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LAND RESOURCE INVENTORY AND SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS FOR WATERSHED PLANNING AND DEVELOPMENT

TIMMAPUR-2 (4D3A9N2b) MICRO WATERSHED

Irakallagada Hobli, Koppal Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

The ICAR-National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS&LUP), Nagpur, a premier Institute of the Indian Council of Agricultural Research (ICAR), was set up during 1976 with the objective to prepare soil resource maps at national, state and district levels and to provide research inputs in soil resource mapping and its applications, land evaluation, land use planning, land resource management, and database management using GIS for optimising land use on different kinds of soils in the country.

The Bureau has been engaged in carrying out soil resource survey, agro-ecological and soil degradation mapping at the country, state and district levels for qualitative assessment and monitoring the soil health towards viable land use planning. The research activities have resulted in identifying the soil potentials and problems, and the various applications of the soil surveys with the ultimate objective of sustainable agricultural development. The Bureau has the mandate to correlate and classify soils of the country and maintain a National Register of all the established soil series. The Institute is also imparting in-service training to staff of the soil survey agencies in the area of soil survey, land evaluation and soil survey interpretations for land use planning. The Bureau in collaboration with Panjabrao Krishi Vidyapeeth, Akola is running post-graduate teaching and research programme in land resource management, leading to M.Sc. and Ph.D. degrees.

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PREFACE

In Karnataka, as in other Indian States, the livelihoods of rural people are intertwined with farming pursuits. The challenges in agriculture are seriously threatening the livelihood of a large number of farmers as they have been practicing farming in contextual factors beyond their control. Climatic factors are the most important ones and have become much more significant in recent times due to rapid climate changes induced by intensive anthropogenic activities affecting our ecosystem in multiple ways. Climate change has become the reality, it is happening and efforts to evolve and demonstrate climate resilient technologies have become essential. Due to the already over stressed scenario of agrarian sector, the climate change is resulting in manifold increase in the complexities, pushing the rural mass to face more and more unpredictable situations. The rising temperatures and unpredictable rainfall patterns are going to test seriously the informed decisions farmers have to make in order to survive in farming and sustain their livelihood.

It is generally recognized that impacts of climate change shall not be uniform across the globe. It is said that impact of climate change is more severe in South Asia. Based on the analysis of meteorological data, it is predicted that in India, there will be upward trend in mean temperature, downward trend in relative humidity, annual rainfall and number of wet days in a year. Also, in general, phenomena like erratic monsoon, spread of tropical diseases, rise in sea levels, changes in availability of fresh water, frequent floods, droughts, heat waves, storms and hurricanes are predicted. Each one of these adverse situations are already being experienced in various parts of India and also at the global level. Decline in agricultural productivity of small and marginal farmers becoming more vulnerable is already witnessed.

In Karnataka, more than 60 per cent of the population live in rural areas and depend on agriculture and allied activities for their livelihood. Though the state has achieved significant progress in increasing the yield of many crops, there is tremendous pressure on the land resources due to the growing and competing demands of various land uses. This is reflected in the alarming rate of land degradation observed. Already more than 50 per cent of the area is affected by various forms of degradation. If this trend continues, the sustainability of the fragile ecosystem will be badly affected. The adverse effects of change in the climatic factors are putting additional stress on the land resources and the farmers dependent on this.

The natural resources (land, water and vegetation) of the state need adequate and constant care and management, backed by site-specific technological interventions and investments particularly by the government. Detailed database pertaining to the nature of

the land resources, their constraints, inherent potentials and suitability for various land based rural enterprises, crops and other uses is a prerequisite for preparing location-specific action plans, which are in tune with the inherent capability of the resources. Any effort to evolve climate resilient technologies has to be based on the baseline scientific database. Then only one can expect effective implementation of climate resilient technologies, monitor the progress, make essential review of the strategy, and finally evaluate the effectiveness of the implemented programs. The information available at present on the land resources of the state are of general nature and useful only for general purpose planning. Since the need of the hour is to have site-specific information suitable for farm level planning and detailed characterization and delineation of the existing land resources of an area into similar management units is the only option.

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of for Timmapur-2 microwatershed in Koppal Taluk, Koppal District, Karnataka" for integrated development was taken up in collaboration with the State Agricutural Universities, IISC, KSRSAC, KSNDMC as Consortia partners. The project provides detailed land resource information at cadastral level (1:7920 scale) for all the plots and socio-economic status of farm households covering thirty per cent farmers randomely selected representing landed and landless class of farmers in the micro-watershed. The project report with the accompanying maps for the microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

It is hoped that this database will be useful to the planners, administrators and developmental agencies working in the area in not only for formulating location specific developmental schemes but also for their effective monitoring at the village/watershed level.

Nagpur
Date: 05-07-2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Timmapur-2 microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and these physiographic delineations were used as base for mapping soils. The soils were studied in several transects and a soil map was prepared with phases of soil series as mapping units. Random checks were made all over the area outside the transects to confirm and validate the soil map unit boundaries. The soil map shows the geographic distribution and extent, characteristics, classification, behavior and use potentials of the soils in the microwatershed.

The present study covers an area of 501 ha in Koppal taluk and district, Karnataka. The climate is semiarid and categorized as drought - prone with an average annual rainfall of 662 mm, of which about 424 mm is received during south–west monsoon, 161 mm during north-east and the remaining 77 mm during the rest of the year. An area of about 84 per cent is covered by soils, 14 per cent by rock outcrops and 2 per cent by water bodies, settlements and others. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 12 soil series and 21 soil phases (management units) and 5 Land management units.*
- *The length of crop growing period is <90 days and starts from 2nd week of August to 2nd week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 320 m grid interval.*
- *Land suitability for growing 31 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About 37 per cent of the soils are shallow (50-75 cm), 25 per cent of the soils are moderately shallow (50-75 cm), 6 per cent of the soils are moderately deep (75-100 cm) and 17 per cent area has deep (100-150 cm) to very deep (>150 cm) soils.*
- *About 43 per cent area has clayey soils at the surface and 41 per cent loamy soils at the surface.*
- *About 13 per cent of the area has non-gravelly (<15%) soils, 19 per cent gravelly (15-35 % gravel) and 52 per cent very gravelly (35-60%) soils.*
- *About 60 per cent are very low (<50 mm/m), 12 per cent low (51-100 mm/m), 2 per cent medium (101-150 mm/m) and 10 per cent high (151-200 mm/m) in available water capacity.*

- *About 10 per cent is nearly sloping (0-1%), 73 per cent area has very gently sloping (1-3%) and 1 per cent area has gently sloping (0-1%) lands.*
- *An area of about 30 per cent has soils that are slightly eroded (e1) and 54 per cent moderately eroded (e2) lands.*
- *An area of about 1% strongly acid (ph 5.0-5.5), 23 per cent has moderately acid (ph 5.5-6.0), 26 per cent has soils that are slightly acid (pH 6.0-6.5), 24 per cent soils are neutral (pH 6.5-7.3), 7 per cent are slightly alkaline (pH 7.3 to 8.4) and 2 per cent are moderately alkaline (pH 7.8-8.4) in soil reaction.*
- *The Electrical Conductivity (EC) of the soils is <2 dS m^{-1} and as such the soils are non-saline.*
- *Organic carbon is medium (0.5-0.75%) in about 82 per cent and 2 per cent of the soils are high (>0.75%) in organic carbon.*
- *Available phosphorus is medium (23-57 kg/ha) in about 71 per cent and high (>57 kg/ha) in about 13 per cent area of the microwatershed.*
- *About 65 per cent of the soils are low (<145 kg/ha), 14 per cent of the soils are medium (145-337 kg/ha) and 5 per cent soils are high (>337 kg/ha) in available potassium content.*
- *Available sulphur is low (<10 ppm) in about 34 per cent, medium (10-20 ppm) in 40 per cent and high (>320 ppm) in 11 per cent soils.*
- *Available boron is low (0.5 ppm) in about 83 per cent area and <1 per cent area is medium (0.5-1.0 ppm).*
- *Available iron is sufficient (>4.5 ppm) in the entire area.*
- *Available zinc is deficient (<0.6 ppm) in 42 per cent and sufficient (>0.6 ppm) in about 42 per cent area.*
- *Available manganese and copper are sufficient in all the soils.*
- *The land suitability for 31 major agricultural and horticultural crops grown in the microwatershed were assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the microwatershed

Crop	Suitability Area in ha (%)		Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)		Highly suitable (S1)	Moderately suitable (S2)
Sorghum	-	*160 (32)*	*Sapota*	-	*19 (4)*
Maize	-	*159 (32)*	*Pomegranate*	-	*78 (15)*
Bajra	-	*200 (40)*	*Musambi*	-	*78 (15)*
Groundnut	-	*107 (21)*	*Lime*	-	*78 (15)*
Sunflower	-	*75 (15)*	*Amla*	-	*237 (47)*
Red gram	-	*66 (13)*	*Cashew*	-	*36 (7)*
Bengalgram	-	*176 (35)*	*Jackfruit*	-	*19 (4)*
Cotton	-	*160 (32)*	*Jamun*	-	*69 (14)*
Chilli	-	*101 (20)*	*Custard apple*	-	*237 (47)*
Tomato	-	*101 (20)*	*Tamarind*	-	*66 (13)*
Brinjal	*16 (3)*	*135 (27)*	*Mulberry*	-	*113 (23)*
Onion	*16 (3)*	*62 (12)*	*Marigold*	-	*159 (32)*
Bhendi	*16 (3)*	*120 (24)*	*Chrysanthemum*	-	*159 (32)*
Drumstick	-	*93 (18)*	*Jasmine*	-	*101 (20)*
Mango	-	*16 (3)*	*Crossandra*	-	*110 (22)*
Guava	-	*19 (4)*			

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 5identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops that helps in maintaining productivity and ecological balance in the microwatershed.

- *Maintaining soil-health is vital for crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested for these problematic soils like saline/alkali, highly eroded, sandy soils etc.*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. That would help in supplementing the farm income, provide fodder and fuel, and generate lot of biomass which in turn would help in maintaining the ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

Land is a scarce resource and basic unit for any material production. It can support the needs of the growing population, provided they use the land in a rational and judicious manner. But what is happening in many areas of the state is a cause for concern to everyone involved in the management of land resources at the grassroots level. The area available for agriculture is about 51 per cent of the total area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. The limited land area is under severe stress and strain due to increasing population pressure and competing demands of various land uses. Due to this, every year there is significant diversion of farm lands and water resources for non-agricultural purposes. Apart from this, due to lack of interest in farmers for farming, large tracts of cultivable lands are turning into fallows in many areas and this trend is continuing at an alarming rate.

Further, land degradation has emerged as a serious problem which has already affected about 38 lakh ha of cultivated area in the state. Soil erosion alone has degraded about 35 lakh ha. Almost all the uncultivated areas are facing various degrees of degradation, particularly soil erosion. Salinity and alkalinity has emerged as a major problem in more than 3.5 lakh ha in the irrigated areas of the state. Nutrient depletion and declining factor productivity is common in both rainfed and irrigated areas. The degradation is continuing at an alarming rate and there appears to be no systematic effort among the stakeholders to contain this process. In recent times, an aberration of weather due to climate change phenomenon has added another dimension leading to unpredictable situations to be tackled by the farmers.

In this critical juncture, the challenge before us is not only to increase the productivity per unit area which is steadily declining and showing a fatigue syndrome, but also to prevent or at least reduce the severity of degradation. If the situation is not reversed at the earliest, then the sustainability of the already fragile crop production system and the overall ecosystem will be badly affected in the state.

The continued neglect and unscientific use of the resources for a long time has led to the situation observed at present in the state. It is a known fact and established beyond doubt by many studies in the past that the cause for all kinds of degradation is the neglect and irrational use of the land resources. Hence, there is urgent need to generate a detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

Therefore, the land resource inventory required for farm level planning is the one which investigates not only the surface but also consider the other parameters which are critical for productivity *viz.*, soils, climate, water, minerals and rocks, topography, geology, hydrology, vegetation, crops, land use pattern, animal population, socio-economic conditions, infrastructure, marketing facilities and various schemes and

developmental works of the government etc. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed.

The Land Resource Inventory is basically done for identifying potential and problem areas, developing sustainable land use plans, estimation of surface run off and water harvesting potential, preparation of soil and water conservation plans, land degradation/desertification etc. The Bureau is presently engaged in developing an LRI methodology using high resolution satellite remote sensing data and Digital Elevation Model (DEM) data to prepare Landscape Ecological Units (LEU) map representing agro-ecosystem as a whole. The LEU is preferred over landform as the base map for LRI. LEU is the assemblage of landform, slope and land use. An attempt was made to upscale the soil resource information from 1:250000 and 1:50000 scale to the LEU map in Goa and other states.

The land resource inventory aims to provide site specific database for Timmapur-2 microwatershed in Koppal Taluk, Koppal District, Karnataka State for the Karnataka Watershed Development Department. The database was generated by using cadastral map of the village as a base along with high resolution IRS LISS IV and Cartosat-1 merged satellite imagery. Later, an attempt will be made to uplink this LRI data generated at 1:7920 scale under Sujala-III Project to the proposed Landscape Ecological Units (LEUs) map.

The study was organized and executed by the ICAR- National Bureau of Soil Survey and Land Use Planning, Regional Centre, Bangalore under Generation of Land Resource Inventory Data Base Component-1 of the Sujala-III Project funded by the World Bank.

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Timmapur-2 Microwatershed is located in the central part of northern Karnataka in Koppal Taluk, Koppal District, Karnataka State (Fig. 2.1). It comprises of parts of Archara Timmapura, Challari, Hiresoolokeri and Chikkasoolikeri villages. It lies between $15^0$32' – $15^0$34' North latitudes and $76^0$14' – $76^0$16' East longitudes and covers an area of 501ha. It is surrounded by Challari village on the north, Chikkasoolikeri village on the east, Archara Thimmapura village on the west and Hiresoolikeri on the southern side.

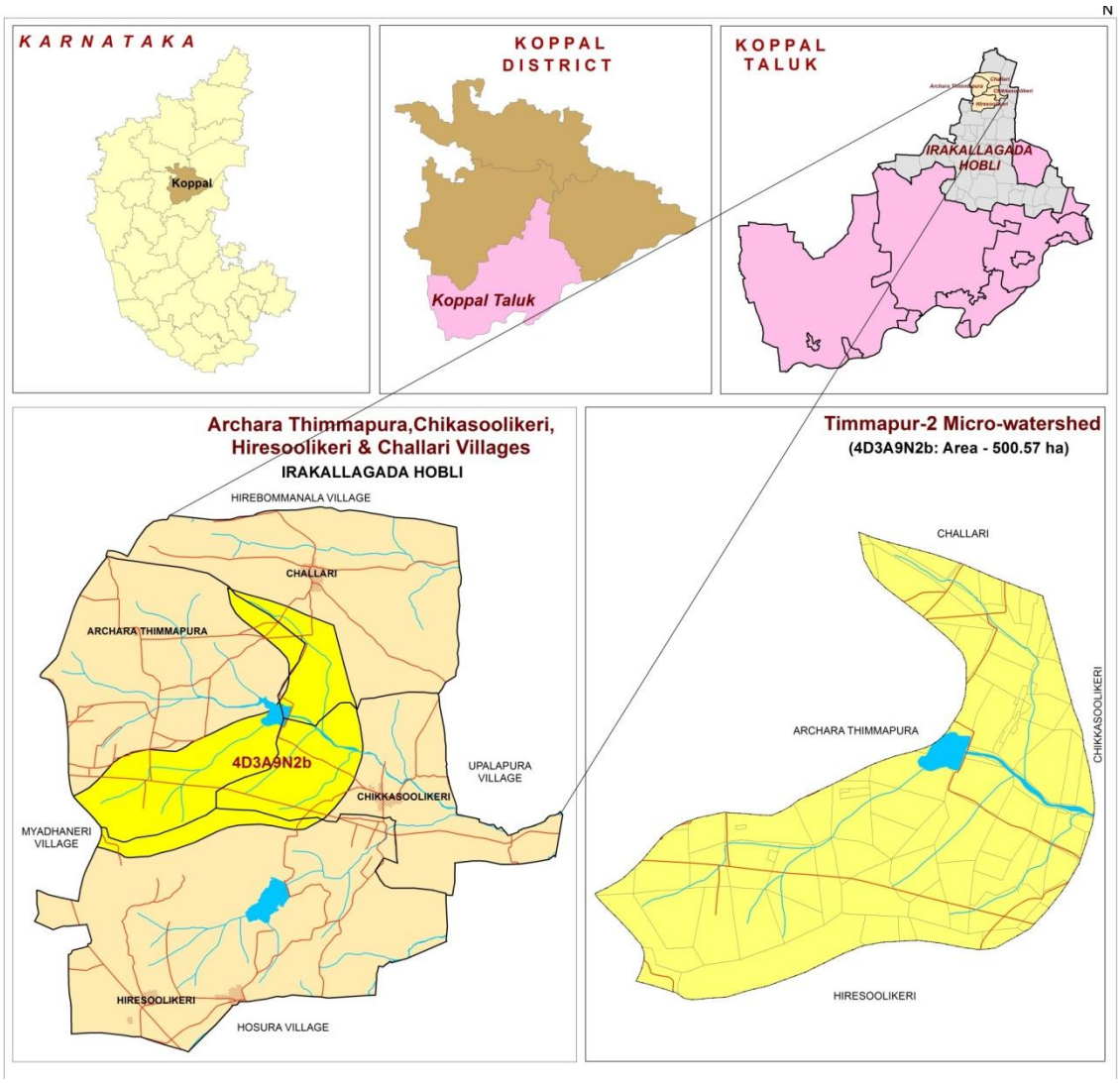


Fig. 2.1 Location map of Timmapur-2 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Figs. 2.2a and b). Granite gneisses are essentially pink to gray and are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The

gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in the village. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent palaeo black soils originally formed at higher elevation, but now occupying river valleys.

Fig. 2.2 a Granite and granite gneiss rocks

Fig. 2.2 b Alluvium

2.3 Physiography

Physiographically, the area has been identified as granite gneiss and alluvial landscapes based on geology. The microwatershed area has been further divided into summits, very gently sloping uplands and nearly level plains based on slope and its relief features. The elevation ranges from 595-629 m in the gently sloping uplands.

2.4 Drainage

The area is drained by several small seasonal streams that join Hire *halla* and Chenna *halla* along its course. Though, the streams are not perennial, during rainy season they carry large quantities of rain water. The microwatershed has only few small tanks which are not able to store the water flowing during the rainy season. Due to this, the ground water recharge is very much affected in the villages. This is reflected in the failure of many bore wells in the villages. If the available rain water is properly harnessed by constructing tanks and recharge structures at appropriate places in the villages, then the drinking and irrigation needs of the area can be easily met. The drainage network is dendritic to sub parallel.

2.5 Climate

The district falls under semiarid tract of the state and is categorized as drought-prone with an average annual rainfall of 662 mm (Table 2.1). Maximum of 424 mm precipitation takes place during the south-west monsoon period from June to September, north-east monsoon contributes about 161 mm and prevails from October to early December and the remaining 77 mm takes place during the rest of the year. The winter season is from December to February. During April and May, the temperatures reach up to 45 °C and in December and January, the temperatures will go down to 16 °C. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo Transpiration (PET) is 145 mm and varies from a low of 101 mm in December and 193 mm in the month of May. The PET is always higher than precipitation in all the months except in the month of September. Generally, the Length of crop Growing Period (LGP) is <90 days and starts from 2nd week of August to 2nd week of November.

Table 2.1 Mean Monthly Rainfall, PET, 1/2 PET at Koppal Taluk and District

Sl. No.	Months	Rainfall	PET	1/2 PET
1	January	1.60	116.70	58.35
2	February	1.50	129.20	64.60
3	March	14.10	169.80	84.90
4	April	18.10	180.60	90.30
5	May	41.60	193.50	96.75
6	June	85.80	167.90	83.95
7	July	72.10	156.20	78.10
8	August	110.50	152.50	76.25
9	September	155.60	138.50	69.25
10	October	116.30	122.30	61.15
11	November	36.00	106.40	53.20
12	December	9.10	101.00	50.50
	TOTAL	**662.30**	**144.55**	

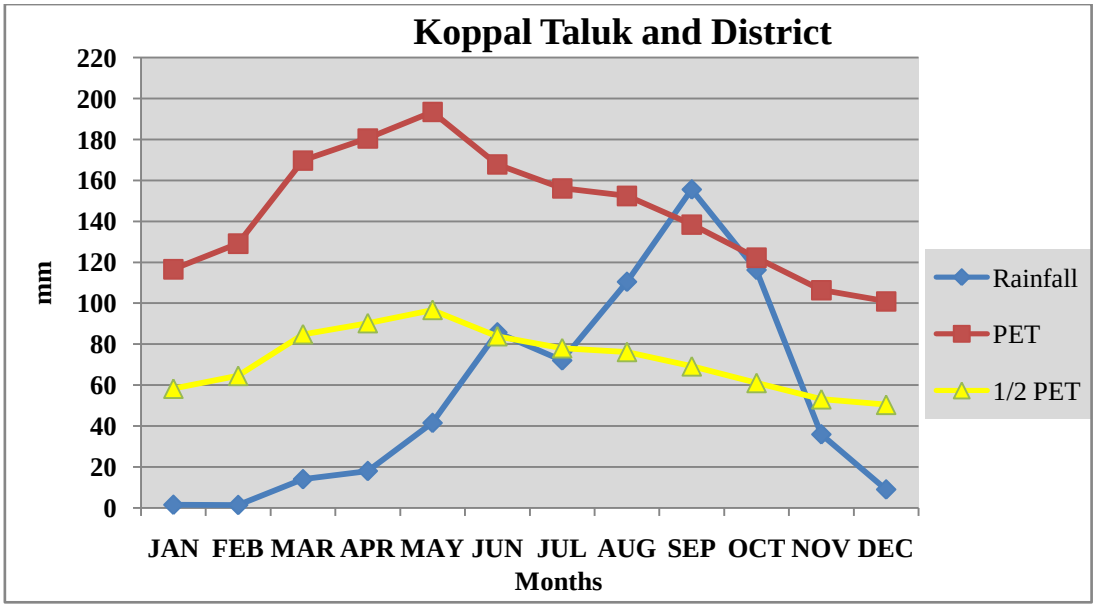


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

2.6 Natural Vegetation

The natural vegetation is sparse comprising few tree species, shrubs and herbs. The mounds, ridges and boulders occupy sizeable areas which are under thin to moderately thick forest vegetation. Still, there are some remnants of the past forest cover which can be seen in patches in some ridges and hillocks in the microwatershed (Fig 2.4).

Apart from the continuing deforestation, the presence of large population of goats, sheep and other cattle in the microwatershed is causing vegetative degradation of whatever little vegetation left in the area. The uncontrolled grazing has left no time for the regeneration of the vegetative cover. This leads to the accelerated rate of erosion on the hill slopes, resulting in the formation of deep gullies in the foot slopes and eventually resulting in the heavy siltation of few tanks and reservoirs in the microwatershed.

Fig 2.4 Natural vegetation of Timmapur-2 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 16 per cent of the area is sown more than once. The cropping intensity is 118 per cent. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, bengalgram and groundnut (Fig 2.5). While carrying out land resource inventory, the land use/land cover particulars are collected from all the survey numbers and a current land use map of the microwatershed is prepared. The current land use map prepared shows the arable and non-arable lands, other land uses and different types of crops grown in the area. The current land use map of Timmapur-2 Microwatershed is presented in Fig. 2.6. Simultaneously, enumeration of existing wells (bore wells and open wells) and other soil and water conservation structures in the microwatershed is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and other water bodies in Timmapur-2 Microwatershed is given Fig. 2.7.

Table 2.2 Land Utilization in Koppal District

Sl. no.	Agricultural land use	Area (ha)	Per cent
1	Total geographical area	552495	
2	Total cultivated area	500542	90.6
3	Area sown more than once	92696	16.8
4	Trees and groves	210	0.04
5	Cropping intensity	-	118
6	Forest	29451	5.33
7	Cultivable wasteland	2568	0.46
8	Permanent Pasture land	14675	2.66
9	Barren land	16627	3.01
10	Non agricultural land	40591	7.35
11	Current fallow	19660	3.56

Fig. 2.5 (a) Different crops and cropping systems in Timmapur-2 Microwatershed

Fig. 2.5 (b) Different crops and cropping systems in Timmapur-2 Microwatershed

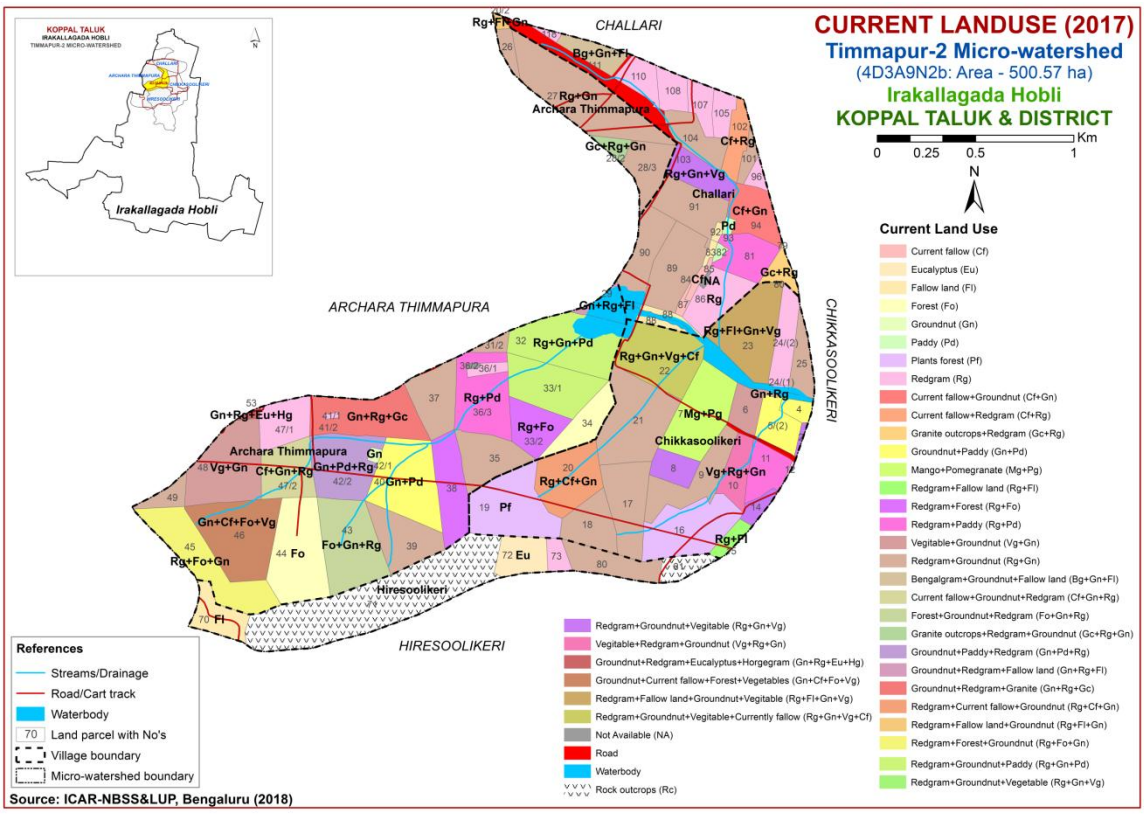


Fig. 2.6 Current Land Use – Timmapur-2 Microwatershed

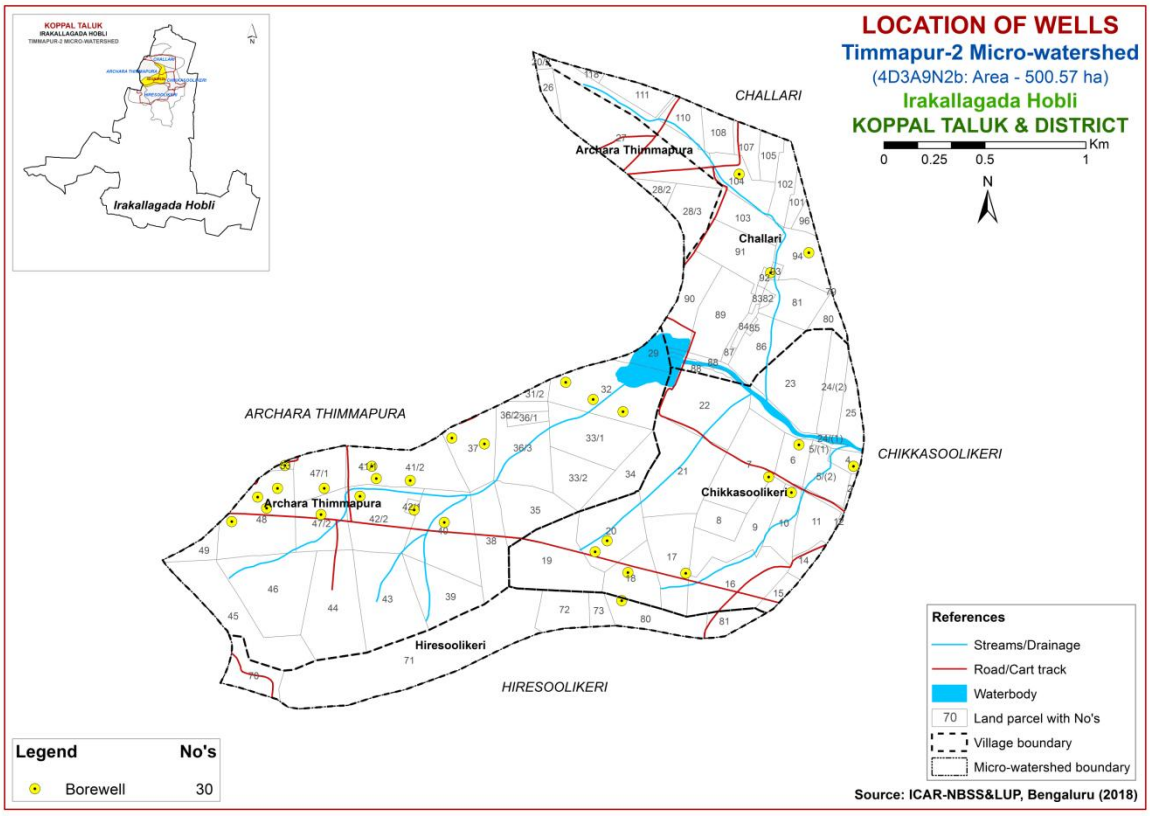


Fig. 2.7 Location of wells-Timmapur-2 Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly for a given level of management. This was achieved in Timmapur-2 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units and showing their extent and geographic distribution on the microwatershed cadastral map. The detailed soil survey at 1:7920 scale was carried out in 501 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

The detailed survey of the land resources occurring in the microwatershed was carried out by using digitized cadastral map and satellite imagery as base supplied by the KSRSAC. The cadastral map shows field boundaries with their survey numbers, location of tanks, streams and other permanent features of the area (Fig. 3.1). Apart from the cadastral map, remote sensing data products from Cartosat-1 and LISS IV merged at the scale of 1:7920 were used in conjunction with the cadastral map to identify the geology, landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig. 3.2). The cadastral map was overlaid on the satellite imagery (Fig. 3.3) that helps to identify the parcel boundaries and other permanent features. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were used for initial traversing, identification of geology, landscapes and landforms, drainage features, present land use and also for selection of transects in the microwatershed.

3.2 Image Interpretation for Physiography

False Colour Composites (FCC) of Cartosat-I and LISS-IV merged satellite data covering the microwatershed area was visually interpreted using image interpretation elements and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss and alluvial landscapes and is divided into landforms such as ridges, mounds and uplands based on slope. They were further subdivided into physiographic/ image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

- G1 Hills/ Ridges/ Mounds
  - G11 Summits
  - G12 Side slopes
    - G121 Side slopes with dark grey tones
- G2 Uplands
  - G21 Summits
  - G22 Gently sloping uplands
    - G221 Gently sloping uplands, yellowish green (eroded)
    - G222 Gently sloping uplands, yellowish white (severely eroded)
  - G23 Very gently sloping uplands
    - G231 Very gently sloping uplands, yellowish green
    - G232 Very gently sloping uplands, medium green and pink
    - G233 Very gently sloping uplands, pink and green (scrub land)
    - G234 Very gently sloping uplands, medium greenish grey
    - G235 Very gently sloping uplands, yellowish white (eroded)
    - G236 Very gently sloping uplands, dark green
    - G237 Very gently sloping uplands, medium pink (coconut garden)
    - G238 Very gently sloping uplands, pink and bluish white (eroded)

DSe Alluvial landscape

Dse 1 Summit

- Dse 11 Nearly level Summit with dark grey tone
- Dse 12 Nearly level Summit with medium grey tone
- Dse 13 Nearly level Summit with whitish grey tone
- Dse 14 Nearly level Summit with whitish tone (Calcareousness)
- Dse 15 Nearly level Summit with pinkish grey tone
- Dse 16 Nearly level Summit with medium pink tone
- Dse 17 Nearly level Summit with bluish white tone
- Dse 18 Nearly level Summit with greenish grey tone

Dse 2 Very genetly sloping

- Dse 21 Very gently sloping, whitish tone
- Dse 22 Very gently sloping, greyish pink tone
- Dse 23 Very gently sloping, whitish grey tone
- Dse 24 Very gently sloping, medium grey tone
- Dse 25 Very gently sloping, medium pink tone
- Dse 26 Very gently sloping, dark grey tone
- Dse 27 Very gently sloping, bluish grey tone
- Dse 28 Very gently sloping, greenish grey tone
- Dse 29 Very gently sloping, Pinkish grey

Dsa 25 – Nearly Level Lands

- Dsa 251- Nearly level, Grayish green tone
- Dsa 252- Nearly level, Bluish grey tone
- Dsa 253- Nearly level, Light green tone
- Dsa 254- Nearly level, Medium green tone
- Dsa 255- Nearly level, Greenish pink tone
- Dsa 256- Nearly level, Whitish green
- Dsa 257- Nearly level, Pink tone
- Dsa 258- Nearly level, Whitish grey tone
- Dsa 259- Nearly level, Grayish Pink

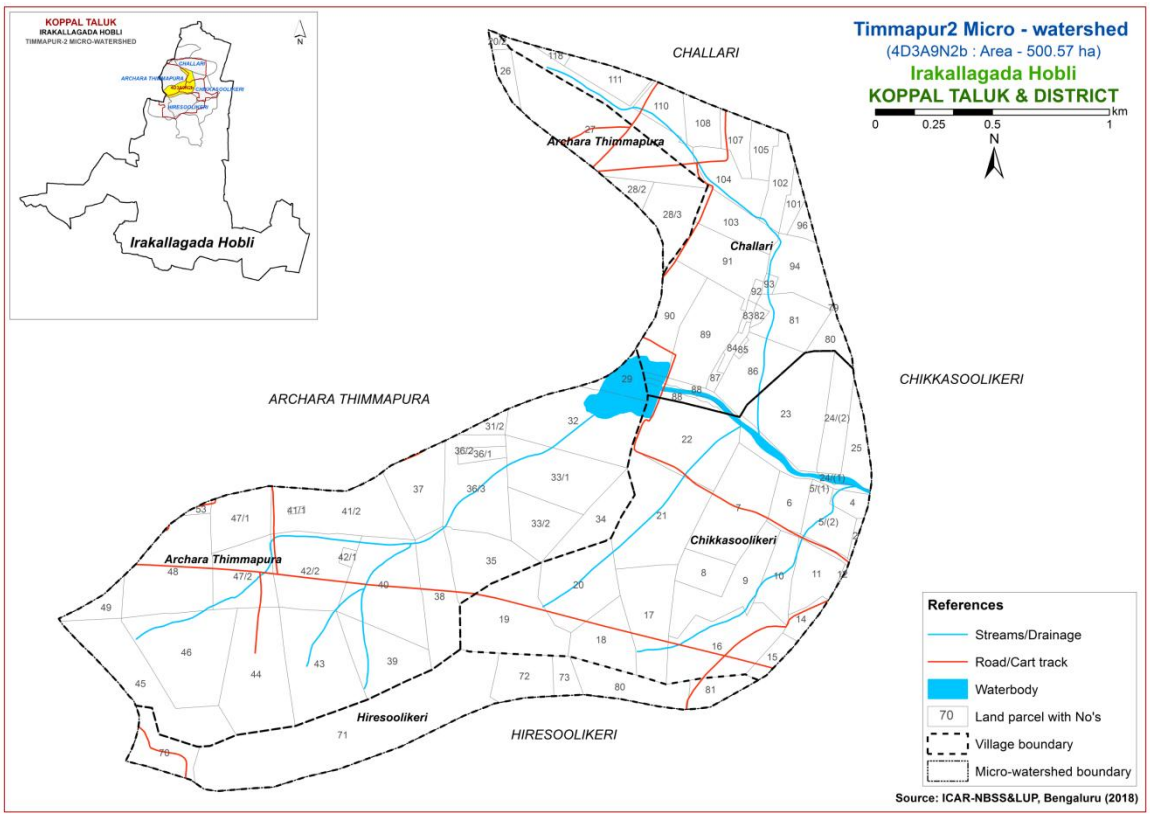


Fig. 3.1 Scanned and Digitized Cadastral map of Timmapur-2 Microwatershed

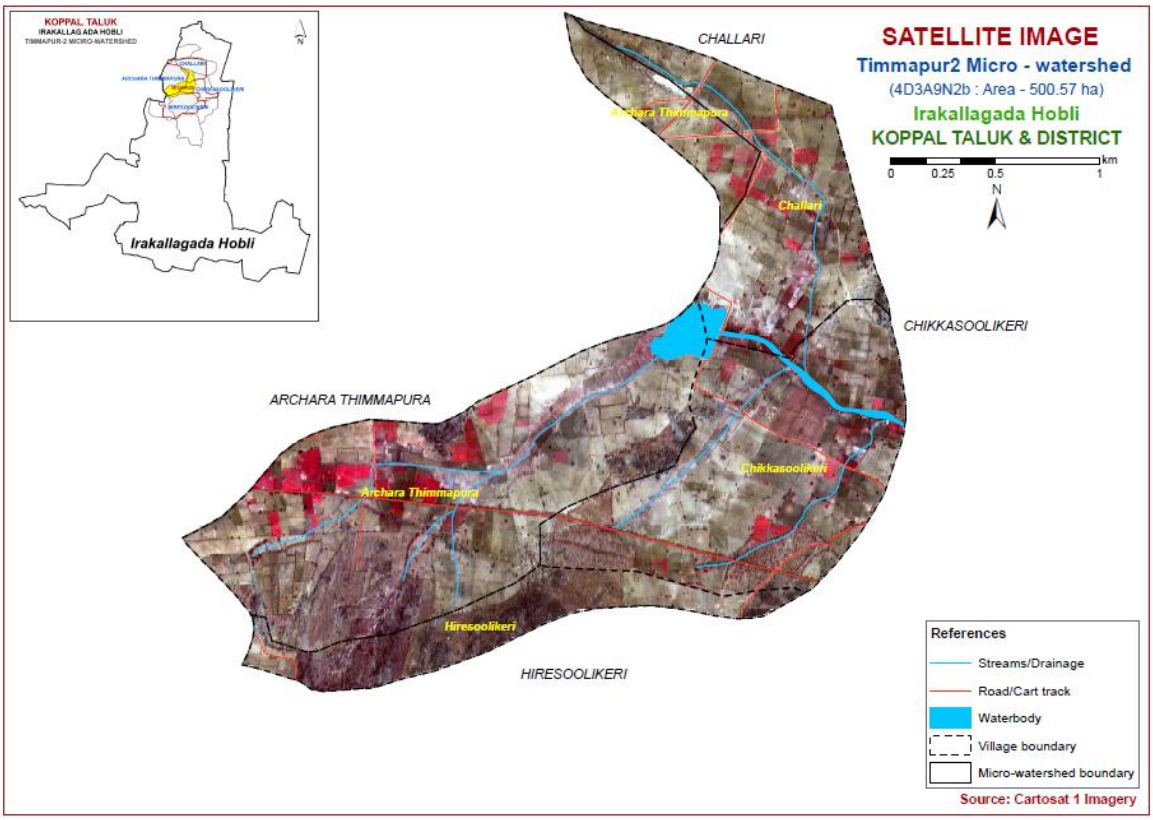


Fig. 3.2 Satellite Image of Timmapur-2 Microwatershed

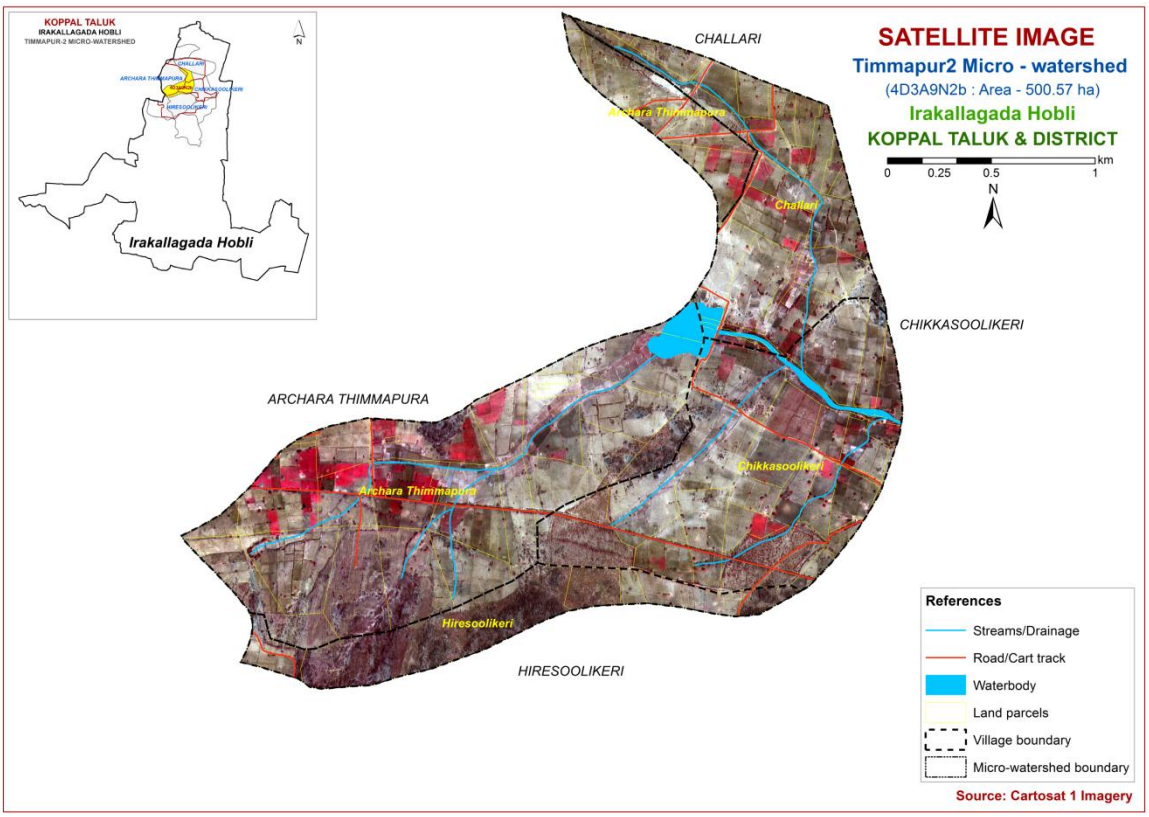


Fig. 3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Timmapur-2 Microwatershed

3.3 Field Investigation

The field boundaries and survey numbers given on the cadastral sheet were located on the ground by following permanent features like roads, cart tracks, *nallas*, streams, tanks etc., and wherever changes were noticed, they were incorporated on the microwatershed cadastral map. Preliminary traverse of the microwatershed was carried out with the help of cadastral map, imagery and toposheets. While traversing, landforms and physiographic units identified were checked and preliminary soil legend was prepared by studying soils at few selected places. Then, intensive traversing of each physiographic unit like hills, ridges, uplands and plains was carried out. Based on the variability observed on the surface, transects (Fig. 3.4) were selected across the slope covering all the landform units in the microwatershed (Natarajan and Dipak Sarkar, 2010).

