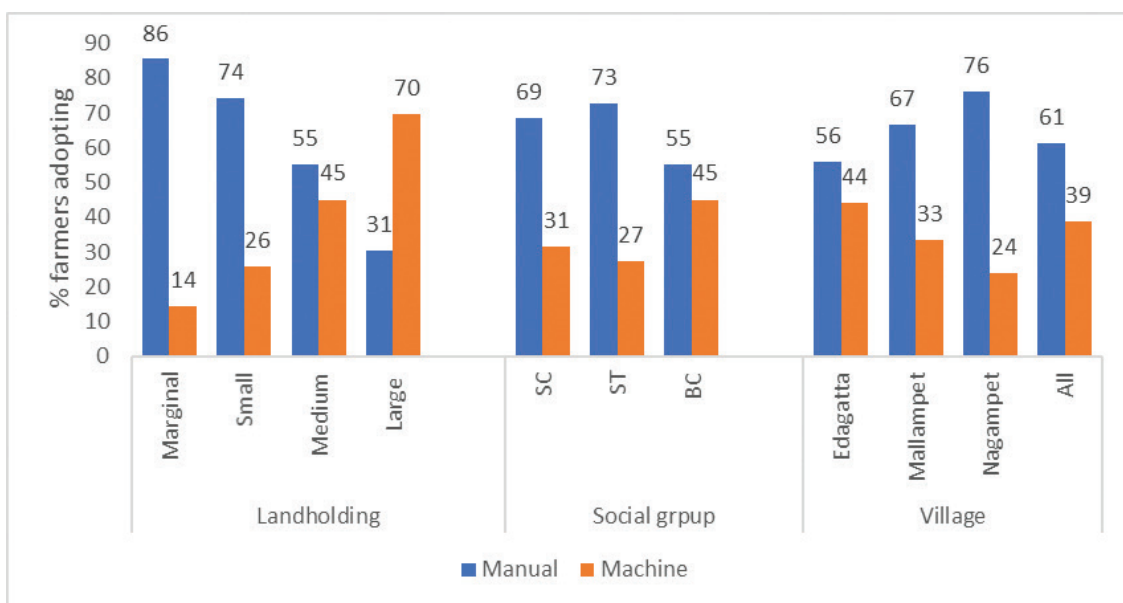


Figure 11.4: Harvesting methods used in paddy cultivation by different groups



Figure 11.5: Indigenous storage structures for grain

Table 11.11: Technology adoption in paddy crop cultivation by social group

Technology Category	SC	ST	BC	All
Seed (bags/acre)	1.80	1.91	1.81	1.81
Urea (bags/acre)	2.89	2.36	2.92	2.86
DAP (bags/acre)	2.28	1.73	2.38	2.26
MoP/Complex fertilizers (bags/acre)	1.62	2.36	2.27	1.79
FYM (bullock cart load/acre)	0.94	1.27	0.96	0.97
Micro-nutrients (packets/acre)	0.72	1.55	0.58	0.76
Number of irrigations	1.99	3.82	2.69	2.25
Number of fertilizer applications	2.73	4.09	3.31	2.93

Note: As in Table 11.1

Table 11.12: Technology adoption in paddy crop cultivation by land class

Technology Category	Marginal	Small	Medium	Large	All
Seed (bags/acre)	1.81	1.87	1.91	1.57	1.84
Urea (bags/acre)	2.51	3.06	3.37	2.14	2.91
DAP (bags/acre)	1.86	2.19	2.93	2.14	2.25
MoP/Complex fertilizers (bags/acre)	1.59	1.79	2.30	1.43	1.82
FYM (bullock cart load/acre)	1.05	0.81	0.93	1.14	0.93
Micro-nutrients (packets/acre)	0.81	0.63	0.52	1.29	0.70
Number of irrigations	2.76	2.52	1.59	0.71	2.28
Number of fertilizer applications	2.92	3.02	2.85	2.29	2.91

Note: As in Table 11.1

Harvesting through combined harvester is picking up in many parts of India, even in remote areas to overcome peak harvest period labour shortage. Being very remote and under-developed areas, the level of farm mechanization is still low in the study villages. However, the mechanization is much higher among large farmers (70 per cent) due to their large landholdings and intention to harness scale economies. Mechanization of harvesting operations is still very low among marginal farmers (only 14 per cent).

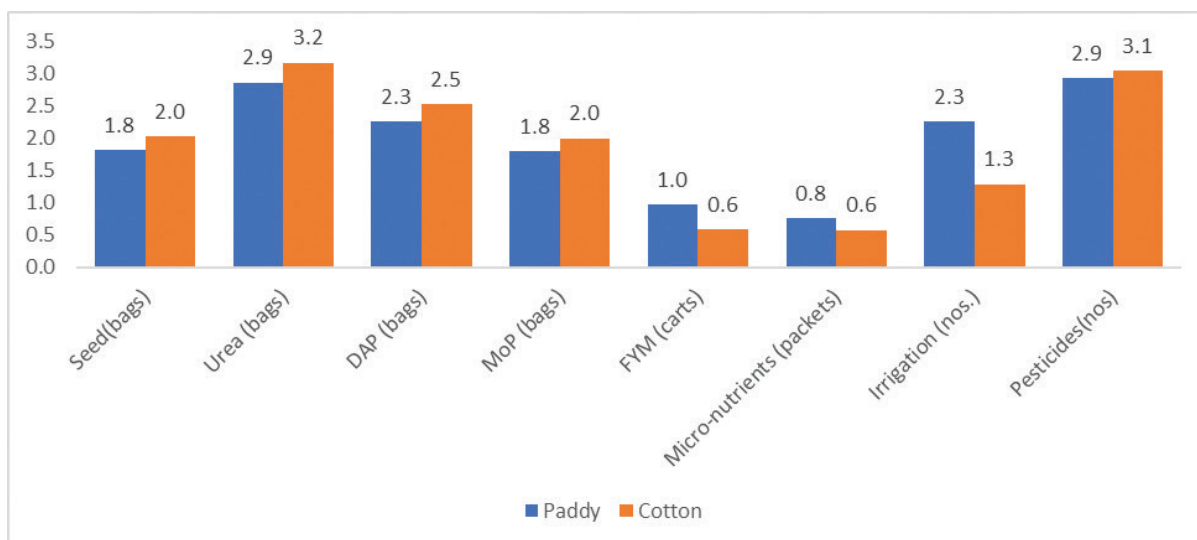


Figure 11.6: Technology adoption in paddy and cotton cultivation

In general, farmers are using more fertilizers in cotton cultivation than paddy, mainly farmers have more expectations on returns from cotton crop, although it is with more price and yield risk. Farmers spray more pesticides in cotton than paddy. However, in case of paddy they gave more number of irrigations (Figure 11.6).

References

- Palanisami, K., Hailelassie, A., Kakumanu, K. R., Ranganathan, C. H., Wani, S. P., Craufurd, P., & Shalander, K. (2015). Quantification of risk associated with technology adoption in dryland systems of South Asia: A household level analysis in Andhra Pradesh, Karnataka and Rajasthan States of India; Research Report No. 66, ICRISAT, Hyderabad.
- Pandey, C., & Diwan, H. (2021). Assessing fertilizer use behaviour for environmental management and sustainability: a quantitative study in agriculturally intensive regions of Uttar Pradesh, India. *Environment, Development and Sustainability*, 23(4), 5822-5845.
- Reddy, A. (2014). Profitability and labour use in cropping systems. *Indian J. Dryland Agric. Res. & Dev*, 29(1), 97-106.

HORTICULTURE

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Horticultural crops are the future engine of growth for increasing farmer's income. The demand growth rates from both domestic and international markets especially fruits and vegetables and also plantation crops are increasing at the rate of 5-7 per cent per annum while the growth rates of food grains and other crops are stagnant (Kumar and Mittal, 1998; Joshi *et al.*, 2004; Chand *et al.*, 2008). Recognizing this, both state and central governments are promoting the horticultural crops, wherever possible by providing various kind of incentives like subsidized plant material, maintenance subsidy until gestation period is over, drip and sprinkler irrigation systems etc. (Paroda and Kumar, 2000; Sharma *et al.*, 2018). Mango production in India is 4.3 million MT as per NHB-2017, Uttar Pradesh stands first as mango producing state. This is followed by Telangana (2.73 million MT), Karnataka (1.75 million MT) and Bihar (1.36 million MT) (NHB, 2017). Mango is one of the major horticultural crops having good demand in Telangana. Mancherial is the one of the Telangana largest mango producing district. During 2019-20 in Mancherial district the area of mango is 17,927 acres, production 75,293.4 MT's and productivity is 4.2 MT/ha (Horticulture department Telangana) and it is very less when compared to national productivity average 9.7 MT/ha. In Mancherial mango orchards were planted without any pattern and recommended spacing and also pruning of the trees was not practiced. Overcrowding results in the production of fewer fruits which are apt to be poorly colored and infected with diseases. Tall trees also present a harvesting problem and create difficulties during spraying and pruning. Nearly most of the farmers did not supplement their trees with any form of fertilizer but some use organic fertilizers such as compost and manure. However, the rates of fertilizer required for mango trees are not met in these areas. Mango trees are usually left unfertilized once established. Regarding insect pests and their management, the major insect pests were red ant, leaf webbing red ant, hopper, fruit fly, thrips and termites while diseases included powdery mildew and anthracnose. Anthracnose is common during wet weather and powdery mildew is common during hot weather season. The study team of ICAR-CRIDA plans to provide information and other support services for adoption of better management practices in mango orchards in the study villages, so that the farmers income can be increased significantly in Figure 12.1

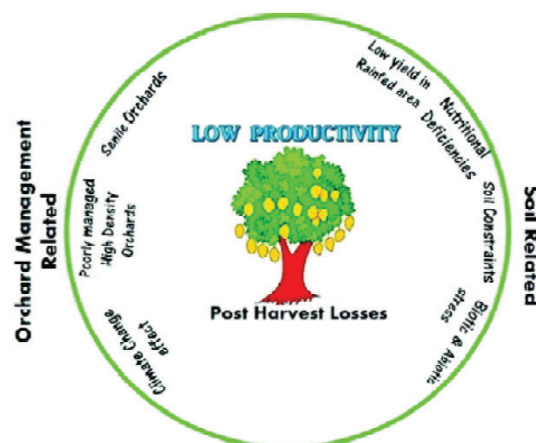


Figure 12.1: Causes of low productivity of Mango

Impact of changing climate on mango productivity

Climatic change and unseasonal rain regularly dampen the prospects of mango farmers in southern India. Late flowering and delayed fruit maturity and the resultant delay in harvest gets mango caught in rains leading to very poor quality of mango. On the other hand with the prevailing severe cold, dew and fog during the nights and increasing temperatures during the day, the mango flowering is subjected to damage. However, throughout the country the rain and hailstorm accompanied by strong winds are another climatic factor severely damaging the yields of mango crop. The mango hoppers and the powdery mildew are affecting mango flowers to a large extent and it is now a regular trend. Under favorable season if the mango harvest is delayed till pre-monsoon period then there will be severe damage due to fruit fly and stone weevil. Apart from this, mealy bugs and tearstains are showing an increasing trend leading to very poor quality fruits. An aberration in weather shows severe staggered flowering leading to irregular maturity time of fruits. Severity of the problem is such that even paclobutrasol applications have failed to induce flowering. Recurrent flowering from January-April diverts assimilates towards the new panicles depriving the developing fruits. About 18 insects and 14 fungal and bacterial pathogens do cause appreciable economic losses to mango in different growing regions.

What we can do: Mango crop can be brought to good production by doing pruning, proper irrigation methods, manures and fertilizer application, plant protection and intercultural operations like weeding.

Pruning

Mango trees are generally pruned to remove dead or diseased wood to allow more light to penetrate into the leaf canopy and to control the overall tree height. About 25-30 per cent of moderate pruning is done on commercially grown mango orchards to reduce the canopy height and width of large trees. Ideally, the tree will be shaped to have three and not more than four main trunks, have ample interior canopy space and is 12-15 feet (3.5-4.5 m.) tall. Moderate, and even severe pruning, will not damage the tree, but it will reduce production for one to several seasons, though is worth it in the long run. Spreading branches are more fruitful than erect branches, so pruning seeks to remove them. Lower branches are also pruned to four feet from ground level to ease the tasks of weed removal, fertilizer application and watering. The basic idea is to maintain a modest height and improve flowering, thus fruit set. Mango trees do not need pruning every year (figure 12.2)

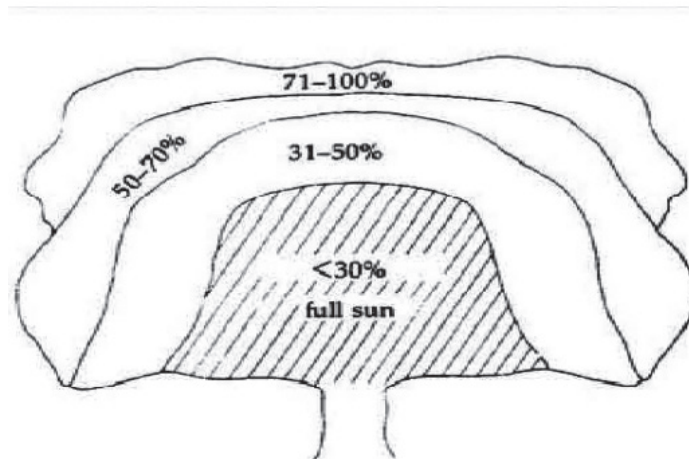


Figure 12.2: A schematic view of light penetration in mango tree

Irrigation

Mango needs to be watered throughout the first two years of their life to supplement rainfall and encourage growth. Each tree needs about 26 gallons of water per week. Once established, watering is done only during the flowering and fruiting periods, usually December to increase the number of flowers and keep formed flowers from dropping. Controlling the amounts of water before and during flowering will help maximize fruit yields.

Water harvesting technologies for supplemental irrigation

Mango in rainfed areas faces water shortage during critical stages. Harvesting of rain water holds promise to provide the much needed water at critical growth stages of mango and/or crops grown on orchard floors. Several examples of success of rainwater harvest under mango systems have been reported. In Chittoor (Andhra Pradesh), farm pond water is used for supplemental irrigation in mango (Kumar *et al.*, 2016). Similarly, in a one hectare model 35 year old Alphonso mango based farming system developed at ICAR-IIHR, Bengaluru under NICRA has shown that it is possible to harvest water received during early monsoon period for irrigating intercrops during mid monsoon dry periods. Further the water harvested from the rains received during receding South West monsoon and further during cyclones during North East monsoon benefit the crops during post monsoon period (Manjunath *et al.*, 2018). In hot semi-arid areas of Karnataka micro-catchments constructed in half-moon shape (semi-circular) across mango trees capture surface runoff. Such constructions have resulted in yield enhancement by over 22 per cent (Ali *et al.* 2017). In HDP (5m x 5m) of Arka Neelachal Kesri in Eastern India, cup-and-plate system of rainwater harvesting and mulching with paddy straw has resulted in maximum increase in fruit yield. Such several ways of rainwater harvested in mango orchards are in place in several regions (Figure 12.3).

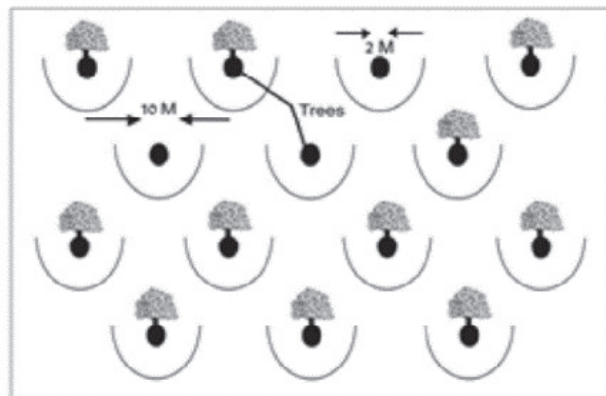


Figure 12.3: Half-moon shaped micro-catchment

Pitcher irrigation: It is probably the poor farmers drip irrigation, but less expensive to install. The pitchers are the round earthen containers used in rural areas for water storage, ranging from 10 to 20 liters in capacity. This is a highly efficient traditional method in which unglazed porous earthen pots containing water are buried under the soil to provide controlled irrigation to plants. Water slowly moves out through the wall to meet the plant's water requirement. In certain cases, pitcher irrigation may outperform drip irrigation in Water Use Efficiency (WUE). This kind of irrigation is ideal for establishing orchards for saplings, promoting deep root growth and to supply water at critical stages of

crops during drought. Soluble fertilizers can also be mixed with water and applied through the pitcher as fertigation. It can also permit sustained use of saline irrigation water.