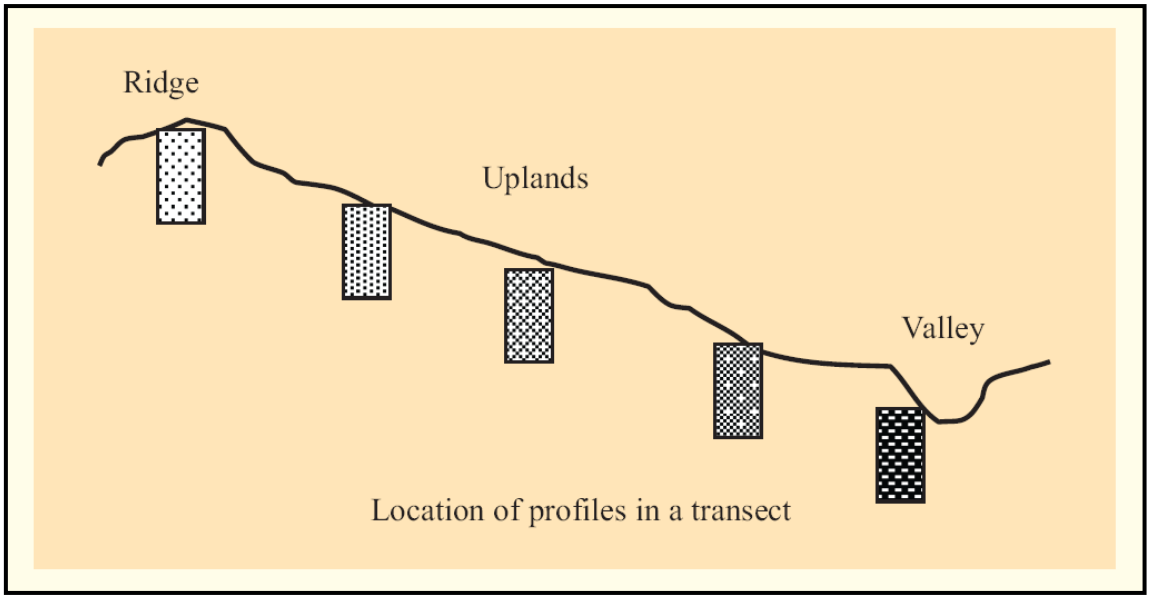


Fig. 3.4 Location of profiles in a transect

In the selected transect, soil profiles (Fig. 3.4) were located at closely spaced intervals to take care of any change in the land features like break in slope, erosion, gravel, stones etc. In the selected sites, soil profiles (vertical cut showing the soil layers from surface to the rock) were opened upto 200 cm or to the depth limited by rock or hard substratum and studied in detail for all their morphological and physical characteristics. The soil and site characteristics were recorded for all profile sites on a standard proforma as per the guidelines given in USDA Soil Survey Manual (Soil Survey Staff, 2012). Apart from the transect study, profiles were also studied at random, almost like in a grid pattern, outside the transect areas to validate the soil map unit boundaries.

Based on the soil characteristics, the soils were grouped into different soil series. Soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management. Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, calcareousness, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 12 soil series were identified in Timmapur-2 Microwatershed.

Table 3.1 Differentiating Characteristics used for identifying Soil Series (Characteristics are of Series Control Section)

Soils of Granite gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareo-usness**
1	Harve (HRV)	25-50	2.5YR3/4,3/6 5YR3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr-	-
2	Abbigere (ABR)	25-50	2.5YR 3/3, 3/4	sc	>35	Ap-Bt-Cr	-
3	Kethanapura (KTP)	50-75	2.5YR3/4, 3/6	gscl	15-35	Ap-Bt-Cr	50-75
4	Hatti (HTI)	50-75	5 YR 3/3, 3/4,	gsc	15-35	Ap-Bt-Cr	50-75
5	Mukhadahalli (MKH)	50-75	5YR3/3,3/4,4/3, 5/4,6/6 2.5YR3/4	gscl	>35	Ap-Bt-Cr	-
6	Hooradhahalli (HDH)	75-100	2.5YR2.5/4,3/4, 3/6	gsc-gc	>35	Ap-Bt-Cr	75-100
7	Bidanagere (BDG)	75-100	5YR3/3,3/4,4/3,5/4 2.5YR3/4	gc	35-60	Ap-Bt-Cr	75-100
8	Nagalapur (NGP)	100-150	5YR2.5/2,3/2, 2.5YR3/6,4/6	gsc-gc	>35	Ap-Bt-Cr	100-150
9	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	100-150
10	Niduvalalu (NDL)	>150	2.5YR2.5/3,2.5/4, 3/3,4/6	gsc	>35	Ap-Bt	>150
Soils of Alluvial Landscape							
11	Dambarahalli (DRL)	75-100	10YR 2/1, 3/1, 4/3	c	<15	Ap-Bss-Ck	e-es
12	Budagumpa (BGP)	.>150	7.5YR3/2,5/1 10YR4/1,4/4	c	<15	Ap-Bw	e

3.4 Soil Mapping

The area under each soil series was further separated into 21 soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management.

The soil mapping units are shown on the soil map (Fig. 3.5) in the form of symbols. During the survey many soil profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map. The soil map shows the geographic distribution of 21 mapping units representing 12 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 21 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar

soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Laboratory Characterization

Soil samples for each soil series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2017 from Timmapur-2 farmer's fields (52 samples) for fertility status (major and micronutrients) at 320 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Timmapur-2 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss landscape				
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark reddish brown, red gravelly loamy soils occurring on nearly level to gently sloping uplands under cultivation		**154 (30.75)**
27		HRVhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	60 (11.9)
30		HRViB1g2	Sandy clay surface, slope 1-3%, slight erosion, very gravelly (35-60%)	44 (8.89)
31		HRViB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	36 (7.15)
465		HRVcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	14 (2.81)
	ABR	Abbigere soils are shallow (25-50 cm), well drained, have dark reddish brown gravelly red sandy clay soils occurring on very gently sloping uplands under cultivation		**30 (5.99)**
472		ABRiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	30 (5.99)
	KTP	Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown red gravelly sandy clay loam soils occurring on very gently sloping uplands under cultivation		**10 (2.09)**
73		KTPiB1	Sandy clay surface, slope 1-3%, slight erosion	7 (1.45)
74		KTPiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	3 (0.65)
	HTI	Hatti soils are moderately shallow (50-75 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**15 (2.99**)
94		HTIhB1g1	Sandy clay loam surface, slight erosion, gravelly (15-35%)	4 (0.72)

98		HTIiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	11 (2.27)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly red sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**98 (19.57)**
77		MKHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1 (0.25)
78		MKHcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	38 (7.57)
79		MKHcC2g2	Sandy loam surface, slope 3-5%, moderate erosion, very gravelly (35-60%)	6 (1.26)
86		MKHhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	48 (9.57)
88		MKHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	5 (0.92)
	HDH	Hooradhahalli soils are moderately deep (75-100 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay to clay soils occurring on nearly level to moderately sloping uplands under cultivation		**3 (0.59)**
128		HDHiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	3 (0.59)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown red sandy gravelly clay soils occurring on nearly level to gently sloping uplands under cultivation		**18 (3.51)**
193		BDGiB1g2	Sandy clay surface, slope 1-3%, slight erosion, very gravelly (35-60%)	18 (3.51)
	NGP	Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**7 (1.31)**
259		NGPhB1g2	Sandy clay loam surface, slight erosion, very gravelly (35-60%)	7 (1.31)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**12 (2.35)**
232		BPRhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	12 (2.35)
	NDL	Niduvalalu soils are very deep (>150 cm), well drained, have red to dark reddish brown red gravelly sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**16 (3.21)**
296		NDLhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	16 (3.21)
Soils of Alluvial landscape				
	DRL	Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have dark brown to very dark		**9 (1.71)**

		gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		
350		DRLmB2	Clay surface, slope 1-3%, moderate erosion	9 (1.71)
	BGP	Budagumpa soils are very deep (>150 cm), moderately well drained, have dark yellowish brown to dark brown and dark gray, slightly calcareous black clay soils occurring on nearly level to very gently sloping plains under cultivation		**50 (9.9)**
395		BGPmA1	Clay surface, slope 0-1%, slight erosion	50 (9.9)
999	Rock outcrops		Rock lands, both massive and bouoldary	71(14.26)
1000	Others		Habitaion and waterbody	9 (1.76)

*Soil map unit numbers are continuous for the taluk, not the microwatersheds

3.6 Land management units

The 21 soil phases identified and mapped in the microwatershed were regrouped into 5 Land management units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land management units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been choosen for identification and delineation of LMUs. For Timmapur-2 Microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The Land management units are expected to behave similarly for a given level of management.

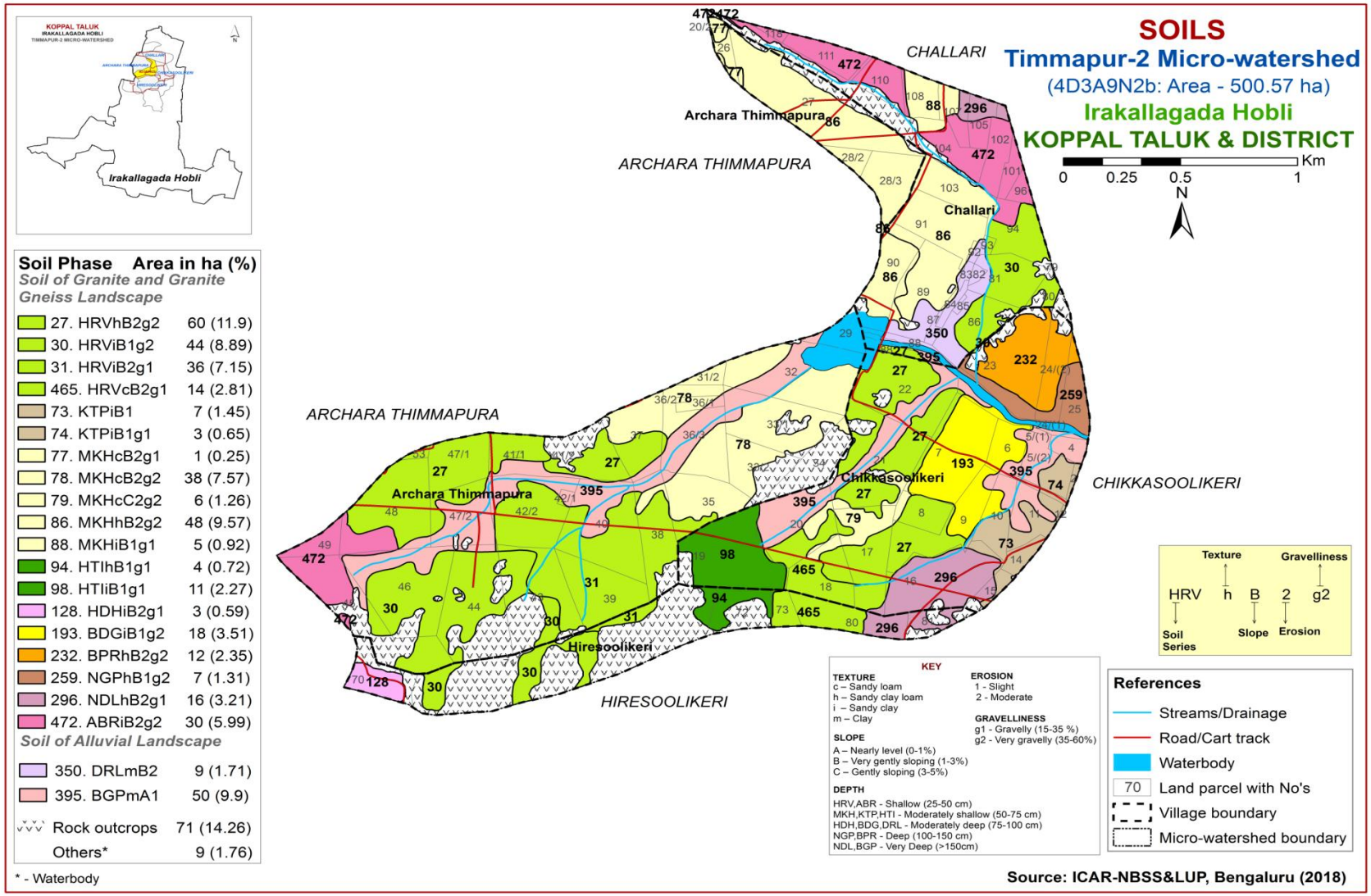


Fig 3.4 Soil Phase or Management Units-Timmapur-2 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Timmapur-2 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 12 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 12 soil series identified followed by 21 soil phases (management units) mapped (Fig. 3.4) are furnished below. The physical and chemical characteristics of soil series identified in Timmapur-2 microwatershed are given in Table 4.1. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of granite and granite gneiss landscape

In this landscape, 10 soil series are identified and mapped. Of these, Harve (HRV) series occupies maximum area of 154 (31%), Mukhadahalli (MKH) 98 (20%), Abbigere (ABR) 30 (6%), Bidanagere (BDG) 18 ha (4%), Niduvalalu (NDL) 16 ha (3%), Hatti (HTI) 15 ha (3%), Balapur (BPR) 12 ha (2%), Kethanapura (KTP) 10 ha (2%), Nagalapur (NGP) 7 ha (1%) and Hooradhahalli (HDH) occupy minor area of about 3 ha (<1%) in the microwatershed. The brief description of each soil series along with the soil phases identified and mapped is given below.

4.1.1 Harve (HRV) Series: Harve soils are shallow (25-50 cm), well drained, have reddish brown to dark red gravelly sandy clay loam soils. They have developed from weathered granite gneiss and occur on very gently to moderately sloping uplands. The Harve series has been classified as a member of the loamy-skeletal, mixed, isohyperthermic family of (Paralithic) Rhodustalfs.

The thickness of the solum ranges from 28 to 48 cm. The thickness of A-horizon ranges from 12 to 17 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from loamy sand to sandy loam with 20 to 60 per cent gravel. The thickness of B-horizon ranges from 16 to 32 cm. Its colour is in 2.5 YR and 5 YR hue with value 3 to 4 and chroma 4 to 6. Its texture is sandy clay loam with gravel

content of more than 35 per cent. The available water capacity is very low (<50 mm/m). Four phases were identified and mapped.

Landscape and soil profile characteristics of Harve (HRV) Series

4.1.2 Abbigere (ABR) Series: Abbigere soils are shallow (25-50 cm), well drained, have dark reddish brown red gravelly sandy clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. Abbigere series has been classified as a member of the clayey- skeletal, mixed, isohyperthermic family of (Paralithic) Rhodustalfs.

The thickness of the solum ranges from 28 to 48 cm. The thickness of A-horizon ranges from 12 to 17 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 4. The texture is sandy clay with 20 to 35 per cent gravel. The thickness of B-horizon ranges from 16 to 32 cm. Its colour is in 2.5 YR and 5 YR hue with value 2.5 to 4 and chroma 2 to 3. Its texture is sandy clay to clay with gravel content of more than 35 per cent. The available water capacity is very low (<50 mm/m). One phase was identified and mapped.

4.1.3 Kethanapura (KTP) Series: Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown gravelly sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Kethanapura series has been classified as a member of the fine, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 53 to 72 cm. The thickness of A-horizon ranges from 11 to 16 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 6. The texture varies from loamy sand to sandy clay loam with 15 to 40 per cent gravel. The thickness of B-horizon varies from 41 to 56 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is dominantly sandy clay loam with 15

to 35 per cent gravel. The available water capacity is medium (101-150 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Kethanapura (KTP) Series

4.1.4 Hatti (HTI) Series: Hatti soils are moderately shallow (50-75 cm), well drained, have dark reddish brown gravelly sandy clay red soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Hatti series has been classified as a member of the fine, mixed, isohyperthermic Typic Paleustalfs.

The thickness of the solum ranges from 57 to 74 cm. The thickness of A horizon ranges from 16 to 20 cm. Its colour is in 5 YR hue with value and chroma 3 to 4. The texture varies from sandy loam to sandy clay loam and sandy clay with 15 to 60 per cent gravel. The thickness of B horizon ranges from 45 to 56 cm. Its colour is in 5 YR hue with value 3 and chroma 3 to 4. Texture is sandy clay with 15 to 35 per cent gravel. The available water capacity is low (50-100 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Hatti (HTI) Series

4.1.5 Mukhadahalli (MKH) Series: Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Mukhadahalli series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Typic Haplustalfs.

The thickness of the solum ranges from 51 to 72 cm. The thickness of A horizon ranges from 12 to 17 cm. Its colour is in 5 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 4. The texture varies from loamy sand to sandy loam with 20 to 45 per cent gravel. The thickness of B horizon ranges from 40 to 68 cm. Its colour is in 2.5 YR and 5 YR hue with value and chroma 3 to 6. Texture is sandy clay loam to sandy clay with 35 to 50 per cent gravel. The available water capacity is low (50-100 mm/m). Five phases were identified and mapped

Landscape and soil profile characteristics of Mukhadahalli (MKH) Series

4.1.6 Hooradhahalli (HDH) Series: Hooradhahalli soils are moderately deep (75-100 cm), well drained, have red to dark red and reddish brown gravelly sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Hooradhahalli series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 11 to 19 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 6. The texture varies from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon varies from 65 to 83 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is low (50-100 mm/m). Only one phase was identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

4.1.7 Bidanagere (BDG) Series: Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Bidanagere soil series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 78 to 99 cm. The thickness of A-horizon ranges from 12 to 19 cm. Its colour is in 2.5 YR and 5 YR hue with value 2 to 3 and chroma 3 to 4. The texture varies from sandy clay loam to sandy clay with 10 to 20 per cent gravel. The thickness of B-horizon ranges from 68 to 85 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 5 and chroma 3 to 4. Its texture is gravelly clay with gravel content of 35-60 per cent. The available water capacity is very low (<50 mm/m). Only phase was identified and mapped.

Landscape and soil Profile Characteristics of Bidanagere (BDG) Series

4.1.8 Nagalapur (NGP) Series: Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Nagalapur series has been classified as a member of the clayey-skeletal mixed isohyperthermic family of Typic Paleustalfs.

The thickness of the solum ranges from 105 to 145 cm. The thickness of A-horizon ranges from 14 to 20 cm. Its colour is in 7.5 YR hue with value and chroma 3 to 4. The texture ranges from sandy loam to sandy clay with 10 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 128 cm. Its colour is in 2.5 YR, 5 YR and 7.5 YR hue with value 3 to 5 and chroma 3 to 6. Texture is sandy clay to clay with 35 to 80 per cent gravel. The available water capacity is low (51-100 mm/m). Only phase was identified and mapped.

Landscape and soil Profile Characteristics of Nagalapur (NGP) Series

4.1.9 Balapur (BPR) Series: Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils. These soils are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Balapur series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Typic Rhodustalfs.

The thickness of the solum ranges from 102 to 147 cm. The thickness of A horizon ranges from 12 to 17 cm. Its colour is in 5 YR and 2.5 YR hue with value and chroma 3 to 4. The texture ranges from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 132 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is medium (100-150 mm/m). Only phase was identified and mapped.

Landscape and soil profile characteristics of Balapur (BPR) Series

4.1.10 Niduvalalu (NDL) Series: Niduvalalu soils are very deep (>150 cm), well drained, have dark red and dark reddish brown gravelly sandy clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands under cultivation. Niduvalalu series has been classified as a member of the clayey–skeletal, mixed isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum is more than 150 cm. The thickness of A-horizon ranges from 11 to 15 cm. Its colour is in 5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from sandy loam to sandy clay loam with 10 to 30 per cent gravel. The thickness of B-horizon ranges from 150 to 160 cm. Its colour is in 2.5 YR and 5 YR hue with value 2.5 to 4 and chroma 4 to 6. Its texture is sandy clay and ranges from gravelly sandy clay with 20 to 75 per cent gravel. The available water capacity is low (50-100 mm/m). Only phase was identified and mapped.

Landscape and soil Profile Characteristics of Niduvalalu (NDL) Series

4.2 Soils of Alluvial landscape

In this landscape, two soil series has been identified and mapped. The brief description of soil series along with the soil phases identified and mapped is given below.

4.2.1 Dambarahalli (DRL) Series: Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have black and very dark gray to dark brown calcareous cracking clay soils. They have developed from alluvium and occur on very gently to gently sloping uplands under cultivation. The Dombarahalli series has been classified as a member of the very fine, smectitic (calc) isohyperthermic family of Typic Haplusterts.

The thickness of the solum ranges from 75 to 99 cm. The thickness of A horizon ranges from 13 to 24 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay. The thickness of B horizon ranges from 54 to 85 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is clay and are calcareous. The available water capacity is high (151-200 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Dambarahalli (DRL) Series

4.2.2 Budagumpa (BGP) Series: Budagumpa soils are very deep (>150 cm), well drained, black calcareous clay soils. They have developed from alluvium and occur on very gently sloping uplands under cultivation. The Budagumpa series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 16 to 26 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2 to 4. The texture varies from sandy clay to clay with 5 to 10 per cent gravel. The thickness of B horizon ranges from 130 to 160 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 5 and chroma 1 to 4. Its texture is clay with gravel content of <15 per cent. These soils are calcareous that increase with depth. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and soil Profile Characteristics of Budagumpa (BGP) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Timmapur-2 microwatershed

Series Name: Harve (HRV) **Pedon:** R-10
Location: $15^0$25'11.63"N, $76^0$22'03.65"E Jabbaragudda village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Loamy-skeletal, mixed, isohyperthermic (Paralithic) Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	65.64	9.07	25.28	29.04	12.99	9.00	3.48	11.15	50	scl	12.87	4.81
15-29	Bt1	56.13	7.75	36.12	27.81	11.43	7.21	1.44	8.24	60	sc	15.69	6.24
29-47	Bt2	63.42	6.53	30.05	32.38	13.93	7.48	5.74	3.89	60	scl	15.41	9.29

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	6.05	-	-	0.21	0.93	-	8.89	1.96	0.50	0.08	11.43	11.24	0.44	100.00	0.73
15-29	5.99	-	-	0.15	0.29	-	9.72	2.75	0.51	0.09	13.07	12.71	0.35	100.00	0.74
29-47	6.07	-	-	0.11	0.38	-	9.35	2.47	0.49	0.06	12.36	12.71	0.42	97.29	0.44

Contd...

Series Name: Abbigeri (ABR) **Pedon:**R-11

Location: $15^0$26'14.0"N, $76^0$16'39.0"E Abbigeri village, Koppal Taluk and District

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey- skeletal, mixed, isohyperthermic (Paralithic) Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-10	Ap	81.18	8.29	10.53	24.31	11.90	19.33	16.07	9.56	20	ls	7.13	3.91
10-25	Bt1	54.32	7.39	38.29	26.64	11.34	5.83	6.24	4.27	40	sc	14.71	11.30
25-40	Bt2	53.84	7.99	38.17	22.10	14.32	6.43	6.85	4.15	50	sc	16.45	12.00

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-10	6.13	-	-	0.02	0.81	-	1.56	0.50	0.04	0.01	2.12	3.60	0.34	58.76	0.36
10.-25	6.32	-	-	0.03	0.79	-	5.63	2.41	0.12	0.01	8.17	10.60	0.28	77.07	0.10
25-40	6.27	-	-	0.03	0.64	-	5.41	2.24	0.08	0.01	7.74	12.40	0.32	62.44	0.09

Contd...

Series Name: Kethanapura (KTP) **Pedon:** R-9
Location: $15^0$25'28.81"N, $76^0$22'00.76" E Jabbaragudda village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	83.64	10.52	5.84	25.61	22.36	15.24	13.52	6.91	10	ls	7.92	2.58
18-38	Bt1	46.06	5.63	48.31	21.58	9.54	3.53	4.15	7.26	30	sc	19.62	14.48
38-73	Bt2	52.31	6.91	40.78	24.56	12.74	5.96	5.55	3.49	30	sc	17.73	11.95

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	6.42	-		0.07	1.24	-	2.95	0.93	0.57	0.02	4.48	4.41	0.75	100.00	0.05
18-38	6.63	-	-	0.09	0.70	-	11.71	3.53	0.98	0.08	16.31	16.59	0.34	98.30	0.50
38-73	6.88	-	-	0.15	0.48	-	11.36	3.30	0.72	0.13	15.50	15.75	0.39	98.42	0.80

Contd...

Series Name: Hatti (HTI) **Pedon:** R-20
Location: Lakshmapura village Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic Typic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-16	Ap	65.33	22.48	12.19	13.79	11.32	13.37	18.31	8.54	15-20	scl	16.83	5.49
16-41	Bt1	41.54	44.42	14.04	6.47	6.26	9.50	13.36	5.95	15-20	c	27.26	16.64
41-64	Bt2	48.71	42.81	8.48	26.06	7.55	5.38	6.31	3.41	55-60	sc	27.22	12.63

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-16	7.11			0.109	0.92		21.06	8.23	0.39	0.06	29.74	20.19	1.65	147	0.30
16-41	7.54			0.220	0.92		21.93	8.47	0.23	0.27	30.90	31.31	2.23	99	0.85
41-64	7.82			0.168	0.55		19.43	7.09	0.31	0.47	27.30	26.57	3.13	103	1.77

Contd...

Series Name: Mukahadahalli (MKH), Pedon: R-11
Location: $15^0$22'05.4"N, $76^0$04'10.3"E, Halageri village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey-skeletal, mixed, isohyperthermic Typic Haplustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-19	Ap	65.71	8.83	25.46	9.27	9.06	14.42	21.52	11.43	70	scl	16.54	8.60
19-32	Bt	55.89	11.13	32.98	6.47	9.18	11.89	19.19	9.18	50	scl	19.24	12.78
32-58	Bt	47.95	10.41	41.63	17.52	3.78	9.13	9.55	7.97	50	sc	24.03	16.02

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-19	7.38			0.09	0.2	0.00	8.97	4.32	0.26	0.22	13.77	14.84	0.58	93	1.49
19-32	7.5			0.106	0.41	0.00	15.98	3.27	0.16	0.50	19.91	20.88	0.63	95	2.38
32-58	7.46			0.173	0.49	0.00	19.71	4.53	0.23	1.32	25.79	25.76	0.62	100	5.11

Contd...

Soil Series: Hooradhahalli (HDH), **Pedon:** RM-69
Location: $13^0$24'31"N, $76^0$33'41"E, (4D3D8G2d), Hesarahalli village, Chikkanayakanahalli taluk, Tumukura district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	72.56	15.17	12.27	4.57	8.33	17.38	23.88	18.39	35	sl	-	-
18-33	Bt1	56.29	10.75	32.96	7.88	10.24	13.41	14.43	10.34	55	scl	-	-
33-58	Bt2	46.66	10.79	42.55	10.79	9.87	8.43	9.04	8.53	55	sc	-	-
58-90	Bt3	43.09	13.63	43.27	9.90	8.25	7.32	8.76	8.87	45	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	6.54	-	-	0.07	0.60	0.00	2.68	1.38	0.44	0.42	4.91	5.84	0.48	84.07	7.11
18-33	5.90	-	-	0.07	0.52	0.00	3.99	1.27	0.09	0.37	5.71	8.61	0.26	66.32	4.29
33-58	6.16	-	-	0.07	0.44	0.00	4.92	1.67	0.08	0.55	7.22	10.00	0.24	72.23	5.50
58-90	6.39	-	-	0.06	0.40	0.00	4.30	2.02	0.08	0.46	6.87	9.21	0.21	74.61	5.05

Contd...

Series: Bidanagere (BDG), **Pedon**: RM-3
Location: $13^0$22'11"N, $76^0$38'03"E, (4D3D8G1a), Tharabenahalli village, Chikkanayakanahalli Taluk, Tumakuru District.
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-20	Ap	81.19	11.25	7.56	12.54	15.07	17.90	21.94	13.75	50	ls	-	-
20-35	Bt1	57.45	11.45	31.10	12.76	11.02	10.92	12.45	10.31	50	scl	-	-
35-92	Bt2	44.63	7.85	47.52	12.40	9.61	8.37	7.75	6.51	60	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-20	6.24	-	-	0.06	0.60	0.00	1.61	0.26	0.10	0.01	1.98	3.76	0.50	52.56	0.35
20-35	5.99	-	-	0.02	0.40	0.00	4.25	0.46	0.08	0.28	5.07	8.02	0.26	63.18	3.46
35-92	6.70	-	-	0.03	0.20	0.00	5.45	0.31	0.10	0.22	6.09	9.90	0.21	61.48	2.24

Contd...

Series Name: Nagalapur (NGP) **Pedon :** R-10
Location: $15^0$26'38.0"N, $76^0$10'27.0" E Budashettynala village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey- skeletal, mixed, isohyperthermic Typic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-16	Ap	78.43	6.36	15.21	25.23	18.82	14.04	13.22	7.12	30	sl	9.32	5.56
16-38	Bt1	46.97	8.53	44.51	14.33	12.34	7.43	6.80	6.07	30	sc	18.70	13.79
38-58	Bt2	51.92	7.48	40.60	20.98	10.07	7.37	7.48	6.02	40	sc	17.93	13.75
58-81	Bt3	54.05	7.18	38.77	27.07	10.58	5.91	5.81	4.67	50	sc	17.92	11.87
81-104	Bt4	59.03	8.93	32.04	21.88	13.11	8.88	8.05	7.12	50	scl	16.63	10.55
104-126	BC	62.35	9.26	28.40	21.19	14.51	9.88	8.13	8.64	60	scl	15.03	10.06

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-16	6.77	-	-	0.09	0.82	-	3.52	2.14	0.18	0.03	5.87	7.10	0.47	82.70	0.46
16-38	6.89	-	-	0.06	0.57	-	9.35	3.85	0.10	0.21	13.50	14.70	0.33	91.87	1.40
38-58	6.80	-	-	0.06	0.52	-	8.76	3.42	0.10	0.26	12.55	14.20	0.35	88.35	1.85
58-81	6.84	-	-	0.06	0.32	-	7.67	2.77	0.10	0.58	11.12	12.90	0.33	86.18	4.48
81-104	6.86	-	-	0.05	0.20	-	6.97	2.07	0.09	0.95	10.07	11.90	0.37	84.59	7.95
104-126	6.70	-	-	0.07	0.10	-	5.53	1.77	0.07	0.73	8.09	9.40	0.33	86.09	7.77

Contd...

Soil Series: Balapur (BPR), **Pedon**: RM-78
Location: $13^0$26'39"N, $76^0$35'03"E, (4D3D8G2c), Kasaba, Chikkanayakanahalli taluk, Tumakuru district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	65.66	18.66	15.68	4.14	6.16	13.33	21.82	20.20	-	sl	-	-
12-34	Bt1	61.91	11.52	26.57	2.36	6.78	12.53	21.36	18.89	-	scl	-	-
34-60	Bt2	51.81	11.24	36.94	4.66	5.70	12.23	15.96	13.26	30	sc	-	-
60-84	Bt3	46.61	9.02	44.37	14.70	6.88	7.51	8.97	8.55	55	sc	-	-
84-112	Bt4	48.75	12.92	38.33	15.73	8.13	6.87	8.23	9.79	60	sc	-	-
112-127	Bc	50.98	24.74	24.28	5.25	4.63	5.15	10.92	25.03	50	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	6.64	-	-	0.03	0.56	0.00	1.90	1.32	0.21	0.03	3.46	5.45	0.35	63.48	0.51
12-34	6.99	-	-	0.02	0.48	0.00	3.66	1.90	0.07	0.08	5.70	7.82	0.29	72.93	0.96
34-60	7.29	-	-	0.02	0.40	0.00	5.13	2.08	0.11	0.20	7.52	11.19	0.30	67.18	1.75
60-84	7.50	-	-	0.02	0.32	0.00	5.83	6.36	0.13	0.23	12.55	12.38	0.28	101.43	1.83
84-112	7.54	-	-	0.02	0.24	0.00	6.02	6.59	0.11	0.25	12.96	12.77	0.33	101.49	1.97
112-127	7.90	-	-	0.02	0.20	0.00	8.04	3.62	0.07	0.32	12.04	12.47	0.51	96.56	2.55

Contd...

Series Name: Niduvalalu (NDL) **Pedon:** R-20
Location: $15^0$12'78.8"N, $75^0$57'44.0" E Raghunathanahalli village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey –skeletal, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-16	Ap	79.83	7.02	13.15	9.36	11.02	19.54	28.59	11.33	35-40	sl	14.30	5.17
16-31	Bt1	54.75	10.89	34.36	12.81	7.47	12.17	11.95	10.35	55-60	scl	24.67	14.17
31-44	Bt2	44.64	2.31	53.06	17.06	8.48	7.19	8.05	3.86	65-70	c	30.02	17.19
44-79	Bt3	47.28	2.50	50.21	24.17	8.20	6.07	5.96	2.88	65-70	sc	27.19	14.87
79-107	Bt4	47.79	8.17	44.04	13.38	5.72	11.11	11.87	5.72	60-65	sc	25.96	14.23
107-140	Bt5	46.16	3.57	50.27	21.75	7.57	6.40	6.72	3.73	60-65	sc	27.28	15.13
140-180	Bt6	49.47	3.94	46.59	22.49	8.21	6.29	7.78	4.69	65-70	sc	27.56	14.76

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-16	7.46	-	-	0.08	0.76		6.26	4.05	0.12	0.09	10.52	11.45	0.87	91.88	0.32
16-31	7.84	-	-	0.28	1.05	2.86	-	-	0.18	1.41	-	27.36	0.80	100.00	2.06
31-44	7.69	-	-	0.46	0.81	2.99	-	-	0.24	2.63	-	32.59	0.61	100.00	3.23
44-79	7.92	-	-	0.11	0.35	1.69	16.29	3.51	0.14	2.63	22.57	22.56	0.45	100.03	4.66
79-107	7.86	-	-	0.09	0.23	1.43	12.98	2.83	0.10	1.82	17.73	17.88	0.41	99.19	4.07
107-140	8.20	-	-	0.07	0.23	1.17	16.26	3.41	0.13	1.85	21.65	20.82	0.41	104.01	3.56
140-180	8.11	-	-	0.20	0.15	1.82	-	-	0.11	1.29	-	20.71	0.44	100.00	2.49

Contd...

Series Name: Dombarahalli (DRL) **Pedon:** R-8
Location: $15^0$13'96.2"N, $75^0$57'48.6" E Ragunathanahalli village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, (calc) isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	28.25	19.48	52.27	4.76	4.44	4.87	8.23	5.95	-	c	39.86	27.20
15-27	BA1	21.55	20.00	58.45	3.76	2.76	3.43	6.30	5.30	-	c	46.35	34.84
27-45	Bss1	14.86	20.89	64.25	2.46	2.23	2.23	3.91	4.02	-	c	57.99	41.06
45-80	Bss2	10.42	19.04	70.54	1.74	1.97	1.27	2.78	2.66	-	c	66.36	36.24

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	8.78	-	-	0.42	0.32	12.35	-	-	0.59	4.25	-	49.70	0.95	100.00	5.62
15-27	9.03	-	-	0.61	0.30	12.48	-	-	0.30	8.96	-	57.23	0.98	100.00	10.07
27-45	9.10	-	-	0.67	0.34	11.70	-	-	0.25	11.85	-	60.71	0.95	100.00	14.05
45-80	9.18	-	-	0.86	0.32	13.39	-	-	0.27	15.40	-	63.33	0.90	100.00	18.45

Contd...

Series Name: Budagumpa (BGP) **Pedon:** R-21
Location: $15^0$23'45"N, $76^0$08'52"E Neregalla village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-16	Ap	58.30	18.10	23.60	6.34	11.75	11.66	17.44	11.10	-	scl	18.24	10.29
16-38	Bw1	44.26	18.39	37.36	4.71	9.79	9.32	12.24	8.19	-	cl	32.99	18.12
38-68	Bw2	37.84	24.91	37.25	3.66	7.51	8.45	10.89	7.32	-	cl	39.50	22.32
68-83	Bw3	19.17	19.89	60.93	0.87	3.47	3.85	6.07	4.91	-	c	47.27	28.52
83-107	Bw4	14.76	23.22	62.02	0.63	2.41	3.25	4.61	3.87	-	c	46.10	29.36
107-131	Bw5	11.86	17.75	70.39	0.85	2.73	2.45	3.20	2.64	-	c	50.52	28.09
131-160	Bw6	14.48	18.21	67.31	2.23	2.50	2.59	3.84	3.31	-	c	59.14	28.35

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-16	9.20	-	-	0.27	0.51	6.24	-	-	0.42	3.11	-	19.60	0.83	100.00	3.84
16-38	9.29	-	-	0.88	0.35	5.98	-	-	0.17	9.36	-	28.40	0.76	100.00	15.38
38-68	8.95	-	-	2.37	0.31	4.81	-	-	0.31	24.10	-	34.90	0.94	100.00	42.65
68-83	8.65	-	-	4.28	0.33	4.42	-	-	0.39	27.95	-	45.10	0.74	100.00	25.94
83-107	8.10	-	-	9.50	0.30	3.38	-	-	0.44	31.29	-	44.10	0.71	100.00	12.82
107-131	8.16	-	-	9.32	0.22	2.73	-	-	0.63	37.86	-	47.20	0.67	100.00	20.37
131-160	8.49	-	-	5.29	0.19	3.51	-	-	0.60	34.82	-	43.70	0.65	100.00	48.66

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

The most important soil and site characteristics that affect the land use and conservation needs of an area are land capability, land irrigability, soil depth, soil texture, coarse fragments, available water capacity, soil slope, soil erosion, soil reaction etc. These are interpreted from the data base generated through land resource inventory and several thematic maps are generated. These would help in identifying the areas suitable for growing crops and, soil and water conservation measures and structures needed thus helping to maintain good soil health for sustained crop production. The various thematic maps generated are described below.

5.1 Land Capability Classification

Land capability classification is an interpretative grouping of soil map units (soil phases) mainly based on inherent soil characteristics, external land features and environmental factors that limit the use of land for agriculture, pasture, forestry or other uses on a sustained basis (IARI, 1971). The land and soil characteristics used to group the land resources in an area into various land capability classes, subclasses and units are

Soil characteristics: Soil depth, soil texture, coarse fragments, soil reaction, available water capacity, calcareousness, salinity/alkali *etc*.

Land characteristics: Slope, erosion, drainage, rock outcrops.

Climate: Total rainfall and its distribution, and length of crop growing period.

The land capability classification system is divided into land capability classes, subclasses and units based on the level of information available. Eight land capability classes are recognized. They are

Class I: They are very good lands that have no limitations or very few limitations that restrict their use.

Class II: They are good lands that have minor limitations and require moderate conservation practices.

Class III: They are moderately good lands that have severe limitations that reduce the choice of crops or that require special conservation practices.

Class IV: They are fairly good lands that have very severe limitations that reduce the choice of crops or that require very careful management.

Class V: Soils in these lands are not likely to erode, but have other limitations like wetness that are impractical to remove and as such not suitable for agriculture, but suitable for pasture or forestry with minor limitations.

Class VI: The lands have severe limitations that make them generally unsuitable for cultivation, but suitable for pasture or forestry with moderate limitations.

Class VII: The lands have very severe limitations that make them unsuitable for cultivation, but suitable for pasture or forestry with major limitations.

Class VIII: Soil and other miscellaneous areas (rock lands) that have very severe limitations that nearly preclude their use for any crop production, but suitable for wildlife, recreation and installation of wind mills.

The land capability subclasses are recognised based on the dominant limitations observed within a given land capability class. The subclasses are designated by adding a lower case letter like 'e', 'w', 's', or 'c' to the class numeral. The subclass "e" indicates that the main hazard is risk of erosion, "w" indicates drainage or wetness as a limitation for plant growth, "s" indicates shallow soil depth, coarse or heavy textures, calcareousness, salinity/alkalinity or gravelliness and "c" indicates limitation due to climate.

The land capability subclasses have been further subdivided into land capability units based on the kinds of limitations present in each subclass. Ten land capability units are used in grouping the soil map units. They are stony or rocky (0), erosion hazard (slope, erosion) (1), coarse texture (sand, loamy sand, sandy loam) (2), fine texture (cracking clay, silty clay) (3), slowly permeable subsoil (4), coarse underlying material (5), salinity/alkali (6), stagnation, overflow, high ground water table (7), soil depth (8) and fertility problems (9). The capability units thus identified have similar soil and land characteristics that respond similarly to a given level of management. The soils of the microwatershed have been classified upto land capability subclass level.

The 21 soil map units identified in the Timmapur-2 microwatershed are grouped under two land capability classes and four land capability subclasses (Fig. 5.1).

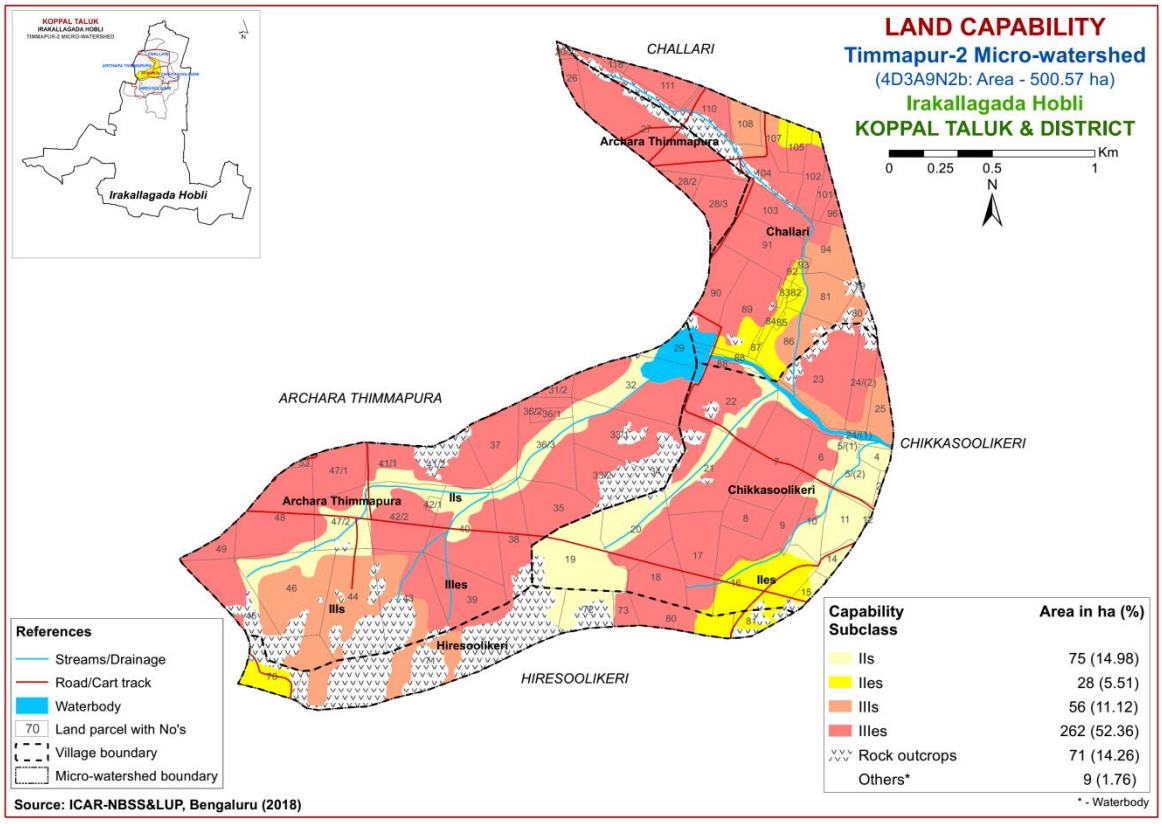


Fig. 5.1 Land Capability map of Timmapur-2 Microwatershed

Entire area of the microwatershed is suitable for agriculture. An area of 103 ha (20%) are good lands (Class II) that have minor limitations and require moderate conservation practices and are distributed in the northern, central, western and southeastern part of the microwatershed. Moderately good lands (Class III) cover an area of 318 ha (63%) and are distributed in all parts of the microwatershed with moderate problems of soil that require special conservation practices. The other miscellaneous areas cover about 14 per cent that have very severe limitations that preclude them for any crop productivity, but well suited for wildlife, recreation and installation of wind mills.

5.2 Soil Depth

Soil depth refers to the depth of the soil occurring above the parent material or hard rock. The depth of the soil determines the effective rooting depth for plants and in accordance with soil texture, mineralogy and gravel content, the capacity of the soil column to hold water and nutrient availability. Soil depth is one of the most important soil characteristic that is used in differentiating soils into different soil series. The soil depth classes used in identifying soils in the field are very shallow (<25 cm), shallow (25-50 cm), moderately shallow (50-75 cm), moderately deep (75-100 cm), deep (100-150 cm) and very deep (>150 cm). They were used to classify the soils into different depth classes and a soil depth map was generated (Fig. 5.2).

Shallow (25-50 cm) soils occupy an area of 184 ha (37%) and are distributed in the northern, northeastern, central and western part of the microwatershed. An area of 123 ha (25%) is moderately shallow (50-75 cm) and are distributed in the northern, northwestern, central and eastern part of the microwatershed. Moderately deep soils (75-100 cm) occupy an area of 29 ha (6%) and occur in the central and eastern part of the microwatershed. Deep (100-150 cm) to very deep (100->150 cm) soils occupy an area of 84 ha (17%) and are distributed in the northern, western, central and eastern part of the microwatershed.

The most problem lands with an area of about 184 ha (37%) having shallow (25-50 cm) rooting depth. They are suitable for growing short duration agricultural crops but well suited for pasture, forestry or other recreational purposes. The most productive lands cover a minor area about 84 ha (17%) where all climatically adapted long duration crops be grown.

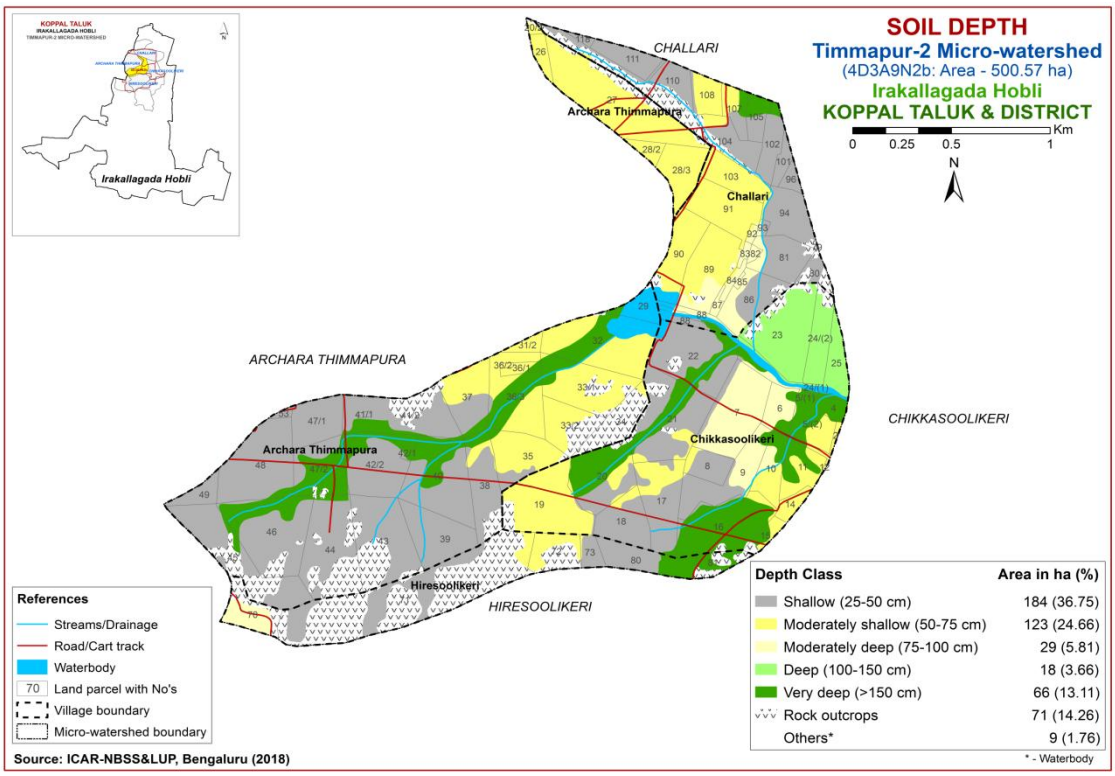


Fig. 5.2 Soil Depth map of Timmapur-2 Microwatershed

5.3 Surface Soil Texture

Texture is an expression to indicate the coarseness or fineness of the soil as determined by the relative proportion of primary particles of sand, silt and clay. It has a direct bearing on the structure, porosity, adhesion and consistence. The surface layer of a soil to a depth of about 25 cm is the layer that is most used by crops and plants. The surface soil textural class provides a guide to understanding soil-water retention and availability, nutrient holding capacity, infiltration, workability, drainage, physical and chemical behaviour, microbial activity and crop suitability. The textural classes used for LRI were used to classify and a surface soil texture map was generated (fig. 5.3). The area extent and their spatial distribution in the microwatershed is shown in figure 5.3.

An area of about 205 ha (41%) has soils that are loamy soils at the surface. They are distributed in the northern, central, western and eastern part of the microwatershed. An area of 215 ha (43%) has clayey soils at the surface and are distributed in the eastern, central and western part of the microwatershed (Fig. 5.3).

The most productive lands 215 ha (43%) with respect to surface soil texture are the clayey soils that have high potential for soil-water retention and availability, and nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems. The other most productive lands 205 ha (41%) are loamy soils which also have high potential for AWC, nutrient availability but have no drainage or other physical problems compared to loamy soils.

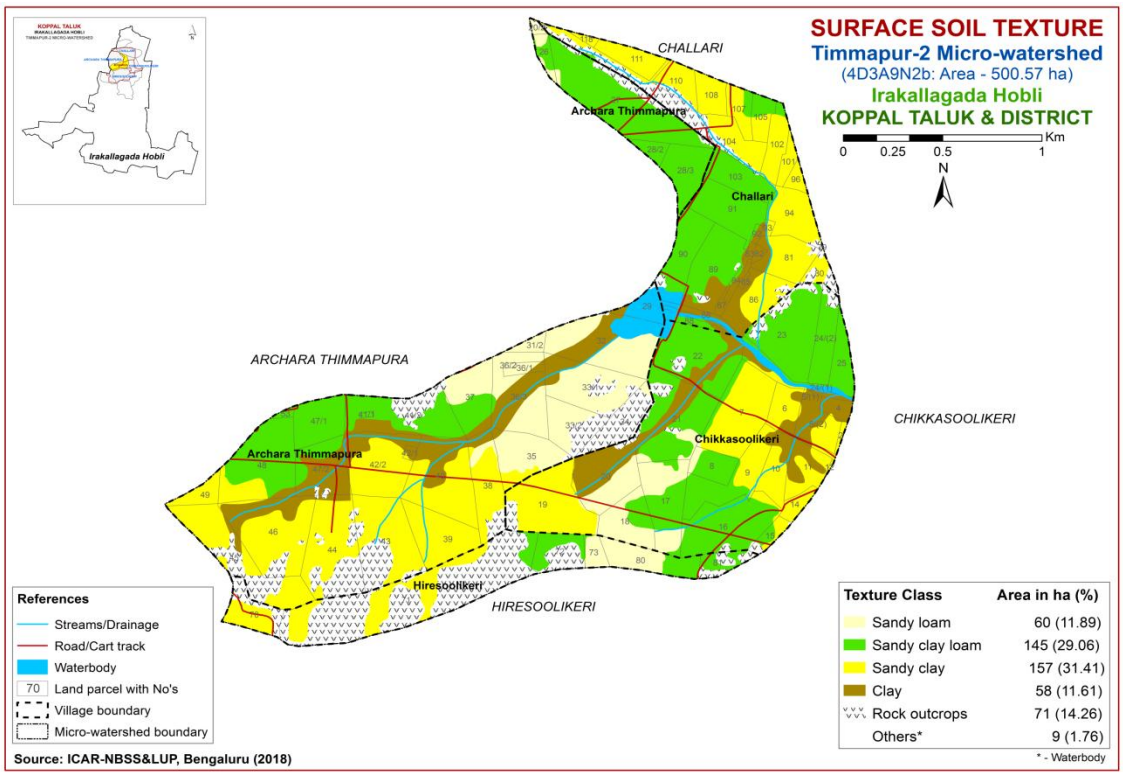


Fig. 5.3 Surface Soil Texture map of Timmapur-2 Microwatershed

5.4 Soil Gravelliness

Gravel is the term used for describing coarse fragments between 2 mm and 7.5 cm diameter and stones for those between 7.5 cm and 25 cm. The presence of gravel and stones in soil reduces the volume of soil responsible for moisture and nutrient storage, drainage, infiltration and runoff, and hinders plant growth by impeding root growth and seedling emergence, intercultural operations and farm mechanization. The gravelliness classes used in LRI were used to classify the soils and using these classes a gravelliness map was generated. The area extent and their spatial distribution in the microwatershed is given in figure 5.4.

The soils that are non-gravelly (<15% gravel) cover an area of 65 ha (13%) and are distributed in the central, eastern and western part of the microwatershed. An area of 93 ha (19%) is covered by gravelly (15-35% gravel) soils and are distributed in the northern, eastern, central and western part of the microwatershed. Major area of about 262 ha (52%) is very gravelly (35-60%) and are distributed in all parts of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 13%. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem soils that are gravelly (15-35%) to very gravelly (35-60%) cover 355 ha (71%) where only short or medium duration crops can be grown.

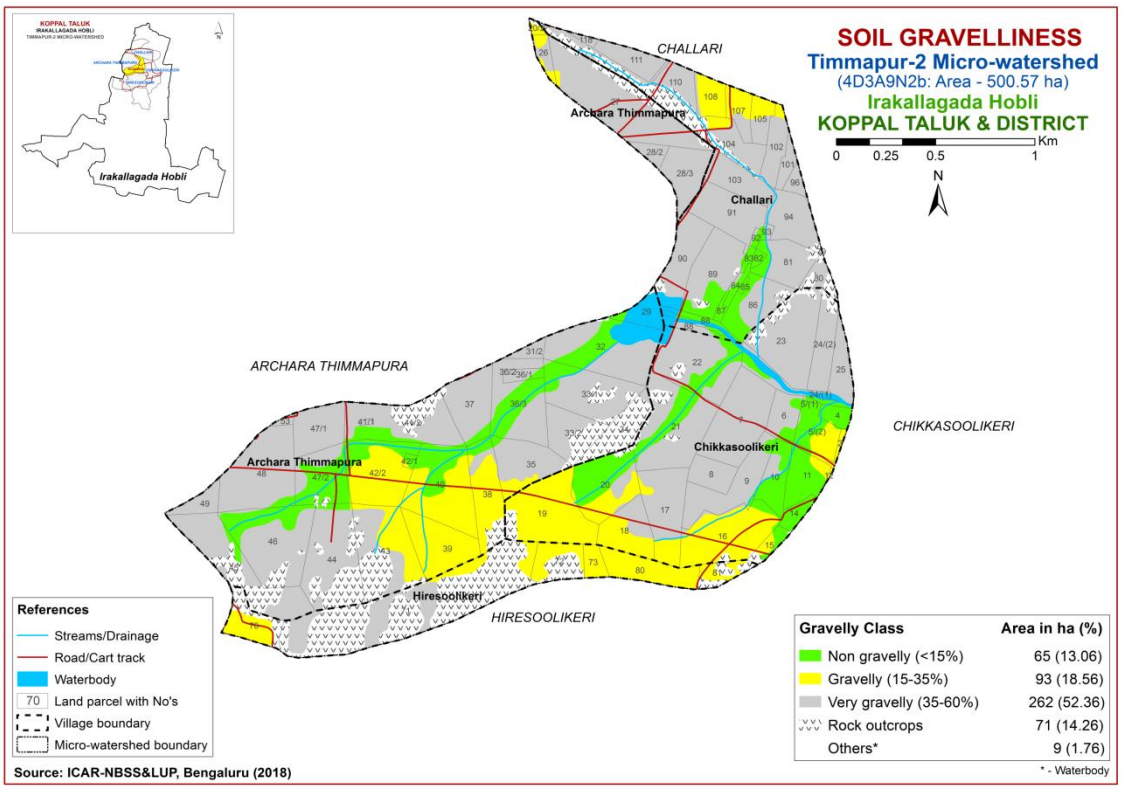


Fig. 5.4 Soil Gravelliness map of Timmapur-2 Microwatershed

5.5 Available Water Capacity

The soil available water capacity (AWC) is estimated based on the ability of the soil column to retain water between the tensions of 0.33 and 15 bar in a depth of 100 cm or the entire solum if the soil is shallower. The AWC of the soils (soil series) as estimated by considering the soil texture, mineralogy, soil depth and gravel content (Sehgal *et al.*, 1990) and accordingly the soil map units were grouped into five AWC classes *viz*, very low (<50 mm/m), low (50-100 mm/m), medium (100-150 mm/m), high (150-200 mm/m) and very high (>200 mm/m) and using these values, an AWC map was generated (Fig. 5.5), showing the area extent and their spatial distribution in the microwatershed.

An area of about 302 ha (60%) are very low (<50 mm/m) in available water capacity and are distributed in the major part of the microwatershed. An area of about 60 ha (12%) has soils that are low (51-100 mm/m) in available water capacity and are distributed in the northern, eastern and southern part of the microwatershed. Soils with medium available water capacitiy (101-150 mm/m) occupy a small area of 9 ha (2%) and are distributed in the northern part of the microwatershed. An area of about 50 ha (10%) is high (151-200 mm/m) in available water capacity and are distributed in the central, western and eastern part of the microwatershed.

An area of about 302 ha (60%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. The potential soils with respect to AWC cover about 50 ha (10%) that have high AWC, where all climatically adapted long duration crops can be grown.

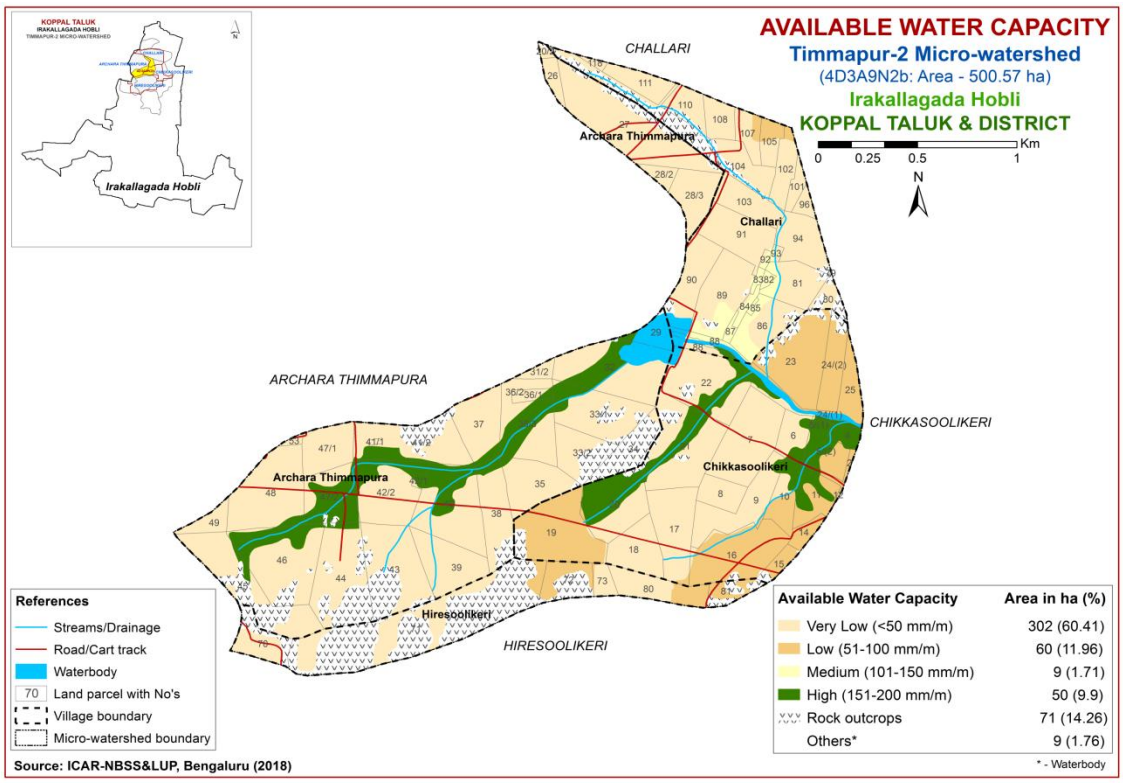


Fig. 5.5 Soil Available Water Capacity map of Timmapur-2 Microwatershed

5.6 Soil Slope

Soil slope refers to the inclination of the surface of the land. It is defined by gradient, shape and length, and is an integral feature of any soil as a natural body. Slope is considered important in soil genesis, land use and land development. The length and gradient of slope influences the rate of runoff, infiltration, erosion and deposition. The soil map units were grouped into four slope classes and a slope map was generated showing the area extent and their geographic distribution of different slope classes in the microwatershed (Fig. 5.6).

Nearly level (0-1%) soils occupy an area of 50 ha (10%) and are distributed in the central, western and eastern part of the microwatershed. Major area of about 365 ha (73%) falls under very gently sloping (1-3% slope) and are distributed in all parts of the microwatershed. Gently sloping (3-5%) areas covers an area of 6 ha (1%) and are distributed in the central part of the microwatershed. In all these lands, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

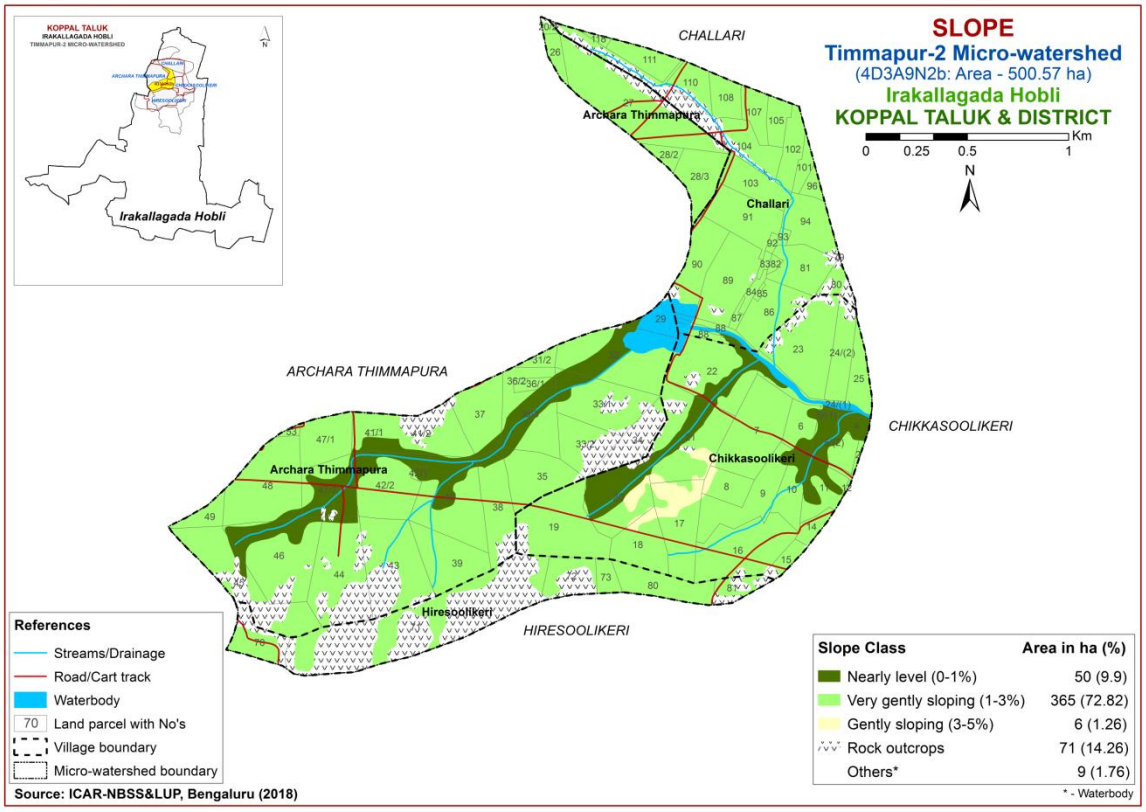


Fig. 5.6 Soil Slope map of Timmapur-2 Microwatershed

5.7 Soil Erosion

Soil erosion refers to the wearing away of the earth's surface by the forces of water, wind and ice involving detachment and transport of soil by raindrop impact. It is used for accelerated soil erosion resulting from disturbance of the natural landscape by burning, excessive grazing and indiscriminate felling of forest trees and tillage, all usually by man. The erosion classes showing an estimate of the current erosion status as judged from field observations in the form of rills, gullies or a carpet of gravel on the surface are recorded. Four erosion classes, viz, slight erosion (e1), moderate erosion (e2), severe erosion (e3) and very severe erosion (e4) are recognized. The soil map units were grouped into different erosion classes and a soil erosion map generated. The area extent and their spatial distribution in the microwatershed is given in Figure 5.7.

Soils that are slightly eroded (e1 Class) occupy an area of about 148 ha (30%) and are distributed in the northern, eastern, central and western part of the microwatershed. Moderately eroded (e2 Class) soils cover an area of 272 ha (54%) and are distributed in the major part of the microwatershed. An

An area of about 272 ha (54%) in the microwatershed is problematic because of moderate erosion. These areas need soil and water conservation and other land development measures for restoring the soil health.

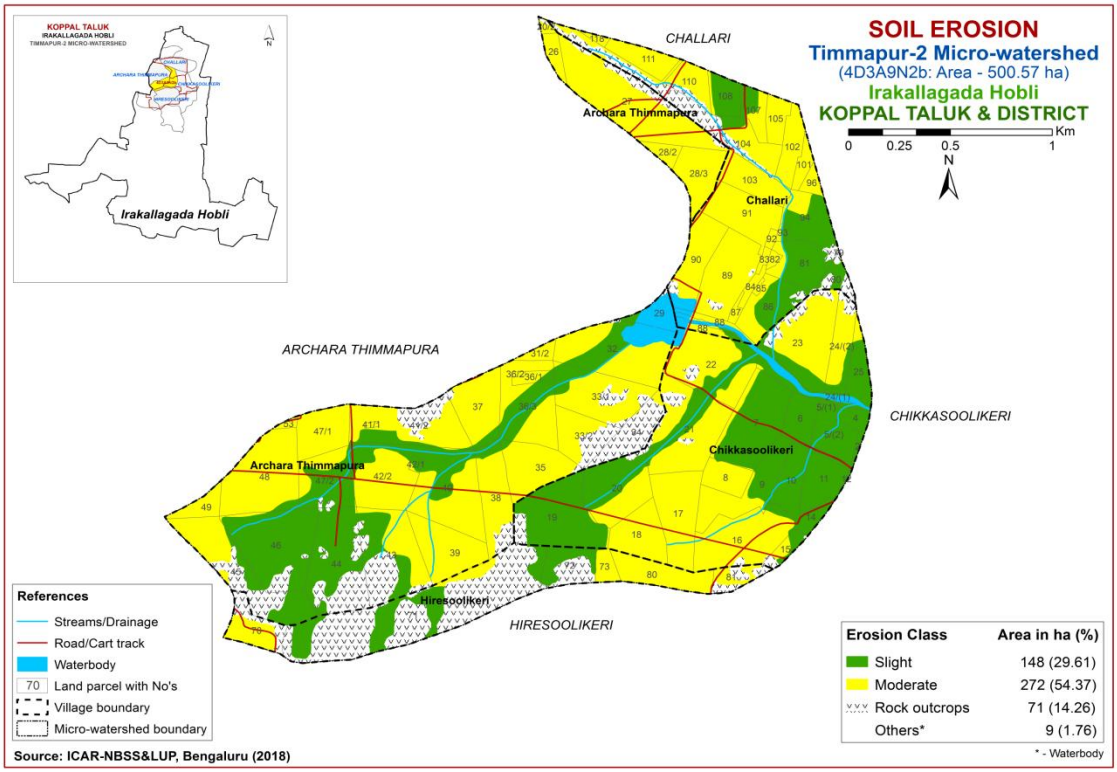


Fig. 5.7 Soil Erosion map of Timmapur-2 Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status, as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 320 m grid interval) all over the microwatershed through land resource inventory in the year 2017 were analysed for pH, EC, organic carbon, available phosphorus and potassium and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

Soil fertility data generated has been assessed and individual maps for all the nutrients for the microwatershed have been generated by using the Kriging method under GIS. The village/survey number wise fertility data for the microwatershed is given in Appendix-II.

6.1 Soil Reaction (pH)

The soil analysis of the Timmapur-2 microwatershed for soil reaction (pH) showed that an area of 8 ha (2%) is moderately alkaline (pH 7.8-8.4) and are distributed in the northeastern and western part of the microwaterhsed. An area of 36 ha (7%) is slightly alkaline (pH 7.3-7.8) and are distributed in the northeastern, southeastern and western part of the microwaterhsed. An area of about 122 ha (24%) is neutral (pH 6.5-7.3) and are distributed in the northern, eastern, southeastern and western part of the microwatershed. Slightly acid (pH 6.0-6.5) soils cover an area of 131 ha (26%) and are distributed in the northern, eastern, central and western part of the microwatershed. An area of 171 ha (23%) is moderately acid (pH 5.5-6.0) and are distributed in the northern, central and western part of the microwatershed. Strongly acid (pH 5.0-5.5) soils occupy a minor area of 6 ha (1%) and are distributed in the southern part of the microwatershed. Thus, major soils in the microwatershed are acidic covering 354 ha, alkaline soils cover 44 ha and neutral soils about 122 ha in reaction.

6.2 Electrical Conductivity (EC)

The Electrical Conductivity of the soils is <2 dS m^{-1} in the entire microwatershed (Fig. 6.2) area and as such the soils are nonsaline.

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) in the soils of the microwatershed is medium (0.5-0.75%) covering an area of 410 ha (82%) and is distributed in the major part of the microwatershed. An area of 11 ha (2%) is high (>75%)

in organic carbon content and is distributed in the western and southern part of the microwatershed (Fig. 6.3).

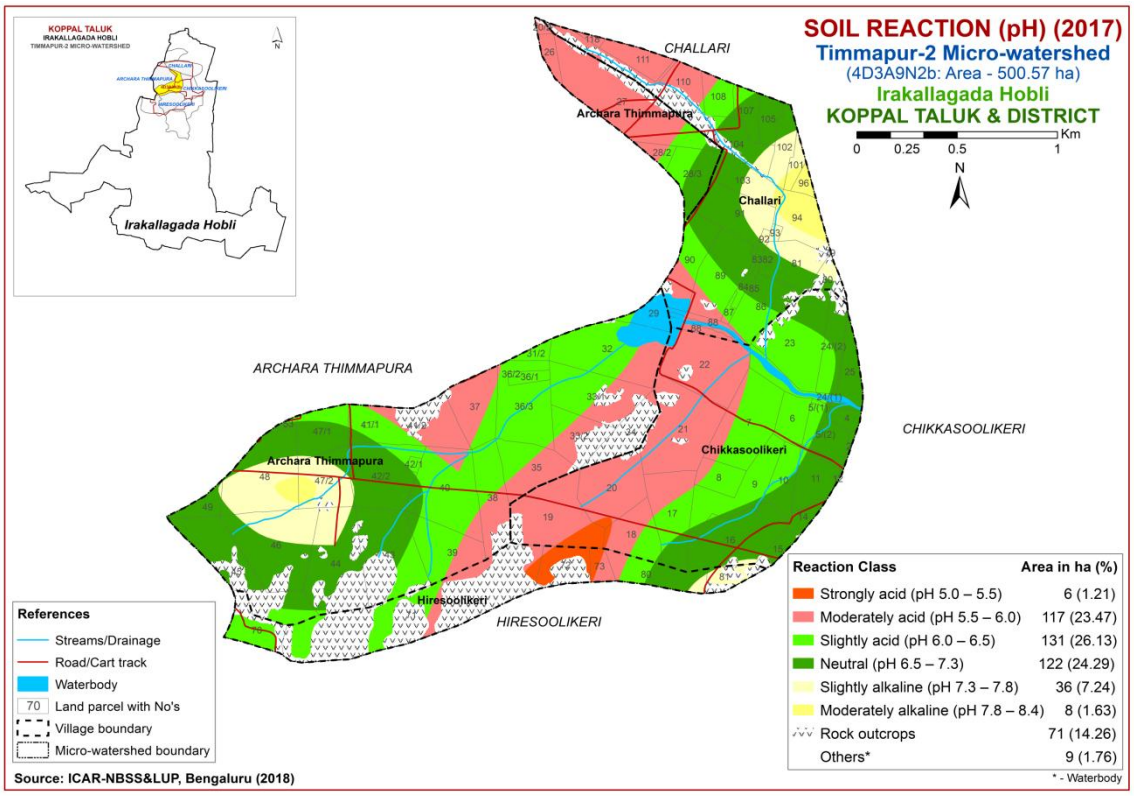


Fig. 6.1 Soil Reaction (pH) map of Timmapur-2 Microwatershed

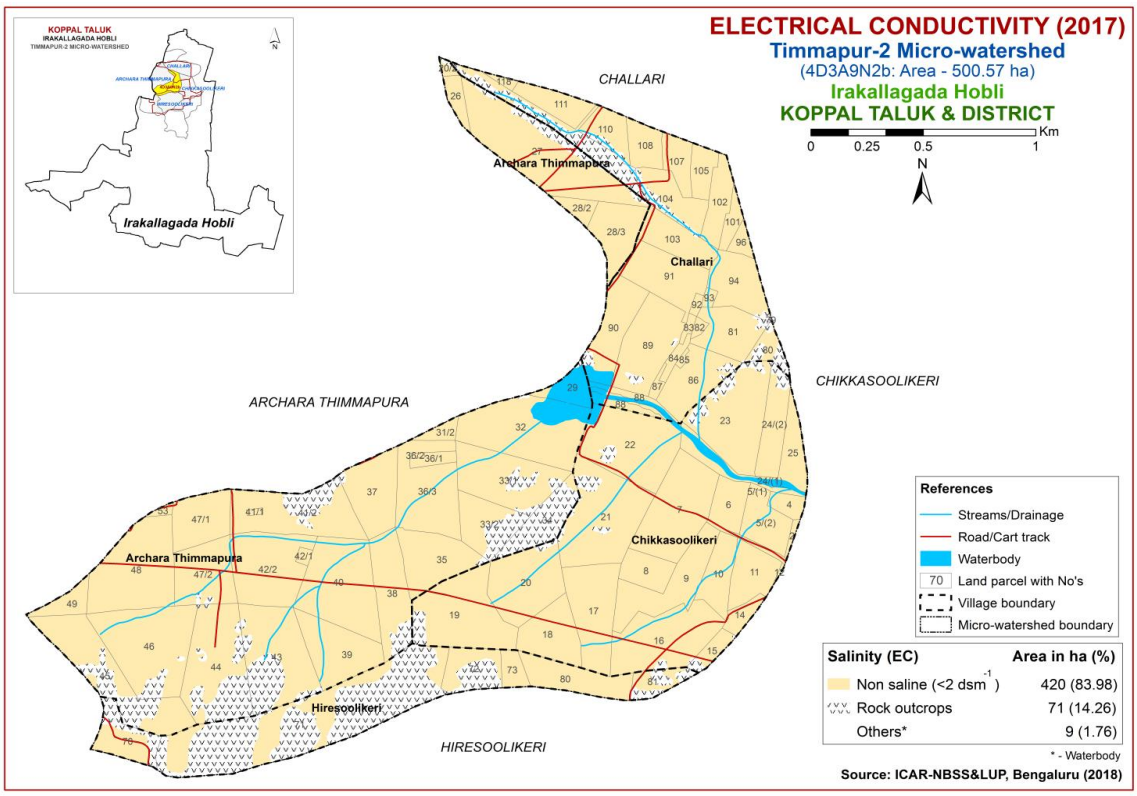


Fig. 6.2 Electrical Conductivity (EC) map of Timmapur-2 Microwatershed

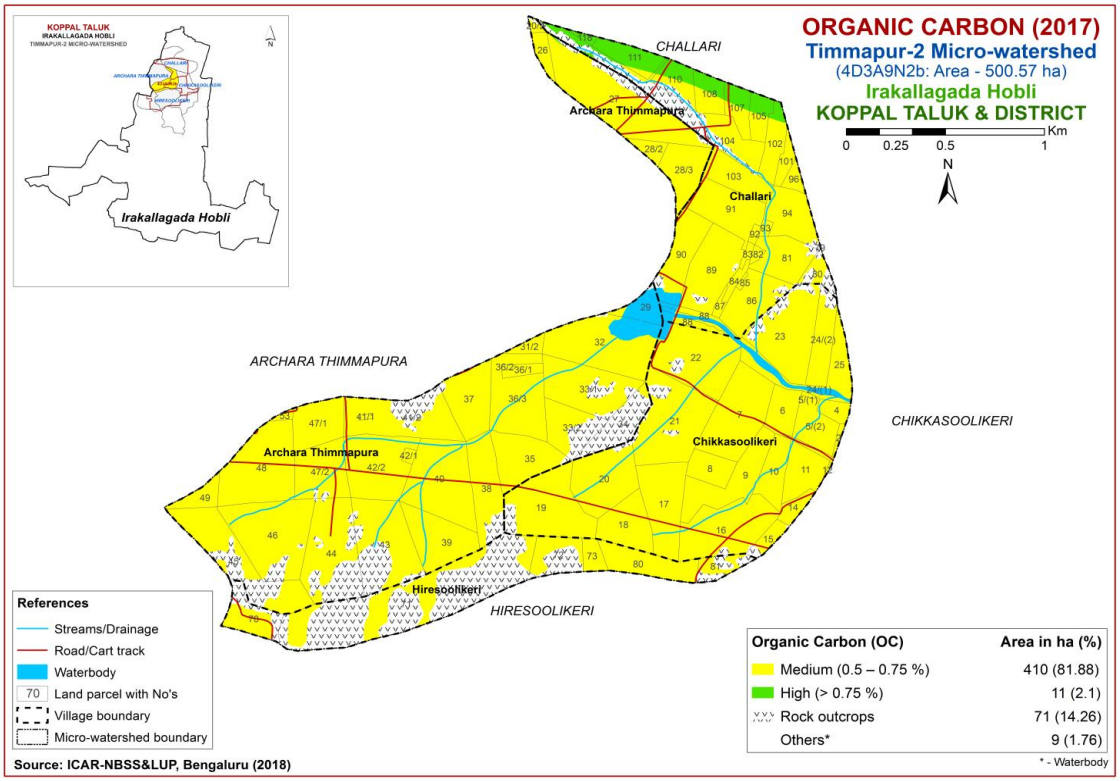


Fig. 6.3 Soil Organic Carbon map of Timmapur-2 Microwatershed

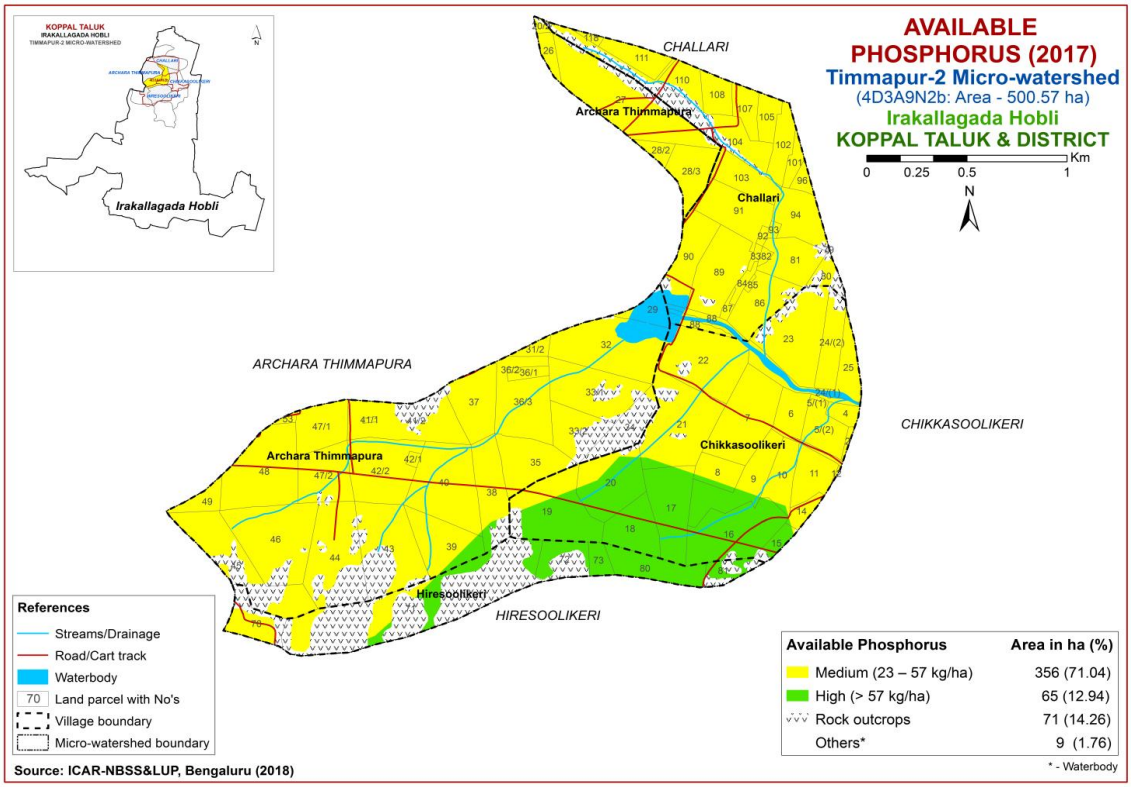


Fig. 6.4 Soil Available Phosphorus map of Timmapur-2 Microwatershed

6.4 Available Phosphorus

Major cultivated area of about 356 ha (71%) is medium (<23 kg/ha) in available phosphorus and is distributed in the major part of the microwatershed. High (>57 kg/ha) in available phosphorus cover an area of 65 ha (13%) and are distributed in the southern part of the microwatershed (Fig. 6.4).