Drip irrigation and fertigation: Irrigation to mango crop is still under controversial situation in India. Generally, it is taken for granted that mango tree does not require an irrigation and can survive on rainfall (700 to 800 mm during June to September). However, irrigation to mango orchards has shown the beneficial effect that the tree bears fruits earlier *i.e.*, 6 year onwards the number of fruits and fruit size is increased. Similarly the effective fertigation programme of giving NPK nutrition becomes easier through drip irrigation. Management of drip irrigation is of prime importance in mango orchards. In drip irrigation, the drippers operate at a slow rate; usually the discharge matches the soil infiltration rate which neither allows surface flooding nor the runoff, making water losses minimal. Fertilizers and nutrients are also applied through this system and their losses made minimal by localized application and reduced percolation.

Manures and fertilizer application

Fertilizers may be applied in two split doses, one half immediately after the harvesting of fruits in June/ July and the other half in October, in both young and old orchards followed by irrigation if there are no rains. Foliar application of 3 per cent urea in sandy soils is recommended before flowering. Well decomposed farm-yard manure may be applied every year. For trench application of fertilizers, 400g. each of N and K₂O and 200g. of P₂O₅ per plant should be provided. Micro-nutrients may be applied as per the requirement in the form of foliar sprays.

Integrated Nutrient Management

The continuous use or excess supply of inorganic fertilizers as source of nutrient in imbalanced proportion is a problem, causing economic inefficiency, damage to the environment and in certain situations harm the trees themselves. INM involves maintenance or adjustment of tree nutrient supply to an optimum level for sustaining the desired fruit productivity.

Plant protection measures

Mango hoppers

First spray of carbaryl at the time of panicle emergence and second spray two weeks after first spray. Wettable sulphur @ 2 g/lit may be sprayed after spraying carbaryl to avoid mite resurgence. The mixture toxaphene with Sulphur (1:1) have been reported to be effective against pest. Neem oil 5 ml/lit of water can be mixed with any insecticides. Spray 3 per cent neem oil or neem seed kernel extracts 5 per cent

Red ant

Nests should be removed and destroyed mechanically or by spraying any of the contact insecticides. such as, Monocrotophos 2 ml/lit or DDPV 100 EC 1ml/lit

Powdery mildew

In order to control powdery mildew, three sprays of fungicides are recommended. The first spray comprising of wettable sulphur (0.2 per cent, *i.e.*, 2 g per litre of water) should be done when the panicles are 8-10 cm in size as a preventive spray.



Figure 12.4: Mango orchards in Mallampet village of Kotapally mandal



Figure 12.5: Leaf webbing by red ants

Way Forward

Recent efforts in doubling of agricultural production have been successful through intensification leading to increased yields per unit area. The potential for a further doubling in yields now attracts increasing attention and research. There is need to revitalize yield growth in a sustainable manner by reducing the inputs and using fewer resources. The current trend is to focus on ecological intensification, sustainable intensification and evergreen revolution. Constraints are bound to occur in the way including land and water, environmental degradation and climate change. A two way schematic representation of how we must approach the issue of enhancing the productivity and yield of mango without degrading the environment is presented in fig. 25 (Figure below). We must adopt sub optimal tree and soil management practices to enhance the productivity and income of the farmers. The challenge is how to apply good governance using existing agricultural sciences and technologies without affecting the needed advances in tree productivity and yield. In this direction we must focus on two main components. (i) the development of integrated soil orchard systems management, which will address key constraints in existing tree management and; (ii) look for new ways that offer higher yields but use less water, fertilizer or other inputs and insulate against drought, heat, submersion, and pests and diseases. Conservation horticulture holds the key. Efforts must be made to create awareness among mango farmers and popularize the concept of conservation horticulture to achieve the goal of enhanced mango productivity.

Application and extension of existing technologies

Mango is national fruit and deserves a nationwide attention to achieve the top position in the world to retain the title of national fruit and to help the farmers to make profit from mango orchards. Available evidence suggests that the yield gap between average farm yields and the experiments yield on research farms are derived from factors such as: (i) low profitability of mango production; (ii) limited access to new orchard technologies and; (iii) poor soil and orchard management by farmers. We must focus on a mission mode to adopt the available technologies of orchard management across the country to enhance the productivity, yield and profitability of mango orchards and achieving the goal of doubling the income of mango farmers (Figure 12.6)

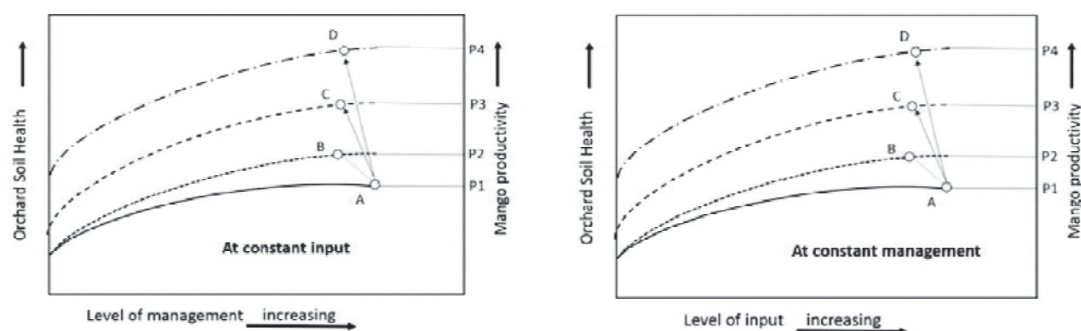


Figure 12.6: A two way schematic representation of approaches to enhance the productivity and yield of mango.

References

- Ali, S. M., Bai, K., Hanumantharaya, B. G., & Nagraj, K. H. (2017). Micro-catchment techniques: An effective water conservation practice in mango. *Int. J. Curr. Microbiol. App. Sci*, 6(5), 2965-2969
- Chand, R., Raju, S. S., & Pandey, L. M. (2008). Progress and potential of horticulture in India. *Indian Journal of Agricultural Economics*, 63(902-2016-67340).
- Ganeshamurthy A. N., Rupa T. R., & Shivananda T.N. (2018). Enhancing mango productivity through sustainable resource management. *J. Hortl. Sci*, 13(1), 1-31.
- Joshi, P. K., Gulati, A., Birthal, P. S., & Tewari, L. (2004). Agriculture diversification in South Asia: patterns, determinants and policy implications. *Economic and Political Weekly*, 2457-2467.
- Kumar, P., & Mitta, S. (1998). Market prospects for horticultural products in India. *Agricultural Economics Research Review*, 11(1), 35-47.
- NHB. (2017). Horticultural Statistics at a Glance 2017 Horticulture Statistics Division Department of Agriculture, Cooperation & Farmers Welfare Ministry of Agriculture & Farmers Welfare Government of India.
- Paroda, R. S., & Kumar, P. (2000). Food production and demand in South Asia. *Agricultural Economics Research Review*, 13(1), 1-24.
- Sharma, B. R., Gulati, A., Mohan, G., Manchanda, S., Ray, I., & Amarasinghe, U. (2018). Water productivity mapping of major Indian crops, Think-Asia, New Delhi, India.

KITCHEN GARDEN

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India may be the world's second largest producer of food, but it has its second largest undernourished population. Further, more than half of women in India suffer from anemia, which is one of the reasons for the high rate of low-birth weight babies. An unbalanced diet and lack of food is directly linked to high rates of stunting, excessive weight, and death in children lesser than five years of age (Bhatta, *et al.*, 2008; Birdi and Shah, 2016). The Government of India has implemented programmes for providing food security and ensuring access to adequate quantity of quality food. There is a need to look at multiple strategies to combat the issue of food security. Community and nutrition gardens can play an important role in enhancing national food security and dietary diversity to combat malnutrition. Fruits and vegetables from the kitchen gardens are good source of micro-nutrients especially in the poor households. Rural areas have ample space and establishing a kitchen garden is far simpler as farm families are involved in agriculture.

Nutrition gardens are a micro-solution and an affordable way of ensuring healthy food and balanced nutrition. Different studies on home gardens concludes it to be an effective and sustainable means of improving nutritional standards of low-income rural families through integrated household food production. Nutrition-gardening presents an innovative solution to ensure food security, employment of youth, and an alternative way to generate extra income in developing countries.

In Mancherial district is carved out of erstwhile Adilabad district most of the rural villages lot of space available for Nutrition gardens and some families are already involved in growing selected or few crops like maize, gourds and beans. They are using only native seeds and one season for *i.e.*, *kharif* for growing vegetables in the backyard.

There is lot of scope for diversification with different crops, seasons and improved seed for year around production (Table 13.1 and Figure 13.1).

Table 13.1: Crops suited for kitchen garden

Fruits	Vegetables	Spices	Medicinal plants	Flowers
Mango	Tomato	Chilli	Aloe	Rose
Banana	Brinjal	Turmeric	Mint	Marigold
Sapota	Chilli	Coriander	Basil	Jasmine
Guava	Onion	Fenugreek	Tulsi	Nerium
Papaya	Big onion	Ajwain		
Acid lime	Bhendi	Ginger		
Amla	Bitter gourd			
Pomegranate	Snake gourd			
Anona	Ribbed gourd			
	Bottle gourd			
	Amaranthus			
	Lab lab			
	Beetroot			
	Radish			
	Curry leaf			
	Moringa			
	Spinach			
	Cluster bean			
	Cowpea			
	Tapioca			
	Ash gourd			

Advantages of kitchen garden

- ▶ Supply fresh fruits and vegetables high in nutritive value
- ▶ Supply fruits and vegetables free from toxic chemicals
- ▶ Help to save expenditure on purchase of vegetables
- ▶ Vegetables harvested from home garden taste better than those purchased from market
- ▶ Effective utilization of kitchen waste water and kitchen waste materials
- ▶ Exercise to the body and mind

Site selection

- ▶ Backyard of house
- ▶ Preferably open areas with plenty of sunlight near the water source

Size and shape of vegetable garden depends on

- ▶ Availability of land
- ▶ Number of persons in family and
- ▶ Spare time available for its care
- ▶ Nearly five cents of land (200 m²) is sufficient to provide vegetables throughout year for a family consisting of five members
- ▶ A rectangular garden is preferred than a square plot or a long strip of land

Layout of kitchen garden

- ▶ Fence-barbed wire fence or live fence with agathi
- ▶ Perennial crops (Mango, Sapota, Acid lime, Amla, Morniga) should be planted at the peripheral areas of kitchen garden (avoid shading)
- ▶ One or two compost pits may be provided on one corner
- ▶ Fences on all sides should be trained with cucurbitaceous vegetables (Bottle gourd, Bitter gourd and Snake gourd)
- ▶ Some vegetables are direct sown-(Amaranthus, Bottle gourd, Bitter gourd and Snake gourd)
- ▶ Some vegetables are nursery transplanted (Tomato, Brinjal, Chillies and Onion)
- ▶ Divide the area into equal sized plots for raising annual vegetable crops
- ▶ As intensive and continuous cropping is done in a kitchen garden
- ▶ Fertility and texture of soil may be maintained by applying adequate quantities of organic manures frequently
- ▶ Ridges and furrows are formed in each plots
- ▶ Season of planting: June-July and September-October
- ▶ Bee-hive may be provided for ensuring adequate pollination of crops besides obtaining honey
- ▶ However, in order to harvest good crop, chemical fertilizers are also essential
- ▶ Pick and destroy the larvae found on fruits and vegetables and then spray Neem oil @ 4 ml/liter of water or Neem Seed Kernel Extract @ 3 per cent
- ▶ Avoid spraying of toxic chemicals



Figure 13.1: Kitchen garden in villages of Kotapally mandal, Mancherial district

References

- Bhatta, K. P., Ishida, A., Taniguchi, K., & Sharma, R. (2008). Does kitchen garden and backyard livestock farming help combat food insecurity-An example of Nepalese households. *Journal of Rural Economics, Special Issue*, 376-383.
- Birdi, T. J., & Shah, S. U. (2016). Implementing perennial kitchen garden model to improve diet diversity in Melghat, India. *Global Journal of Health Science*, 8(4), 10.

LIVESTOCK AND ANIMAL HUSBANDRY

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Livestock provides livelihood to two-third of rural community. It also provides employment to about 8.8 per cent of the population in India. India has vast livestock resources. Livestock sector contributes 4.11 per cent GDP and 25.6 per cent of total Agriculture GDP (Kumar *et al.*, 2018; Vanam and Lakshmi, 2020). The livestock is especially important for providing regular source of income through dairy animals, through sale of meat and chicken for small holder farmers (Ravichandran *et al.*, 2020; Kumar *et al.*, 2020). However, productivity of Indian livestock is somewhat less than that of the world average in milk and meat, *etc.* It might be due to low productive breeds, low quality sheds or feed and fodder (Balehegn *et al.*, 2020).

This chapter illustrates the population of various livestock by village, social group and land class category and strategies for increasing incomes from the livestock. On an average, only 50 per cent of the households own different types of livestock ranging from buffalo to poultry. About 47 per cent of the households have bullocks, 25 per cent have poultry, 23 per cent have local cows, 20 per cent have young cattle, 16 per cent have goats, 3 per cent have improved cows, 2 per cent have she-buffalo, about 1 per cent have sheep, 0.79 per cent have he-buffalo and only 0.2 per cent have pigs (Figure 14.1).

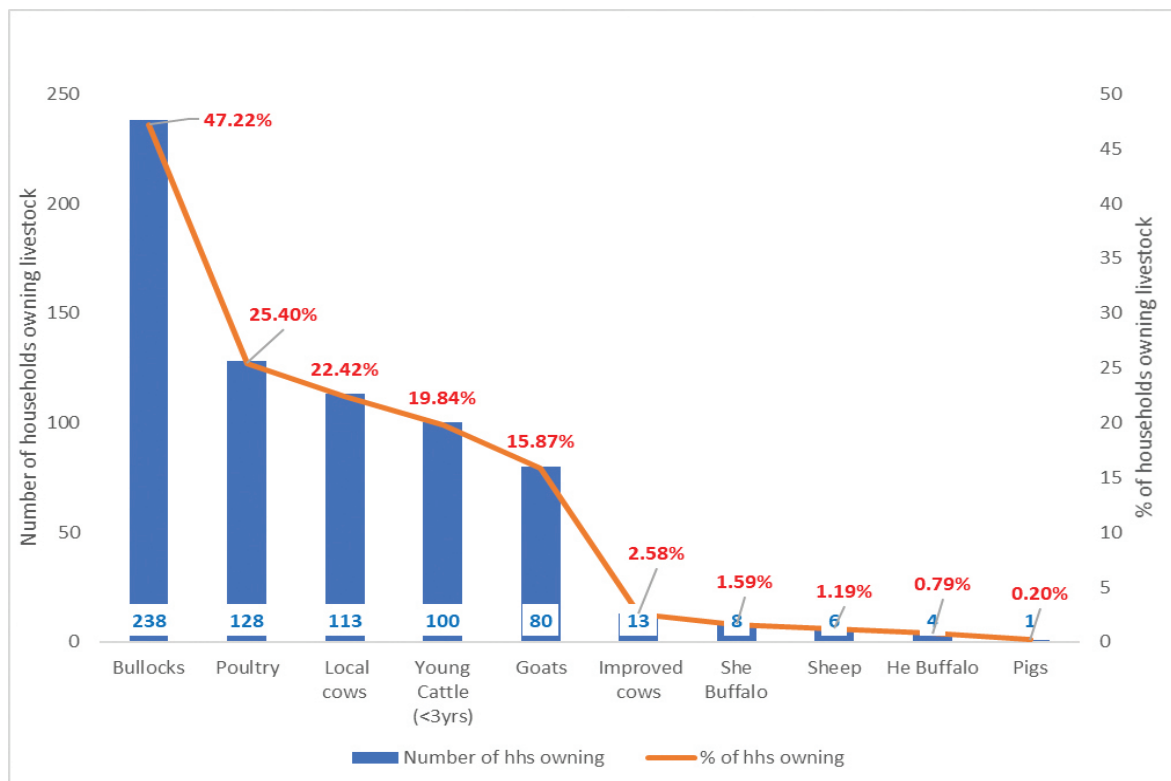


Figure 14.1: Ownership of different types of livestock (in three villages together)

Given that, only a few households have different types of livestock, in the following section, we are presenting analysis of only households having animals. Analysis excludes the households who don't have animals.