6.5 Available Potassium

Major area of about 324 ha (65%) is low (<145 kg/ha) and are distributed in the major part of the microwatershed. Medium (145-337 kg/ha) in available potassium content occupy an area of 72 ha (14%) and are distributed in the eastern, southern and southwestern part of the microwatershed. An area of about 24 ha (5%) is high (>337 kg/ha) and are distributed in the southern part of the microwatershed (Fig. 6.5).

6.6 Available Sulphur

Soils that are low in available sulphur content (<10 ppm) cover an area of 169 ha (34%) and are distributed in the northern, central, eastern and western part of the microwatershed. An area of 198 ha (40%) is medium (10-20 ppm) in available sulphur content and are distributed in the central, eastern, southern and western part of the microwatershed. High (>20 ppm) in available sulphur content occupy an area of 54 ha (11%) and are distributed in the southern and southwestern part of the microwatershed (Fig. 6.6). The areas that are low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or factomphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.

6.7 Available Boron

Available boron content is low (<0.5 ppm) in an area of 418 ha (83%) and are distributed in all parts of the microwatershed. An area of about 3 ha (<1%) is medium (0.5-1.0 ppm) in available boron and are distributed in the southeastern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in the entire part of the microwatershed (Fig. 6.8).

6.9 Available Manganese

Available manganese content is sufficient (>1.0 ppm) in the entire microwatershed area (Fig. 6.9).

6.10 Available Copper

Available copper content is sufficient (>0.2 ppm) in the entire microwatershed area (Fig. 6.10).

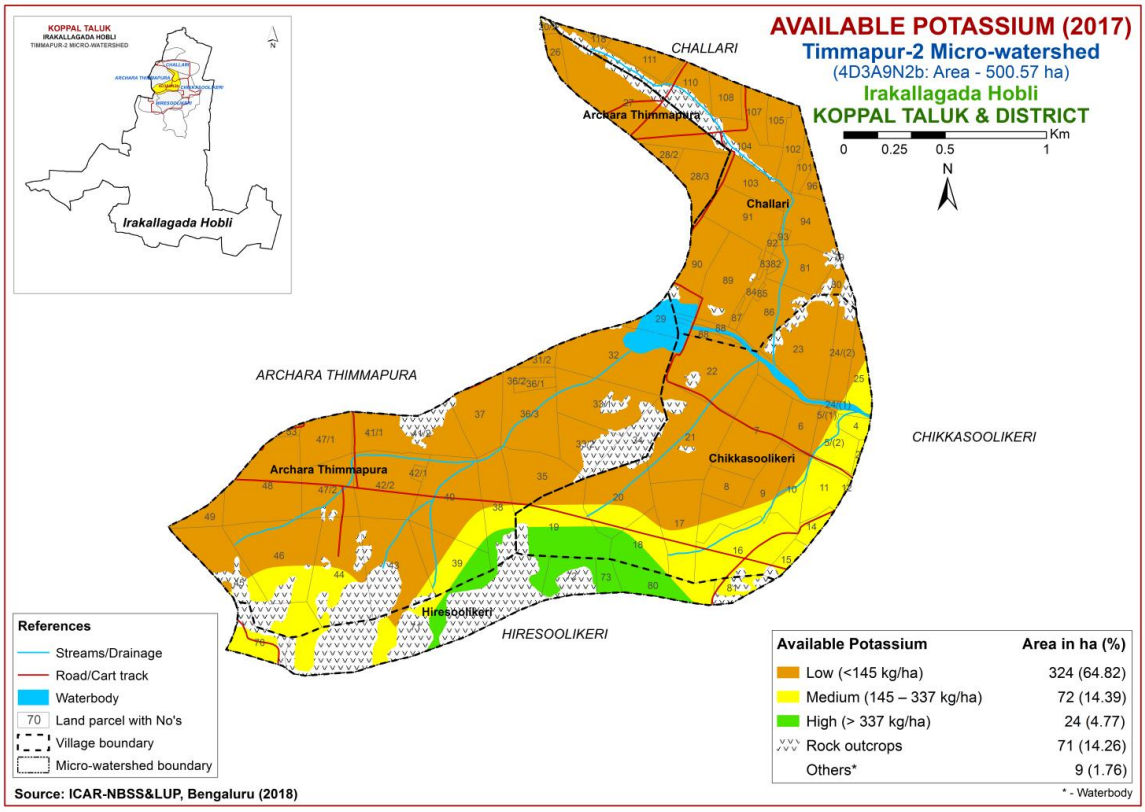


Fig. 6.5 Soil Available Potassium map of Timmapur-2 Microwatershed

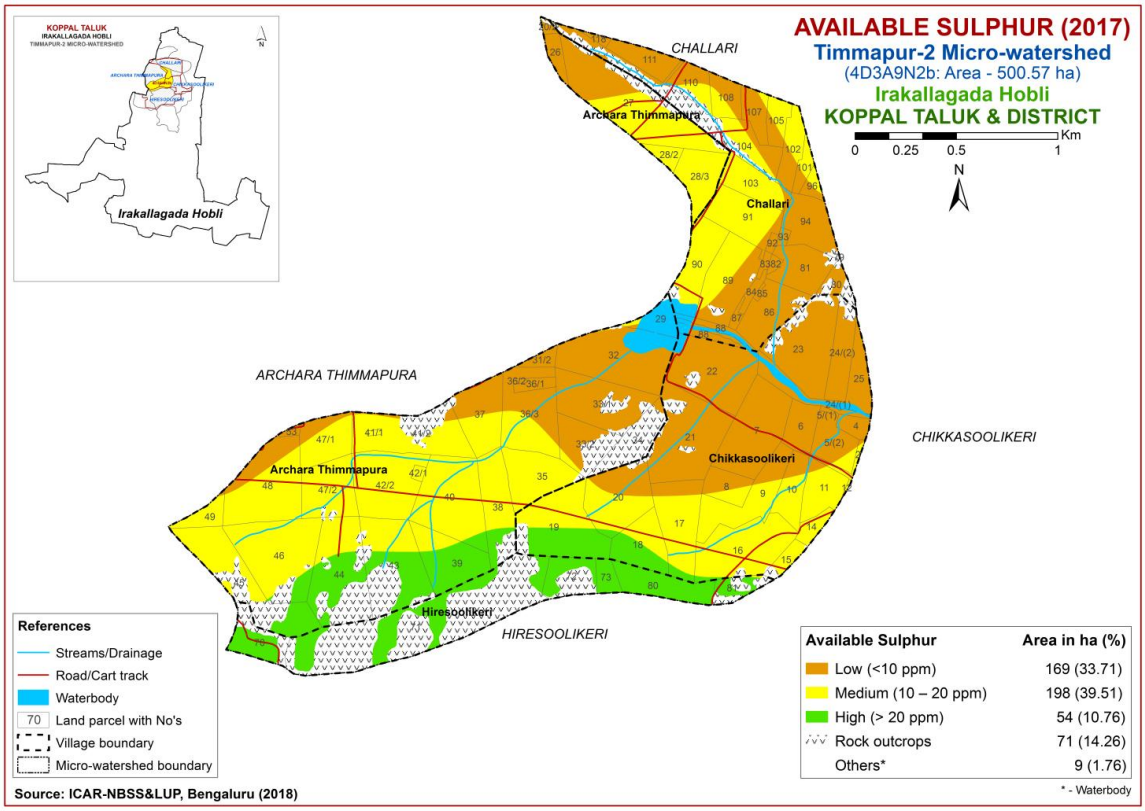


Fig. 6.6 Soil Available Sulphur map of Timmapur-2 Microwatershed

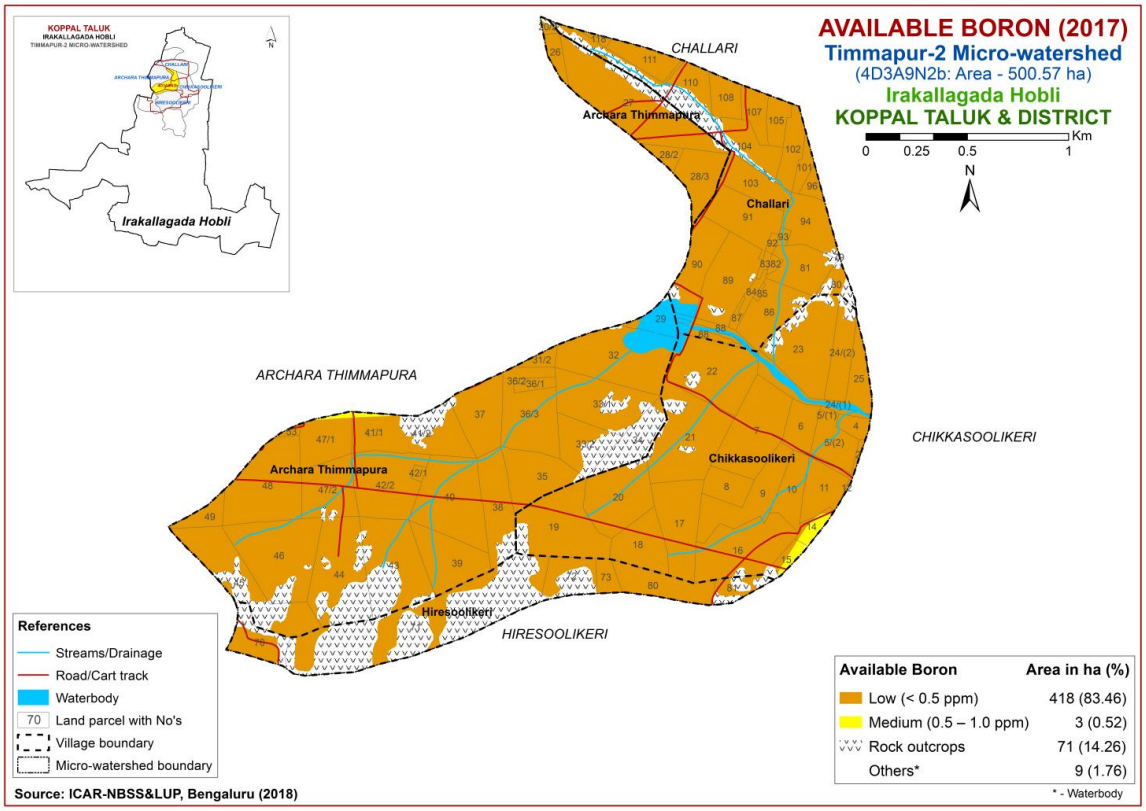


Fig. 6.7 Soil Available Boron map of Timmapur-2 Microwatershed

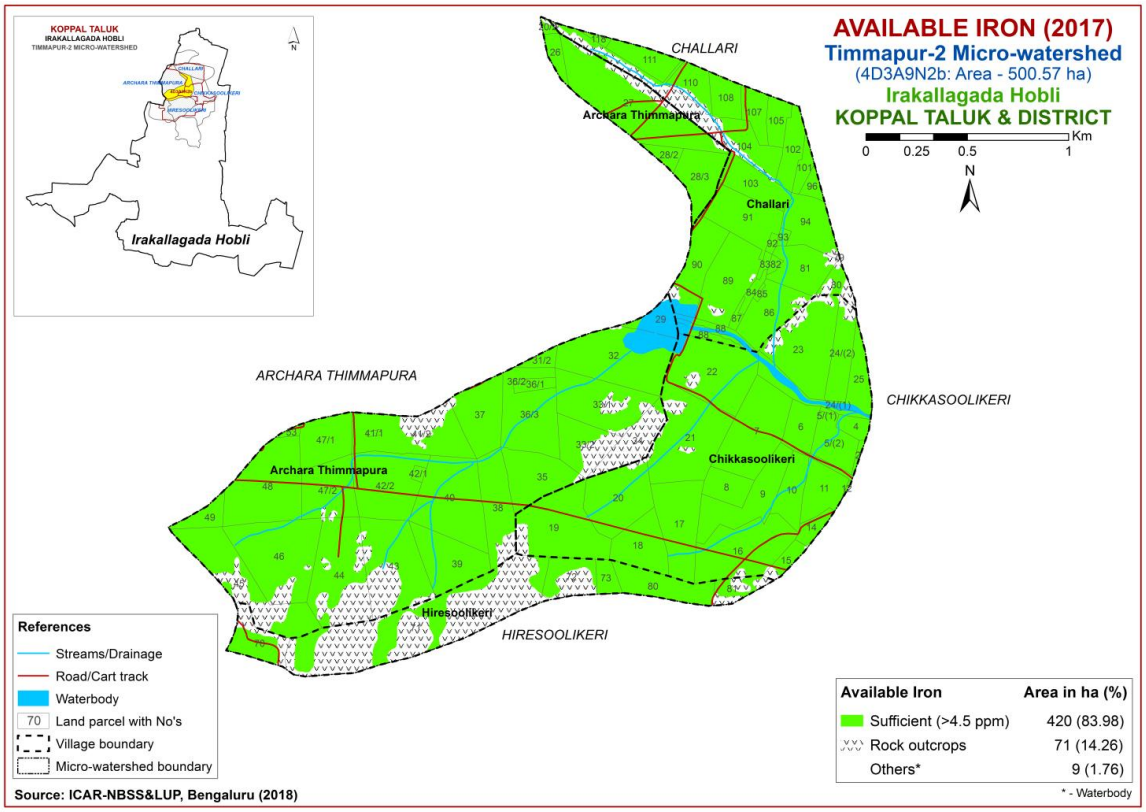


Fig. 6.8 Soil Available Iron map of Timmapur-2 Microwatershed

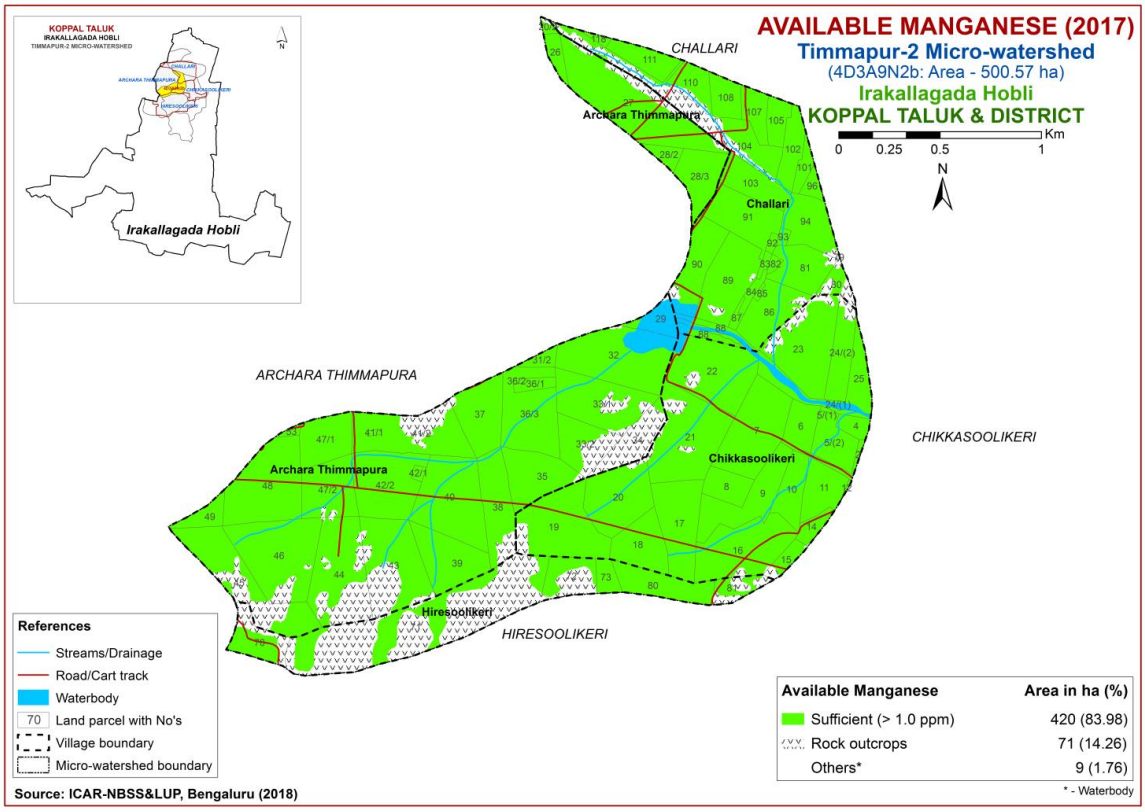


Fig. 6.9 Soil Available Manganese map of Timmapur-2 Microwatershed

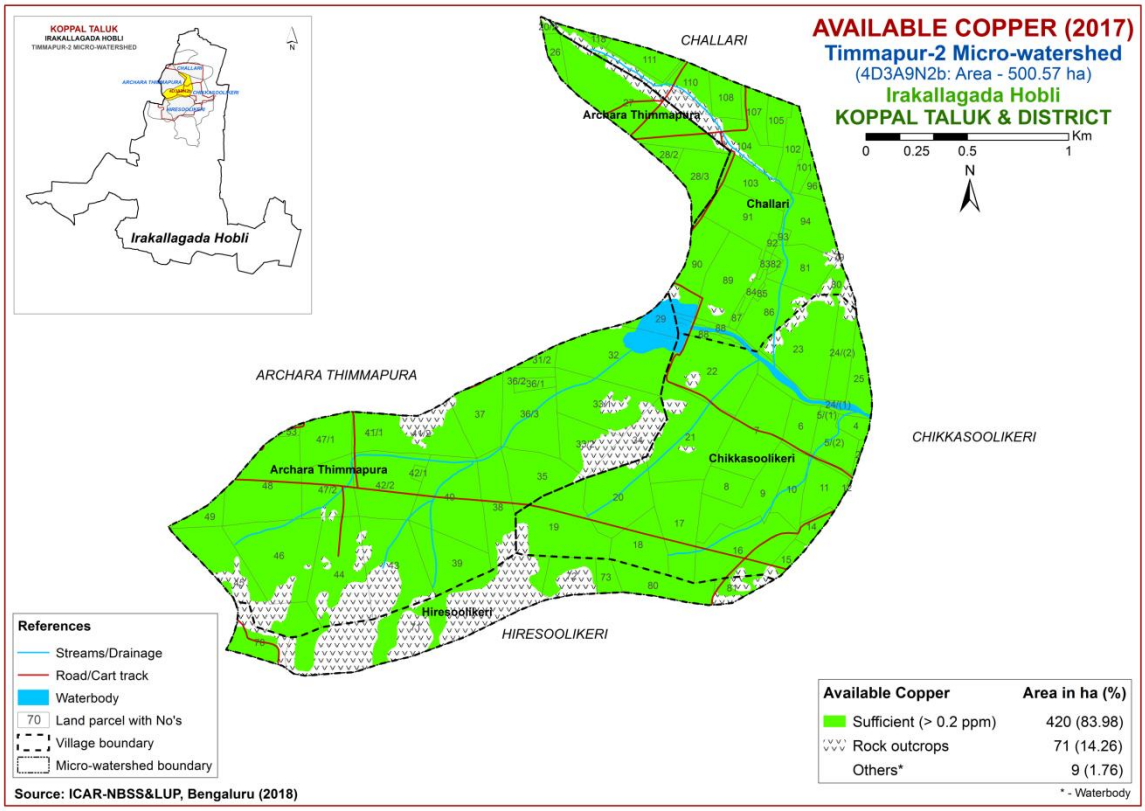


Fig. 6.10 Soil Available Copper map of Timmapur-2 Microwatershed

6.11 Available Zinc

Available zinc content is sufficient (>0.6 ppm) in an area of 211 ha (42 %) and are distributed in the northern, eastern and southern part of the microwatershed. An area of 209 ha (42%) is deficient (<0.6 ppm) and are distributed in the central, southeastern and western part of the microwatershed (Fig. 6.11).

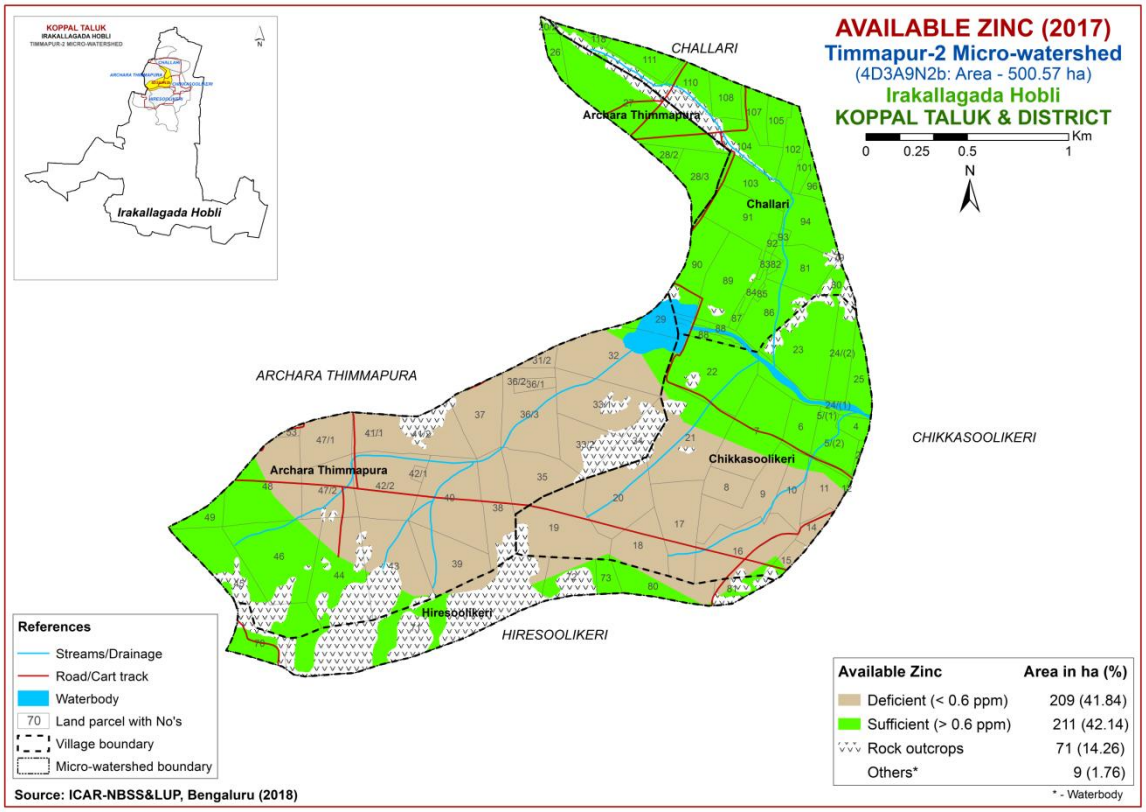


Fig. 6.11 Soil Available Zinc map of Timmapur-2 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Timmapur-2 Microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements (Table 7.2 to 7.33) were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N- Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3-Marginally Suitable. Order N has two Classes, N1-Currently not Suitable and N2-Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3, N1 and N2 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 'z' for calcareousness 's' for sodium and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 31 major agricultural and horticultural crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

Sorghum is one of the major food crop grown in Karnataka in an area of 10.47 lakh ha in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad, Bellary, Chitradurga, Mysore and Chamarajnagar districts. The crop requirements for growing sorghum (Table 7.2) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing sorghum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure. 7.1.

There are no highly suitable (Class S1) lands for growing sorghum in the microwatershed. An area of 160 ha (32%) is moderately suitable (Class S2) and are distributed in the northern, southeastern, central and western part of the microwatershed. They have minor limitations of gravelliness, calcareousness, nutrient availability and

rooting condition. Maximum area of about 261 ha (52%) is marginally suitable (Class S3) for growing sorghum and are distributed in the major part of the microwatershed with moderate limitations of gravelliness and rooting condition.

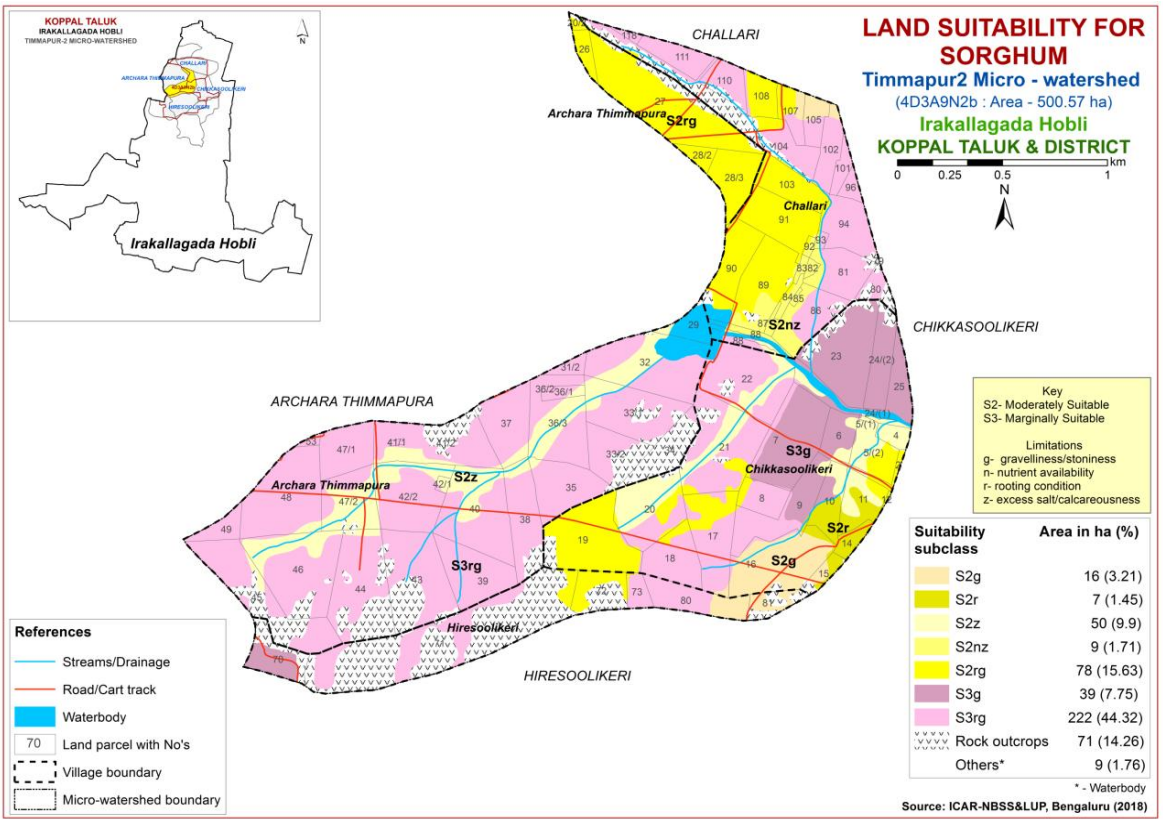


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

Maize is one of the most important food crop grown in an area of 13.37 lakh ha in almost all the districts of the State. The crop requirements for growing maize (Table 7.3) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing maize was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.2.

There are no highly suitable (Class S1) lands for growing maize in the microwatershed. An area of 159 ha (32%) is moderately suitable (Class S2) for growing maize and are distributed in the southeastern, central, northern and western part of the microwatershed with minor limitations of gravelliness, rooting condition, calcareousness and texture. Marginally suitable (Class S3) lands cover a major area of 261 ha (52%) and are distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting condition.

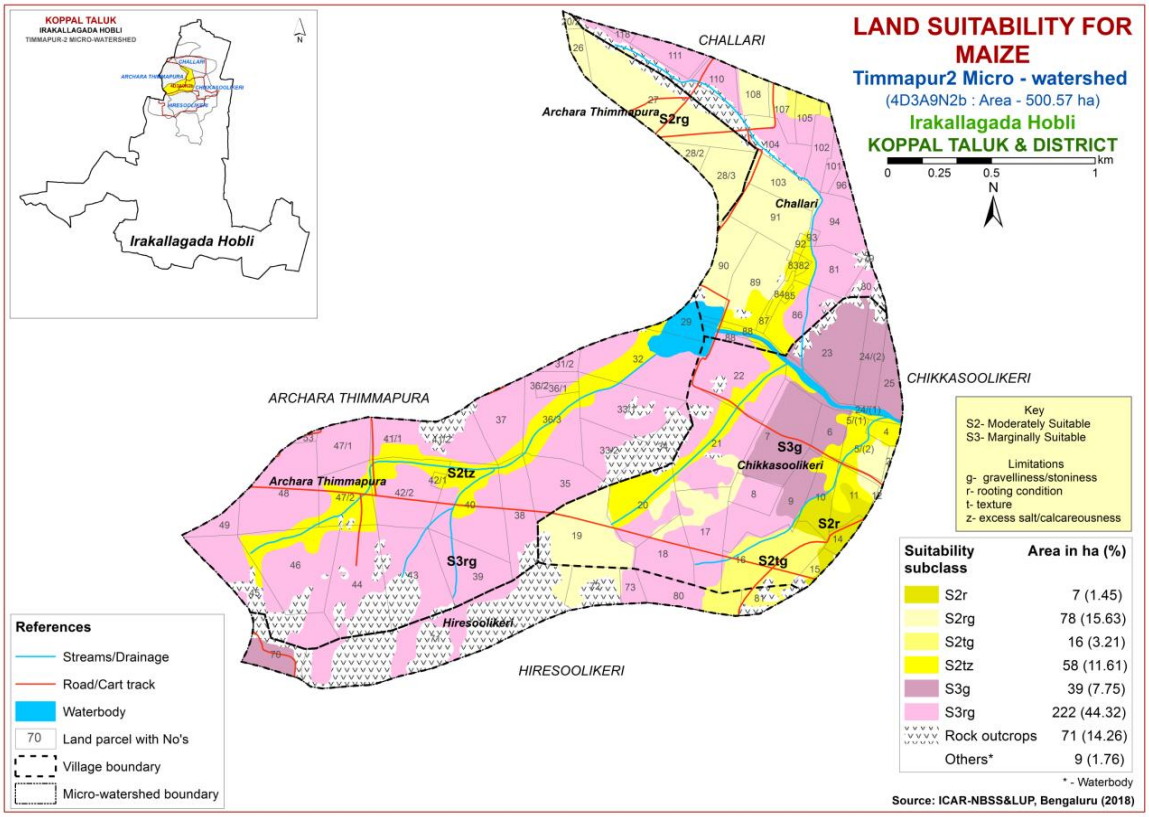


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

Bajra is one of the major food crop grown in an area of 2.34 lakh ha in the northern districts of the Karnataka State. The crop requirements for growing bajra (Table 7.4) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing bajra was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.3.

There are no highly suitable (Class S1) lands for growing bajra in the microwatershed. An area of 200 ha (40%) is moderately suitable (Class S2) and are distributed in the southeastern, northern, central and western part of the microwatershed with minor limitations of gravelliness, rooting condition, texture and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of 220 ha (44%) and are distributed in the northern, central, southern and southwestern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

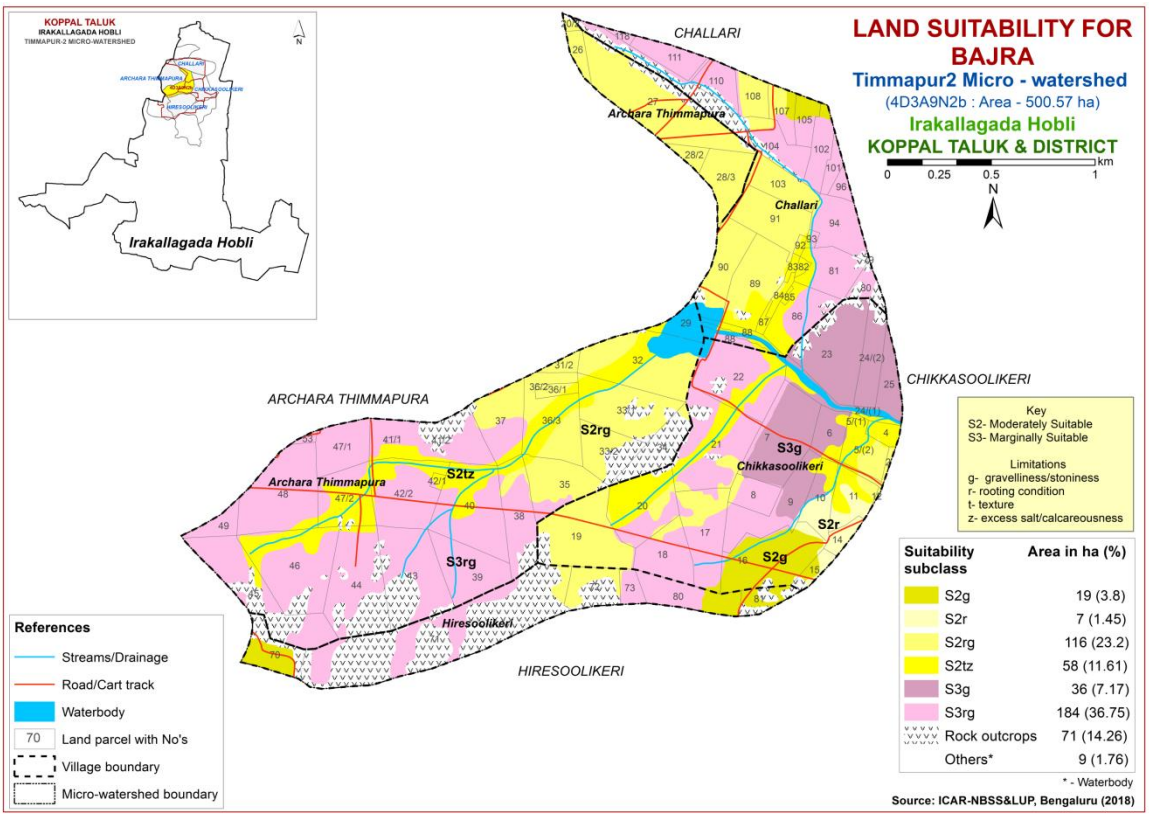


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in Karnataka in most of the districts either as rainfed or irrigated crop. The crop requirements for growing groundnut (Table 7.5) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.4.

There are no highly suitable (Class S1) lands for growing groundnut in the microwatershed. An area of 107 ha (21%) is moderately suitable (Class S2) land and are distributed in the northern, northwestern, western, southern, central and eastern part of the microwatershed. They have minor limitations of rooting condition and gravelliness. An area of 314 ha (63%) is marginally suitable (Class S3) for groundnut and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting condition, calcareousness and texture.