Figure 14.2 illustrates the various types of livestock and their value. On average, households (averages are calculated for households who have at least one animal in the respective category) in the study area owned about 8 sheep, 5 goats, 3 male buffalo, 1-2 female buffalo, 2 bullocks and cows, 1-2 cross breed cows and about 4 poultry. The livestock population in the villages are very diversified as they are used for multiple purpose as draught animals, milk, meat, eggs, *etc.* In terms of value, bullock comes first followed by female buffalo, goat, cross bred cows, sheep, local cows, male buffalo, young cattle, pigs and poultry. It indicates, in the villages still draught animals play an important role in cultivation, hence more number of bullocks.

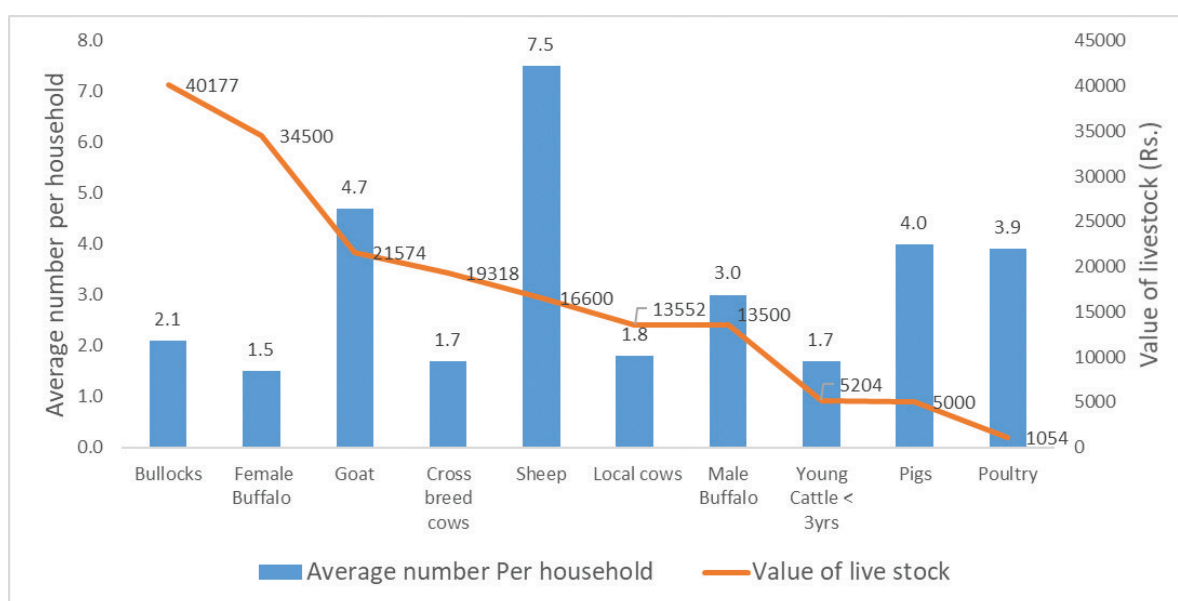


Figure 14.2: Average number of livestock per household and their value
(Averages are calculated for the households having at least one animal in the respective category)

Table 14.1 to 14.3 represents the livestock status in the study area by village, social group and landholding class. The tables show the per cent of households possessing different type of livestock and average number per household. On average, number of sheep are higher (about 7 to 8 per household), followed by goat (4-5), poultry (3-4), male-buffalo (3), bullock (about 2), local cow and cross bred cow (1-2), when we not take in to account households without livestock. Sheep rearing is done only in Mallampet and Nagampet villages by scheduled caste and backward caste group villagers. Pigs are reared by only one family who belongs to ST with marginal landholding in Nagampet village.

Table 14.1: Pattern of farm livestock holding by village

Livestock	Edagatta		Mallampet		Nagampet		All	
	(%) of hhs owning	Average per family (nos.)	(%) of hhs owning	Average per family (nos.)	(%) of hhs owning	Average per family (nos.)	(%) of hhs owning	Average per family (nos.)
Bullocks	46.7	2.0	46.2	2.1	48.1	2.0	47.2	2.1
Male buffalo	1.0	4.0	0.0		1.2	2.7	0.8	3.0
Female buffalo	1.0	2.0	4.5	1.4	0.0		1.6	1.5
Local cows	31.4	1.7	18.6	1.9	21.0	1.8	22.4	1.8
Crossbred cows	5.7	1.5	0.6	2.0	2.5	1.8	2.6	1.7
Young cattle < 3 years	21.9	1.7	19.9	1.8	18.9	1.5	19.8	1.7
Goat	12.4	4.8	9.0	6.1	21.8	4.2	15.9	4.7
Sheep	0.0		1.3	5.5	1.6	8.5	1.2	7.5
Pigs	0.0		0.0		0.4	4.0	0.2	4.0
Poultry	30.5	3.9	25.6	3.4	23.0	4.2	25.4	3.9

Note: Averages are calculated for the households having at least one animal in the respective category

A minimum of two bullocks are being reared by all the socio-economic groups costing an average of Rs. 40,000. Female buffaloes are being reared by SC, OBC and FC/OC household's in Edagatta and Mallampet villages. But the value of the breed reared by other caste group is almost double that of what the SC household's rear. Farmers of Edagatta and Nagampet village rear three male buffaloes by OBC household's only for breeding purpose. On average one to two bullocks are being raised by marginal, small, medium and large farmers, albeit, the value of those raised by large farmers is greater than others. In general, large farmers rear a greater number of bullocks and cows than small landholding farmers. Landless and marginal farmers are rearing a greater number of sheep and goat relative to their land size.

Table 14.2: Pattern of farm livestock holding among social groups

Livestock	SC		ST		OBC		FC/OC	
	(%) of hhs owning	Average per family	(%) of hhs owning	Average per family	(%) of hhs owning	Average per family	(%) of hhs owning	Average per family
Bullocks	53.2	2.1	20.7	2.0	32.0	1.9	100.0	2.0
Male buffalo	0.0		0.0		4.0	3.0	0.0	
Female buffalo	0.5	1.5	0.0		5.0	1.4	100.0	2.0
Local cows	23.0	1.9	24.1	1.9	20.0	1.5	0.0	
Cross bred cows	1.1	2.3	6.9	1.5	7.0	1.4	0.0	
Young cattle < 3yrs	22.5	1.8	10.3	1.0	13.0	1.2	0.0	
Goat	13.4	3.1	10.3	2.3	27.0	7.8	0.0	
Sheep	0.8	1.7	0.0		3.0	13.3	0.0	
Pigs	0.0		3.4	4.0	0.0		0.0	
Poultry	24.1	3.5	20.7	4.3	32.0	4.8	0.0	

Note: Averages are calculated for the households having at least one animal in the respective category

Table 14.3: Pattern of farm livestock holding among land size category

Livestock type	Landless		Marginal		Small		Medium		Large	
	(%) of hhs owning	Average per family	(%) of hhs owning	Average per family	(%) of hhs owning	Average per family	(%) of hhs owning	Average per family	(%) of hhs owning	Average per family
Bullocks	27.4	1.9	35.4	2.0	49.2	2.1	55.0	2.1	79.7	2.2
Male buffalo	0.9	4.0	2.5	4.5	0.0		0.8	5.0	0.0	
Female buffalo	0.9	1.0	2.5	1.5	0.0		1.6	1.5	5.1	1.7
Local cows	11.5	1.5	16.5	1.2	30.6	1.8	24.8	2.0	28.8	2.1
Improved cows	0.9	1.0	2.5	1.5	1.6	1.0	4.7	2.0	3.4	2.0
Young cattle < 3yrs	10.6	1.2	16.5	1.1	25.8	1.6	18.6	1.7	32.2	2.4
Goats	13.3	4.9	17.7	4.1	16.9	4.5	15.5	5.4	16.9	3.9
Sheep	0.9	2.0	2.5	1.5	0.0		1.6	15.0	1.7	10.0
Pigs	0.9	4.0	0.0		0.0		0.0		0.0	
Poultry	15.0	4.6	17.7	4.4	34.7	3.1	23.3	4.5	40.7	3.6

Note: Averages are calculated for the households having at least one animal in the respective category

It is evident that mixed farming is being practiced across the land class groups, as goats, poultry, dairy and even the young cattle are being raised by marginal, small, medium and large farmers. Poultry, goats and dairy farming is being taken up by the scheduled caste, scheduled tribe and backward caste family households. Value of goats, poultry birds and crossbred cows reared by the other-backward caste are priced higher than those of the scheduled caste and scheduled tribe. Although the count of livestock is lower in case of large farmers as compared to others, they rear a greater number of large animals like bullocks and cows and also cross bred cows. Goat farming is being taken up by the scheduled caste, scheduled tribe and backward caste population of all the three village farmers across the land classes.

The major problem in livestock rearing is the majority are local bred with low yield potential (Figures 14.3 to 14.5). It is proposed that the improved breeds of goats and sheep as well as poultry to be distributed under the SCSP along with distribution of seeds of improved fodder varieties for yearlong availability of fodder.



Figure 14.3: Backyard poultry production



Figure 14.4: Poultry production at home



Figure 14.5: Indigenous cattle kept on local resources

References

- Balehgn, M., Duncan, A., Tolera, A., Ayantunde, A. A., Issa, S., Karimou, M., & Adesogan, A. T. (2020). Improving adoption of technologies and interventions for increasing supply of quality livestock feed in low-and middle-income countries. *Global Food Security*, 26, 100372.
- Kumar, A., Saroj, S., Joshi, P. K., & Takeshima, H. (2018). Does cooperative membership improve household welfare? Evidence from a panel data analysis of smallholder dairy farmers in Bihar, India. *Food Policy*, 75, 24-36.
- Kumar, S., Mishra, A. K., Pramanik, S., Mamidanna, S., & Whitbread, A. (2020). Climate risk, vulnerability and resilience: Supporting livelihood of smallholders in semiarid India. *Land Use Policy*, 97, 104729.
- Ravichandran, T., Teufel, N., Capezzone, F., Birner, R., & Duncan, A. J. (2020). Stimulating smallholder dairy market and livestock feed improvements through local innovation platforms in the Himalayan foothills of India. *Food Policy*, 95, 101949.
- Vanan, T. T., & Lakshmi, D. D. (2020). Sustainable livestock management systems for Indian rural livelihood: Mitigation of climate change. In *Global Climate Change: Resilient and Smart Agriculture*. Springer, Singapore, 187-198.

TECHNOLOGY ADOPTION PATTERN

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Technological adoption is driving force for increasing agricultural production, productivity and farm incomes (Kassie *et al.*, 2011). Farmers are also looking to new technologies as a way to reduce cost of cultivation (Subramanian and Qaim, 2009). Technological adoption also will have wider area wise impacts in terms of better livelihoods opportunities, increased wage employment and food and nutritional security (Ward and Singh, 2015). In this chapter, we have examined the overall adoption level of technology in terms of improved seed, fertilizer consumption per unit area, use of micro-nutrients and pesticides and also irrigation application. Since, we have covered crop wise data in earlier chapter, in this chapter we have taken farm holding as a unit and examined overall adoption of these technologies rather than crop wise. It gives overall indication of adoption rate of different technologies on a broader scale in areas, among different social groups of farmers and also land-class wise.

A) Technology adoption in crop cultivation

Adoption of technology in terms of use and quantity of different types of inputs like fertilizers in the crops per unit area in the sample villages were examined village wise, social group and also land-class are presented in Table 15.1 and Figure 15.3 and 15.4. In the sample villages, average seed sown per acre is 2 bags/acre. Generally, the recommended dose is only one bag, but farmers are using two bags. Farmers of the village on average use 2.9 bags of Urea, 2.3 bags of DAP and 1.8 bags of MoP/complex fertilizers. On average, they use about one cart of FYM, less than one packet of micro-nutrients per acre. On average, they apply irrigation about two times and pesticides about 3 times per crop season. There is no significant difference among the villages, except that in Edagatta use of Urea, complex fertilizers and pesticides are higher might be due to a more number of irrigations given to crops (Figure 15.1), which will provide suitable conditions to use more inputs. Being remote, the farm mechanization and labour availability was good enough to meet peak season demands for cotton picking, *etc.*

Table 15.1: Technology adoption in crops by village (overall)

Village	Edagatta	Mallampet	Nagampet	All
Seed (bag/acre)	1.9	2.2	1.9	2.0
Urea (bags/acre)	3.2	3.2	2.7	2.9
DAP (bags/acre)	1.3	2.5	2.5	2.3
MoP/Complex fertilizers (bags/acre)	2.3	1.6	1.7	1.8
FYM (carts/acre)	0.1	0.6	1.6	1.0
Micronutrient (packets/acre)	0.0	0.5	1.5	0.8
Irrigation (nos)	5.3	1.4	1.2	2.1
Pesticides (nos)	3.7	2.8	2.5	2.9

Note: The recommended dose of seed rate is one bag/acre for both cotton and paddy. One cotton seed bag contains 450 gm in case of hybrids and 3 kg in case of varieties, while paddy seed bag contains 10 kg. Generally, one bag is recommended per one acre in both cotton and paddy case. 1 bag Urea contains 45 kg, 1 bag DAP and MoP/complex fertilizers contain 50 kg each.



Figure 15.1: Monitoring of the ground water in a horticultural garden

SC farmers are using more of Urea and DAP, but less of the MoP/complex fertilizers, FYM, micro-nutrients and number of irrigations compared to other social groups. The use of more Urea and DAP and less of MoP/complex and micro-nutrients may be an indication of traditional cultivation and inertia to use new and modern inputs. This inertia to change to modern inputs and varieties among socially backward farmers is observed in many earlier studies (Gupta *et al.*, 2020).

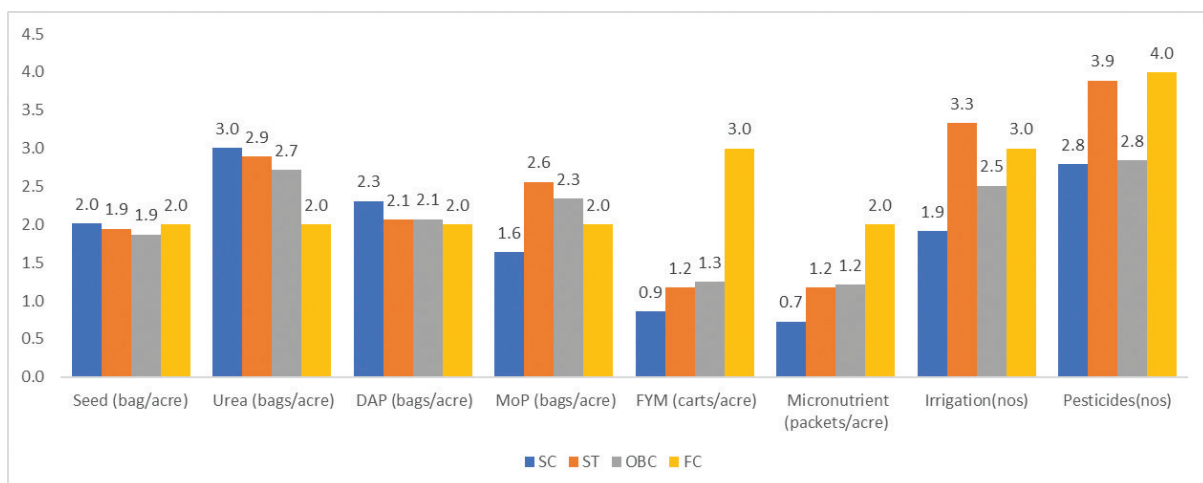


Figure 15.2: Technology adoption in crop cultivation by social group (all crops)

Unlike social groups, technology adoption rate is having strong positive relationship with landholding size up to medium landholding size, there after there was slight decline for large landholders, especially in adoption of Urea, DAP and MoP/complex fertilizers. It shows that, marginal and small holders don't have enough purchasing power to purchase these inputs, hence there is a need for modifications.