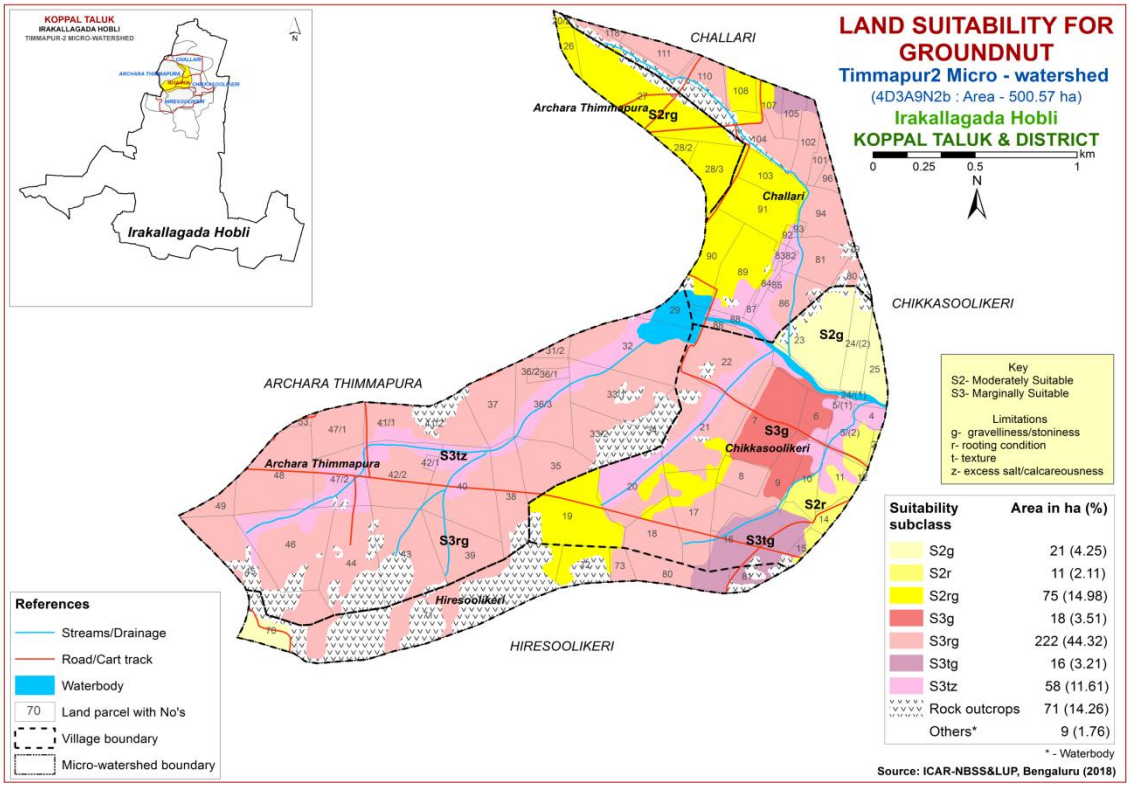


Fig. 7.4 Land Suitability map of Groundnut

7.5 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.6) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

There are no highly suitable (Class S1) lands for growing sunflower in the microwatershed. An area of 75 ha (15%) is moderately suitable (Class S2) and are distributed in the northeastern, eastern, central and western part of the microwatershed. They have minor limitations of gravelliness, calcareousness and rooting condition. An area of 162 ha (32%) is marginally suitable (Class S3) for growing sunflower with moderate limitations of rooting condition and gravelliness. Currently not suitable (Class N1) lands cover an area of 184 ha (37%) and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

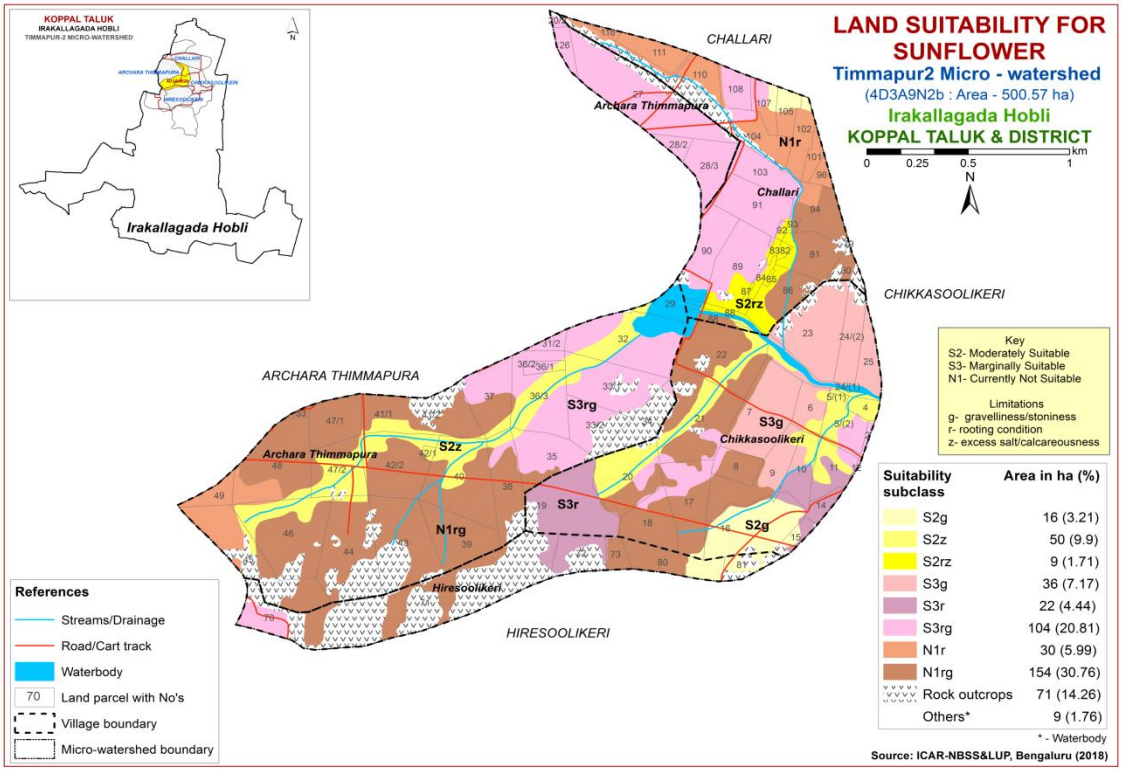


Fig. 7.5 Land Suitability map of Sunflower

7.6 Land Suitability for Red gram (*Cajanus cajan)*

Redgram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing redgram (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing redgram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

There are no highly suitable (Class S1) lands growing redgram the microwatershed. Moderately suitable (Class S2) lands occupy an area of 66 ha (13%) and are distributed in the northern, southeastern, central and western part of the microwatershed with minor limitations of gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of 171 ha (34%) and are distributed in the northern, northwestern, western, central and eastern part of the microwatershed. They have moderate limitations of gravelliness, calcareousness and rooting condition. Currently not suitable (Class N1) lands cover an area of 184 ha (37%) for growing redgram and are distributed in the major part of the microwatershed with severe limitations of gravelliness and rooting condition.

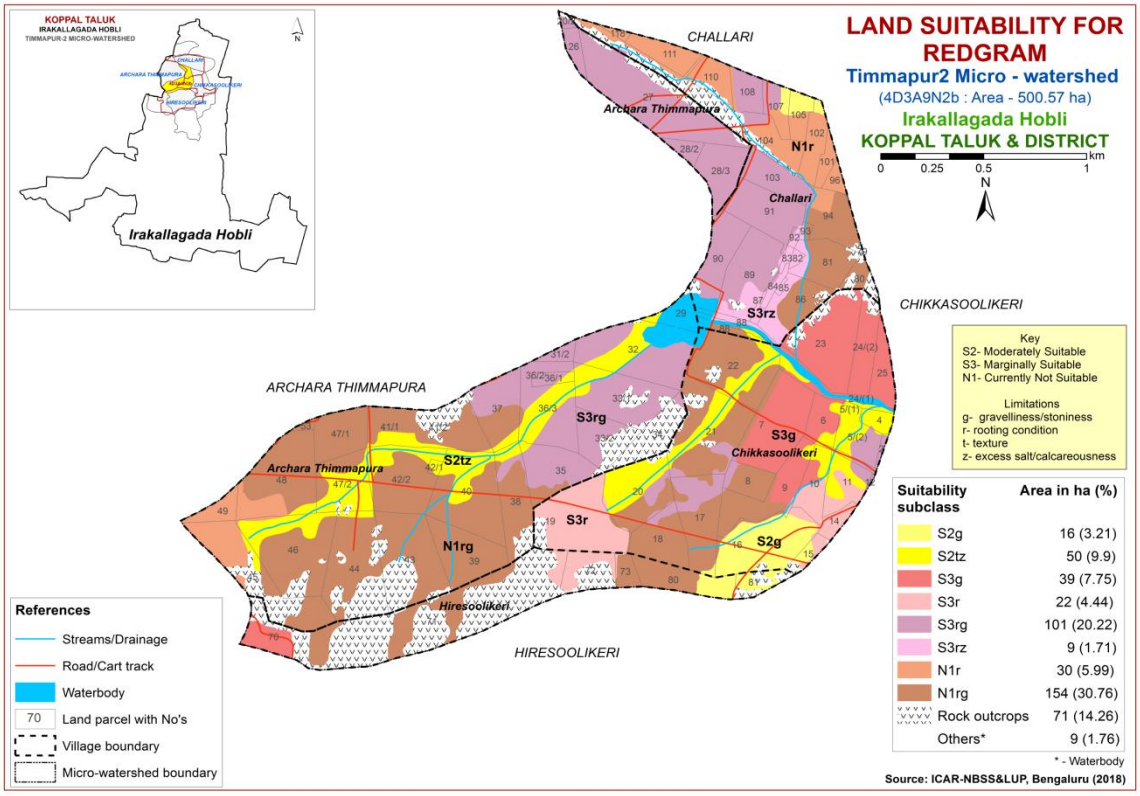


Fig. 7.6 Land Suitability map of Redgram

7.7 Land Suitability for Bengalgram (*Cicer arietinum*)

Bengalgram is one of the major pulse crop grown in an area of 9.39 lakh ha in northern Karnataka in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing Bengalgram (Table 7.8) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing Bengalgram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.7.

There are no highly suitable (Class S1) lands available for growing bengalgram in the microwatershed. Moderately suitable lands (Class S2) occupy an area of 176 ha (35%) and are distributed in the eastern, southern and western part of the microwatershed with minor limitations of northern, northwestern, western, central and eastern part of the microwatershed. Marginally suitable (Class S3) lands cover an area of 245 ha (49%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting condition, gravelliness and texture.

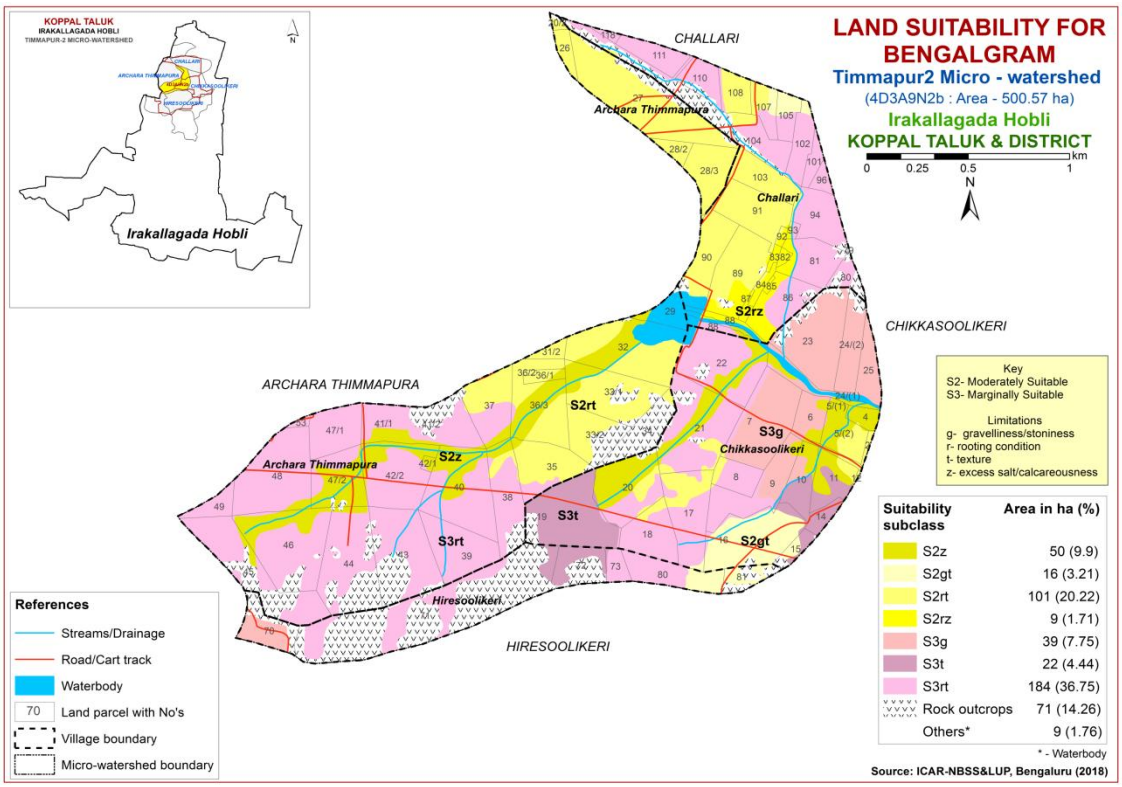


Fig. 7.7 Land Suitability map of Bengalgram

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is one of the most important fibre crop grown in the State in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.9) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cotton was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.8.

There are no highly suitable (Class S1) lands for growing cotton in the microwatershed. Moderately suitable (Class S2) lands occupy an area of 160 ha (32%) and are distributed in the northern, northwestern, central, southern and southeastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of 261 ha (52%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting condition.

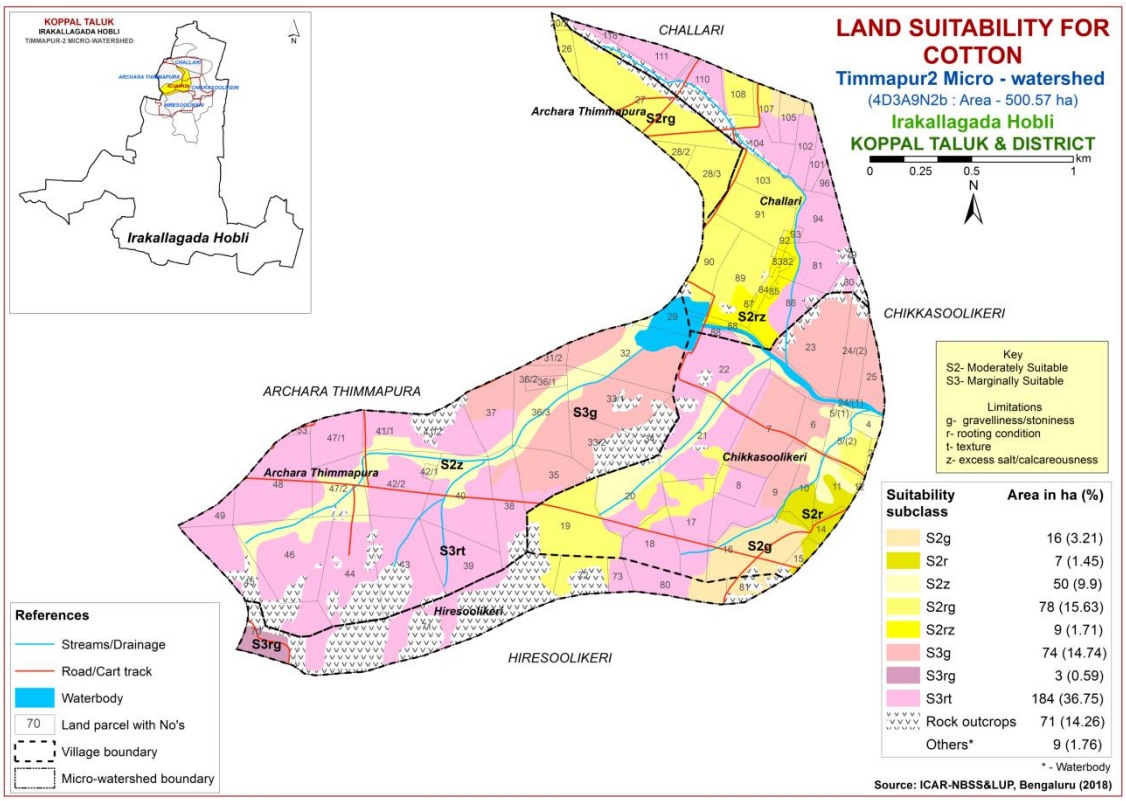


Fig. 7.8 Land Suitability map of Cotton

7.9 Land Suitability for Chilli (*Capsicum annuum L*)

Chilli is one of the most important commercial spice crop grown in an area of 0.89 lakh ha in all the districts of Karnataka State. The crop requirements for growing chilli (Table 7.10) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing chilli was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.9.

There are no highly suitable (Class S1) lands for growing chilli in the microwatershed. Moderately suitable (Class S2) lands cover an area of 101 ha (20%) and are distributed in the northern, southern and southeastern part of the microwatershed. They have minor limitations of gravelliness, texture and rooting condition. Marginally suitable (Class S3) lands cover an area of about 319 ha (64%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting condition.

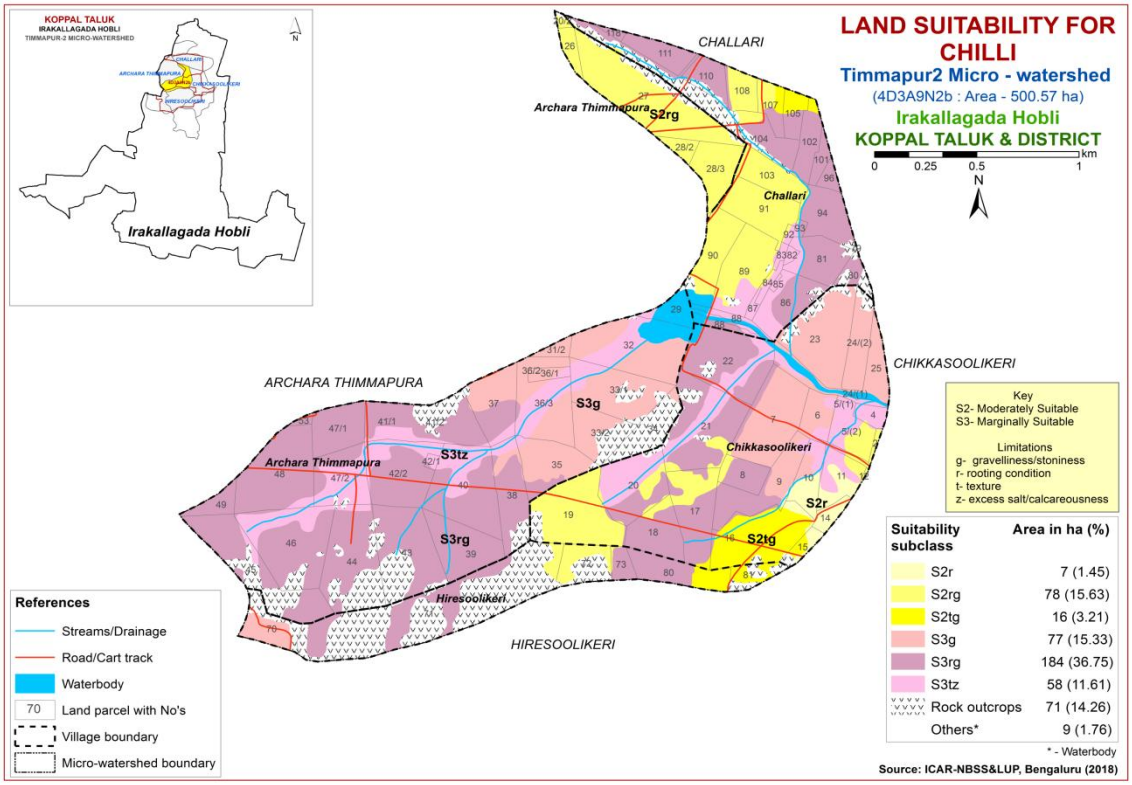


Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

Tomato is one of the most important vegetable crop grown in an area of 0.65 lakh ha in almost all the districts of the State. The crop requirements (Table 7.11) for growing tomato were matched with the soil-site characteristics (Table 7.11) and a land suitability map for growing tomato was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.10.

There are no highly suitable (Class S1) lands for growing tomato in the microwaterhsed. An area of 101 ha (20%) is moderately suitable (Class S2) for growing tomato and are distributed in the northern, northwestern, southern and southeastern part of the microwatershed. Marginally suitable (Class S3) lands occupy a maximum area of 319 ha (64%) and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, rooting condition, texture and calcareousness.

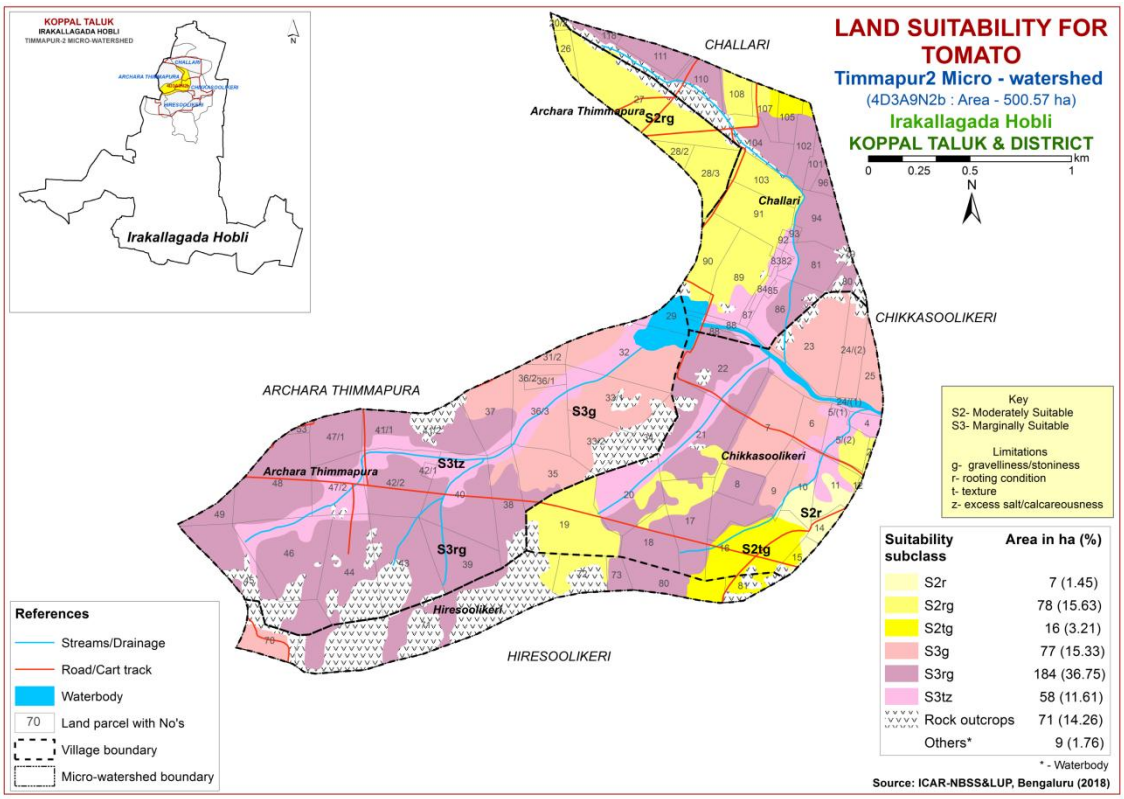


Fig. 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Brinjal (*Solanum melongena*)

Brinjal is one of the most important vegetable crop grown in all the districts. The crop requirements for growing brinjal (Table 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing brinjal was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.11.

An area of 16 ha (3%) is highly suitable (Class S1) for growing brinjal and are distributed in the northern and southeastern part of the microwatershed. An area of about 119 ha (24%) is moderately suitable (Class S2) for growing brinjal and are distributed in the central, eastern and western part of the microwatershed with minor limitations of texture, calcareousness, gravelliness and rooting depth. Marginally suitable lands (Class S3) for growing brinjal occur in a maximum area of 285 ha (57%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth and gravelliness.

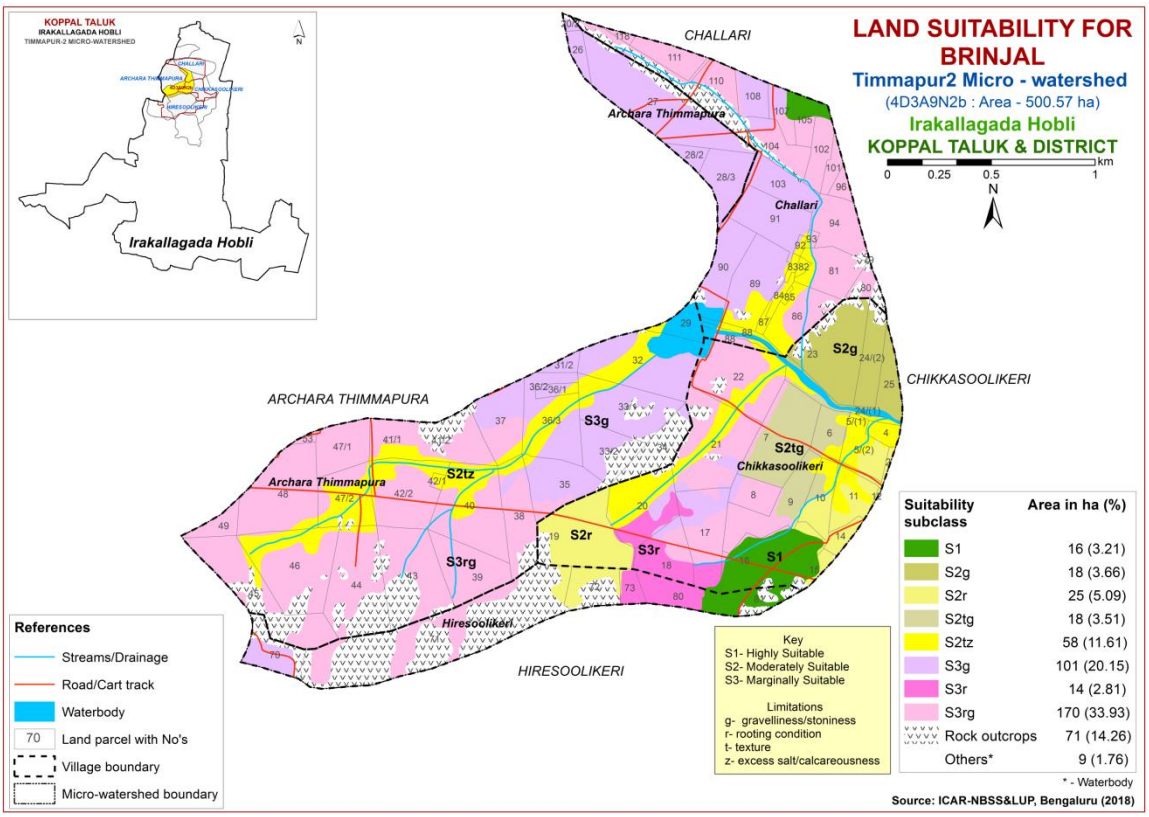


Fig. 7.11 Land Suitability map of Brinjal

7.12 Land Suitability for Onion (*Allium cepa*)

Onion is one of the most important vegetable crop grown in Raichur, Dharwad, Belgaum, Gulbarga, Bijapur, Bidar, Bellary, Chitradurga and Tumakuru districts. The crop requirements for growing onion (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Onion was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.12.

An area of 16 ha (3%) is highly (Class S1) suitable and are distributed in the northern and southeastern part of the microwatershed. Moderately suitable (Class S2) lands occur in an area of 62 ha (12%) for growing Onion and are distributed in the eastern and southern part of the microwatershed. Marginally suitable lands (Class S3) for growing onion occupy a maximum area of 343 ha (69%) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth, gravelliness, calcareousness and texture.

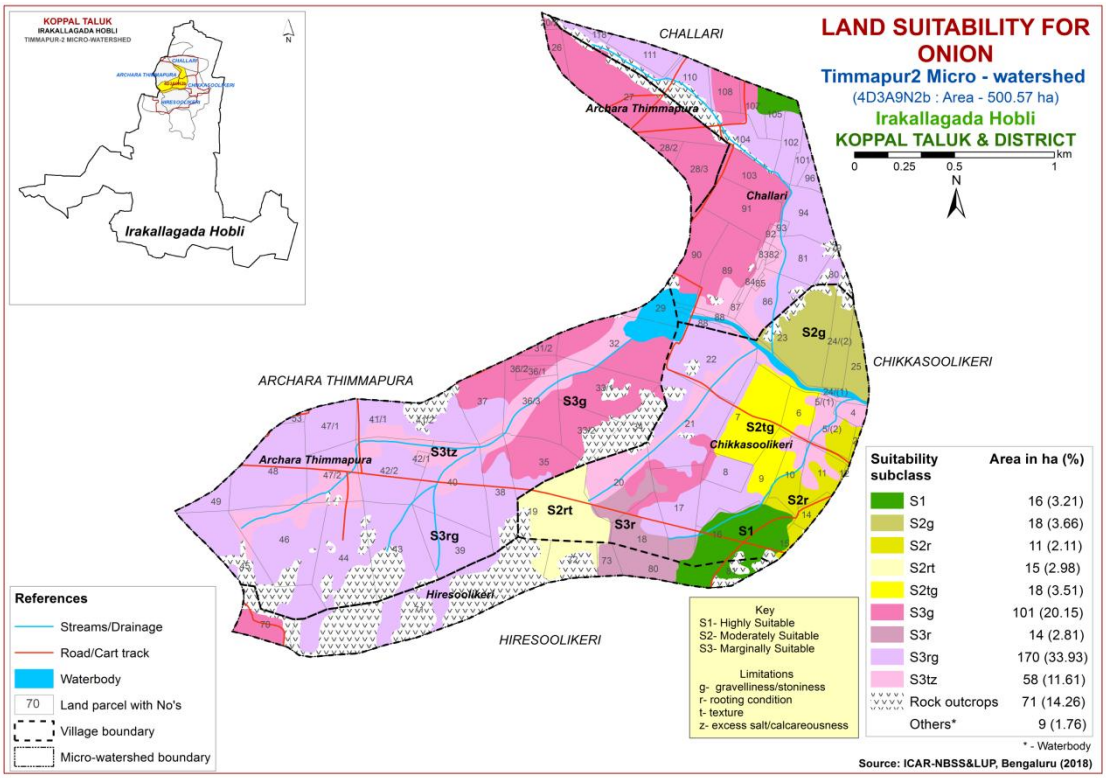


Fig. 7.12 Land Suitability map of Onion

7.13 Land Suitability for Bhendi (*Abelmoschus esculentus*)

Bhendi is one of the most important vegetable crop grown in all the districts. The crop requirements for growing bhendi (Table 7.14) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing bhendi was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.13.

An area of 16 ha (3%) is highly suitable (Class S1) for growing bhendi and are distributed in the northern and southeastern part of the microwatershed. An area of about 120 ha (24%) is moderately suitable (Class S2) and are distributed in the eastern, southern and western part of the microwatershed with minor limitations of texture, calcareousness, gravelliness and rooting depth. Marginally suitable lands (Class S3) occur in a maximum area of 285 ha (57%) and are distributed in all parts of the microwatershed with major limitations of rooting depth and gravelliness.

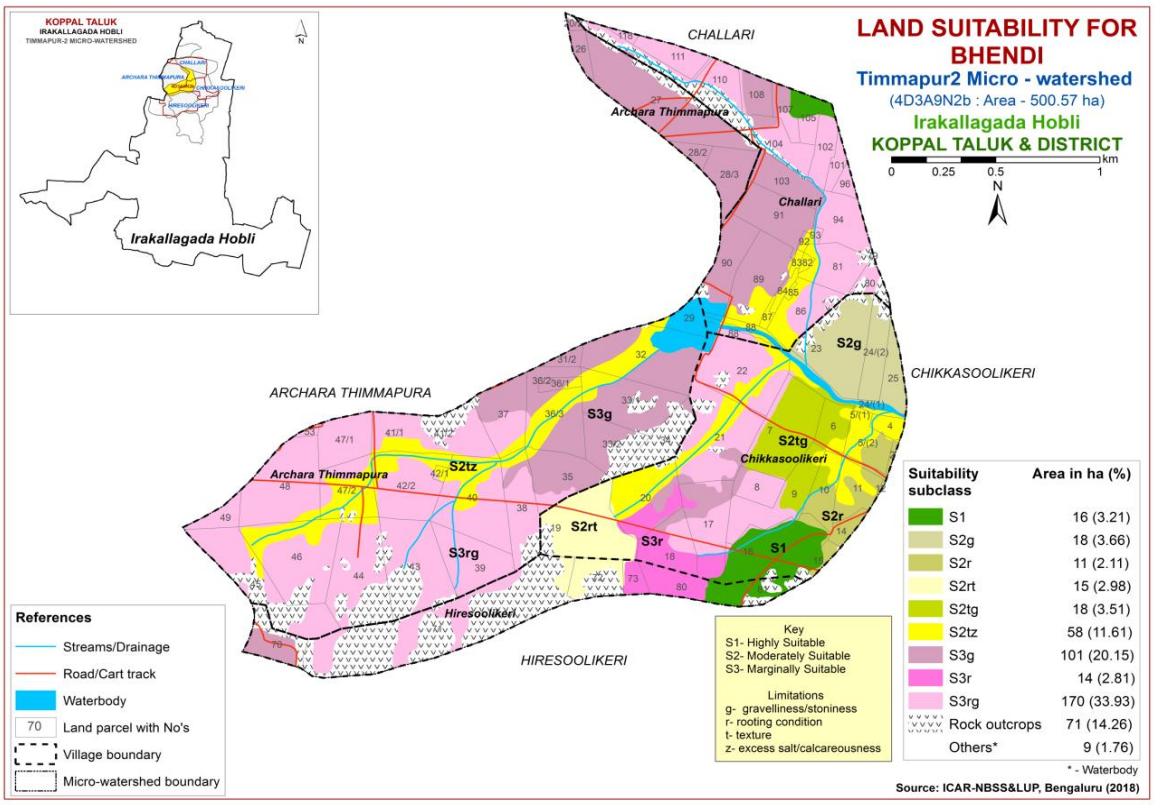


Fig. 7.13 Land Suitability map of Bhendi

7.14 Land Suitability for Drumstick (*Moringa oleifera)*

Drumstick is one of the most important vegetable crop grown in 2403 ha area in the State. The crop requirements for growing drumstick (Table 7.15) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.14.

There are no highly suitable (Class S1) lands for growing drumstick in the microwaterhsed. An area of 93 ha (18%) is moderately suitable (Class S2) and are distributed in the eastern, northeastern, central and western part of the microwatershed. They have minor limitations of gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of 143 ha (29%) and are distributed in the northern, northwestern, eastern, central and western part of the microwatershed. They have moderate limitations of gravelliness and rooting condition. Currently not suitable (Class N1) lands cover an area of 184 ha (37%) and are distributed in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

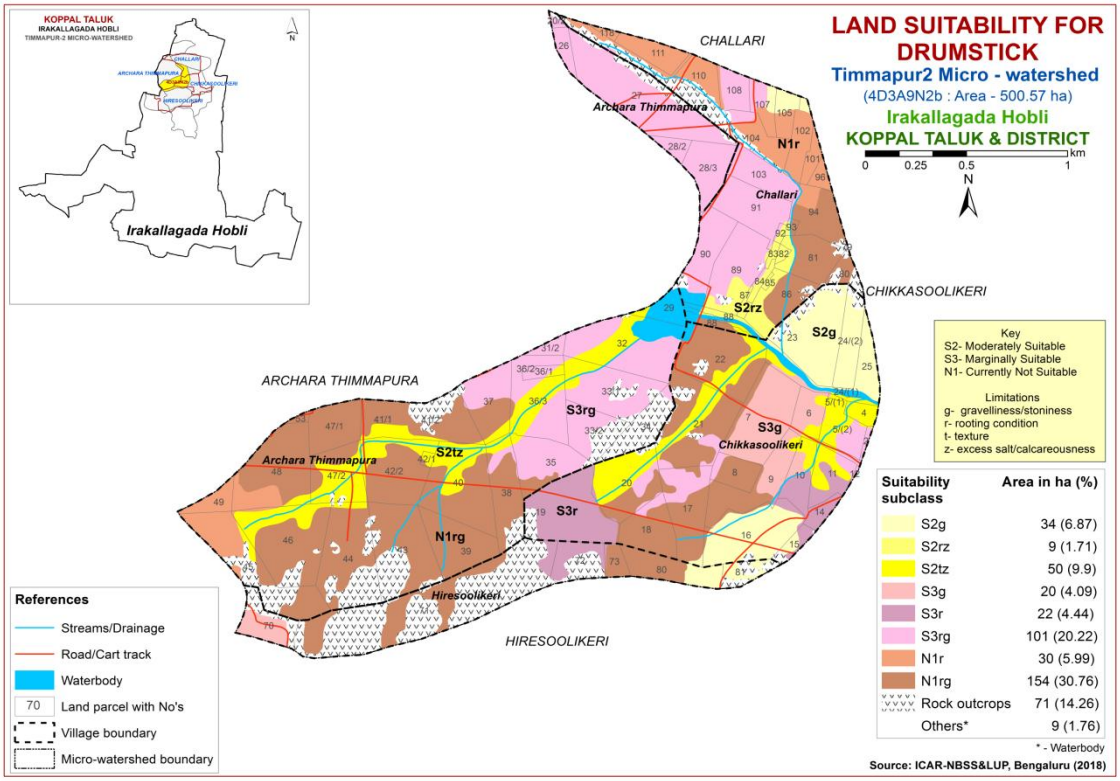


Fig. 7.14 Land Suitability map of Drumstick

7.15 Land Suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.16) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.15.

There are no highly (Class S1) suitable lands for growing mango in the microwaterhsed. Moderately suitable (Class S2) lands occupy an area of 16 ha (3%) and are distributed in the northern and southeastern part of the microwatershed. They have minor limitation of gravelliness. Marginally suitable (Class S3) lands cover an area of 98 ha (20%) and are distributed in the eastern, central and western part of the microwatershed. They have moderate limitations of texture, gravelliness, rooting condition and calcareousness. An area of 304 ha (61%) is currently not suitable (Class N1) for growing mango and occur in all parts of the microwatershed with severe limitations of gravelliness and rooting condition.

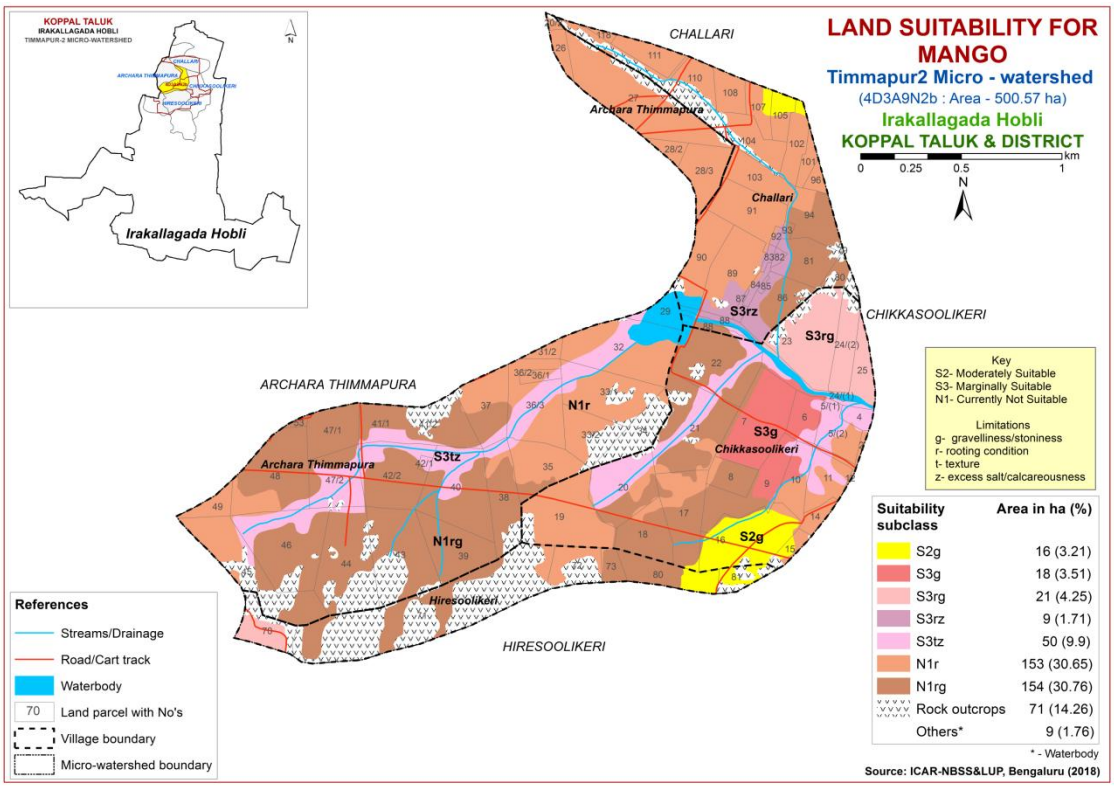


Fig. 7.15 Land Suitability map of Mango

7.16 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 0.64 lakh ha in almost all the districts of the State. The crop requirements (Table 7.17) for growing guava were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing guava was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.16.