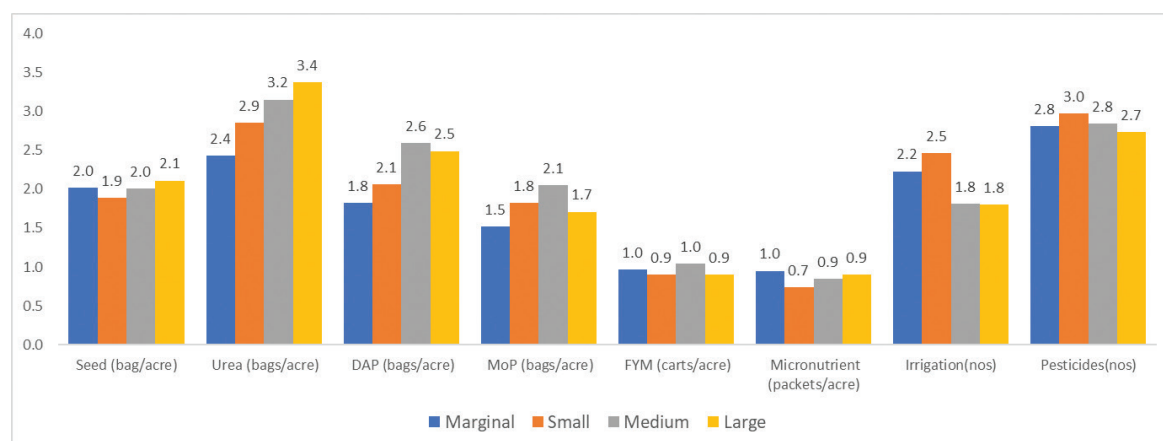


Figure 15.3: Use of farm inputs by farm size (all crops)

B) Technology adoption in Livestock Production Management (LPM)

On average, about 50 per cent of the households own different types of livestock. About 47 per cent of the households have bullocks, 25 per cent have poultry, 23 per cent have local cows, 20 per cent have young cattle, 16 per cent have goats, 3 per cent have improved cows, 2 per cent have she-buffalo, about 1 per cent have sheep, he-buffalo and only 0.2 per cent have pigs. Whereas, on average, 14.5 per cent of the households in villages are keeping their livestock in sheds and vaccination to the animals was carried out by only 11 per cent of the households. Technology adoption in livestock rearing by the households is highest in Mallampet village with vaccination at 32 per cent, where as in Nagamepet and Edagatta vaccination rate is very poor.

Access to vaccination was again in direct positive relationship with landholding size (Figure 15.4) with very low vaccination by landless (4 per cent of households done vaccination for their animals) and highest among large households with 22 per cent of the households. Interestingly vaccination rates for animals are significantly better among SC households than ST households. Only a few are using concentrate mixture for their livestock, low use of concentrate feed is the greatest hindrance in improving productivity of animals. Artificial insemination is not at all practiced in the sample villages which are also reflected in dominance of local breeds with low milk yielding capacity.

C) Animal shelter management

Overall, only 15 per cent of the households are having livestock sheds. A significant number of large farmers have animal shelters, while the majority of small farmers don't. It indicates the majority of the households keep their animals in open places or under the trees. Scientifically constructed livestock shelters are very important to manage micro-climate for the animal's health, comfort and convenience. The properly constructed animal shelters are also easy to maintain and clean, reduce drudgery for farm workers. Hence the study team identified animal shelter construction and management is one of the interventions for improving animal health and productivity in the study villages.

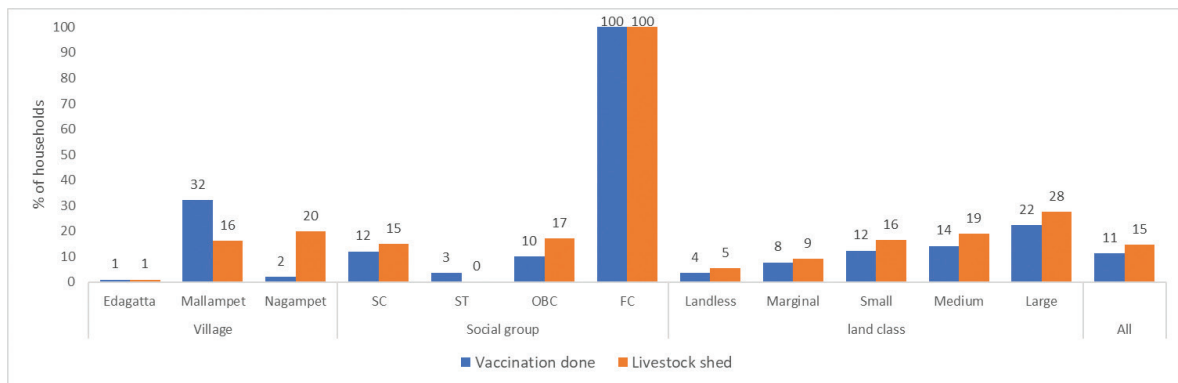


Figure 15.4: Percentage of household's in technology adoption in livestock

Overall, adoption level of technologies was on higher side for crop cultivation, with saturation in adoption of improved variety seed, fertilizer and pesticides uses. However, they are using more of nitrogenous fertilizers and less of potash and other micro-nutrients. Although, there is good animal population, use of FYM is also very limited. In case of livestock, they are still practicing age old animal husbandry practices. They rear mostly local breeds with low milk yielding capacity (Basunathe *et al.*, 2010). The vaccination rate has recently increased, only a few are using concentrate feed mixtures to feed animals, a few are having separate shed for animals. There is a need of increasing vaccination, use of concentrates artificial insemination to increase productivity of livestock (Rathod *et al.*, 2017).

References

- Basunathe, V. K., Sawarkar, S. W., & Sasidhar, P. V. K. (2010). Adoption of dairy production technologies and implications for dairy development in India. *Outlook on Agriculture*, 39(2), 134-140.
- Gupta, I., Veetil, P. C., & Speelman, S. (2020). Caste, social networks and variety adoption. *Journal of South Asian Development*, 15(2), 155-183.
- Kassie, M., Shiferaw, B., & Muricho, G. (2011). Agricultural technology, crop income, and poverty alleviation in Uganda. *World Development*, 39(10), 1784-1795.
- Rathod, P., Chander, M., & Sharma G, C. (2017). Adoption status of artificial insemination in Indian dairy sector: Application of multinomial logit model. *Journal of Applied Animal Research*, 45(1), 442-446.
- Subramanian, A., & Qaim, M. (2009). Village-wide effects of agricultural biotechnology: the case of Bt cotton in India. *World Development*, 37(1), 256-267.
- Ward, P. S., & Singh, V. (2015). Using field experiments to elicit risk and ambiguity preferences: Behavioural factors and the adoption of new agricultural technologies in rural India. *The Journal of Development Studies*, 51(6), 707-724.

CREDIT UTILIZATION PATTERN

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Majority of the Indian farmers are small and marginal and lack of necessary capital to invest in agriculture (Reddy, 2012; Kumar, 2013; Ramprasad, 2019). Hence, availability of credit at low interest rates are crucial for adoption of various inputs and also to meet daily consumption needs. The availability of credit determines input use pattern, technology adoption, investments in land development, cost of cultivation and farm incomes (Cole, 2009; Reddy *et al.*, 2020; Reddy *et al.*, 2021). In general farmers first preference is formal sources like commercial banks, Regional Rural banks (RRBs), cooperatives, then from the semi-formal institutions like Self-Help Groups (SHGs) and last preference is informal sources like friends and family, traders, input dealers and moneylenders as they charge higher interest rates. Since years, farmers have been taking credit from different sources as they are unable to get optimum income from the agricultural activities. The credit behavior of the households by village, social group and land class are discussed in this chapter.

Figure 16.1 presents the per cent of household's accessed credit during the study year. About 86 per cent of household's have taken credit atleast from any one source. Share of households who accessed credit is low in Mallampet (79 per cent of household's) and highest in Nagampet (90 per cent), access to credit is higher among OBC household's (91 per cent), while less among ST household's (72 per cent) and among SC household's it was 86 per cent. Access to credit was lower at 73 per cent among landless and marginal farmers (84 per cent) than small farmers (93 per cent). Overall, the Figures indicated that SC/ST household's and landless labour had less access to credit compared to other household's.

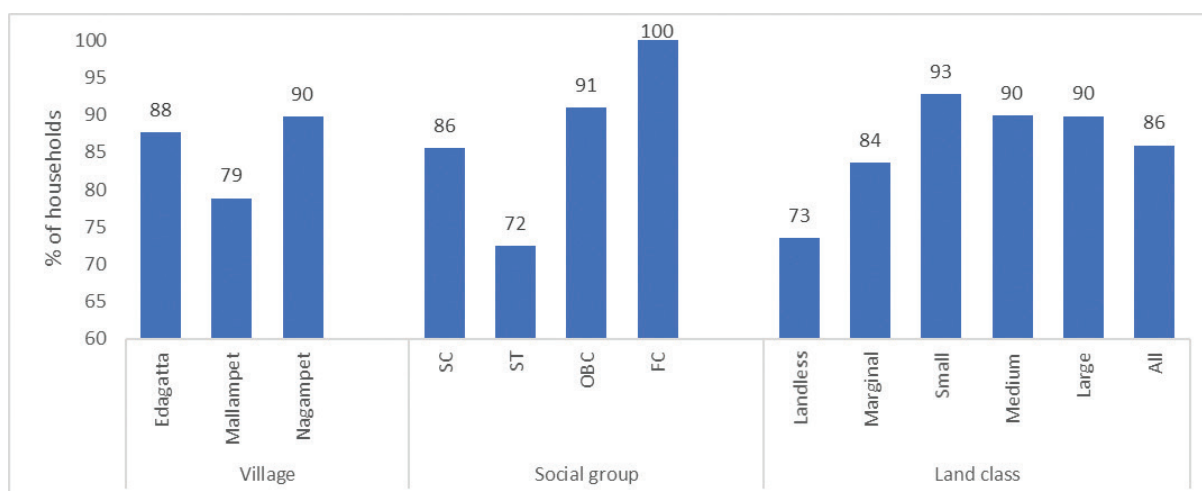


Figure 16.1: Percentage of household's access to credit by village, social group and land class

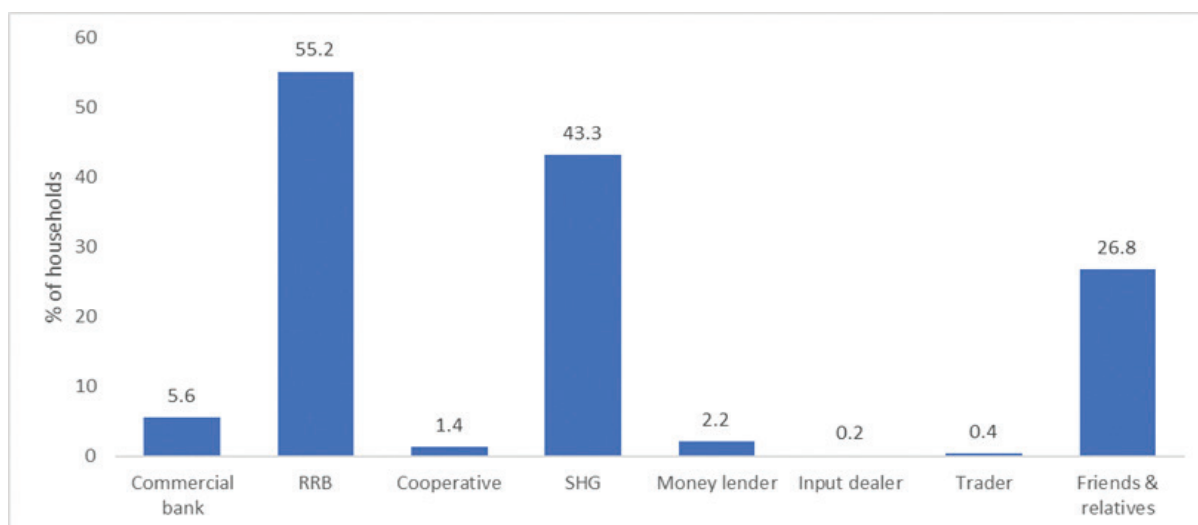


Figure 16.2: Sources of finance in the study villages

Figure 16.2, indicates sources of credit and the main source of credit in the villages are RRBs (55.2 per cent of the household's accessed credit) followed by SHGs (43.3 per cent) and friends and relatives (26.8 per cent). Access from commercial banks, cooperatives, moneylenders, input dealers and traders are very less. Overall, the findings indicate that farmers are accessing credit from low interest charging sources like RRBs, SHGs and friends and relatives compared to higher interest charging sources like moneylenders (Figure 16.2 and 16.3).

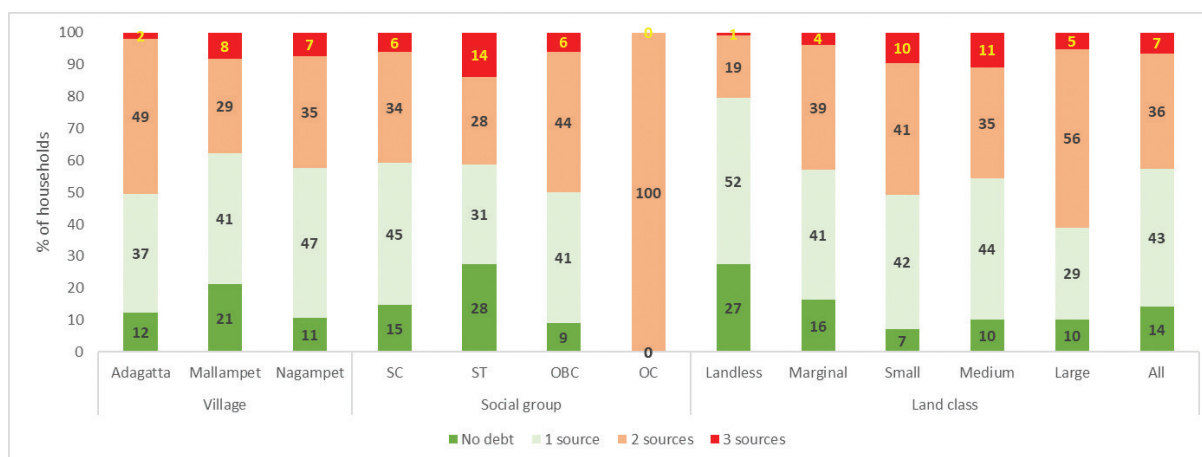


Figure 16.3: Number of sources of credit taken by household's by village, social group and land class

Taking credit from multiple sources is increasing, because they may not be getting the required amount from single source. Although only 86 per cent of household's have access to credit some are having access to credit from 2-3 sources. Figure 16.3 presents number of sources from which farmers accessed credit. Overall, 43 per cent accessed credit from single source, while 36 per cent accessed from 2 sources and 7 per cent accessed from 3 sources. About 14 per cent ST household's, 10 per cent of small and 11 per cent of medium size landholding category farmers accessed credit from three sources. 52 per cent of landless, 44 per cent medium and 42 per cent small landholding farmers accessed credit from two sources. Overall, the data indicate that taking loans from multiple sources are problem for small and

medium farmers as well as ST household's for others problem is not serious.