There are no highly (Class S1) suitable lands for growing guava in the microwatershed. An area of about 19 ha (4%) is moderately suitable (Class S2) and are distributed in the northern and southeastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness and texture. Marginally suitable (Class S3) lands cover a maximum area of 217 ha (43%) and are distributed in the northern, northwestern, western, central and eastern part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting condition and calcareousness. An area of about 184 ha (37%) area is currently not suitable (Class N1) for growing guava and occur in the major part of the microwatershed with severe limitations of rooting condition and gravelliness.

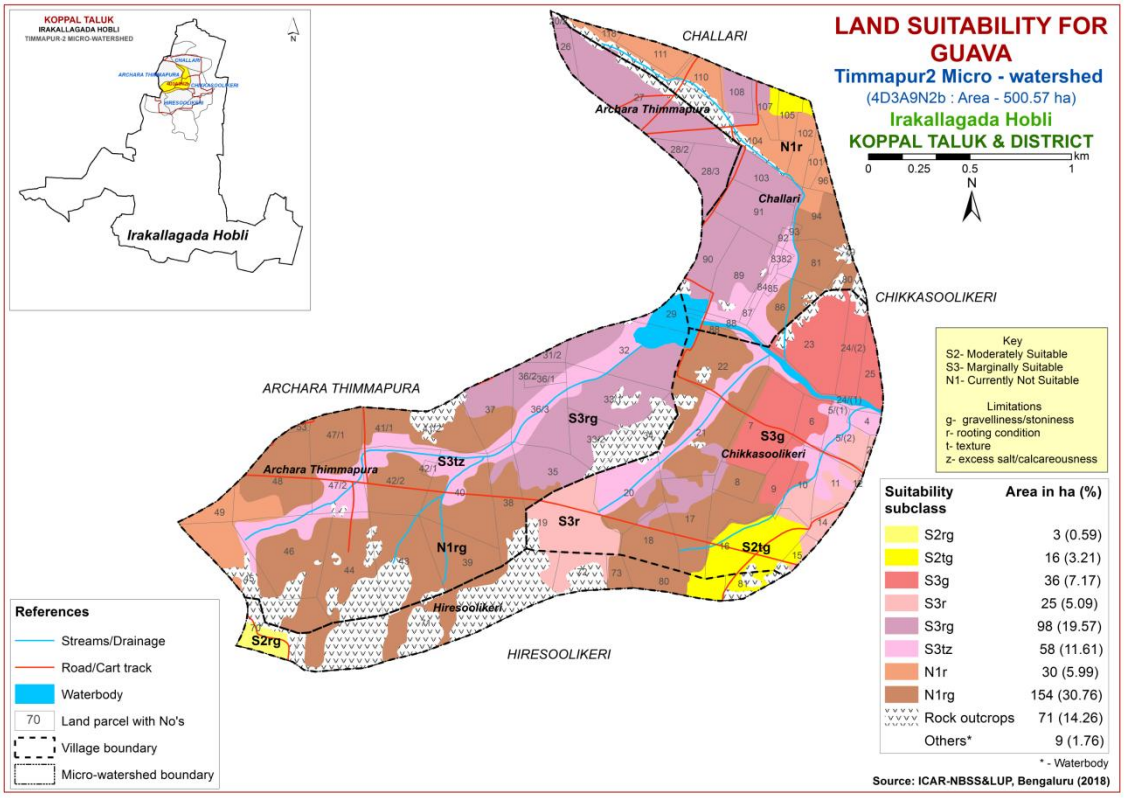


Fig. 7.16 Land Suitability map of Guava

7.17 Land Suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of about 29373 ha in almost all the districts of the State. The crop requirements (Table 7.18) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.17.

There are no highly (Class S1) lands for growing sapota in the microwatershed. An area of about 19 ha (4%) is moderately suitable (Class S2) and are distributed in the northern and southeastern part of the microwaterhsed. They have minor limitations of gravelliness and rooting condition. Marginally suitable (Class S3) lands cover a maximum area of 217 ha (43%) and occur in the northern, northwestern, western, central and eastern part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting condition and calcareousness. An area of 184 ha (37%) is currently not suitable (Class N1) for growing sapota and occur in the major part of the microwatershed with severe limitations of gravelliness and rooting condition.

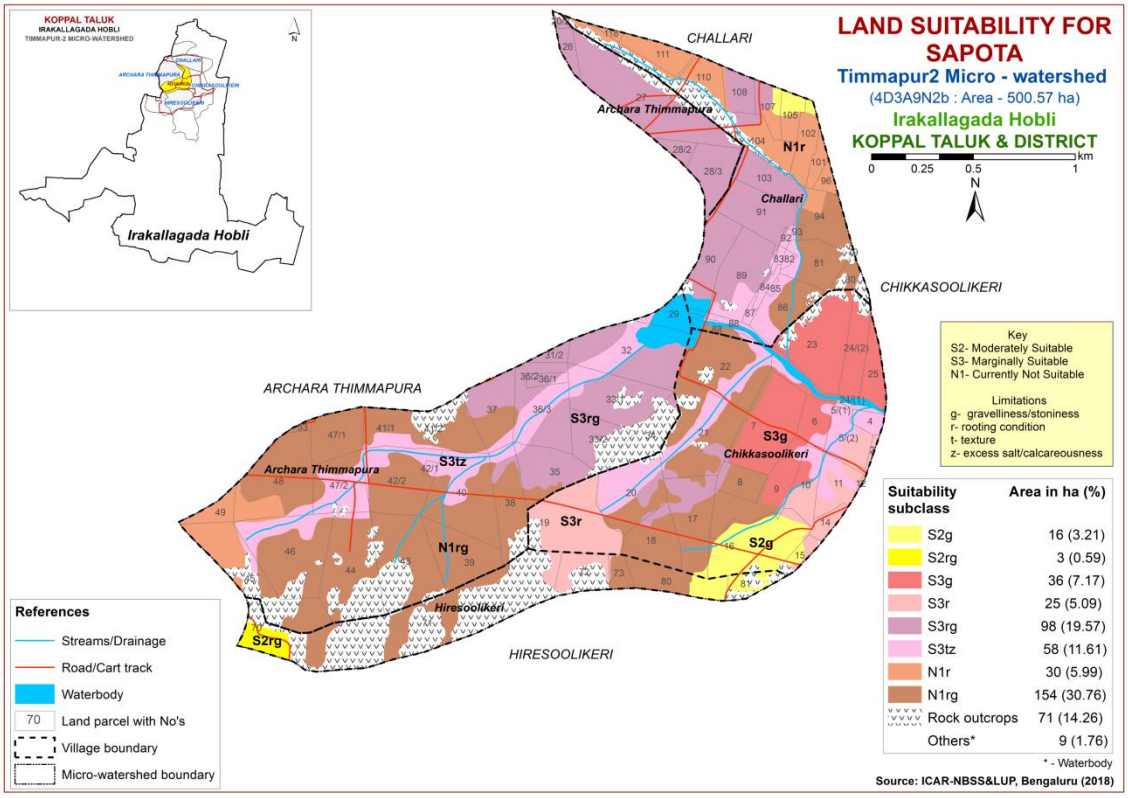


Fig. 7.17 Land Suitability map of Sapota

7.18 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the commercially grown fruit crop in about 18488 ha in Karnataka mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The crop requirements for growing pomegranate (Table 7.19) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing pomegranate was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

There are no highly suitable (Class S1) lands for growing pomegranate in the microwatershed. Moderately suitable (Class S2) lands occupy an area of 78 ha (15%) and are distributed in the northern, central, eastern, southeastern and western part of the microwatershed. They have minor limitations of texture, rooting condition, gravelliness and calcareousness. An area of 159 ha (32%) is marginally suitable (Class S3) for growing pomegranate and are distributed in the northern, northwestern, eastern, southern and western part of the microwatershed. They have moderate limitations of rooting condition and gravelliness. An area of 184 ha (37%) is currently not suitable (Class N1) for growing pomegranate and are distributed in the major part of the microwatershed with severe limitations of gravelliness and rooting condition.

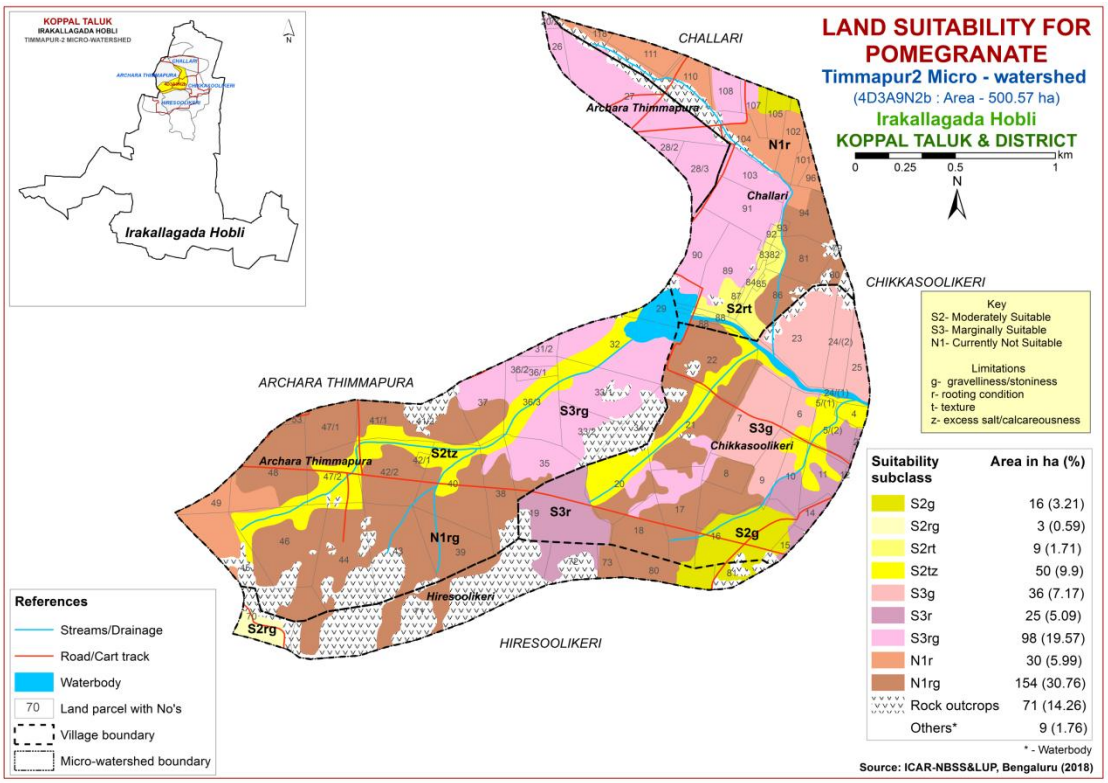


Fig. 7.18 Land Suitability map of Pomegranate

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in almost all the districts of the State. The crop requirements for growing musambi (Table 7.20) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.19.

There are no highly suitable (Class S1) lands for growing musambi in the microwatershed. An area of 78 ha (15%) is moderately suitable (Class S2) and are distributed in the northern, southeastern, central and western part of the microwatershed. They have minor limitations of calcareousness, rooting condition, gravelliness. Marginally suitable (Class S3) lands occur in an area of 159 ha (32%) and are distributed in the northern, northwestern, western, eastern and southern part of the microwatershed with moderate limitations of rooting condition and gravelliness. An area of 184 ha (37%) is currently not suitable (Class N1) for growing musambi and are distributed in the major part of the microwatershed. They have severe limitations of gravelliness and rooting condition.

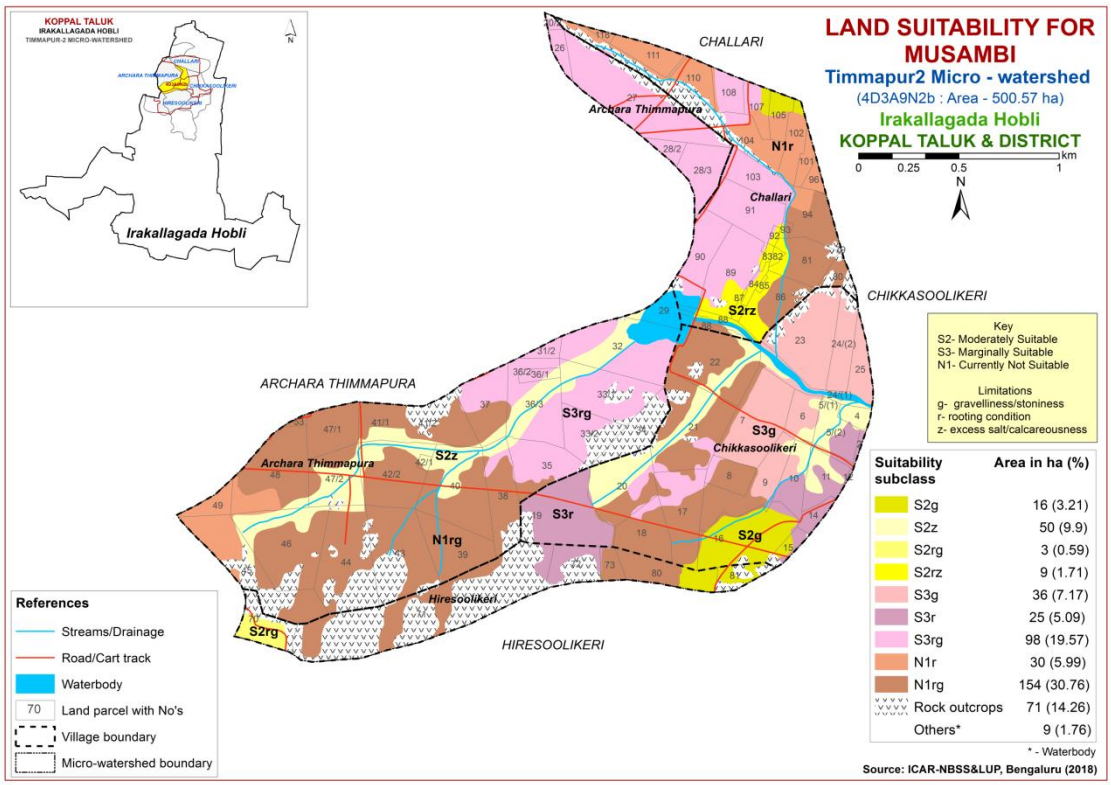


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 0.11 lakh ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.21) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

There are no highly suitable (Class S1) lands for growing lime in the microwatershed. A minor area of 78 ha (15%) is moderately suitable (Class S2) and are distributed in the northern, eastern, southeastern, central and western part of the microwatershed. They have minor limitations of calcareousness, rooting condition and gravelliness. Marginally suitable (Class S3) lands occur in an area of 159 ha (32%) for growing lime and distributed in the northern, north-western, central and eastern part of the microwatershed with moderate limitations of rooting condition and gravelliness. An area of 184 ha (37%) is currently not suitable (Class N1) for growing lime and are distributed in the major part of the microwatershed with severe limitations of gravelliness and rooting condition.

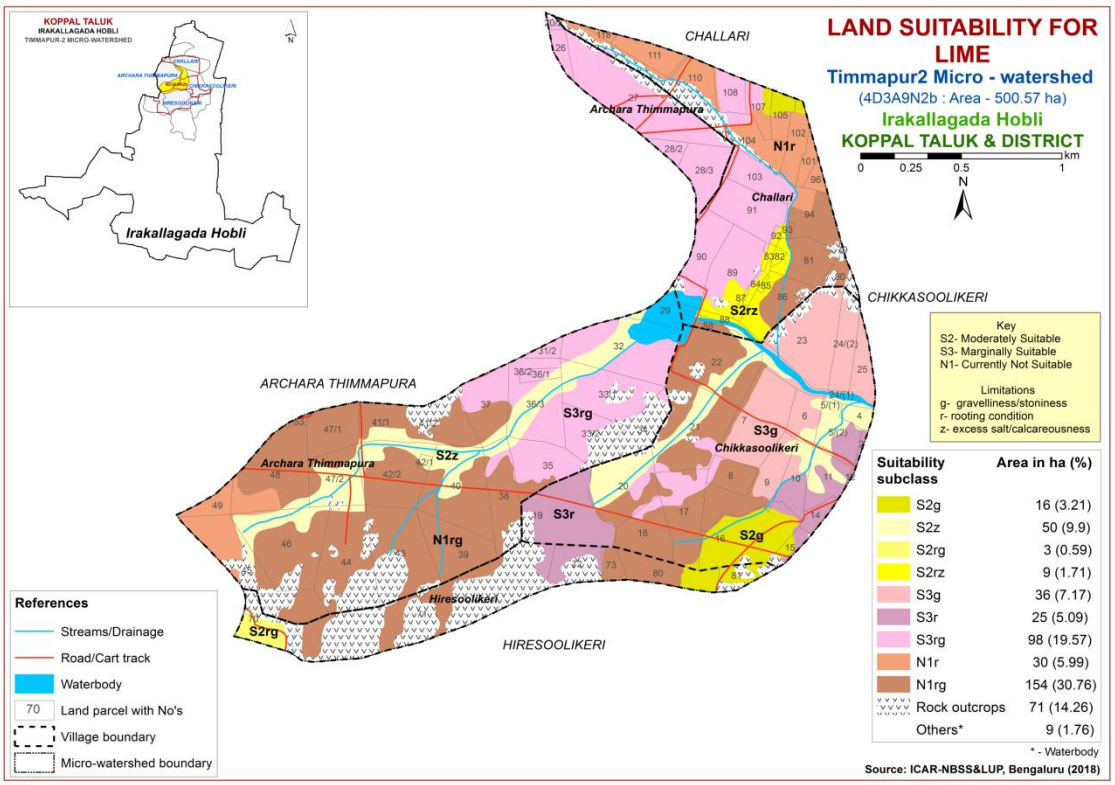


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in 151 ha area and distributed in almost all the districts of the State. The crop requirements for growing amla (Table 7.22) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

There are no highly suitable (Class S1) lands for growing amla in the microwatershed. An area of 237 ha (47%) has soils that are moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of rooting condition, gravelliness, texture and calcareousness. The marginally suitable (Class S3) lands cover an area of 184 ha (37%) and occur in the northern, northeastern, central and western part of the microwatershed with moderate limitations of gravelliness and rooting condition.

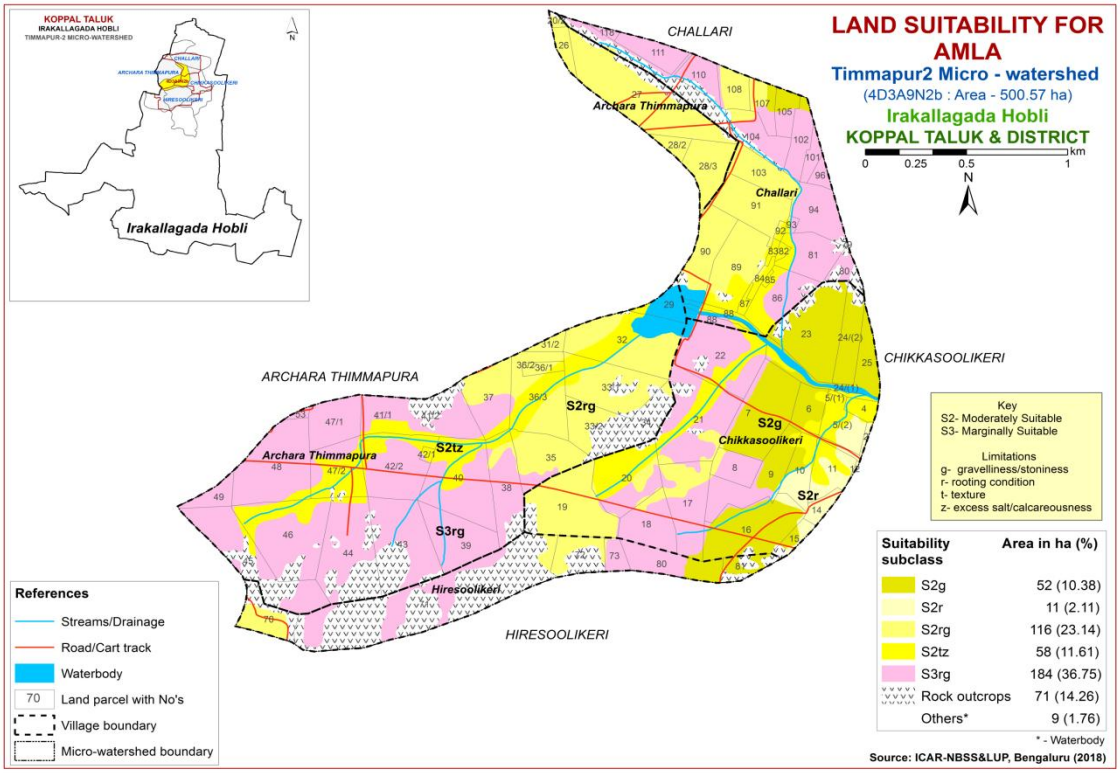


Fig. 7.21 Land Suitability map of Amla

7.22 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important nut crop grown in an area of 1.24 lakh ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.23) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

There are no highly (Class S1) suitable for growing cashew in the microwatershed. An area of about 36 ha (7%) is moderately suitable (Class S2) and are distributed in the northern, southeastern and western part of the microwatershed. They have minor limitations of texture, rooting condition and gravelliness. Marginally suitable (Class S3) lands occur in an area of 141 ha (28%) for growing cashew and are distributed in the northern, northwestern, southern and eastern part of the microwatershed with moderate limitations of gravelliness and rooting condition. Maximum area of about 242 ha (48%) is currently not suitable (Class N1) for growing cashew and are distributed in the major part of the microwaterhsed with severe limitations of texture, rooting condition, calcareousness and gravelliness.

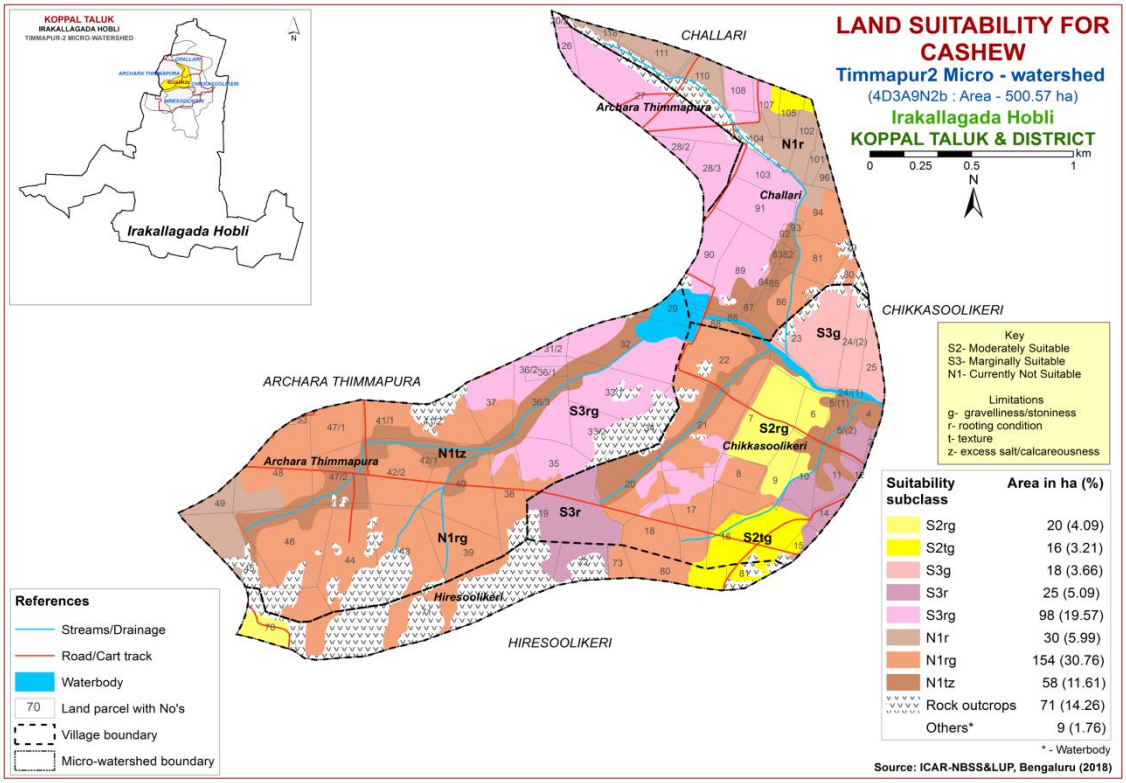


Fig. 7.22 Land Suitability map of Cashew

7.23 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in all the districts of the State. The crop requirements for growing jackfruit (Table 7.24) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in figure 7.23.

There are no highly (Class S1) lands suitable for growing jackfruit in the microwatershed. An area of about 19 ha (4%) is moderately suitable (Class S2) and are distributed in the northern, southeastern and western part of the microwatershed. They have minor limitations of gravelliness and rooting condition. Marginally suitable (Class S3) lands cover a maximum area of 217 ha (43%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting condition and calcareousness. An area of 184 ha (37%) is currently not suitable (Class N1) for growing jackfruit and occur in the northern, central, eastern and western part of the microwatershed with severe limitations of gravelliness and rooting condition.

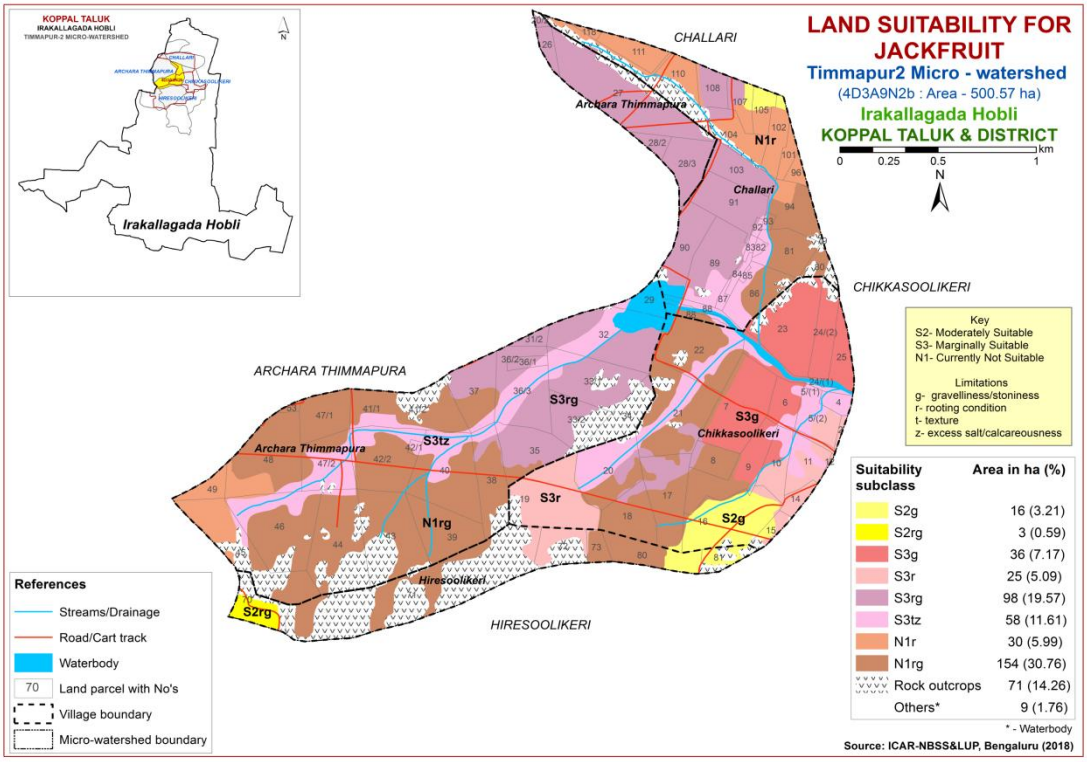


Fig. 7.23 Land Suitability map of Jackfruit

7.24 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the State. The crop requirements for growing jamun (Table 7.25) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jamun was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.24.

There are no highly suitable (Class S1) lands for growing jamun in the microwatershed. An area of 69 ha (14%) is moderately suitable (Class S2) and occur in the northern, southeastern, central and western part of the microwatershed. They have minor limitations of gravelliness, rooting condition, texture and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of 168 ha (34%) and are distributed in the northwestern, central and eastern part of the microwatershed with moderate limitations of rooting condition, calcareousness and gravelliness. An area of 184 ha (37%) is currently not suitable (Class N1) for growing jamun and are distributed in the major part of the microwatershed with severe limitations of gravelliness and rooting condition.

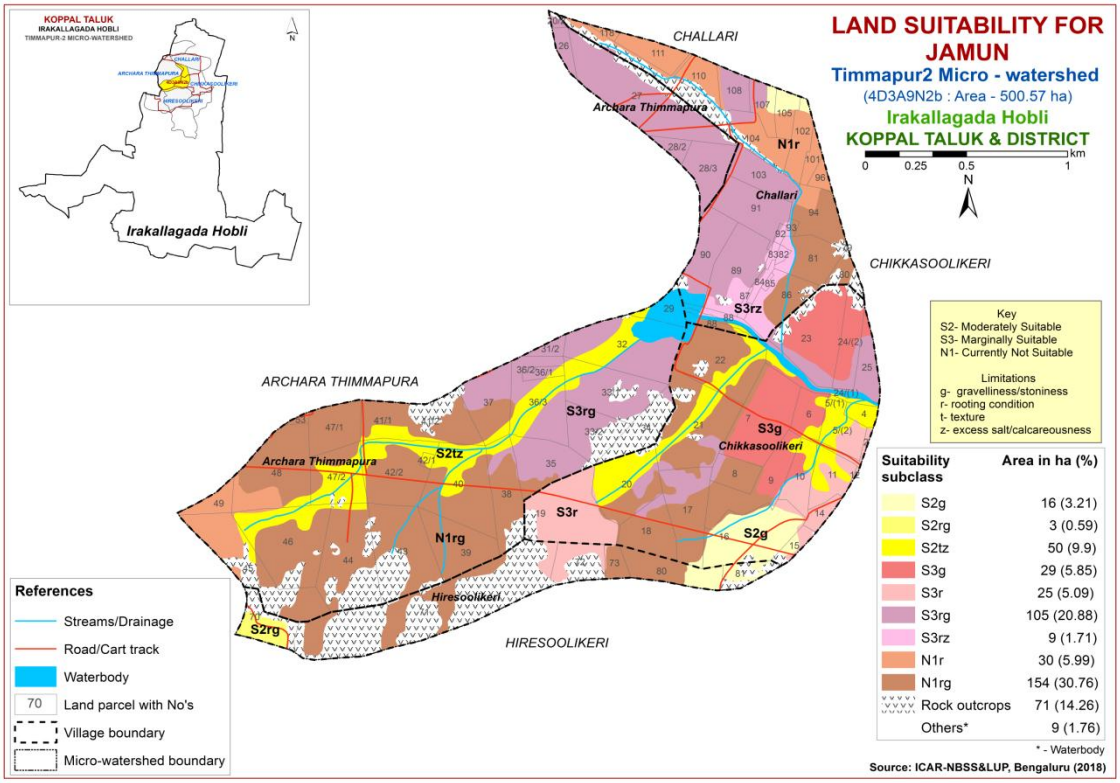


Fig. 7.24 Land Suitability map of Jamun

7.25 Land Suitability for Custard Apple (*Annona reticulata*)

Custard apple is one of the most important fruit crop grown in almost all the districts of the State. The crop requirements for growing custard apple (Table 7.26) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing custard apple was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.25.

There are no highly (Class S1) suitable lands for growing custard apple in the microwatershed. Maximum area of 237 ha (47%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting condition and calcareousness. An area of 184 ha (37%) is marginally suitable (Class S3) for growing custard apple and are distributed in the northern, northeastern, central and western part of the microwatershed with moderate limitations of gravelliness and rooting condition.

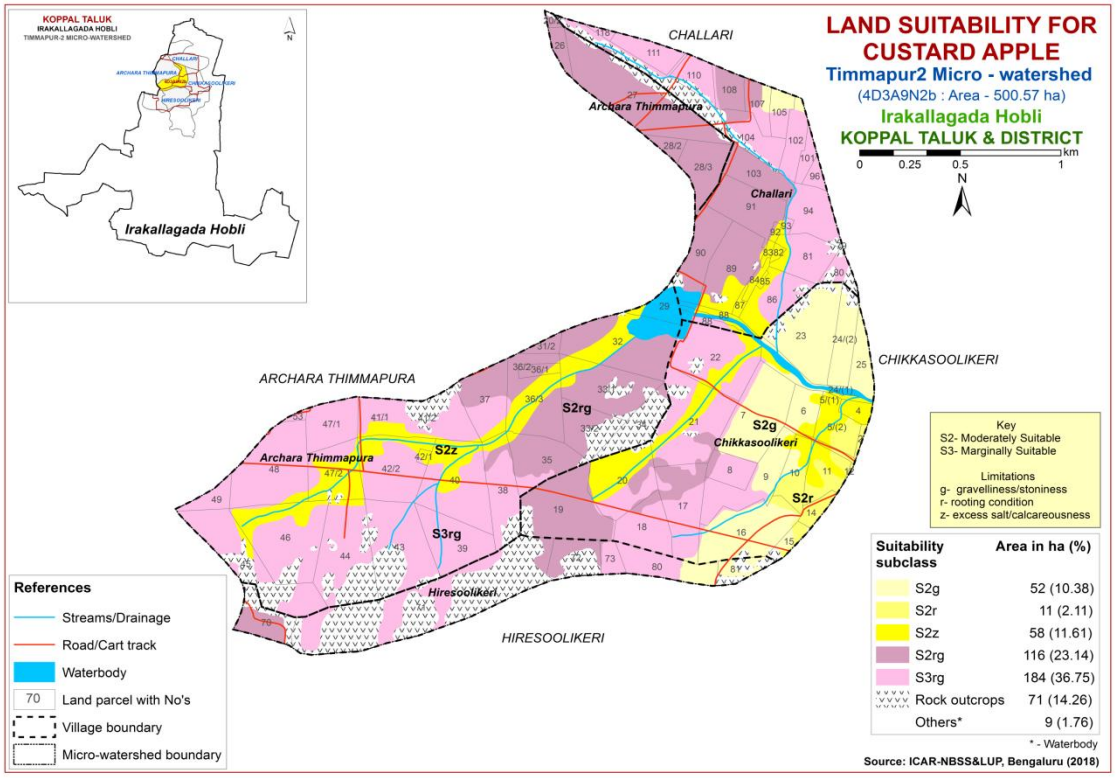


Fig. 7.25 Land Suitability map of Custard Apple

7.26 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop grown in 14897 ha in all the districts of the State. The crop requirements for growing tamarind (Table 7.27) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

There are no highly (Class S1) suitable lands for growing tamarind in the microwatershed. An area of 66 ha (13%) is moderately suitable (Class S2) and occur in the northern, southeastern, central and western part of the microwatershed. They have minor limitations of texture, gravelliness and calcareousness. An area of 48 ha (9%) is marginally suitable (Class S3) and occur in the eastern and western part of the microwatershed with moderate limitations of gravelliness, calcareousness and rooting condition. Maximum area of 307 ha (61%) is currently not suitable (Class N1) and are distributed in all parts of the microwatershed with severe limitations of rooting condition and gravelliness.

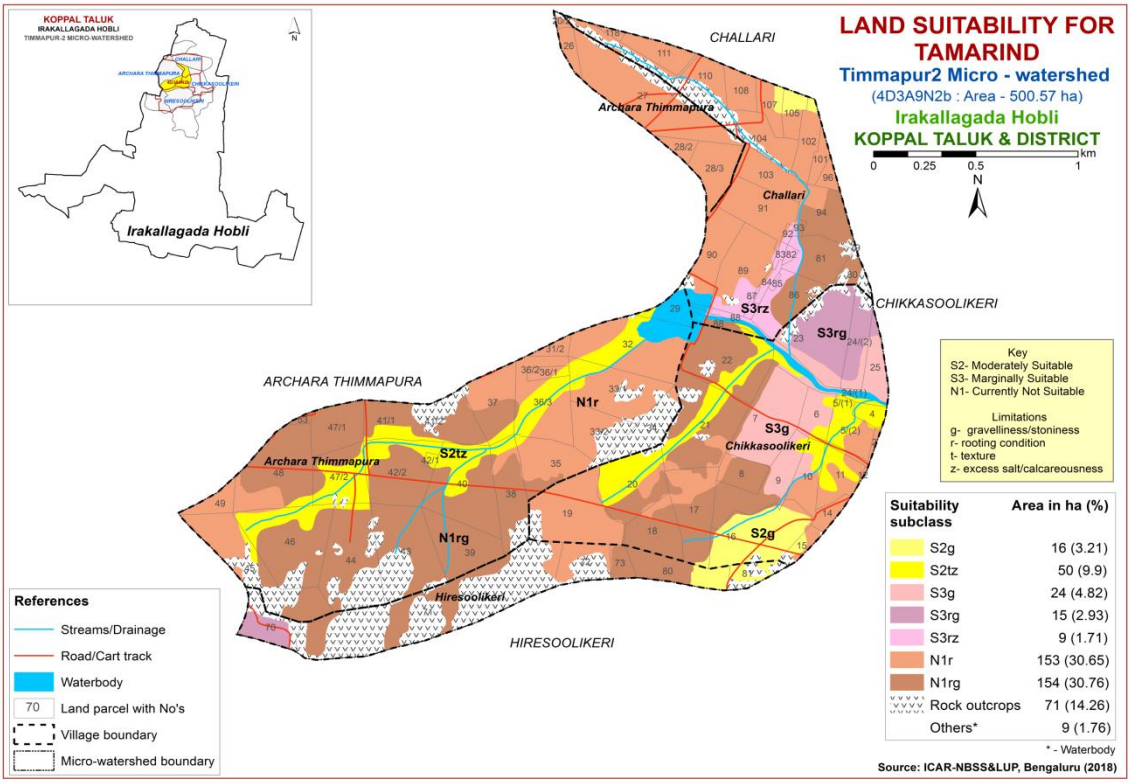


Fig. 7.26 Land Suitability map of Tamarind

7.27 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the most important leaf crop grown for rearing silkworms in about 1.66 lakh ha in all the districts of the State. The crop requirements for growing mulberry (Table 7.28) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.27.

There are no highly suitable (Class S1) lands for growing mulberry in the microwatershed. Moderately suitable (Class S2) lands occupy an area of 113 ha (23%) and are distributed in the northern, central, eastern, southeastern and western part of the microwatershed. They have minor limitations of calcareousness, gravelliness and texture. Marginally suitable (Class S3) lands cover an area of 123 ha (25%) and are distributed in the northern, northwestern, southern and southeastern part of the microwatershed. They have moderate limitations of rooting condition and gravelliness. An area of 184 ha (37%) is currently not suitable (Class N1) and are distributed in the major part of the microwatershed with severe limitations of rooting depth and gravelliness.

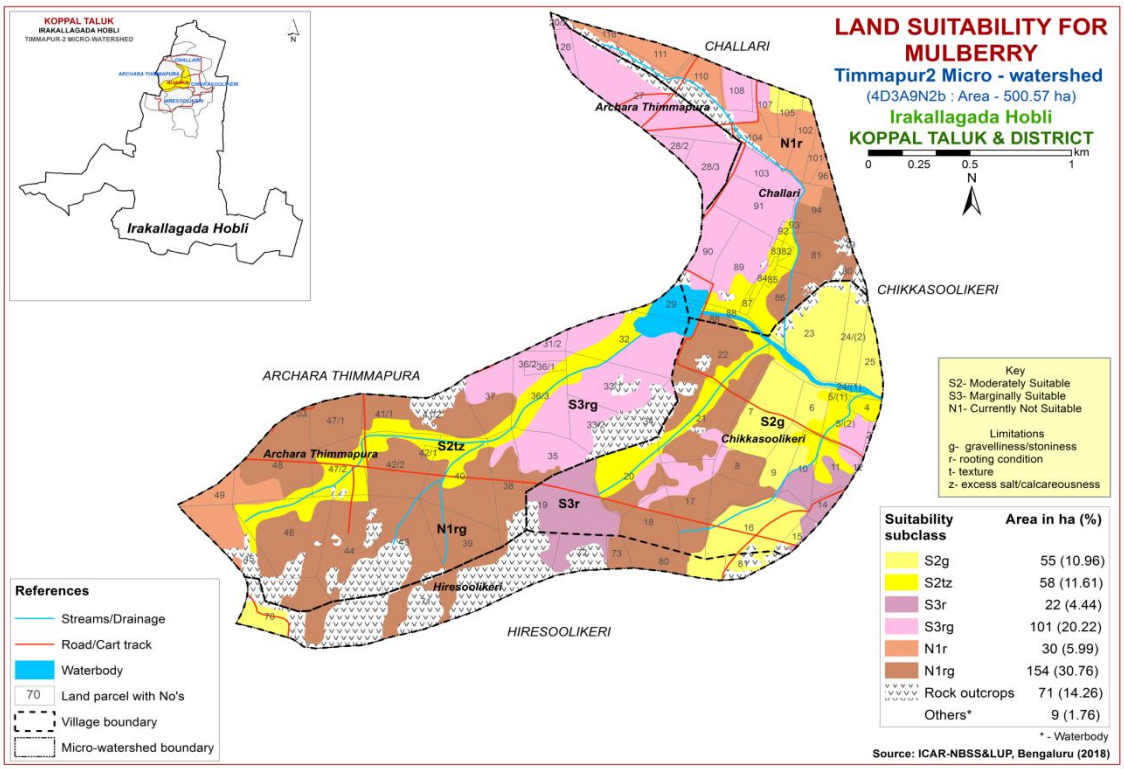


Fig. 7.27 Land Suitability map of Mulberry

7.28 Land Suitability for Marigold (*Tagetes erecta*)

Marigold is one of the most important flower crop grown in an area of 1858 ha in almost all the districts of the State. The crop requirements for growing marigold (Table 7.29) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.28.

There are no highly suitable (Class S1) lands for growing marigold in the microwatershed. An area of 159 ha (32%) is moderately suitable (Class S2) for growing marigold and are distributed in the northern, northwestern, central, southeastern and western part of the microwatershed. They have minor limitations of texture, gravelliness, rooting condition and calcareousness. Major area of 261 ha (52%) is marginally suitable (Class S3) for growing marigold and are distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting condition.

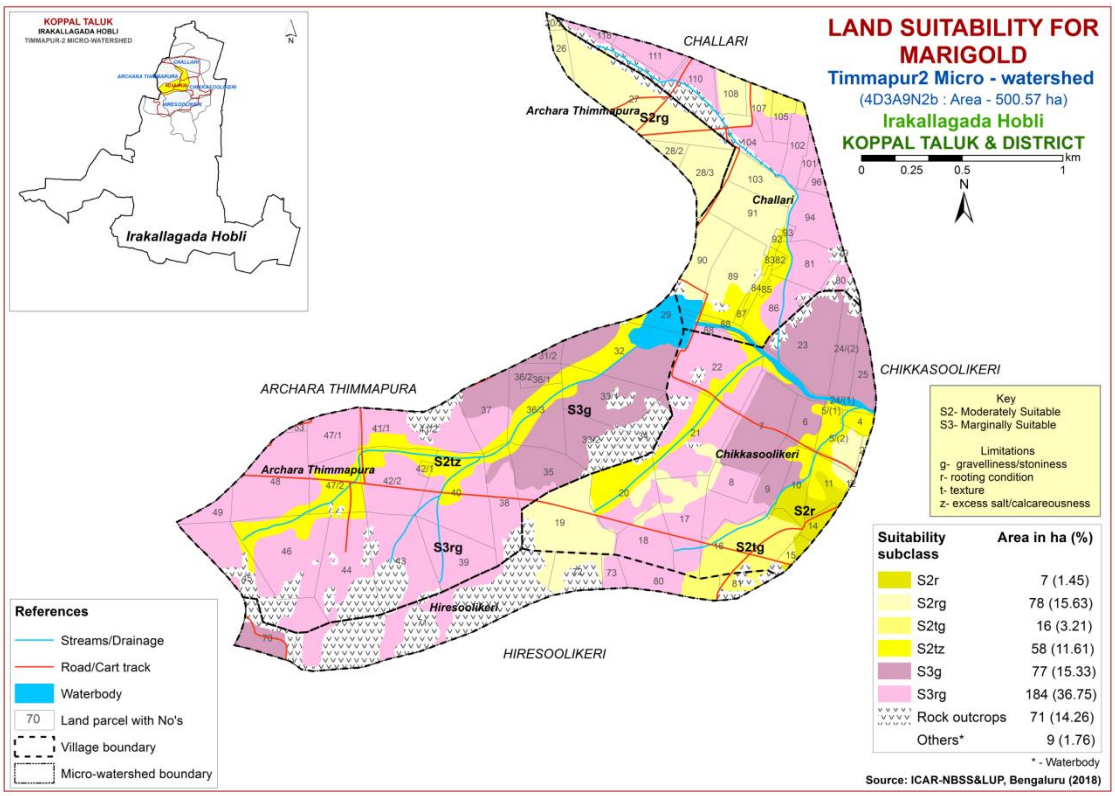


Fig. 7.28 Land Suitability map of Marigold

7.29 Land Suitability for Chrysanthemum (*Chrysanthemum indicum*)

Chrysanthemum is one of the most important flower crop grown in an area of 4978 ha in almost all the districts of the State. The crop requirements for growing chrysanthemum (Table 7.30) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.29.

There are no highly suitable (Class S1) lands for growing chrysanthemum in the microwatershed. An area of 159 ha (32%) is moderately suitable (Class S2) for growing chrysanthemum and are distributed in the northern, northwestern, central, southeastern and western part of the microwatershed. They have minor limitations of calcareousness, gravelliness, rooting condition and texture. Maximum area of 261 ha (52%) is marginally suitable (Class S3) for growing chrysanthemum and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and texture.

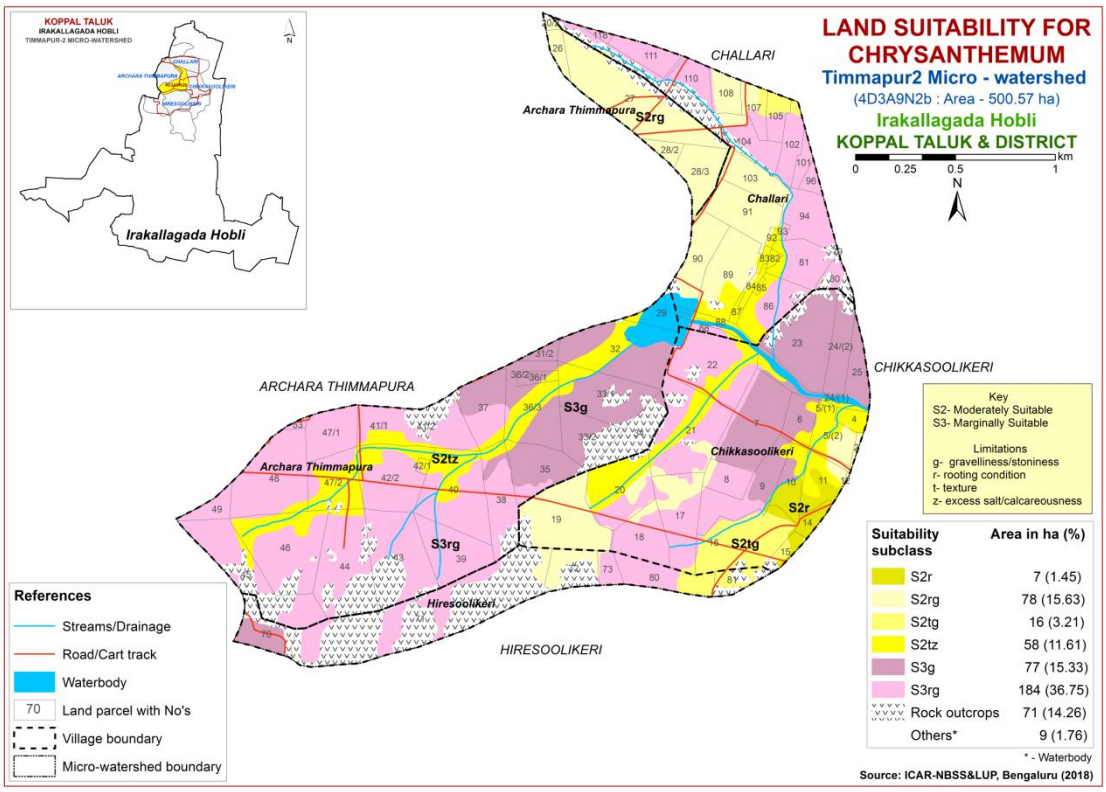


Fig. 7.29 Land Suitability map of Chrysanthemum

7. 30 Land Suitability for Jasmine *(Jasminum sp.)*

Jasmine is one of the most important flower crop grown in an area of 6146 ha in almost all the districts of the State. The crop requirements (Table 7.31) for growing jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jasmine was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.30.

There are no highly suitable lands (Class S1) for growing jasmine in the microwatershed. An area of 101 ha (20%) is moderately suitable (Class S2) for growing jasmine and occur in the northern, southern and southeastern part of the microwatershed. They have minor limitations of rooting condition, texture and gravelliness. A maximum area of 319 ha (64%) is marginally suitable (Class S3) for growing jasmine and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting condition, texture and calcareousness.

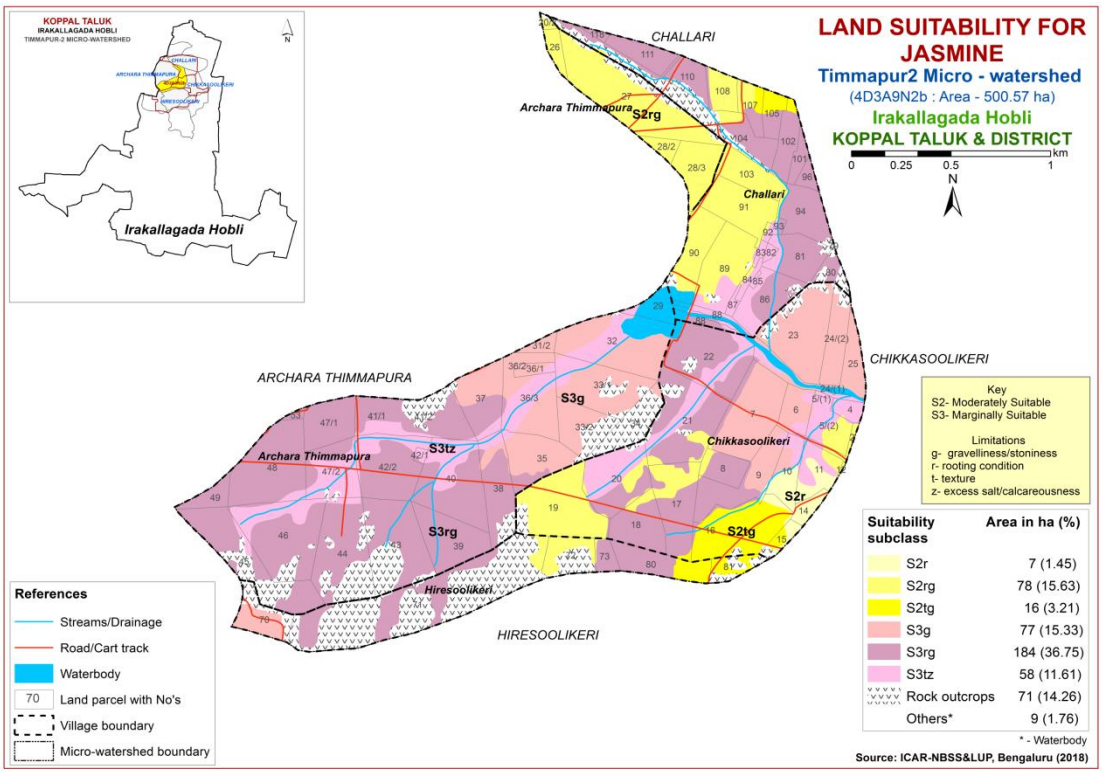


Fig. 7.30 Land Suitability map of Jasmine

7. 31 Land Suitability for Crossandra *(Crossandra in fundibuliformis)*

Crossandra is one of the most important flower crop grown in an area of 6146 ha in almost all the districts of the State. The crop requirements (Table 7.32) for growing crossandra were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing crossandra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.31.

There are no highly suitable lands (Class S1) for growing crossandra in the microwatershed. An area of 110 ha (22%) is moderately suitable (Class S2) for growing crossandra and occur in the northern, southern, northwestern and southeastern part of the microwatershed. They have minor limitations of rooting condition, calcareousness and gravelliness. A maximum area of 311 ha (62%) is marginally suitable (Class S3) for growing jasmine and are distributed in all parts of the microwatershed. They have moderate limitations of gravelliness, rooting condition, texture and calcareousness.

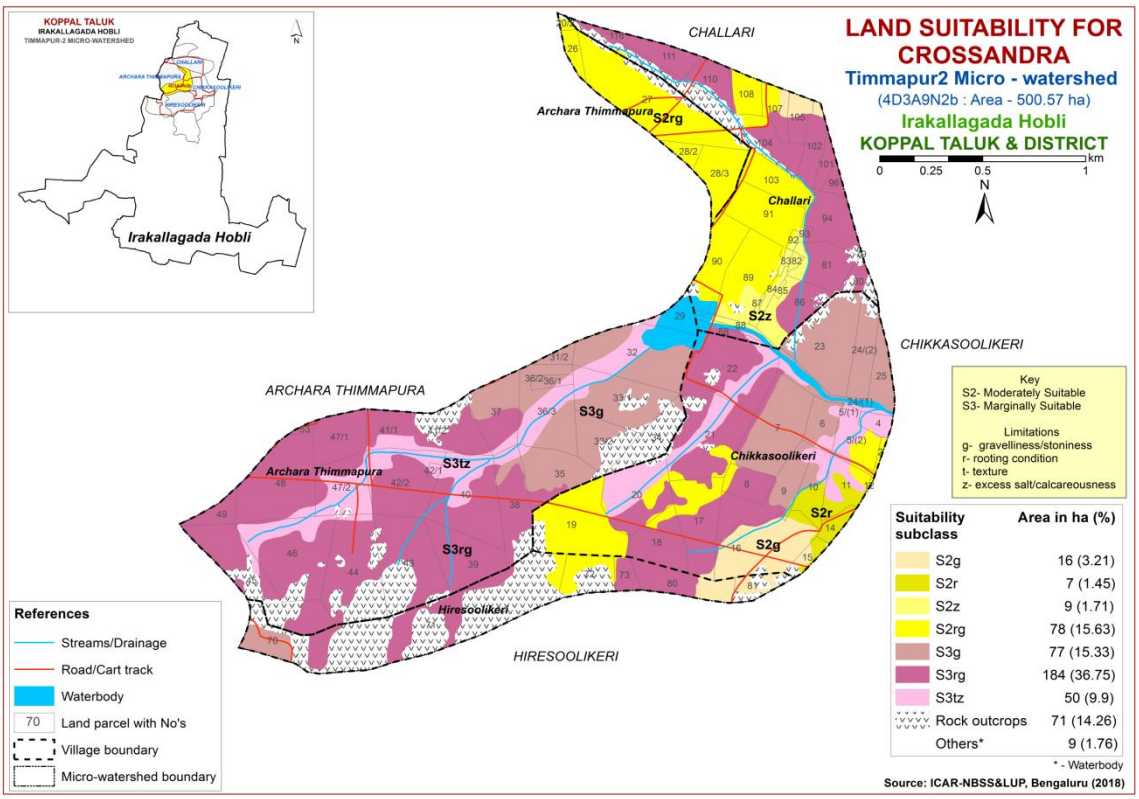


Fig. 7.31 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Timmapur-2 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p^+) kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
HRVhB2g2	662	90	WD	25-50	scl	gscl	35-60	>35	<50	1-3	Moderate	6.05	0.21	0.73	11.24	100
HRViB1g2	662	90	WD	25-50	sc	gscl	35-60	>35	<50	1-3	Slight	6.05	0.21	0.73	11.24	100
HRViB2g1	662	90	WD	25-50	sc	gscl	15-35	>35	<50	1-3	Moderate	6.05	0.21	0.73	11.24	100
HRVcB2g1	662	90	WD	25-50	sl	gscl	15-35	>35	<50	1-3	Moderate	6.05	0.21	0.73	11.24	100
ABRiB2g2	662	90	WD	25-50	sc	sc-c	35-60	>35	<50	1-3	Moderate	6.13	0.02	0.36	3.60	58.76
KTPiB1	662	90	WD	50-75	sc	scl	-	15-35	101-150	1-3	Slight	6.42	0.07	0.05	4.41	100
KTPiB1g1	662	90	WD	50-75	sc	scl	15-35	15-35	101-150	1-3	Slight	6.42	0.07	0.05	4.41	100
HTIhB1g1	662	90	WD	50-75	scl	gsc	15-35	15-35	50-100	-	Slight	-	-	-	-	-
HTIiB1g1	662	90	WD	50-75	sc	gsc	15-35	15-35	50-100	1-3	Slight	-	-	-	-	-
MKHcB2g1	662	90	WD	50-75	sl	gscl	15-35	>35	50-100	1-3	Moderate	7.38	0.09	1.49	14.84	93
MKHcB2g2	662	90	WD	50-75	sl	gscl	35-60	>35	50-100	1-3	Moderate	7.38	0.09	1.49	14.84	93
MKHcC2g2	662	90	WD	50-75	sl	gscl	35-60	>35	50-100	3-5	Moderate	7.38	0.09	1.49	14.84	93
MKHhB2g2	662	90	WD	50-75	scl	gscl	35-60	>35	50-100	1-3	Moderate	7.38	0.09	1.49	14.84	93
MKHiB1g1	662	90	WD	50-75	sc	gscl	15-35	>35	50-100	1-3	Slight	7.38	0.09	1.49	14.84	93
HDHiB2g1	662	90	WD	75-100	sc	gsc-gc	15-35	>35	50-100	1-3	Moderate	6.54	0.07	7.11	5.84	84.07
BDGiB1g2	662	90	WD	75-100	sc	gc	35-60	35-60	<50	1-3	Slight	6.24	0.06	0.35	3.76	52.56
NGPhB1g2	662	90	WD	100-150	scl	gsc-gc	35-60	>35	51-100	-	Slight	6.77	0.09	0.46	7.10	82.70
BPRhB2g2	662	90	WD	100-150	scl	gsc-gc	35-60	>35	100-150	1-3	Moderate	6.64	0.03	0.51	5.45	63.48
NDLhB2g1	662	90	WD	>150	scl	gsc	15-35	>35	50-100	1-3	Moderate	7.46	0.08	0.32	11.45	91.88
DRLmB2	662	90	MWD	75-100	c	c	-	<15	151-200	1-3	Moderate	8.78	0.32	5.62	49.70	100
BGPmA1	662	90	MWD	>150	c	c	-	<15	>200	0-1	Slight	9.20	0.27	3.84	19.60	100

*Symbols and abbreviations are according to Field Guide for LRI under Sujala-III Project, Karnataka

Table 7.2 Land suitability criteria for Sorghum

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime1	Mean temperature in growing season	°C	26–30	30–34; 24–26	34–40; 20–24	>40; <20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristics					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, c (red), c (black)	scl, cl	ls, sl	-
	pH	1:2.5	5.5-7.8	5.0-5.5 7.8-9.0	>9.0	-
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	10-15
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.3 Land suitability criteria for Maize

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	30-34	35-38 26-30	38-40 26-20	
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc	c (red), c (black)	ls, sl	-
	pH	1:2.5	5.5-7.8	5.0-5.5 7.8-9.0	>9.0	-
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	-
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.4 Land suitability criteria for Bajra

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	33-38 24-27	39-40 20-23	<20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm	500-750	400-500	200-400	<200
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl, scl, cl,sc,c (red)	C (black)	ls	-
	pH	1:2.5	6.0-7.8	5.0-5.5 7.8-9.0	5.5-6.0 >9.0	
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	15-35	35-60	>60	
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	1-3	3-5	5-10	>10

Table 7.5 Land suitability criteria for Groundnut

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	24–33	22–24; 33–35	20–22; 35–40	<20; >40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. Well drained	Poorly drained	Very Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl	sl,cl, sc	c (red), c (black), ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<35	35-60	>60	
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.6 Land suitability criteria for Sunflower

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	24–30	30–34; 20–24	34–38; 16–20	>38; <16
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	mod. Well drained	-	Poorly to very drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	cl, sc,c (red), c (black)	scl	ls, sl	-
	pH	1:2.5	6.5-7.8	7.8-8.4 5.5-6.5	8.4-9.0; 5.0-5.5	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.7 Land suitability criteria for Red gram

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	30-35(G) 20-25(AV) 15-18 (F&PS) 35-40(M)	25-30(G) 20-25 (AV) 12-15 (F&PS) 30-35(M)	20-25(G) 15-20(AV) 10-12 (F&PS) 25-30(M)	< 20 <15 <10 <25
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. Well drained	Poorly drained	Very Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, c (red)	c (black),sl, scl, cl	ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-9.0	5.0-5.5 >9.0	-
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-50	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<1.0	1.0-2.0	>2.0	
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.8 Land suitability criteria for Bengal gram

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	20–25	25–30; 15–20	30–35; 10–15	>35; <10
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. Well drained	Poorly drained	Very Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	C (black)	-	c (red), scl, cl, sc	ls, sl
	pH	1:2.5	6.0-7.8	5.0-6.0 7.8-9.0	>9.0	-
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	-
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.9 Land suitability criteria for Cotton

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	22-32	>32	<19	-
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well to moderately well	Poorly drained/Some what excessively drained	-	very poorly/excessively drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, c (red,black)	cl	scl	ls, sl
	pH	1:2.5	6.5-7.8	7.8-8.4	5.5-6.5 8.4->9.0	<5.5
	CEC	C mol (p+)Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	50-100	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	5-10	10-15	>15	
Erosion hazard	Slope	%	<3	3-5	-	>5

Table 7.10 Land suitability criteria for Chilli

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	25-32	33-35 20-25	35-38 <20	>38
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc	c (black), sl	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.11 Land suitability criteria for Tomato

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	25-28	29-32 20-24	15-19 33-36	<15 >36
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl, scl, cl, sc, c (red)	-	ls, c(black)	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.12 Land suitability criteria for Brinjal

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class				
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl, scl, cl, sc c (red)	-	ls, c (black)	-
	pH	1:2.5	6.0-7.3	7.3-8.4 5.0-6.0	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.13 Land suitability criteria for Onion

Land use requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable (S2)	Marginally suitable (S3)	Not suitable (N1)
Climatic regime	Mean temperature in growing season	°C	20-30	30-35	35-40	>40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately /imperfectly	-	Poorly to V poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl,cl,sc,c (red)	-	c (Black),ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<1.0	1.0-2.0	2.0-4.0	<4
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.14 Land suitability criteria for Bhendi

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	25-28	29-32 20-24	15-19 33-36	<15 >36
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly to very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl,sc, c (red)	c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.15 Land suitability criteria for Drumstick

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, scl, cl, c (red)	sl, c (black)	ls	s
	pH	1:2.5	6.0-7.3	5.0-5.5 7.3-7.8	5.5-6.0 7.8-8.4	>8.4
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<35	35-60	60-80	>80
Soil toxicity	Salinity (EC saturation extract)	dS/m				
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-10	-	>10

Table 7.16 Land suitability criteria for Mango

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	24-27 33-35	36-40	20-24
	Min temp. before flowering	^{0}C	10-15	15-22	>22	-
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration	Days				
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	-	ls, sl, c (black)	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	75-100	<75
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.17 Land suitability criteria for Guava

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	33-36 24-27	37-42 20-23	
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl	c (black), ls	-
	pH	1:2.5	6.0-7.8	5.0-6.0	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.18 Land suitability criteria for Sapota

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-32	33-36 24-27	37-42 20-23	>42 <18
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	-	Poorly to very drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl	ls, c (black)	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.19 Land suitability criteria for Pomegranate

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	30-34	35-38 25-29	39-40 15-24	
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl,cl, sc, c (red)	c (black),sl	ls	-
	pH	1:2.5	5.5-7.8	7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.20 Land suitability criteria for Musambi

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-30	31-35 24-27	36-40 20-23	>40 <20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately drained	poorly	Very poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c	sl	ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.21 Land suitability criteria for Lime

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	28-30	31-35 24-27	36-40 20-23	>40 <20
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately drained	poorly	Very poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c	sl	ls	-
	pH	1:2.5	6.0-7.8	5.5-6.0 7.8-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.22 Land suitability criteria for Amla

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	c (black)	ls, sl	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15-35	35-60	60-80	-
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.23 Land suitability criteria for Cashew

Land use requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable (S2)	Marginally suitable (S3)	Not suitable (N1)
Climatic regime	Mean temperature in growing season	°C	32 to 34	28 to 32; 34 to 38	24 to 28; 38 to 40	<20; >40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	moderately well drained	Poorly drained	Very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	-	sl, ls	c (black)
	pH	1:2.5	5.5-6.5	5.0-5.5 6.5-7.3	7.3-7.8	>7.8
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-10	>10	-

Table 7.24 Land suitability criteria for Jackfruit

Land use requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable (S2)	Marginally suitable (S3)	Not suitable (N1)
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well	Poorly	V. Poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	-	sl, ls, c (black)	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10-

Table 7.25 Land suitability criteria for Jamun

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well	Mod. well	Poorly	V.Poorly
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c(red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.8	5.0-6.0	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	50-100	<50
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	>60
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.26 Land suitability criteria for Custard apple

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	Scl, cl, sc, c (red), c (black)	-	Sl, ls	-
	pH	1:2.5	6.0-7.3	5.5-6.0 7.3-8.4	5.0-5.5 8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15-35	35-60	60-80	-
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	>5	-

Table 7.27 Land suitability criteria for Tamarind

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl,sc, c (red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>150	100-150	75-100	<75
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Table 7.28 Land suitability criteria for Mulberry

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	24–28	22–24; 28–32	32–38; 22–18	>38; <18
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V. Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sc, cl, scl	c (red)	c (black), sl, ls	-
	pH	1:2.5	5.5-7.3	5.0-5.5 7.8-8.4	7.3-8.4	>8.4
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>100	75-100	50-75	<50
	Stoniness	%				
	Coarse fragments	Vol %	0-35	35-60	60-80	>80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2	2-4	4-8	>8
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	0-3	3-5	5-10	>10

Note: Suitability evaluation only for Mulberry leaf not for Silk worm rearing

Table 7.29 Land suitability criteria for Marigold

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	18-23	17-15 24-35	35-40 10-14	>40 <10
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl, cl, sc, c (red)	c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.30 Land suitability criteria for Chrysanthemum

Land use requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable (S2)	Marginally suitable (S3)	Not suitable (N1)
Climatic regime	Mean temperature in growing season	°C	18-23	17-15 24-35	35-40 10-14	>40 <10
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl, cl, sc, c (red)	c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.31 Land suitability criteria for jasmine (irrigated)

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	18-23	17-15 24-35	35-40 10-14	-
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Poorly drained	V.Poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c (red)	sl	ls, c (black)	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

7.32 Land suitability criteria for Crossandra

Land use requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately suitable (S2)	Marginally suitable (S3)	Not suitable (N1)
Climatic regime	Mean temperature in growing season	°C				
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	-	Poorly to very poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	scl, cl, sc, c(red)	sl,	c (black),ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-8.4	8.4-9.0	>9.0
	CEC	C mol (p+)/Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2-4	4-8	>8.0
	Sodicity (ESP)	%				
Erosion hazard	Slope	%	<3	3-5	5-10	>10

7.32 Land management units (LMUs)

The 21 soil map units identified in Timmapur-2 microwatershed have been grouped into 5 Land management units (LMUs) for the purpose of preparing a Proposed Crop Plan. Land management units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Use Class map (Fig. 7.32) has been generated. These Land management units are expected to behave similarly for a given level of management.

The map units that have been grouped into five Land management units along with brief description of soil and site characteristics are given below.

LMU No.	Soil map unit number	Mapping unit	Soil and site characteristics
1	350, 395	DRLmB2, BGPmA1	Moderately deep to very deep, black calcareous clayey soils
2	128, 193, 232, 259, 296	HDHiB2g1, BDGiB1g2, BPRhB2g2, NGPhB1g2, NDLhB2g1	Moderately deep to very deep, red gravelly sandy clay to clay soils
3	73, 74, 94, 98	KTPiB1, KTPiB1g1, HTIhB1g1, HTIiB1g1	Moderately shallow, red sandy clay to sandy clay loam soils
4	77, 78,79, 86, 88	MKHcB2g1, MKHcB2g2, MKHcC2g2, MKHhB2g2, MKHiB1g1	Moderately shallow, red gravelly loam soils
5	27, 30, 31, 465, 472	HRVhB2g2, HRViB1g2, HRViB2g1, HRVcB2g1, ABRiB2g2	Shallow, red gravelly sandy clay soils

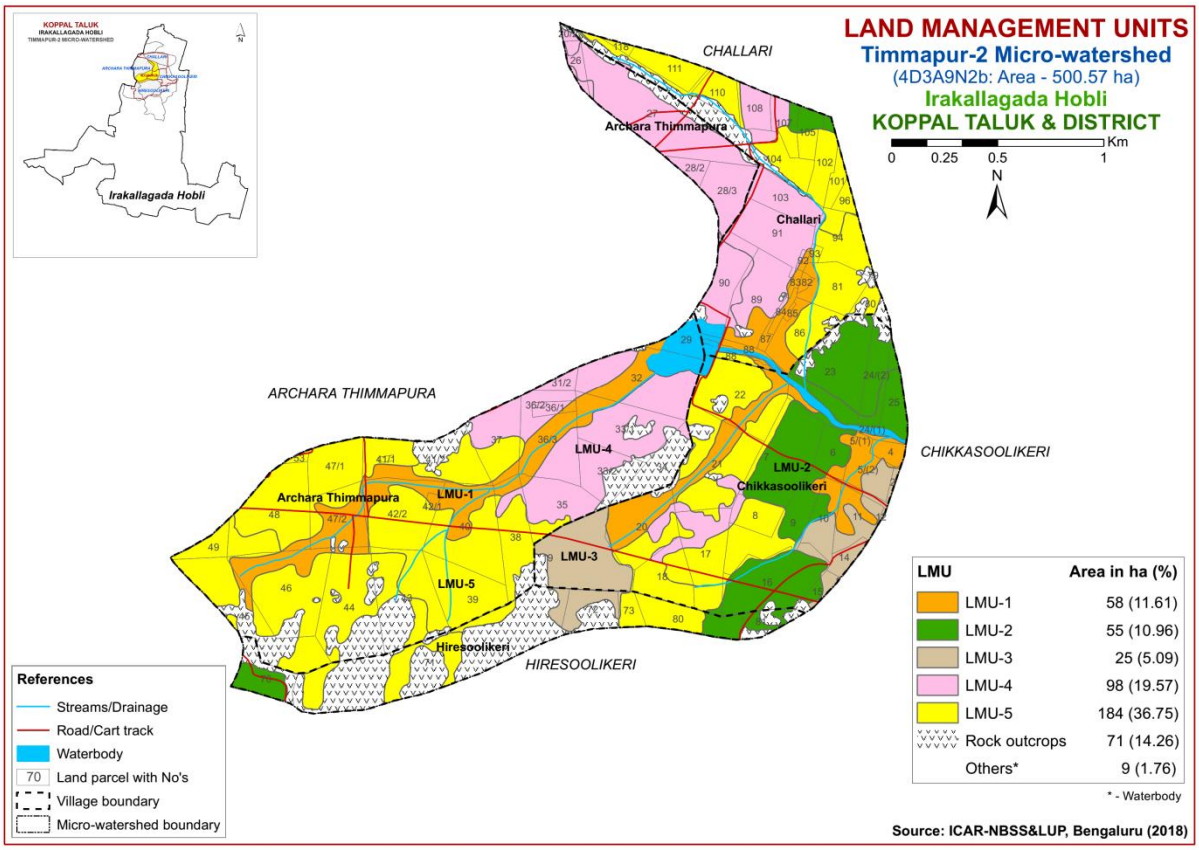


Fig 7.32 Land management units map of Timmapur-2 microwatershed

7.33 Proposed Crop Plan for Timmapur-2 Microwatershed

After assessing the land suitability for the 31 crops, the proposed crop plan has been prepared for the 5 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 28 crops. The resultant proposed crop plan is presented in Table 7.33.

Table 7.33 Proposed Crop Plan for Timmapur-2 Microwatershed

Land Use Class	Soil Map Units	Survey Number	Soil characters	Field Crops	Horticulture Crops	Suitable Interventions
LMU 1 58 ha (12%)	350.DRLmB2 395.BGPmA1	**Archara Thimmapura:**42/1,47/2 **Challari:**82,83,84,85,87,92 **Chikkasoolikeri:**4,5/(1),5/(2), 20	Moderately deep to very deep, black calcareous clayey soils	Maize, Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Sapota, Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple **Vegetables:** Drumstick, Chilli, Coriander, Tomato, Bhendi **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
LMU 2 55 ha (11%)	128.HDHiB2g1 193.BDGiB1g2 232.BPRhB2g2 259.NGPhB1g2 296.NDLhB2g1	**Chikkasoolikeri:**6,7, 16,23,24/(2),25 **Hiresoolikeri:**70	Moderately deep to very deep, red gravelly sandy clay to clay soils	Sorghum, Groundnut, Red gram, Bajra, Horse gram, Castor	**Fruit crops:** Musambi, Lime, Jamun, Jackfruit Amla, Custard apple, Tamarind **Vegetable crops:** Drumstick, Curry leaves	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
LMU 3 25 ha (5%)	73.KTPiB1 74.KTPiB1g1 94.HTIhB1g1 98.HTIiB1g1	**Chikkasoolikeri:**2,10,11,12,14,15,19 **Hiresoolikeri:**72	Moderately shallow, red sandy clay to sandy clay loam soils	Sorghum, Groundnut, Bajra, Green gram, Black gram, Cowpea, Horse gram, Castor,	**Fruit crops:** Lime, Musambi, Amla, Custard apple, Cashew **Flower crops:** Marigold, Chrysanthemum	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
LMU 4 98 ha (20%)	77.MKHcB2g1 78.MKHcB2g2 79.MKHcC2g2 86.MKHhB2g2	**Archara Thimmapura:**20/2,26,27,28/2,28/3,31/2, 32,33/1,33/2,35,36/1,	Moderately shallow, red gravelly loamy soils)	Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Lime, Musambi, Amla, Cashew, Custard apple,	Drip irrigation, mulching, suitable soil and water conservation practices

	88.MKHiB1g1	36/2,36/3,37 **Challari:**89,90,91, 103,107, 108				(Crescent Bunding with Catch Pit etc)
LMU 5 184 ha (37%)	27.HRVhB2g2 30.HRViB1g2 31.HRViB2g1 465.HRVcB2g1 472.ABRiB2g2	**Archara Thimmapura:**38,39,40,41/1,41/2,42/2,43,44,45,46, 47/1,48,49,53 **Challari:**81,86,93,94, 96,101,102,104,105,110, 111,118 **Chikkasoolikeri:**8,9, 17,18,21,22 **Hiresoolikeri:**73,80	Shallow, red gravelly sandy clay to sandy clay soils	Green gram, Black gram, Horse gram	**Agri-Silvi-Pasture:** Custard apple, Amla, Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

Soil health is basic to plant health and plant health is basic to human and bovine health. Soil is fundamental to crop production. Without soil, no food could be produced nor would livestock be fed on a large scale. Because it is finite and fragile, soil is a precious resource that requires special care from its users.

Soil health or the capacity of the soil to function is critical to human survival. Soil health has been defined as: "the capacity of the soil to function as a living system without adverse effect on the ecosystem". Healthy soils maintain a diverse community of soil organisms that help to form beneficial symbiotic associations with plant roots, recycle essential plant nutrients, improve soil structure with positive repercussions for soil, water and nutrient holding capacity and ultimately improve crop production and also contribute to mitigating climate change by maintaining or increasing its carbon content.

Functional interactions of soil biota with organic and inorganic components, air and water determine a soil's potential to store and release nutrients, and water to plants and to promote and sustain plant growth. Thus, maintaining soil health is vital to crop production and conserve soil resource base for sustaining agriculture.

The most important characteristics of a healthy soil are

- Good soil tilth
- Sufficient soil depth
- Good water storage and good drainage
- Adequate supply, but not excess of nutrients
- Large population of beneficial organisms
- Small proportion of plant pathogens and insect pests
- Low weed pressure
- Free of chemicals and toxins that may harm the crop
- Resistance to degradation
- Resilience when unfavourable conditions occur

Characteristics of Timmapur-2 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of Harve (HRV) 154 ha (31%), Mukhadahalli (MKH) 98 ha (20%), Budagumpa (BGP) 50 ha (10%), Abbigere (ABR) 30 ha (6%), Bidanagere (BDG) 18 ha (4%), Niduvalalu (NDL) 16 ha (3%), Hatti (HTI) 15 ha (3%), Balapur (BPR) 12 ha (2%), Kethanapura (KTP) 10 ha (2%), Dambarahalli (DRL) 9 ha (2%), Nagalapur (NGP) 7 ha (1%) and Hooradhahalli (HDH) occupy minor area about 3 ha (<1%) in the microwatershed.

- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II & III). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, an area of about 6 ha (1%) is strongly acid (pH 5.0-5.5), 117 ha (23%) is moderately acid (pH 5.5-6.0), 131 ha (26%) is slightly acid (pH 6.0-6.5), 122 ha (24%) is neutral (pH 6.5-7.3), 36 ha (7%) is slightly alkaline (pH 7.3-7.8) and about 8 ha (2%) is moderately alkaline (ph 7.8-8.4) in the microwatershed. Entire area in the microwatershed is alkaline to acidic in reaction.

Soil Health Management

The following actions are required to improve the current land husbandry practices that provide a sound basis for the successful adoption of sustainable crop production system.

Acid soils

An area of 254 ha is under acid soils.

1. Growing of crops suitable for a particular soil pH.
2. Ameliorating the soils through the application of amendments (liming materials).

Liming materials:

1. $CaCO_3$ (Calcium Carbonate). More than 90% use in India.
2. Dolomite [Ca Mg $(Co_3)_2$]
3. Quick lime (Cao)
4. Slaked lime [Ca $(OH)_2$]

For normal pH and pH-4.8 (35 t/ha) and pH 6 .0-7.0 (4 t/ha) lime is required.

Alkaline soils

Slightly to moderately alkaline soils cover an area of 44 ha.

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of biofertilizers (Azospirullum, Azatobacter, Rhizobium).
3. Application of 25% extra N and P (125 % RDN&P).
4. Application of $ZnSO_4$ – 12.5 kg/ha (once in three years).
5. Application of Boron – 5 kg/ha (once in three years).

Neutral soils

Neutral soils cover about 122 ha area in the microwatershed.

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of biofertilizers, (Azospirullum, Azotobacter, Rhizobium).