Table 16.1 presents different sources of credit by village, social group and land class. Overall, 55 per cent household's have accessed credit through RRBs, 43 per cent from SHGs, 27 per cent from friends and relatives, 6 per cent from commercial banks and very few are taken from cooperatives and money lenders. Among villages, in Edagatta RRBs and SHGs are dominant sources, friends and relatives also played important role in Nagampet and Mallampet. Commercial bank is major source in Mallampet especially for SC farmers and also to medium and large farmers. So, commercial banks are playing major role in disbursing credit to SC farmers under priority sector credit target, especially to meet the needs of agricultural investments.

Table 16.1: Source of credit (percentage of household's who taken credit from different agencies by village, social group and land class)

Category		Commercial bank	RRB	Cooperative	SHG	Money lender	Input dealer	Trader	Friends & relatives	All
Village	Edagatta	0	71	0	67	2	0	0	0	100 (105)
	Mallampet	15	42	1	46	4	0	1	16	100 (156)
	Nagampet	2	57	2	31	1	0	0	45	100 (243)
Social group	SC	7	53	2	41	3	0	1	26	100 (374)
	ST	0	45	0	59	0	0	0	24	100 (29)
	OBC	0	66	1	47	1	0	0	32	100 (100)
	OC	0	100	0	100	0	0	0	0	100 (1)
Land class	Landless	0	14	0	45	2	0	0	33	100 (113)
	Marginal	1	53	1	52	3	1	0	19	100 (79)
	Small	6	72	2	42	3	0	1	27	100 (124)
	Medium	9	69	2	37	2	0	1	27	100 (129)
	Large	12	71	2	44	2	0	0	25	100 (59)
	Total	6	55	1	43	2	0	0	27	100 (504)

The Figures 16.4 to 16.6 shows the average outstanding credit among household's who have taken loans from different sources by village, social group and land class. The average outstanding credit was highest at Rs.1,47,000 from money lenders in Nagampet, followed by Rs.1,27,000 from friends and relatives again from Nagampet, Rs.1,11,000 from RRBs in Edagatta. Generally, loans from cooperatives and SHGs are for smaller amounts between Rs.10,000 to Rs.60,000, whereas, from commercial banks, RRBs, moneylenders and relatives are for larger amounts. Despite of having a high rate of interest the money lenders remain a significant source of credit in all the three villages. It is also noted that, although being a formal institution, the reach of cooperative societies and the commercial banks are very less, which needs to be increased as they charge very less interest rates and also don't follow extortion methods for repayments. Many farmers are feeling that formal institutions are more of procedure bound and more delay and less of customer friendly orientation, ask for many details and security, which may force the farmers to rely on the informal money lenders even at higher interest rates. In our focus group discussions, women expressed that SHG's loans are life line for livelihoods and small businesses for women (Figure 16.7).

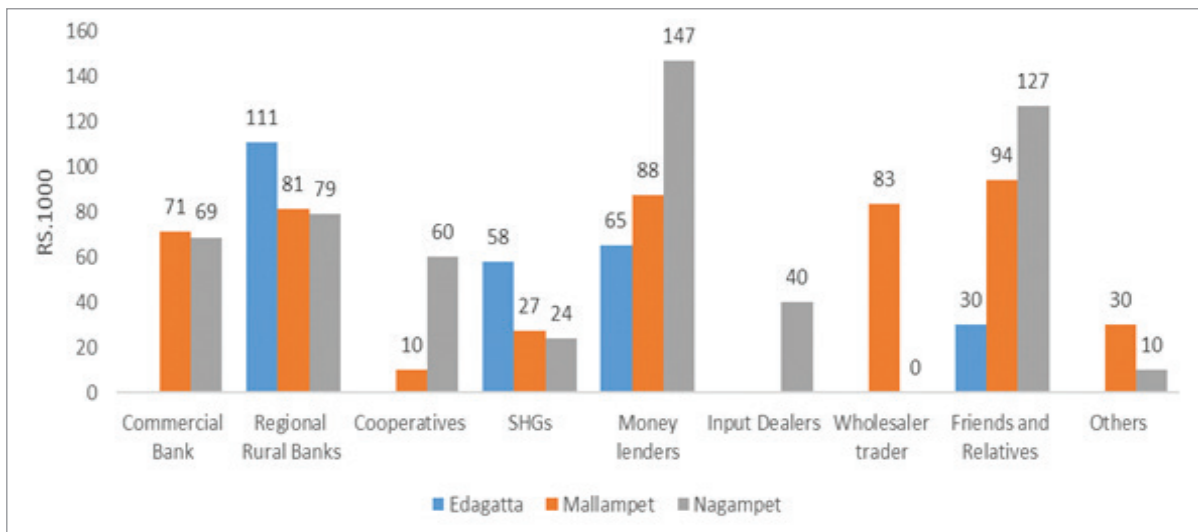


Figure 16.4: Outstanding credit of the household's by village

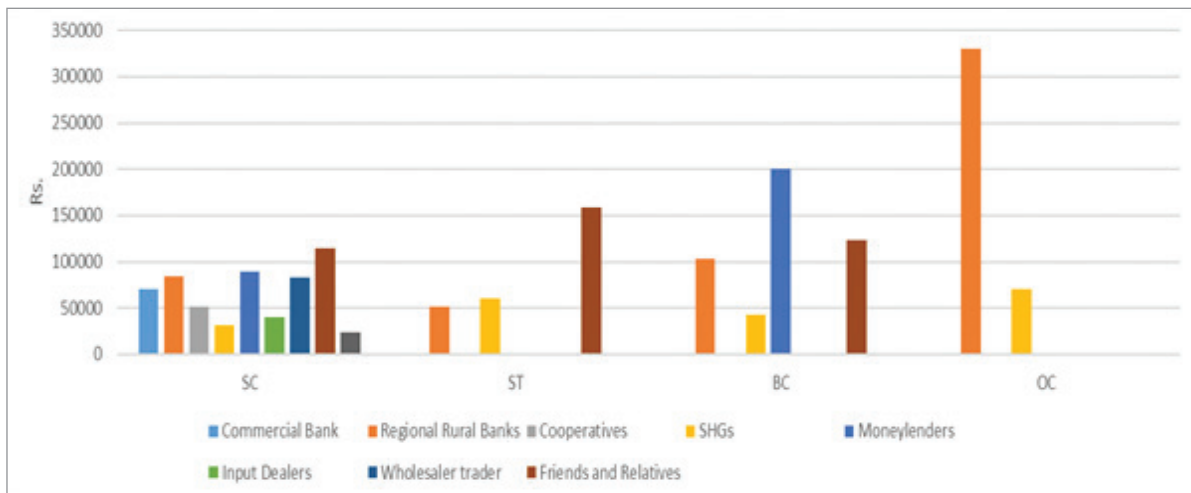


Figure 16.5: Source and amount of credit of the household's by social group

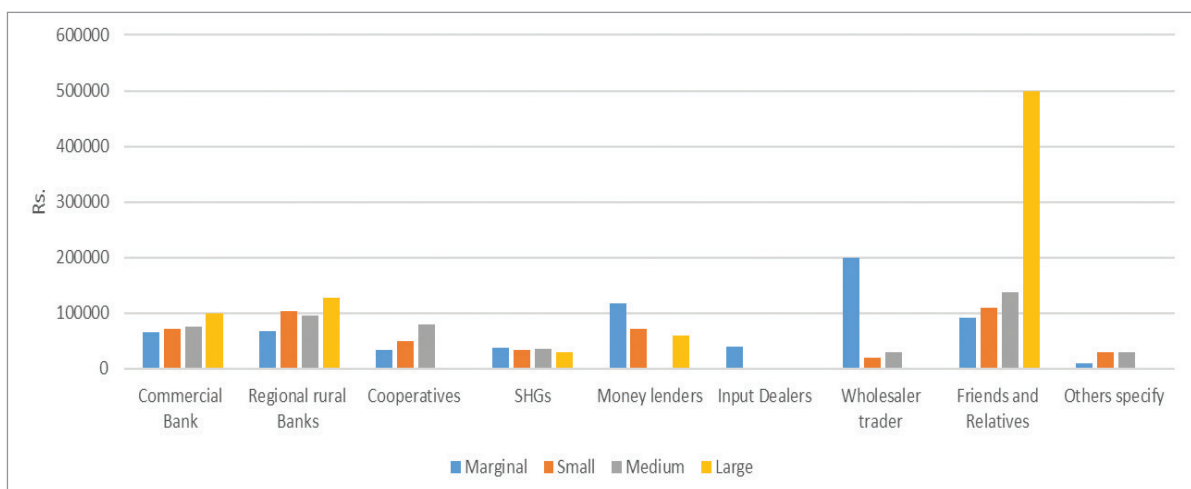


Figure 16.6: Outstanding credit of the household's by land class category



Figure 16.7: Interaction with SHG's

References

- Cole, S. (2009). Fixing market failures or fixing elections? Agricultural credit in India. *American Economic Journal: Applied Economics*, 1(1), 219-50.
- Kumar, S. M. (2013). Does access to formal agricultural credit depend on caste?. *World Development*, 43, 315-328.
- Ramprasad, V. (2019). Debt and vulnerability: Indebtedness, institutions and smallholder agriculture in South India. *The Journal of Peasant Studies*, 46(6), 1286-1307.
- Reddy, A. A. (2012). Structure of Indebtedness of households in semi-arid tropics of India. *Agricultural Economics Research Review*, 25, 473-483.
- Reddy, A. A., Raju S.S., & Bose, A. (2020). Farmers' income, indebtedness and agrarian distress in India. *The Microfinance Review*, XII(1), 20-38.
- Reddy, A. A., Bhattacharya A., Reddy, S. V., & Ricart, S. (2021). Farmers' distress index: An approach for an action plan to reduce vulnerability in the drylands of India, land 10(11), 1236. <https://doi.org/10.3390/land10111236>

INSURANCE COVERAGE OF THE HOUSEHOLDS

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Agriculture is a highly risky economic activity because of its heavy dependence on weather conditions which underscores the need for insurance (Reddy, 2004; Suresh *et al.*, 2017). Insurance is not only an investment to increase income; it also helps to cope with the risk and improving standard of living of agricultural livelihood (Gulati *et al.*, 2018; Aditya *et al.*, 2018). But the close look of the data in the Figures 17.1 to 17.3 revealed the fact that most of the household's are deprived of accessing any of the crop or weather insurance.

The crop insurance scheme is not even reaching the 'FC/OC' group and large farmers unless it was compulsory and linked to crop loans. But it was also noticed in the village wise comparison that there is a better coverage of insurance in Edagatta village compared to other villages.

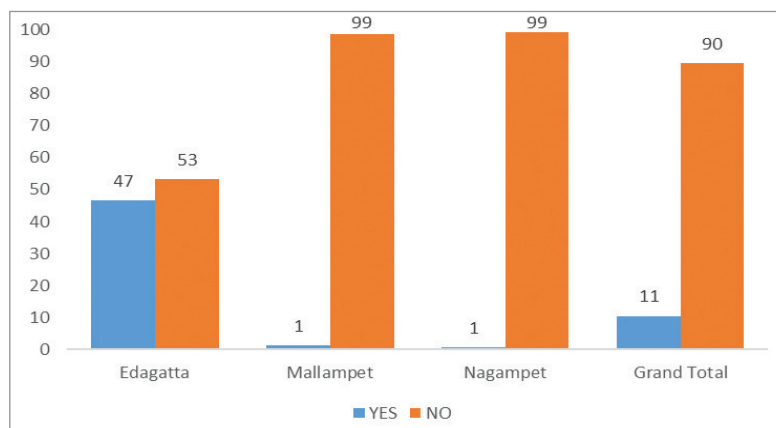


Figure 17.1: Crop insurance by village (Percentage)

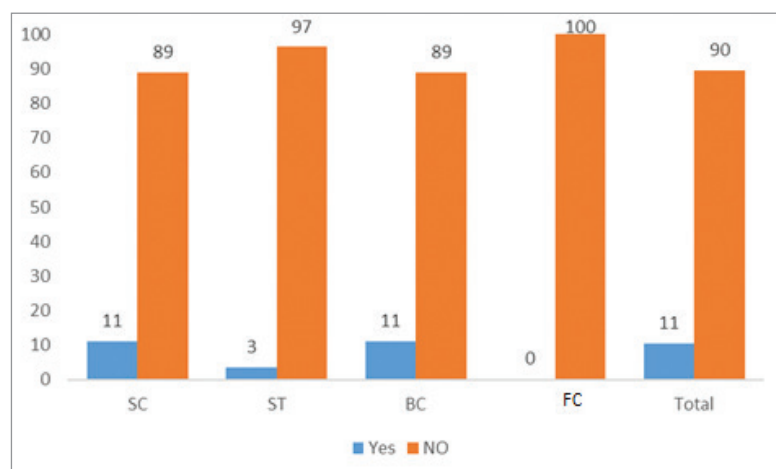


Figure 17.2: Crop insurance by social group

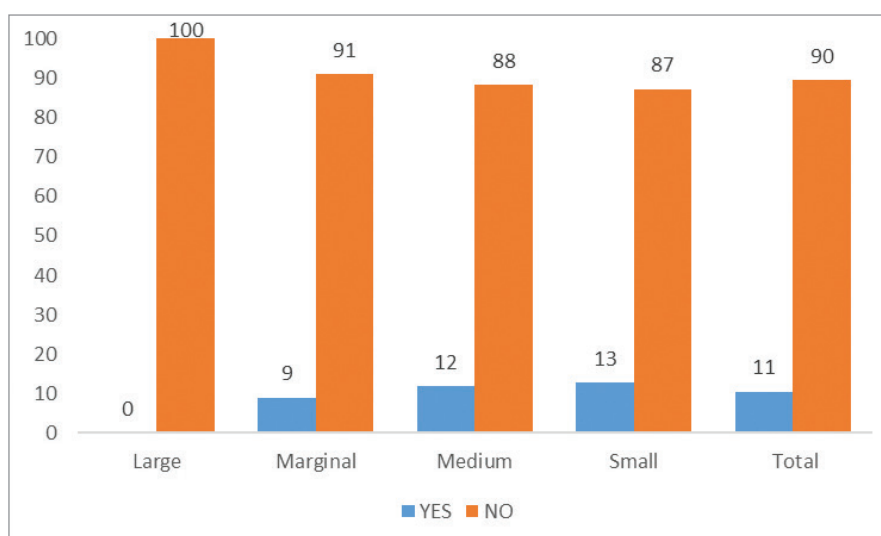


Figure 17.3: Crop insurance by land size class category

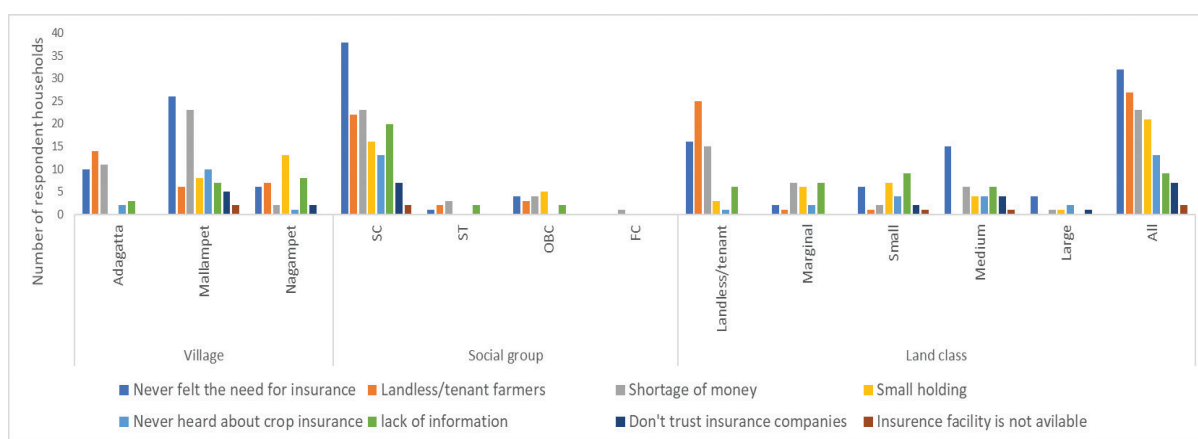


Figure 17.4: Percentage of household's citing reason for not taking insurance

A majority of the sample household's of the three villages across the socio-economic groups have quoted that the reasons for not opting to crop insurance is, they never felt the need for insurance as they are not aware of the crop insurance product (Figure 17.4). The next major reason is as they are tenant farmers, they are not able to take crop insurance as they don't have necessary documents, some farmers expressed that they don't have money to pay premium during the sowing season as they have to purchase other urgent inputs like seed and fertilizer, some of the farmers expressed that their holdings are too small to take crop insurance and benefit from it, some farmers also expressed that they never heard about crop insurance, insurance facility is not available and due to lack necessary information. Some farmers expressed that they don't trust private company who issue policies at the village. It is important to note that despite the overarching central schemes for crop insurance, 17 per cent of Mallampet villagers, 8.3 per cent of scheduled caste and 5 to 10 per cent of small, medium and marginal farmers don't feel the need for crop insurance. The above results indicate that the main reason for not taking crop insurance is lack of awareness, eligibility and lack of money for payment of premium.

References

- Aditya, K. S., Khan, T., & Kishore, A. (2018). Adoption of crop insurance and impact: insights from India. *Agricultural Economics Research Review*, 31(2), 163-174.
- Ashok, G., Prerna, T., & Siraj Hussain. (2018). Crop insurance in India: Key Issues and Way Forward. © Indian Council for Research on International Economic Relations. <http://hdl.handle.net/11540/8052>.
- Reddy, A. A. (2004). Agricultural insurance in India-A perspective. In *6th Global Conference of Actuaries*, New Delhi. http://www.actuariesindia.org/downloads/gcadata/6th%20GCA/pdf/Agricultural%20Insurance%20In%20India%20_A%20Perspective.pdf
- Suresh, A., Praveen, K. V., Reddy, A. A., & Singh, D. R. (2017). Risks in rainfed agriculture and farmers' adaptation practices: A case of cotton farmers of Maharashtra. *Indian Journal of Agricultural Economics*, 72(3), 362-274.

FOOD AND NUTRITION SECURITY

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Food security

Food security historically referred to the overall regional, national, or even global food supply and shortfalls in supply compared to requirements. But, with increased observation of insufficient food intake by certain groups (despite overall adequacy of food supply), the term has more recently been applied mostly at a community, local, household or individual level (Weingärtner, 2009). Further, the term has been broadened beyond notions of food supply to include elements of access, vulnerability, and sustainability (Chambers 1989; Reddy, 2016).

According to a currently accepted definition (FAO 2000), ‘Food Security’ is achieved when it is ensured that “all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life”. Food is here defined as any substance that people eat and drink to maintain life and growth. As a result, safe and clean water is an essential part of food commodities.

The nutrition focus adds the aspects of caring practices and health services and healthy environments to this definition and concept. This aims at what is more precisely called ‘Nutrition Security’, which can be defined as adequate nutritional status in terms of protein, energy, vitamins, and minerals for all household members at all times (Quisumbing 1995).

Now, after incorporating nutrition aspects “Food and nutrition security is achieved, if adequate food (quantity, quality, safety, socio-cultural acceptability) is available and accessible for and satisfactorily used and utilized by all individuals at all times to live a healthy and active life.” This definition combines Food and Nutrition Security (FNS) and emphasizes several aspects, *i.e.*, ‘Availability’, ‘Accessibility’, and ‘Use and Utilization’ of food. The inclusion of the use and utilization aspect underscores the fact that ‘Nutrition Security’ is more than ‘Food Security.’

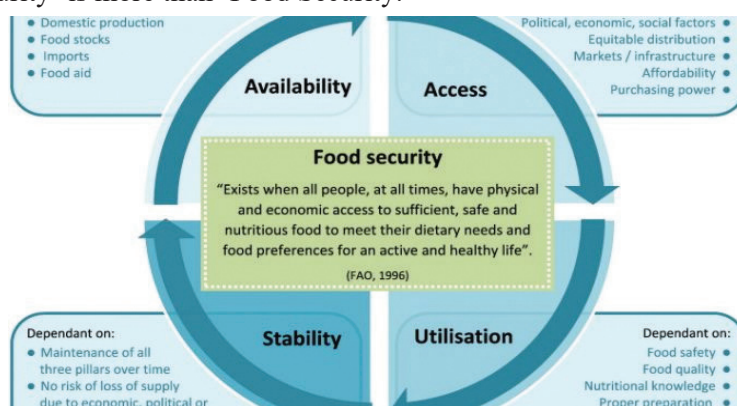


Figure 18.1: Conceptual framework for food security

Source: FAO (1996)

Aspects of Food and nutrition security

The conceptual framework of food security Figure 18.1, illustrates the relationship among the various elements of food security. Two factors influence the framework: a physical and a temporal factor. The physical determinant is the food flow: Availability, Accessibility, Use and Utilization. The temporal determinant of FNS refers to stability, which affects all three physical elements.

In this context **availability** refers to the physical existence of food, be it from own production or on the markets. On national level food availability is a combination of domestic food production, commercial food imports, food aid, and domestic food stocks, as well as the underlying determinants of each of these factors. Use of the term availability is often confusing, since it can refer to food supplies available at both the household level and at a more aggregate (regional or national) level. However, the term is applied most commonly in reference to food supplies at the regional or national level.

Access is ensured when all household's and all individuals within those household's have sufficient resources to obtain appropriate foods for a nutritious diet. It is dependent on the level of household resources-capital, labour, and knowledge and on prices. Note that adequate access can be achieved without households being self-sufficient in food production. More important is the ability of household's to generate sufficient income which, together with own production, can be used to meet food needs. Food access also is a function of the physical environment, social environment and policy environment which determine how effectively households are able to utilize their resources to meet their food security objectives. Drastic changes in these conditions, such as during periods of drought or social conflict, may seriously disrupt production strategies and threaten the food access of affected household's. To the extent that these shocks often lead to the loss of productive assets such as livestock, they also have severe implications for the future productive potential of household's and, therefore, their long-term food security.

Use of food refers to the socio-economic aspect of household food security. If sufficient and nutritious food is both available and accessible the household has to make decisions concerning what food is to be purchased, prepared and consumed (demanded) and how the food is allocated within the household. In household's where distribution is unequal, even if the measured aggregate access is sufficient, some individuals may suffer from food deficiency. The same is true if the composition of the consumed food is unbalanced. Another aspect is the social function that food can have in terms of community cohesion through offerings, ritual meals *etc.*, especially in food deficit times. All these socio-economic aspects are determined by knowledge and habits. This is especially critical for feeding infants (breast feeding, weaning foods *etc.*).

Focusing on the individual level food security also requires taking the biological **utilization** of food into consideration. This refers to the ability of the human body to take food and convert it into either energy which is either used to undertake daily activities or is stored. Utilization requires not only an adequate diet, but also a healthy physical environment, including safe drinking water and adequate sanitary facilities (so as to avoid disease) and an understanding of proper health care, food preparation, and storage processes.

Stability or sustainability refers to the temporal dimension of nutrition security *i.e.*, the time frame over which food security is being considered. In much of the food security literature, a distinction is made between chronic food insecurity-the inability to meet food needs on an ongoing basis-and

transitory food insecurity when the inability to meet food needs is of a temporary nature (Maxwell and Frankenberger 1992). Transitory food insecurity is sometimes divided into two subcategories: (i) cyclical, where there is a regular pattern to food insecurity, *e.g.*, the ‘lean season’ or ‘hungry season’ that occurs in the period just before harvest and; (ii) temporary, which is the result of a short-term, exogenous shock such as droughts or floods.

Conceptual framework for malnutrition

Figure 18.2 shows the conceptual framework of malnutrition, developed by UNICEF and widely accepted at the international level. It is mainly used in the context of under-nutrition in rural areas of developing countries. According to this framework, malnutrition occurs as a result of a number of factors which directly and indirectly cause malnutrition. The immediate causes of the nutritional status manifest themselves at the level of the individual human being. These are dietary intake and health status. These factors themselves are interdependent. Dietary intake must be adequate in quantity and in quality, and nutrients must be consumed in appropriate combinations for the human body to be able to absorb them (energy, protein, fat, and micro-nutrients). On household level the decision what food is being put on the table (demand) and who is to eat it (intra-household distribution) determines the composition of the meals for the individual. Habits (*e.g.* food taboos) and knowledge (*e.g.* preparation, processing, child feeding practices) influence the composition but also the biological utilization of the food. There are strong synergistic relationships between the health status and the nutritional status. A poorly nourished person has a weakened immune system and is more prone to infections. Infections increase the potential for and severity of malnutrition.

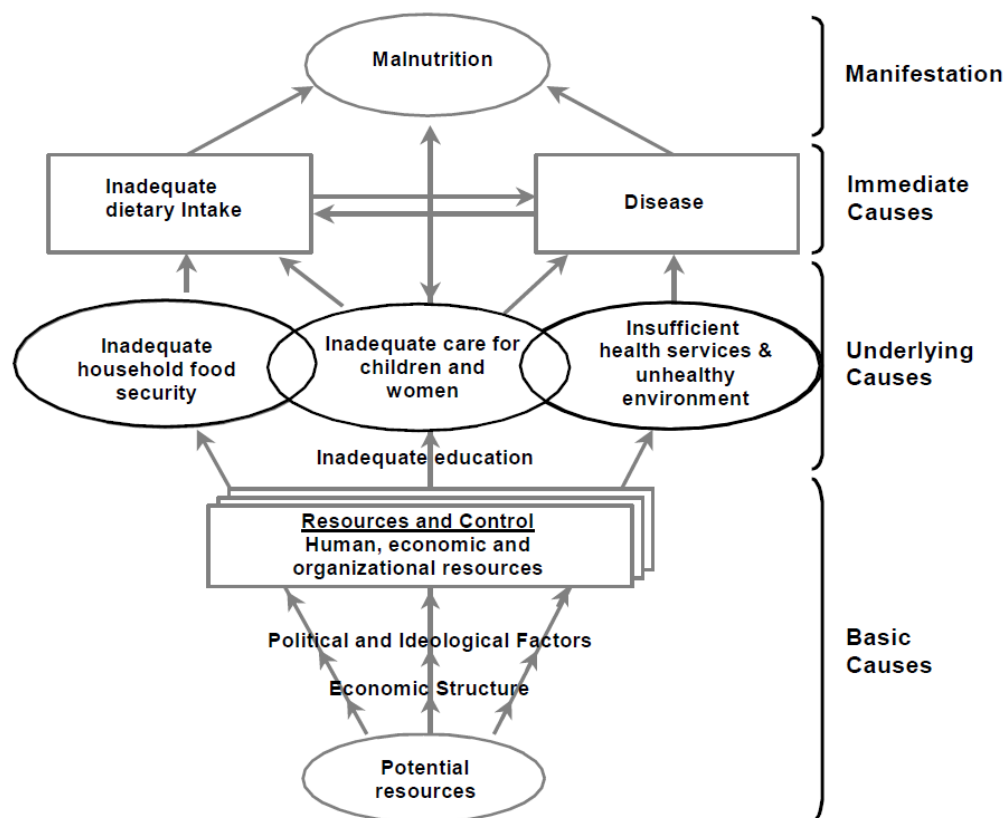


Figure 18.2: Conceptual framework for malnutrition (UNICEF, 1991) as reported in Weingärtner (2009).

Figure 18.3, depicts a simplified causal model of linking nutritional status with causal factors at household level. In this conceptual framework, the nutritional status is an outcome of food intake and health status. However, the underlying causes of health-environmental causes and health services-have been depicted in different boxes due to their different natures. A reduced state of health may be due in part to tenuous access to health care, poor housing and environmental conditions, and is possibly worsened by malnutrition, which predispose individuals to diseases. The distinction between health services and environment is necessary to select appropriate intervention strategies.

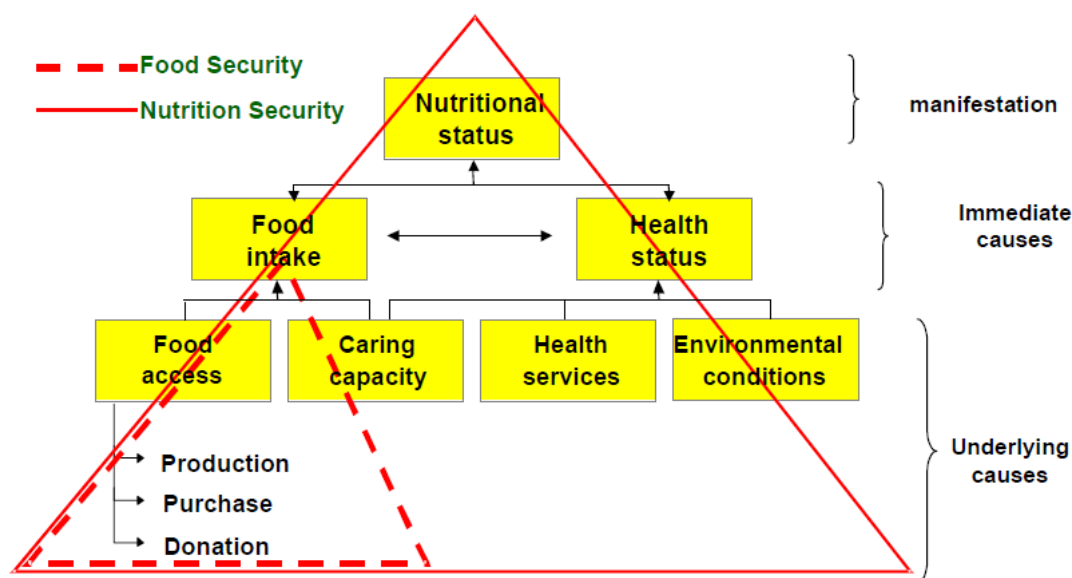


Figure 18.3: Conceptual framework of the nutrition status at household level

Source: Weingärtner, L. (2009)

Application to local situation

In this section, we try to apply the above concept to assess household food and nutritional security. We have canvassed special questionnaire to understand the food consumption habits of the representative household's along with anthropometric indicators like height, weight *etc.*

The food availability in local conditions determined by the food production, purchases and government schemes like Public Distribution System (PDS) for household's. In addition to the above child and women food and nutritional availability depends also on effective functioning of Anganwadi centers and Integrated Child Development Scheme (ICDS) centers. The Anganwadi center is a place where parents feel safe leaving their kids to go to work, and it keeps unattended children off the streets. The ICDS centers provide nutritional meals, preschool education, primary healthcare, immunization, health check-up and referral services to children under 6 years of age and their mothers.

Existing situation of food habits

Kotapally mandal is situated in Mancherial district which is predominantly agrarian society. The major crops grown are cotton and paddy. There is a well-functioning ration shop deliver subsidised rice for each below poverty household. Hence, availability of rice is not a problem for majority of household's. Many household's directly involved in farming and mostly grow paddy and to some extent pulses and other food items within their farms. So, they are not directly exposed to price uncertainty.

Majority of the household's maintain kitchen gardens in the villages. They grow leafy vegetables, pigeon pea, beans, tomato, bhendi and brinjal for their household consumption. Some farmers are also growing desi poultry, goat and sheep for the meat purpose mostly for household consumption. Sometimes, surplus is marketed in the local weekly market to purchase other household items. Some household's are also maintaining dairy animals for milk purpose, they are also selling surplus milk locally at reasonable price, the money received from milk is again used for purchasing farm inputs and hiring agricultural labour.

The general food habits of the villagers are morning breakfast in which they consume mostly *idli*, *dosa*, *puri etc.*, along with tea or coffee. Afternoon they consume mainly rice along with at least one vegetable, sometimes with pulses and sambhar. Pulses and green leafy vegetables were consumed weekly twice. During the dinner again they consume rice along with vegetables and curd. Majority are not using millets and other diversified foods. Consumption of fruits are infrequent, only a few household's that too weekly once or twice. On average, per capita consumption per month was 10 kg of rice, 1 kg of pulses, 1.75 kg edible oils and 0.6 kg green leafy vegetables. On average, monthly once or twice they eat chicken or meat, with about 0.6 kg per person per month. Milk was consumed daily, on average 2.43 liters per month per capita. Overall, it appears that the proportion of calories coming from cereals like rice is much higher, while protein consumption was much less. Since most of the household's are having kitchen gardens, they consume significant amount of vegetables, which meet their fiber and nutritional needs.

Anthropometric indicators

Average age of the head of the household is 48.8 years, with 5.24 feet height and 49.78 kg weight. While among adult females, average age is 40.9 years, height is 4.9 feet and weight is 41.8 kg. Children appeared to be undernourished, although they have Anganwadi and mid-day meal schemes intended to provide nutritious food for at least once a day. The Body Mass Index (BMI) calculated as per the standard formula ($BMI = \text{kg}/\text{m}^2$) for sample household's for both husband and wife to see the gender differences. It is reported that in most of the household's BMI is more or less similar for male and female within the family, in some families female BMI is less than desirable. No one is in overweight range (Figure 18.4).

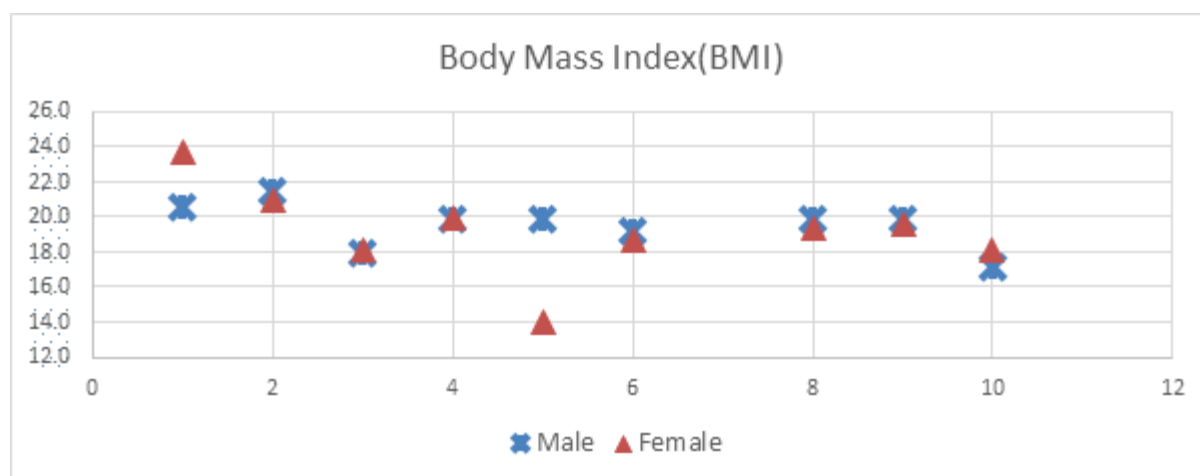


Figure 18.4: Body Mass Index for male and female in the same family

Problem analysis

The study team find out that there is a significant undernourishment especially among women and children from both secondary sources and which were supported by primary data collection. A detailed analysis of the problem was done by drawing fishbone diagram of problem analysis, diagnosis and dissection (Figure 18.5). The major cause of undernourishment are poverty, irregular incomes, low crop yields, unhealthy food habits like excessive proportion of rice compared to fruits and vegetables and infectious diseases.

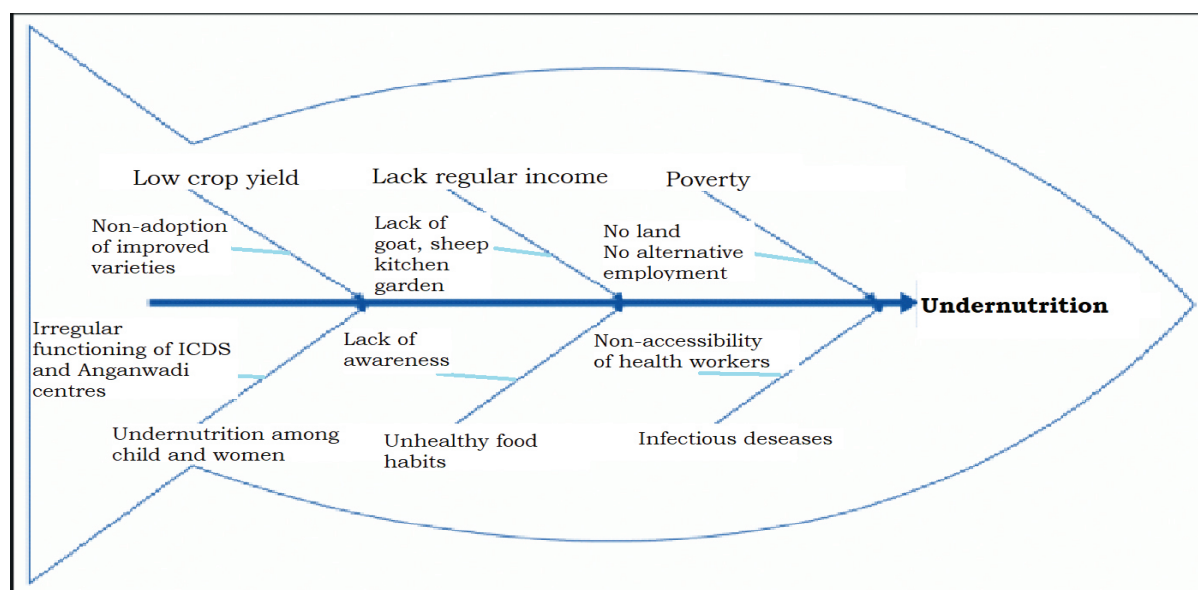


Figure 18.5. Root cause analysis of undernourishment through fishbone diagram

References

- Chambers, R. (1989). Vulnerability, coping, and policy. *IDS Bulletin*, 20 (2), 1-7.
- FAO. (2000). The state of food insecurity in the world 2000. *Rome*.
- FAO. (1996). Declaration on world food security. World food summit. Rome: FAO.
- Maxwell, S., and Frankenberger T. (1992). Household food security: Concepts, indicators, measurements: A technical review. IFAD/UNICEF, Rome.
- Quisumbing, A. R. (1995), Women: The key to food security. IFPRI Food Policy Report. Washington D.C.
- Reddy, A. A. (2016). Food security indicators in India compared to similar countries. *Current Science*, 632-640.
- Weingärtner, L. (2009). The concept of food and nutrition security. *Achieving Food and Nutrition Security*, 3, 21-52.

SUMMARY AND ACTION PLAN

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Hyderabad- 500 059, Telangana State*

The scheduled caste communities are most backward population in India. They are historically neglected since centuries, to compensate this historical negligence, the Government of India (GoI) proactively taking steps to increase their socio-economic status. Among the many programmes, SC-Sub Plan is one with more concentrated efforts to increase farmers' income. The strategy of SCSP consists of important interventions through planning process for social, educational and economic development of Scheduled Castes and also for improvement in their working and living conditions.

Under the Scheduled Castes Development Bureau (SCDB), the Government of India is implementing Schedules Caste Sub-Plan (SCSP) which is an umbrella strategy to ensure flow of targeted financial and physical benefits from all the general sectors of development for the benefit of Scheduled Castes. Under the strategy, each implementing agency is required to formulate and implement Special Component Plan (SCP) for Scheduled Castes as part of their Annual Plans by earmarking resources. At present 27 States/UTs having sizeable SC population are implementing Schedules Caste Sub-Plan.

Objective of the Scheme

The main objective is to give a thrust to family-oriented schemes of economic development of SCs below the poverty line, by providing resources for filling the critical gaps and for providing missing vital inputs so that the schemes can be more meaningful. Since the schemes/programmes for SCs may be depending upon the local occupational pattern and the economic activities available, the implementing agencies have been given a reasonable flexibility in utilizing funds with the only condition that it should be utilized benefit SC households. The implementing agencies have been given flexibility in choice of activities to be implemented, within the overall framework of the scheme. Scheduled Castes Sub Plan (SCSP) is a central scheme under which 100 per cent grant is given to the implementing agencies.

ICAR-CRIDA is implementing the SC-Sub plan in Mancherial district of Telangana state with the aim of doubling farmer's income (DFI) within a five year period. A special focus has been given to inclusive growth especially in empowering women farmers, educated unemployed youth through skill development and entrepreneurship development.

Regular meetings are conducted to examine the feasibility and viability of the activities planned for improving the farmer's incomes. Regular field visits by scientist of ICAR-CRIDA, Hyderabad to examine the shortcomings/loopholes in implementation and taking corrective steps were planned within the action plan. Identification of viable schemes as per the developmental needs of SCs and identification of eligible beneficiaries to be considered for assistance in a financial year will be finalized by the SC communities themselves which will be facilitated by the CRIDA team.

The skill developing training programmes will be conducted with the support of other line departments like NIRD, ICAR Institutes, *etc.*, and formulated in such a way that after the completion of training, the placement of trained candidates either in waged employment or in self-employment is ensured. Follow up of the beneficiaries after the planned activities will be conducted to ascertain whether they have acquired necessary assets and utilizing the assets for income generating activities. ICAR-CRIDA team will do all efforts for ensuring full utilization of SC-Sub Plan funds and effective implementation of scheme for the benefit of the target group.

NRM based development activities

Mancherial district has been classified as Agro Ecological Sub Regions (7.3) and is characterized by semiarid climate with farming situation of vertisols/alfisols and 1150 mm precipitation and the major cropping pattern of cotton followed by rice during *kharif* season and rice fallows during *rabi*. However, agricultural productivity in the region is very poor due to lack of water resources during the terminal drought situation in spite of good annual average rainfall. Water resources development through rejuvenation of percolations tanks, proper shaping of PTs, desliting, application of silt on crop lands and bunds of PTs. Micro irrigations systems (Drip, Sprinklers *etc.*) for increasing the water use efficiency. Introduction of multicropping system like cotton crop in catchment area, on bunds and paddy in command area. Utilisation of residual moisture for *rabi* crops like bengal gram, safflower and chickpea *etc.*, and relay cropping in water storage area of PTs with black gram, green gram and horse gram and also introduction of aquaculture. On farm reservoirs based farming system for enhancing livelihoods and income level of the farmers in this region.

Activities prioritized and responsible organization

Based on the detailed focus group interactions and also interaction with key informants, the study team prioritized the following interventions and also identified responsible institutions/organizations for undertaking the activities in the study area (Table 19.1).

Table 19.1: Activities identified and institutions responsible based on focus group discussions

S.No.	Nature of intervention	Organizations/institutions responsible
1	Promotion of farmers groups, watershed groups, youth groups and women groups	ICAR-CRIDA, Hyderabad
2	Distribution of awareness about Soil Health Cards	ICAR-CRIDA
3	Micro-planning of farming systems	ICAR-CRIDA
4	Demonstration of improved technology for rice and cotton	ICAR-CRIDA; ICAR-Indian Institute of Rice Research (IIRR), Hyderabad; ICAR-Central Institute for Cotton Research (CICR), Nagpur
5	Distribution of improved crop varieties	ICAR-CRIDA, department of agriculture, farmers representatives, private seed companies

S.No.	Nature of intervention	Organizations/institutions responsible
6	Distribution of farm machinery and other items like pump sets, tarpaulin	ICAR-CRIDA, department of agriculture, farmers representatives, local farm implement manufacturers
7	Eco-friendly Integrated Pest Management (IPM) technologies	ICAR-CRIDA
8	Setting up of custom hiring centres	Farmers groups, ICAR-CRIDA
9	Seed distribution for kitchen garden (vegetable seed kits)	ICAR-CRIDA, horticultural department
10	Distribution of saplings of mango, guava and citrus	ICAR-CRIDA, horticultural department
11	Planning and renovation of farm ponds	ICAR-CRIDA, department of rural development, District Rural Development Agency (DRDA)
12	Trainings to village youth for skill development	ICAR-CRIDA, Krishi Vignan Kendra (KVK), NIRD & PR
13	Trainings on improved agricultural technologies	ICAR-CRIDA, KVK
14	Training of women for self-employment	ICAR-CRIDA, NIRD&PR, KVK
15	Improved breeds of livestock	ICAR-CRIDA, ICAR - Directorate of Poultry Research, Department of Animal Husbandry
16	Skill development for agricultural and allied activities	ICAR-CRIDA, NIRD&PR
17	Child and women health and nutrition awareness and nutria-kits distribution	ICAR-CRIDA, Aanganwadi, Integrated Child Development Scheme (ICDS) centres
18	Pre and postnatal health and nutrition	Aasha workers, Primary Health Centres
19	Food processing, off-farm and non-farm employment	DRDA, Department of agriculture. ICAR-CRIDA
20	Market development for value added products	State government, ICAR-CRIDA

PROJECT TEAM

Name	Designation	Position
Dr. V. K. Singh	Principal Scientist (Agronomy)	Director
Dr. M. Osman	Principal Scientist (Agronomy) & Head, PME Cell	Nodal officer
Dr. Ravindra Chary	PC AICRPDA and Principal Scientist (Agronomy)	Member
Dr. S. K. Yadav	Principal Scientist (Bio-chemistry)	Member
Dr. S.S. Balloli	Principal Scientist (Soil Science)	Member
Dr. K.S. Reddy	Principal Scientist (Soil & Water Conservation Engineering)	Member
Dr. K. Srinivas	Principal Scientist (Soil Science)	Member
Dr. G. Pratibha	Principal Scientist (Agronomy)	Member
Dr. I. Srinivas	Principal Scientist (Farm Machinery Power)	Member
Dr. G. Nirmala	Principal Scientist & Head, TOT	Member
Dr. D.B.V. Ramana	Principal Scientist (Livestock Production & Management)	Member
Dr. Manoranjan Kumar	Principal Scientist (Soil & Water Conservation Engineering)	Member
Dr. A. Amarender Reddy	Principal Scientist (Agril. Economics)	Member
Dr. K. Sreedevi Shankar	Principal Scientist (Food & Nutrition)	Member
Dr. B. Sanjeeva Reddy	Principal Scientist (Farm Machinery Power)	Member
Dr. K. Ravi Shankar	Principal Scientist (Agril. Extension)	Member
Dr. K. Nagasree	Principal Scientist (Agril. Extension)	Member
Dr. R. V. Adake	Principal Scientist (Farm Machinery Power)	Member
Dr. R. Rejani	Principal Scientist (Soil & Water Conservation Engineering)	Member
Dr. P.K. Pankaj	Principal Scientist (Livestock & Production Management)	Member
Dr. T.V. Prasad	Principal Scientist (Entomology)	Member
Dr. G. Venkatesh	Principal Scientist (Agroforestry)	Member
Dr. B. Narsimlu	Senior Scientist (Soil & Water Conservation Engg.)	Member
Dr. A.G.K. Reddy	Scientist (Horticulture)	Member
Er. Ashish Dhimate	Scientist (Farm Machinery Power)	Member

Annexure I

ICAR–Central Research Institute for Dryland Agriculture, Hyderabad

Survey Schedule of SC-Sub Plan (Baseline Survey)

A. Location Details:

Village Name: _____ Mandal: _____
 District: _____ Household GPS ID: Longitude (N): _____ Latitude (E): _____ Altitude: _____

B. Farmer details:

Name of the head/respondent: _____
 Son/spouse/daughter of: _____
 Contact No. _____ Age: _____ Education of the head of Household: _____ Caste: SC/ST/OBC/OC, Religion: _____
 Family size: _____ Adult males (), Adult females (), Children (), Old age () Type of house: Kutchra/Pucca _____ Total number of living rooms: _____
 For how many years have you been engaged in farming? _____ (Years) How much do you invest in Agriculture (Rs/year/acre): _____
 How many members of your household are involved in farming? (Total Members)

C. Accessibility to amenities

S. No.	Item	Are you using (Yes/No)
1	Bus stand (distance from home)	
2	PHC-Hospital (km)	
3	School	
4	Ration shop	
5	Market	
6	Bank	
7	Sanitation	
8	Tap water	
9	Electricity	
10	Gas connection for cooking	

D. Use of public facilities

Item	Are you having card (Yes/No)	Are you using card (Yes/No)
Ration card (White-BPL/pink-APL)		
MGNREGA card		
SHC card		
Bank account		
Aarogya sree card		
PM-KISAN		
<i>Rythu Bandhu</i>		
Aasara card		
Are you getting messages from PM Kisan/oblique department/other		
Others		

E. Family details

S. No.	Name	Relation to head	Age (Yrs)	Sex M/F	Marital status	Education	Occupation	Annual income	Migrated (yes/no)	If yes, purpose
1		Head								
2										
3										
4										
5										
6										
7										

F. Source of income and employment pattern for whole family (Rs/year/HH)

S. No.	Particulars	Income (Rs./Year from July 2018 - June 2019)
1	Income from crops	
2	Income from Livestock	
3	Agriculture labour	
4	Non Agriculture labour (construction, works)	
4	Business/non-farm self employment	
5	Regular service in Private/Government	
6	Migration	
7	MGNREGA	
8	Direct Money Transfer (Pension)	
9	<i>Rythu Bandhu</i>	
10	Others (House Rents)	
11	Total	

G. Land holding particulars (acre)

Particulars	Dry land (acre)	Irrigable land (acre)	Source of irrigation*	Fallow (acre)	Total land (acre)	Soil type
Owned land						
Leased in land						
Leased out land						

*1-Bore well, 2-Dug well, 3-Tank, 4-Lift irrigation, 5-River, 6-Canal and other

H. Cropping pattern

S. No.	Crop	Variety	Cropped area (acre)	Season*	Irrigated area (acre)	Main product			By-product	
						Total production (q)	Productivity (q/acre)	Price/q	By product (q)	Price/q
1										
2										
3										
4										

**Kharij/Rabi/Summer/Perennial*

I. Resource Endowments

(1) General living standards

Items	Are you having (Yes/No)
Vehicles (2 wheeler/4 wheeler)	
Mobile (ordinary)	
Mobile (smart)	
TV	
Refrigerator	
Electricity	

(2) Major farm machinery

S. No.	Item	Number	Owned/hired	Hiring charges (Rs./hour; Rs./day)	Constraints
1	Desi plough (Iron/wood)				
2	Modern plough				
3	Blade harrow				
4	Blade hoe				
5	BBF planter				
6	Seed drill				
7	Fertilizer drill				
8	Sprinkler set				
9	Drip irrigation				
10	Manual sprayers/dusters				
11	Power sprayers				
12	Chaff cutter				
13	Power tiller/tractor				
14	Submersible pump				
15	Bullock cart				
16	Diesel pump sets				
17	Other minor implements				
18	Farm shed/farm house				

(3) Livestock

S. No.	Type	Number	Current value	Total milk (litre/day)	Total eggs (no/year)	Total meat (kg/year)	Other Products
1	Bullocks						
2	He buffalo						
3	She buffalo						
4	Local cows						
5	Improved cows						
6	Young cattle (< 3 yrs)						
7	Goats						
8	Sheep						
9	Pigs						
10	Poultry						

J. Credit Behaviour of the farmers:

1. Have you taken any loan for farming in the last five years? 1. Yes 2. No

S. No.	Source	Outstanding amount (Rs.)	Rate of interest (%)	Purpose	Rating (accessibility) 1 (very easy) to 5 (highly difficult)
1	Commercial bank				
2	Regional rural banks				
3	Cooperatives				
4	SHGs				
5	Money lenders				
6	Input dealer				
7	Wholesaler/trader				
8	Friends and Relatives				
9	Others (Specify)				

K. Insurance

1. Did you buy any crop or weather insurance? Yes/No

(A) If yes, insurance: 1. Crop, 2. Weather

(B) If No, Reasons: (1) Shortage of money; (2) Insurance policies not in favor of farmers; (3) Don't trust insurance companies; (4) Never felt the need for insurance; (5) Lack of information; (6) Insurance facility is not available; (7) Landless laborer; (8) Never heard about crop insurance; (9) Other (Specify); (10) Can't say and; (11) NA.

(C) Are you getting any benefits from SC Sub plan? (yes/no) If yes, what are they?

What are the benefits (quantify)?

Give rating of satisfaction of benefits received from SC sub-plan (1 (least benefit) to 10 (highest benefit)) -----

If no, Reasons.

L. Technology adoption in major crop (select one)

Item	Using (Y/N)	How much per acre	Suggested by whom (Dept./scientist/KVK/private/farmer/NA)
Seed			
Fertilizer			
Urea (bags)			
DAP or phosphorous			
MoP/Complex fertilizers / complex			
Organic (FYM)			
Micro-nutrients			
Irrigation (number of times)			
Pesticide and pest management			
Harvest and postharvest (machinery or manual)			

M. Technology adoption in livestock (per animal)

Item	Using (Y/N)	How much	Suggested by whom (Dept./scientist/KVK/private/farmer/NA)
Livestock shed		NA	
Concentrated mixture			
Artificial insemination			
Vaccination			

Mancherial District Profile



Mancherial District

S.No.	Parameters	Unit	Mancherial
1	Key Characteristics		
a	Geographical area	Sq. Km.	4,016.46
2	Administrative Units		
a	Revenue villages	Nos.	382
b	Revenue mandals	Nos.	18
c	Revenue divisions	Nos.	2
d	Gram panchayats	Nos.	311
e	Mandal praja parishads	Nos.	16
f	Zilla parishads	Nos.	1
g	Municipalities	Nos.	7
2	Demographic Profile		
A	Population as per 2011 Census		
a	Total	Nos.	8,07,037
i	Males	Nos.	4,08,272
ii	Females	Nos.	3,98,765
iii	Sex Ratio	Nos.	977
iv	Rural	Nos.	4,40,466
v	Urban	Nos.	3,66,571
vi	Percentage of rural population	%	54.58
vii	Percentage of urban population	%	45.42
B	Households	Nos.	2,06,983
i	Density of the population	Nos.	201
3	Child Population (0-6 Years)		
a	Total	Nos.	73,725
i	Males	Nos.	38,578
ii	Females	Nos.	35,147
iii	Rural	Nos.	43,204
iv	Urban	Nos.	30,521
v	Sex Ratio	Ratio	911
4	Literates		
a	Total	Nos.	4,71,856
i	Males	Nos.	2,69,729
ii	Females	Nos.	2,02,127
5	Literacy Rate		
a	Total	%	64.35
i	Males	%	72.96
ii	Females	%	55.59

S.No.	Parameters	Unit	Mancherial
6	Scheduled Castes Population		
a	Total	Nos.	1,99,493
i	Males	Nos.	1,00,792
ii	Females	Nos.	98,701
iii	Sex ratio	Ratio	979
7	Scheduled Tribes Population		
a	Total	Nos.	56,969
i	Males	Nos.	28,883
ii	Females	Nos.	28,086
iii	Sex ratio	Ratio	972
8	Working Population		
a	Total	Nos.	3,44,785
i	Males	Nos.	2,17,110
ii	Females	Nos.	1,27,675
9	Occupation of Working Population		
A	Cultivators		
a	Total	Nos.	45,831
i	Males	Nos.	33,334
ii	Females	Nos.	12,497
B	Agricultural Labourers		
a	Total	Nos.	1,48,377
i	Males	Nos.	67,031
ii	Females	Nos.	81,346
C	Household Industries		
a	Total	Nos.	8,423
i	Males	Nos.	4,797
ii	Females	Nos.	3,626
D	Other Workers		
a	Total	Nos.	1,42,154
i	Males	Nos.	1,11,948
ii	Females	Nos.	30,206
10	Non Working		
a	Total	Nos.	4,62,252
i	Males	Nos.	1,91,162
ii	Females	Nos.	2,71,090
XI	Population as per Samagra Kutumbha Survey (SKS)		
a	Total Population	Nos.	8,20,137
i	SC population	Nos.	2,13,652
ii	ST population	Nos.	75,526

S.No.	Parameters	Unit	Mancherial
iii	BC population	Nos.	4,47,559
iv	OC population	Nos.	83,400
v	Minorities population (includes II (b to e))	Nos.	55,949
12	Agriculture		
A	Land Holdings		
i	Marginal	Nos.	1,06,185
ii	Small	Nos.	34,118
iii	Semi medium	Nos.	14,123
iv	Medium	Nos.	2,899
v	Large	Nos.	221
	Total	Nos.	1,57,546
B	Cropped Area (Ha)		
i	Gross cropped area		1,33,907
ii	Net cropped area		1,10,787
iii	Gross irrigated area		71,224
iv	Net irrigated area		48,881
C	Area under		
i	Rice		60,285
ii	Jowar		243
iii	Maize		914
iv	Red gram		1,948
v	Green gram		410
vi	Black gram		114
vii	Chillies		486
viii	Cotton		60,229
13	Agricultural Marketing		
i	Agricultural market committees	Nos.	5
ii	<i>Rythu Bazars</i>	Nos.	1
14	Livestock Population		
i	Cattle	Nos.	2,11,945
ii	Buffaloes	Nos.	96,960
iii	Sheep	Nos.	2,96,133
iv	Goat	Nos.	1,45,376
v	Others	Nos.	4,859
	Total		7,55,273
A	Poultry	Nos.	4,95,788
B	Veterinary facilities		
i	Veterinary poly clinics	Nos.	0

S.No.	Parameters	Unit	Mancherial
ii	Veterinary hospitals	Nos.	2
iii	Veterinary dispensaries	Nos.	27
iv	Mobile veterinary clinics	Nos.	1
v	Rural livestock units	Nos.	15
15	HEALTH		
A	Hospitals:		
i	Allopathic Govt. Hospitals (Including PHCs)	Nos.	24
ii	Dispensaries	Nos.	0
iii	Ayurvedic Govt. Hospitals (Including dispensaries)	Nos.	13
iv	Homeopathy Govt. Hospitals (Including dispensaries)	Nos.	3
v	Unani Govt. Hospitals	Nos.	5
vi	Naturopathy Govt. Hospitals (Including dispensaries)	Nos.	1
vii	No.of Doctors in all Govt. Hospitals	Nos.	57
viii	No.of Beds in all Govt. Hospitals	Nos.	274
16	EDUCATION		
A	No. of schools		
i	Primary schools	Nos.	594
ii	Upper primary schools	Nos.	179
iii	High schools	Nos.	289
	Total		1,010
B	Enrollment of Children		
i	Boys	Nos.	57,057
ii	Girls	Nos.	53,149
	Total		1,10,206
C	Teachers working	Nos.	2,261
i	Teacher-pupil ratio	Ratio	26
D	Degree colleges (Including private & aided)	Nos.	29
i	Students enrolled in all degree colleges	Nos.	15,195
ii	Junior colleges	Nos.	64
iii	Students enrolled in junior colleges	Nos.	17,125
iv	Engineering colleges (Including private)	Nos.	1
v	Poly technic colleges (Including private)	Nos.	3
vi	Medical colleges (Including private)	Nos.	0
17	SOCIAL SECURITY		
A	Aasara pensions		
i	Old age pensions	Nos.	33,146
ii	Disabled pensions	Nos.	12,868
iii	Widow pensions	Nos.	38,846
iv	Weavers pensions	Nos.	309

S.No.	Parameters	Unit	Mancherial
v	Toddy tappers pensions	Nos.	935
vi	HIV patients	Nos.	0
vii	Beedi workers	Nos.	2,341
viii	Single women	Nos.	2,478
ix	Filaria patients	Nos.	262
	Total		91,185
18	Public distribution system		
i	Fair price shops	Nos.	430
ii	Food security cards	Nos.	1,99,204
iii	Anthyodaya food security cards	Nos.	15,422
iv	Annapoorna cards	Nos.	171
	Total		2,14,797
19	Power (kilo volts)		
A	Sub-Stations		
i	33/11 KV	Nos.	51
ii	132/11 KV	Nos.	1
iii	132/33KV	Nos.	4
iv	220/132 KV	Nos.	1
v	400/220 KV	Nos.	0
	Total		
B	Electricity Connections		
i	Domestic	Nos.	1,90,373
ii	Industrial	Nos.	1,119
iii	Agriculture	Nos.	31,807
iv	Commercial	Nos.	16,452
v	Others	Nos.	3,404
	Total		2,43,155
20	Road Infrastructure		
A	Road length		
a	Roads and Buildings Department		
i	State highways	Km.	111
ii	Major district roads	Km.	229
iii	Rural roads	Km.	106
	Total	Km.	446
b	Panchayati Raj/GHMC Department		
i	Black top roads	Km.	629
ii	WBM roads	Km.	504
iii	Gravel roads	Km.	321
iv	Earthen roads	Km.	415

S.No.	Parameters	Unit	Mancherial
v	Others (CC Roads)	Km.	121
	Total		1,990
21	Road Transport		
A	Road Transport Corporation (RTC)		
i	RTC bus depots	Nos.	1
ii	RTC fleet of buses	Nos.	143
iii	Daily operated length	Km.	59,314
22	Forest (Provisional)		
i	Forest cover	Sq.Km.	1,759.30
ii	Percentage of forest cover	%	43.80
23	Irrigation		
i	Total minor irrigation tanks	Nos.	952
ii	MI tanks covered under mission kakatiya	Nos.	316
24	Industries (TS-iPASS)		
i	Proposed industries	Nos.	56
ii	Proposed investments	Rs. in Crore	513
iii	Proposed employment	Nos.	730
25	Welfare		
A	Scheduled Castes		
a	Student Hostels (Including Colleges)		
i	Hostels for boys	Nos.	14
ii	Hostels for girls	Nos.	3
	Total		17
b	Boarders		
i	Students (Boys)	Nos.	978
ii	Students (Girls)	Nos.	340
	Total		1,318
B	Scheduled Tribes		
a	Student Hostels (Including Ashram Schools)		
i	Hostels for boys	Nos.	11
ii	Hostels for girls	Nos.	7
	Total		18
b	Boarders		
i	Students (Boys)	Nos.	2,029
ii	Students (Girls)	Nos.	1,908
	Total		3,937
C	Backward Classes		
a	Student Hostels (Including colleges)		
i	Hostels for boys	Nos.	8

S.No.	Parameters	Unit	Mancherial
ii	Hostels for girls	Nos.	6
	Total		14
b	Boarders		
i	Students (Boys)	Nos.	790
ii	Students (Girls)	Nos.	550
	Total		1,340
26	Women & Child Welfare		
A	ICDS		
i	ICDS projects	Nos.	4
ii	Anganwadi centres	Nos.	969
iii	Anganwadi helpers	Nos.	802
iv	Anganwadi teachers	Nos.	924
v	Children enrolled	Nos.	53,234
B	Society for Elimination of Rural Poverty (SERP)		
i	Self help groups	Nos.	9,233
ii	SHG members	Nos.	1,00,449
iii	SHGs provided with bank	Credit Nos.	2,239
iv	Total amount of bank credit provided	Rs. in Crore	77.61
C	Rural Water Supply		
i	Hand pumps	Nos.	5,886
ii	Protected Water Supply Schemes (PWSS)	Nos.	279
iii	Comprehensive Protected Water Supply Schemes (CPWSS)	Nos.	7
iv	Individual sanitary latrines	Nos.	1,23,362
27	Bank Network		
i	Nationalised banks	Nos.	27
ii	State bank and its associates	Nos.	25
iii	Private banks	Nos.	7
iv	Foreign banks	Nos.	0
v	Regional Rural Banks	Nos.	36
	Total		95
28	Communications (BSNL)		
i	Telephone exchanges	Nos.	29
ii	Telephone connections	Nos.	6,887
iii	Public telephone	Nos.	0
29	Post Offices		
i	Head post offices	Nos.	1
ii	Sub-post offices	Nos.	24
iii	Branch post offices	Nos.	114
	Total		139



हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

AgriSearch with a human touch



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