3. Application of 100 per cent RDF.
4. Need based micronutrient applications.

Besides the above recommendations, the best transfer of technology options are also to be adopted.

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. Out of total 501 ha area in the microwatershed, an area of about 148 ha (30%) is suffering from slight erosion and 272 ha (54%) is suffering from moderate erosion. The areas suffering from moderate erosion need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

Any large scale implementation of soil health management requires that supporting information is made available widely, particularly through channels familiar to farmers and extension workers. Given the very high priority attached to soil health especially by the Central Government on issuing Soil-Health Cards to all the farmers, media outlets like Regional, State and National Newspapers, Radio and Dooradarshan programs in local languages but also modern information and communication technologies such as Cellular phones and the Internet, which can be much more effective in reaching the younger farmers.

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning (Saturation plan) in IWMP is focusing on preparation of

1. Soil and Water Conservation Treatment Plans for each plot or farm.
2. Productivity enhancement measures/ interventions for existing crops/livestock/other farm enterprises.
3. Diversification of farming mainly with perennial horticultural crops and livestock.
4. Improving livelihood opportunities and income generating activities.

In this connection, how various outputs of Sujala-III are of use in addressing these objectives of Net Planning are briefly presented below.

- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- **Surface Soil Texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, root vegetables (carrot, raddish, potato etc) but

not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dryland Agriculture, Vijayapura, Karnataka can be adopted.

- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Timmapur-2Microwatershed.
- **Organic Carbon:** The OC content (an index of available Nitrogen) is medium (0.5-0.75%) in 410 ha (82%) and high (>0.75%) in 11 ha (2%). The areas that are medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 410 ha area where OC is medium. For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus:** An area of about 356 ha (71%) is medium (23-57 kg/ha) and 65 ha (13%) is high (>57 kg/ha) in available phosphorus. Hence for all the crops, 25% additional P-needs to be applied where it is medium.
- **Available Potassium:** Available potassium is low (<145 kg/ha) in 324 ha (65%), medium (145-337 kg/ha) in 72 ha (14%) and high (>337 kg/ha) in 24 (5%) in the microwatershed. Additional 25% potassium needs to be applied in areas where it is medium and low.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 169 ha (34%), medium (10-20 ppm) in 198 ha (40%) in the microwatershed. These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertitilizer (13% sulphur) for 2-3 years for the deficiency to be corrected. It is high (>20 ppm) in 54 ha (11%) of the microwatershed.
- **Available Boron:** An area of about 418 ha (83%) is low (<0.5 ppm) in available boron. an area of 3 ha (<1%) is medium (0.5-1.0 ppm) in available boron content. The areas that are low and medium need to be applied with sodium borate @ 10 kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.

- **Available iron:** Entire area is sufficient in (>4.5 ppm) available iron in the microwatershed. To manage iron deficiency, iron sulphate@25 kg/ha needs to be applied for 2-3 years.
- **Available manganese:** Entire area in the microwatershed is sufficient (>1.0 ppm) in available manganese.
- **Available copper:** Entire area is sufficient (>0.2 ppm) in available copper in the microwatershed.
- **Available Zinc:** It is deficient (<0.6 ppm) in 209 ha (42%) and sufficient (>0.6 ppm) in 211 ha (42%) area in the microwatershed. Application of zinc sulphate @ 25 kg/ha is to be followed in areas that are deficient in available zinc.
- **Soil acidity:** The microwatershed has 354 ha (51%) area with soils that are slightly to strongly acid. These areas need application of lime (Calcium Carbonate).
- **Soil alkalinity:** The microwatershed has 44 ha (9%) soils that are slightly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

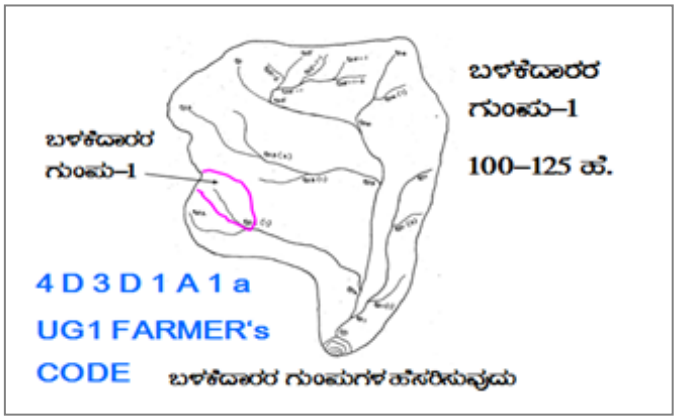
Land suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Timmapur-2 Microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

- Soil depth
- Surface soil texture
- Available water capacity
- Soil slope
- Soil gravelliness
- Land capability
- Present land use and land cover
- Crop suitability maps
- Rainfall map
- Hydrology
- Water Resources
- Socio-economic data



- Contour plan with existing features- network of waterways, pothissa boundaries, cut up/ minor terraces etc.
- Cadastral map (1:7920 scale)
- Satellite imagery (1:7920 scale)

  Apart from these, Hand Level/ Hydro Marker/ Dumpy Level/ Total Station and Kathedars' List to be collected.

Steps for Survey and Preparation of Treatment Plan

The boundaries of Land User Groups' and Survey No. boundaries are traced in the field.

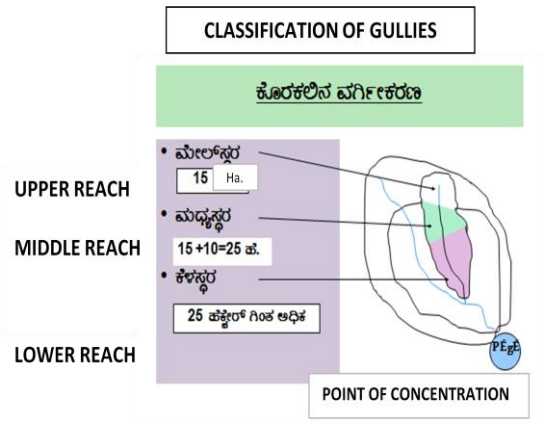
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge structures

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below.

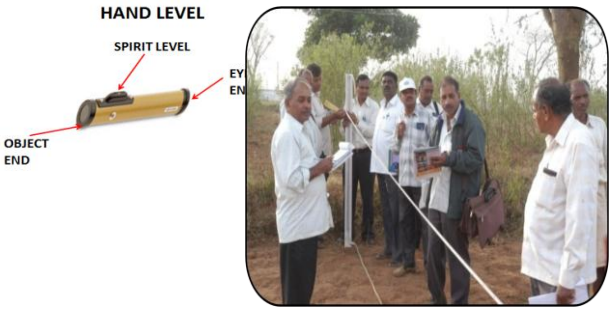
9.1.1 Arable Land Treatment

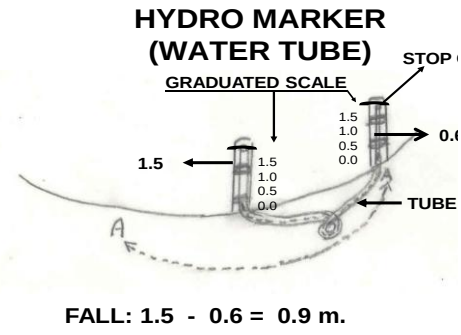
A. BUNDING

Steps for Survey and Preparation of Treatment Plan		USER GROUP-1
Cadastral map (1:7920 scale) is enlarged to a scale of 1:2500 scale Existing network of waterways, pothissa boundaries, grass belts, natural drainage lines/ watercourse, cut ups/ terraces are marked on the cadastral map to the scale Drainage lines are demarcated into		
Small gullies	(up to 5 ha catchment)	
Medium gullies	(5-15 ha catchment)	
Ravines	(15-25 ha catchment) and	
Halla/Nala	(more than 25ha catchment)	

Measurement of Land Slope

Land slope is estimated or determined by the study and interpretation of contours or by measurement in the field using simple instruments like Hand level or Hydromarker.





Vertical and Horizontal intervals between bunds as recommended by the Watershed Development Department.

Slope percentage	Vertical interval (m)	Corresponding Horizontal Distance (m)
2 - 3%	0.6	24
3 - 4%	0.9	21
4 - 5%	0.9	21
5 - 6%	1.2	21
6 - 7%	1.2	21

Note: i) The above intervals are maximum.

(ii) Considering the slope class and erosion status (A1… A= 0-1% slope, 1= slight erosion) the intervals have to be decided.

Bund length recording: Considering the contour plan and the existing grass belts/partitions, the bunds are aligned and lengths are measured.

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class (bg_0 ...b= loamy sand, g_0 = <15% gravel). The recommended sections for different soils are given below.

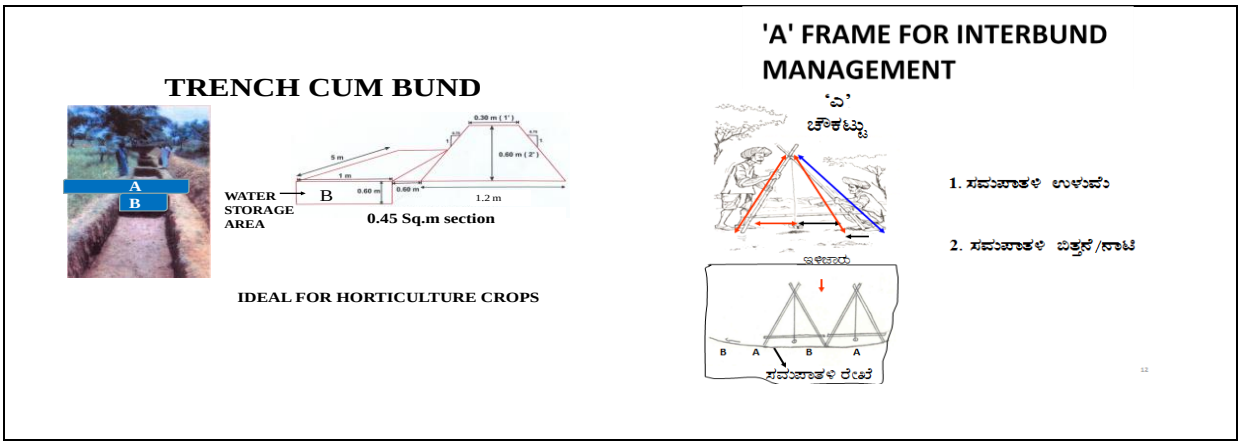
Recommended Bund Section

Top width (m)	Base width (m)	Height (m)	Side slope (Z:1;H:V)	Cross section (sq m)	Soil Texture	Remarks
0.3	0.9	0.3	01:01	0.18	Sandy loam	Vegetative bund
0.3	1.2	0.3	1.5:1	0.225	Sandy clay	
0.3	1.2	0.5	0.9:1	0.375	Red gravelly soils	
0.3	1.2	0.6	0.75:1	0.45		
0.3	1.5	0.6	01:01	0.54	Red sandy loam	
0.3	2.1	0.6	1.5:1	0.72	Very shallow black clayey soils	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow black clayey soils	
0.6	3.1	0.7	1.78:1	1.29	Medium black clayey soils	
0.5	3	0.85	1.47:1	1.49		

Formation of Trench cum Bund

Dimensions of the Borrow Pits/ Trenches to be excavated (machinery are decided considering the Bund Section).

Details of Borrow Pit dimensions are given below



Size of Borrow Pits/ Trench recommended for Trench cum Bund (by machinery)

Bund section	**Bund length**	**Earth quantity**	**Pit**				**Berm (pit to pit)**	**Soil depth Class**
m^2	m	m^3	L(m)	W(m)	D(m)	QUANTITY (m^3)	m	
0.375	6	2.25	5.85	0.85	0.45	2.24	0.15	Shallow
0.45	6	2.7	5.4	1.2	0.43	2.79	0.6	Shallow
0.45	6	2.7	5	0.85	0.65	2.76	1	Moderately Shallow
0.54	5.6	3.02	5.5	0.85	0.7	3.27	0.1	Moderately shallow
0.54	5.5	2.97	5	1.2	0.5	3	0.5	Shallow
0.72	6.2	4.46	6	1.2	0.7	5.04	0.2	Moderately shallow
0.72	5.2	3.74	5.1	0.85	0.9	3.9	0.1	Moderately deep

B. Waterways

a) Existing waterways are marked on the cadastral map (1:7920 scale) and their dimensions are recorded.

b) Considering the contour plan of the MWS, additional waterways/ modernization of the existing ones can be thought of.

c) The design details are given in the Manual.

C. Farm Ponds

Waterways and the catchment area will give an indication on the size of the Farm Pond. Location of the pond can be decided based on the contour plan/ field condition and farmers' need/desire.

D. Diversion channel

Existing EPT/ CPT are marked on the cadastral map. Looking to the need, these can be modernized or fresh diversion channel can be proposed and runoff from this can be stored in *Gokatte*/ Recharge ponds.

9.1.2 Non-Arable Land Treatment

Depending on the gravelliness and crops preferred by the farmers, the concerned authorities can decide appropriate treatment plan. The recommended treatments may be Contour Trench, Staggered Trench, Crescent Bund, Boulder Bund or Pebble Bund.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainage lines (gullies/ *nalas/hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff in water budgeting and quality of water in the wells and site suitability.
e) Detailed Leveling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.
f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.
g) Rainfall intensity data of the nearest Rain Gauge Station is considered for Hydrologic Designs.
h) Silt load to the Storage/Recharge Structures is reduced by providing vegetative, boulder and earthen checks in the natural water course. Location and design details are given in the Manual.

9.2 Recommended Soil and Water Conservation Measures

The appropriate conservation structures best suited for each of the land parcel/ survey number (Appendix-I) are selected based on the slope per cent, severity of erosion, amount of rainfall, land use and soil type. The different kinds of conservation structures recommended are

1. Graded / Strengthening of Bunds
2. Trench cum Bunds (TCB)
3. Trench cum Bunds / Strengthening
4. Crescent Bunds

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. A maximum area of about 362 ha (72%) requires Trench cum Bunding and about 9 ha (2%) area requires Graded Bunding and 50 ha (10%) requires strengthening of existing Bunds / Bunding in the microwatershed. The conservation plan prepared may be presented to all the stakeholders including farmers and after including their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

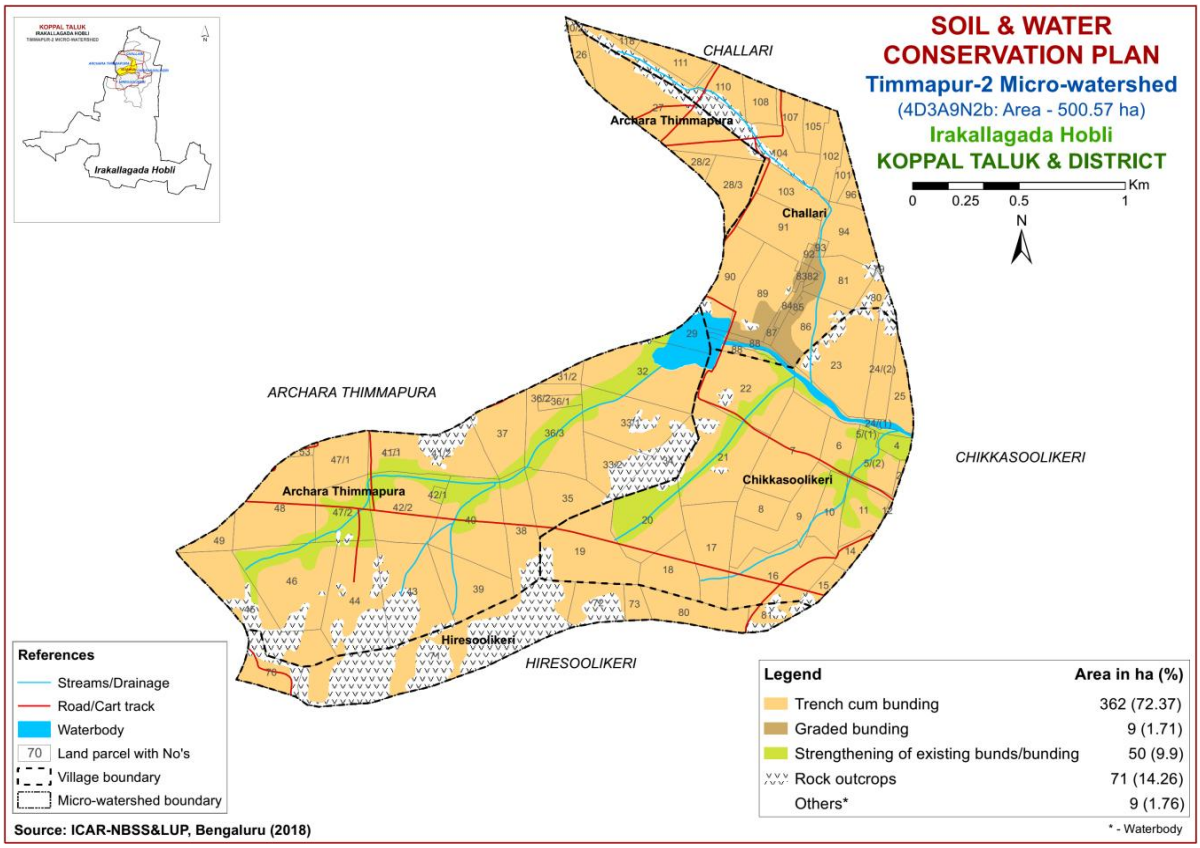


Fig. 9.1 Soil and Water Conservation Plan map of Timmapur-2 Microwatershed

9.3 Greening of Microwatershed

As part of the greening programme in the watersheds, it is envisaged to plant a variety of horticultural and other tree plants that are edible, economical and produce lot of biomass which helps to restore the ecological balance in the watersheds. The lands that are suitable for greening programme are non-arable lands (land capability classes V, VI VII and VIII) and also the lands that are not suitable or marginally suitable for growing annual and perennial crops. The method of planting these trees is given below.

It is recommended to open the pits during the 1st week of March along the contour and heap the dug out soil on the lower side of the slope in order to harness the flowing water and facilitate weathering of soil in the pit. Exposure of soil in the pit also prevents spread of pests and diseases due to scorching sun rays. The pits should be filled with mixture of soil and organic manure during the second week of April and keep ready with sufficiently tall seedlings produced either in poly bags or in root trainer nurseries so that planting can be done during the 2nd or 3rd week of April depending on the rainfall.

The tree species suitable for the area considering rainfall, temperature and adaptability is listed below; waterlogged areas are recommended to be planted with species like Neral (*Sizyzium cumini*) and Bamboo. Dry areas are to be planted with species like Honge, Bevu, Seetaphal *etc*.

Dry Deciduous Species			Temp (°C)	Rainfall (mm)
1.	Bevu	*Azadiracta indica*	21–32	400 –1,200
2.	Tapasi	*Holoptelia integrifolia*	20-30	500 - 1000
3.	Seetaphal	*Anona Squamosa*	20-40	400 - 1000
4.	Honge	*Pongamia pinnata*	20 -50	500–2,500
5.	Kamara	*Hardwikia binata*	25 -35	400 - 1000
6.	Bage	*Albezzia lebbek*	20 - 45	500 - 1000
7.	Ficus	*Ficus bengalensis*	20 - 50	500–2,500
8.	Sisso	*Dalbargia Sissoo*	20 - 50	500 -2000
9.	Ailanthus	*Ailanthus excelsa*	20 - 50	500 - 1000
10.	Hale	*Wrightia tinctoria*	25 - 45	500 - 1000
11.	Uded	*Steriospermum chelanoides*	25 - 45	500 -2000
12.	Dhupa	*Boswella Serrata*	20 - 40	500 - 2000
13.	Nelli	*Emblica Officinalis*	20 - 50	500 -1500
14.	Honne	*Pterocarpus marsupium*	20 - 40	500 - 2000
Moist Deciduous Species			**Temp (°C)**	**Rainfall (mm)**
15.	Teak	*Tectona grandis*	20 - 50	500-5000
16.	Nandi	*Legarstroemia lanceolata*	20 - 40	500 - 4000
17.	Honne	*Pterocarpus marsupium*	20 - 40	500 - 3000
18.	Mathi	*Terminalia alata*	20 -50	500 - 2000
19.	Shivane	*Gmelina arboria*	20 -50	500 -2000
20.	Kindal	*T.Paniculata*	20 - 40	500 - 1500
21.	Beete	*Dalbargia latifolia*	20 - 40	500 - 1500
22.	Tare	*T. belerica*	20 - 40	500 - 2000
23.	Bamboo	*Bambusa arundinasia*	20 - 40	500 - 2500
24.	Bamboo	*Dendrocalamus strictus*	20 – 40	500 – 2500
25.	Muthuga	*Butea monosperma*	20 - 40	400 - 1500
26.	Hippe	*Madhuca latifolia*	20 - 40	500 - 2000
27.	Sandal	*Santalum album*	20 - 50	400 - 1000
28.	Nelli	*Emblica officinalis*	20 - 40	500 - 2000
29.	Nerale	*Sizyzium cumini*	20 - 40	500 - 2000
30.	Dhaman	*Grevia tilifolia*	20 - 40	500 - 2000
31.	Kaval	*Careya arborea*	20 - 40	500 - 2000
32.	Harada	*Terminalia chebula*	20 - 40	500 - 2000

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Appendix-I

Timmapur 2 _9N2b Microwatershed

Soil Phase Information

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Available Water Capacity	Soil Gravelliness	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Chikkasoolikeri	2	0.37	KTPiB1g1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Low (51-100 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut+ Vegitable (Rg+Gn+Vg)	Not Available	IIs	TCB
Chikkasoolikeri	4	1.47	BGPmA1	LMU-1	Very deep (>150 cm)	Clay	High (151-200 mm/m)	Non gravelly (<15%)	Nearly level (0-1%)	Slight	Groundnut+Paddy (Gn+Pd)	1 Borewell	IIs	Graded bunding
Chikkasoolikeri	5/(1)	0.14	BGPmA1	LMU-1	Very deep (>150 cm)	Clay	High (151-200 mm/m)	Non gravelly (<15%)	Nearly level (0-1%)	Slight	Redgram+Groundnut (Rg+Gn)	Not Available	IIs	Graded bunding
Chikkasoolikeri	5/(2)	4.36	BGPmA1	LMU-1	Very deep (>150 cm)	Clay	High (151-200 mm/m)	Non gravelly (<15%)	Nearly level (0-1%)	Slight	Groundnut+Paddy (Gn+Pd)	Not Available	IIs	Graded bunding
Chikkasoolikeri	6	3.27	BDGiB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Vegitable+Groundnut (Vg+Gn)	1 Borewell	IIIes	TCB
Chikkasoolikeri	7	11.3	BDGiB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Mango+Pomegranate (Mg+Pg)	1 Borewell	IIIes	TCB
Chikkasoolikeri	8	3.27	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+ Vegitable (Rg+Gn+Vg)	Not Available	IIIes	TCB
Chikkasoolikeri	9	7.87	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Chikkasoolikeri	10	4.09	KTPiB1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Low (51-100 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Vegitable+Redgram+Groundnut (Vg+Rg+Gn)	1 Borewell	IIs	TCB
Chikkasoolikeri	11	4.61	KTPiB1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Low (51-100 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Redgram+Paddy (Rg+Pd)	Not Available	IIs	TCB
Chikkasoolikeri	12	0.11	KTPiB1g1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Low (51-100 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	TCB
Chikkasoolikeri	14	1.54	KTPiB1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Low (51-100 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut+ Vegitable (Rg+Gn+Vg)	Not Available	IIs	TCB
Chikkasoolikeri	15	1.65	KTPiB1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Low (51-100 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Slight	Redgram+Fallow land (Rg+Fl)	Not Available	IIs	TCB
Chikkasoolikeri	16	11.28	NDLhB2g1	LMU-2	Very deep (>150 cm)	Sandy clay loam	Low (51-100 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Plants forest (Pf)	Not Available	IIes	TCB
Chikkasoolikeri	17	8.9	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	1 Borewell	IIIes	TCB
Chikkasoolikeri	18	5.98	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	1 Borewell	IIIes	TCB
Chikkasoolikeri	19	12.34	HTIiB1g1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay	Low (51-100 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Slight	Plants forest (Pf)	Not Available	IIs	TCB
Chikkasoolikeri	20	9.37	BGPmA1	LMU-1	Very deep (>150 cm)	Clay	High (151-200 mm/m)	Non gravelly (<15%)	Nearly level (0-1%)	Slight	Redgram+Current fallow +Groundnut (Rg+Cf+Gn)	2 Borewell	IIs	Graded bunding
Chikkasoolikeri	21	13.6	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Chikkasoolikeri	22	12.09	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+ Vegitable+Currently fallow(Rg+Gn+Vg+Cf)	Not Available	IIIes	TCB
Chikkasoolikeri	23	11.94	BPRhB2g2	LMU-2	Deep (100-150 cm)	Sandy clay loam	Low (51-100 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Fallow land+Groundnut+Vegitable (Rg+Fl+Gn+Vg)	Not Available	IIIes	TCB

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Available Water Capacity	Soil Gravelliness	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Chikkasoolikeri	24/(1)	0.28	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram (Rg)	Not Available	Others	Others
Chikkasoolikeri	24/(2)	4.86	BPRhB2g2	LMU-2	Deep (100-150 cm)	Sandy clay loam	Low (51-100 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Chikkasoolikeri	25	3.61	NGPhB1g2	LMU-2	Deep (100-150 cm)	Sandy clay loam	Low (51-100 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut (Rg+Gn)	Not Available	IIIs	TCB
Hiresoolikeri	70	4.82	HDHiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	TCB
Hiresoolikeri	71	31.39	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro (Rc)	Not Available	Ro	Ro
Hiresoolikeri	72	4.74	HTIhB1g1	LMU-3	Moderately shallow (50-75 cm)	Sandy clay loam	Low (51-100 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Slight	Eucalyptus (Eu)	Not Available	IIs	TCB
Hiresoolikeri	73	1.7	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hiresoolikeri	80	5.8	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	1 Borewell	IIIes	TCB
Hiresoolikeri	81	2.68	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro (Rc)	Not Available	Ro	Ro
Archara Thimmapura	20/2	0.45	MKHcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Redgram+Fallow land+Groundnut (Rg+Fl+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	26	1.56	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	27	17.49	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	28/2	1.38	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Granite outcrops+Redgram+Groundnut (Gc+Rg+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	28/3	5.38	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	29	2.7	Waterbody	Others	Others	Others	Others	Others	Others	Others	Groundnut+Redgram+Fallow land (Gn+Rg+Fl)	Not Available	Others	Others
Archara Thimmapura	31/2	1.15	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	32	13.78	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Paddy (Rg+Gn+Pd)	3 Borewell	IIIes	TCB
Archara Thimmapura	33/1	10.03	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Paddy (Rg+Gn+Pd)	Not Available	IIIes	TCB
Archara Thimmapura	33/2	5.77	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Forest (Rg+Fo)	Not Available	IIIes	TCB
Archara Thimmapura	34	5.12	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Forest (Fo)	Not Available	Ro	Ro
Archara Thimmapura	35	7.19	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Available Water Capacity	Soil Gravelliness	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Archara Thimmapura	36/1	1.06	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Archara Thimmapura	36/2	0.16	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	TCB
Archara Thimmapura	36/3	10.08	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Paddy (Rg+Pd)	Not Available	IIIes	TCB
Archara Thimmapura	37	7.19	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	2 Borewell	IIIes	TCB
Archara Thimmapura	38	7.73	HRViB2g1	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Redgram+Forest (Rg+Fo)	Not Available	IIIes	TCB
Archara Thimmapura	39	7.69	HRViB2g1	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	40	12.47	HRViB2g1	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Groundnut+Paddy (Gn+Pd)	1 Borewell	IIIes	TCB
Archara Thimmapura	41/1	0.19	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIIes	TCB
Archara Thimmapura	41/2	11.29	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram+Granite (Gn+Rg+Gc)	2 Borewell	IIIes	TCB
Archara Thimmapura	42/1	0.42	BGPmA1	LMU-1	Very deep (>150 cm)	Clay	High (151-200 mm/m)	Non gravelly (<15%)	Nearly level (0-1%)	Slight	Groundnut (Gn)	1 Borewell	IIs	Graded bunding
Archara Thimmapura	42/2	10.19	HRViB2g1	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Groundnut+Paddy+Redgram (Gn+Pd+Rg)	1 Borewell	IIIes	TCB
Archara Thimmapura	43	12.72	HRViB2g1	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Moderate	Forest+Groundnut+Redgram (Fo+Gn+Rg)	Not Available	IIIes	TCB
Archara Thimmapura	44	13.33	HRViB1g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Forest (Fo)	Not Available	IIIs	TCB
Archara Thimmapura	45	12.39	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Forest+Groundnut (Rg+Fo+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	46	14.01	HRViB1g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Groundnut+Current fallow+Forest+Vegetables (Gn+Cf+Fo+Vg)	Not Available	IIIs	TCB
Archara Thimmapura	47/1	5.7	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIIes	TCB
Archara Thimmapura	47/2	7.2	BGPmA1	LMU-1	Very deep (>150 cm)	Clay	High (151-200 mm/m)	Non gravelly (<15%)	Nearly level (0-1%)	Slight	Current fallow+Groundnut+Redgram (Cf+Gn+Rg)	1 Borewell	IIs	Graded bunding
Archara Thimmapura	48	12.87	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Vegitable+Groundnut (Vg+Gn)	4 Borewell	IIIes	TCB
Archara Thimmapura	49	2.23	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Archara Thimmapura	53	0.4	HRVhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram+Eucalyptus+Horgegram (Gn+Rg+Eu+Hg)	1 Borewell	IIIes	TCB
Challari	79	0.02	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Redgram+Groundnut+Vegetable (Rg+Gn+Vg)	Not Available	Ro	Ro
Challari	80	2.01	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Granite outcrops+Redgram (Gc+Rg)	Not Available	Ro	Ro

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Available Water Capacity	Soil Gravelliness	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Challari	81	5.54	HRViB1g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Redgram+Paddy (Rg+Pd)	Not Available	IIIs	TCB
Challari	82	0.41	DRLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Medium (101-150 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Challari	83	0.43	DRLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Medium (101-150 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	Graded bunding
Challari	84	0.84	DRLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Medium (101-150 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Challari	85	0.23	DRLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Medium (101-150 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Challari	86	6.29	HRViB1g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	TCB
Challari	87	0.52	DRLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Medium (101-150 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Challari	88	2.32	Waterbody	Others	Others	Others	Others	Others	Others	Others	Fallow land (Fl)	Not Available	Others	Others
Challari	89	8.9	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Challari	90	6.77	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Challari	91	7.2	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Challari	92	0.39	DRLmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Medium (101-150 mm/m)	Non gravelly (<15%)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	Graded bunding
Challari	93	0.43	HRViB1g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	1 Borewell	IIIs	TCB
Challari	94	5.75	HRViB1g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Slight	Current fallow+Groundnut (Cf+Gn)	1 Borewell	IIIs	TCB
Challari	96	1.05	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Challari	101	1.43	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	TCB
Challari	102	3.5	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Current fallow+Redgram (Cf+Rg)	Not Available	IIIes	TCB
Challari	103	4.76	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+ Vegitable (Rg+Gn+Vg)	Not Available	IIIes	TCB
Challari	104	4.91	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	1 Borewell	IIIes	TCB
Challari	105	2.34	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Challari	107	2.72	MKHiB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	TCB
Challari	108	2.96	MKHiB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Very Low (<50 mm/m)	Gravelly (15-35%)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	TCB
Challari	110	3.24	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Available Water Capacity	Soil Gravelliness	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Challari	111	3.45	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Bengalgram+Groundnut+Fallow land (Bg+Gn+Fl)	Not Available	IIIes	TCB
Challari	118	0.45	ABRiB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay	Very Low (<50 mm/m)	Very gravelly (35-60%)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB

Appendix II

Timmapur -2_9N2b Microwatershed

Soil Fertility Informatio

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Chikkasoolikeri	2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	4	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	5/(1)	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	5/(2)	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	6	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	7	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	8	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	9	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	10	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	11	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	12	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	14	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	15	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	16	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	17	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	18	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	19	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	20	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	21	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Chikkasoolikeri	22	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	23	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Chikkasoolikeri	24/(1)	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Chikkasoolikeri	24/(2)	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Chikkasoolikeri	25	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hiresoolikeri	70	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hiresoolikeri	71	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hiresoolikeri	72	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hiresoolikeri	73	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hiresoolikeri	80	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hiresoolikeri	81	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Archara Thimmapura	20/2	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	26	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	27	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	28/2	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	28/3	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	29	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Archara Thimmapura	31/2	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	32	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	33/1	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	33/2	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	34	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Archara Thimmapura	35	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	36/1	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	36/2	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	36/3	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	37	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	38	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	39	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Archara Thimmapura	40	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	41/1	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	41/2	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	42/1	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	42/2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	43	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	44	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	45	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	46	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	47/1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	47/2	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Archara Thimmapura	48	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	49	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Archara Thimmapura	53	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Challari	79	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Challari	80	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Challari	81	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	82	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	83	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	84	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	85	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	86	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	87	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	88	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Challari	89	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Challari	90	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	91	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	92	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	93	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	94	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	96	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	101	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	102	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	103	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	104	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	105	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	107	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	108	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	110	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	111	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Challari	118	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Appendix III

Timmapur -2_9N2b Microwatershed

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Chikkasoolikeri	2	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2r	S2rg	S2r	S2rg	S3rg	S3rg
Chikkasoolikeri	4	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S3tz	S2tz	S2tz
Chikkasoolikeri	5/(1)	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S3tz	S2tz	S2tz
Chikkasoolikeri	5/(2)	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S3tz	S2tz	S2tz
Chikkasoolikeri	6	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S3g	S2tg	S3g	S3g	S2g
Chikkasoolikeri	7	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S3g	S2tg	S3g	S3g	S2g
Chikkasoolikeri	8	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Chikkasoolikeri	9	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Chikkasoolikeri	10	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Chikkasoolikeri	11	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Chikkasoolikeri	12	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2r	S2rg	S2r	S2rg	S3rg	S3rg
Chikkasoolikeri	14	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Chikkasoolikeri	15	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Chikkasoolikeri	16	S2g	S2tg	S2g	S2g	S2tg	S2g	S2g	S2g	S2gt	S2g	S2g	S2g	S2g	S2g	S2tg	S2g	S2g	S3tg	S1	S2tg	S2tg	S2tg	S2tg	S2g	S2g	S1	S2tg	S1	S2g	S2g	S2g
Chikkasoolikeri	17	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Chikkasoolikeri	18	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1rg	N1rg
Chikkasoolikeri	19	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S3t	S3r	S3r	S2rg	S3r	S2rg	S3r	S3r	S3r	S2rg	S2rt	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2r	S2rg	S2rt	S2rg	S3r	S3r
Chikkasoolikeri	20	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S3tz	S2tz	S2tz
Chikkasoolikeri	21	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Chikkasoolikeri	22	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Chikkasoolikeri	23	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2g
Chikkasoolikeri	24/(1)	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Chikkasoolikeri	24/(2)	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2g
Chikkasoolikeri	25	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2g
Hiresoolikeri	70	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Hiresoolikeri	71	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hiresoolikeri	72	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S3t	S3r	S3r	S2rg	S3r	S2rg	S3r	S3r	S3r	S2rg	S2rt	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2r	S2rg	S2rt	S2rg	S3r	S3r
Hiresoolikeri	73	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1rg	N1rg
Hiresoolikeri	80	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1rg	N1rg
Hiresoolikeri	81	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Archara Thimmapura	20/2	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Archara Thimmapura	26	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Archara Thimmapura	27	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Archara Thimmapura	28/2	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Archara Thimmapura	28/3	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Archara Thimmapura	29	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Archara Thimmapura	31/2	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	32	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	33/1	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	33/2	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	34	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Archara Thimmapura	35	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	36/1	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	36/2	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	36/3	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	37	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Archara Thimmapura	38	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	39	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	40	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	41/1	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	41/2	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	42/1	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S3tz	S2tz	S2tz

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Archara Thimmapura	42/2	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	43	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	44	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	45	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Archara Thimmapura	46	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	47/1	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	47/2	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S3tz	S2tz	S2tz
Archara Thimmapura	48	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Archara Thimmapura	49	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Archara Thimmapura	53	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Challari	79	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Challari	80	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Challari	81	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Challari	82	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S2tz	S3tz	S2tz	S2z	S2rz	S2tz
Challari	83	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S2tz	S3tz	S2tz	S2z	S2rz	S2tz
Challari	84	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S2tz	S3tz	S2tz	S2z	S2rz	S2tz
Challari	85	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S2tz	S3tz	S2tz	S2z	S2rz	S2tz
Challari	86	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Challari	87	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S2tz	S3tz	S2tz	S2z	S2rz	S2tz
Challari	88	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Challari	89	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Challari	90	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Challari	91	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Challari	92	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S2tz	S3tz	S2tz	S2z	S2rz	S2tz
Challari	93	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Challari	94	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Challari	96	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Challari	101	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Challari	102	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Challari	103	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Challari	104	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Challari	105	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Challari	107	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Challari	108	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Challari	110	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Challari	111	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r
Challari	118	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	N1r

Ro-Rock outcrops

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE STUDY

- *The results indicated that 35 farmers were sampled in Timmapur-2 microwatershed among them 4 (11.43%) were marginal farmers, 14 (40%) were small farmers, 8 (22.86 %) were semi medium farmers, 4 (11.43%) were medium farmers and 5 (14.29%) landless farmers were also interviewed for the survey.*
- *The data indicated that there were 191 population households were there in the studied micro watershed. Among them 106 (55.50%) men and 85 (44.50 %) were women. The average family size of landless was 6, marginal farmer was 4, small and semi medium farmers were 5 and medium farmers were 7. On an average the family size was 5.*
- *The data indicated that 40 (20.94%) people were in 0-15 years of age, 91 (47.64 %) were in 16-35 years of age, 47 (24.61 %) were in 36-60 years of age and 13 (6.81%) were above 61 years of age.*
- *The results indicated that the Timmapur-2 had 37.17 per cent illiterates, 35.08 per cent of them had primary school education, 8.38 per cent of them had middle school, 11.52 per cent of them had high school education, 5.76 per cent of them had PUC education, 0.52 had diploma education and 1.05 per cent of them had degree education.*
- *The results indicated that, 80 per cent of households practicing agriculture, 17.14 per cent of the household heads were agricultural labour and 5.71 per cent of the household heads were general labour.*
- *The results indicated that agriculture was the major occupation for 45.55 per cent of the household members, 24.61 per cent were agricultural labourers, 4.71 per cent were general labours and 23.56 per cent of them were students. In case of landless farmers 54.84 per cent of them were agriculture labours, 29.03 per cent of them were general labour and 12.90 per cent of them were students.*
- *The results indicated that, in case of marginal farmers 58.82 per cent of them were doing agriculture, 17.65 per cent of them were agriculture labour and 23.53 per cent of them were students. In small farmers 51.35 per cent of them were doing agriculture, 20.27 per cent of them were agriculture labour and 28.38 per cent of them were student. In case of semi medium farmers, 76. 92 per cent of them were agriculturist, 10.26 per cent of them were agriculture labour and students. In medium farmers 30 per cent of them were agriculturist, 26.67 per cent of them were agricultural labour and 40 per cent of them were students.*
- *The results showed that 100 per cent of them have not participated in any local institutions.*
- *The results indicated that 45.71 per cent of the households possess thatched house, 42.86 per cent of the households possess Katcha house and 11.43 per cent of the households possess Pucca house.*

- *The results showed that, 100 per cent of the households possess TV, 91.43 per cent of the households possess mixer/grinder, 42.86 per cent of the households possess bicycle, 37.14 per cent of the households possess motor cycle and 97.14 per cent of the households possess mobile phones.*
- *The results showed that the average value of television was Rs. 6800, mixer/grinder was Rs. 1656, bicycle was Rs.1750, motor cycle was Rs.29230 and mobile phone was Rs.1544.*
- *The data showed that about 28.57 per cent of the households possess bullock cart, 45.71 per cent of them possess plough, 2.86 per cent of the households possess tractor, 25.71 per cent of the households possess sprayer, 94.29 per cent of the households possess weeder and 11.43 per cent of the households possess chaff cutter.*
- *The results showed that the average value of bullock cart was Rs.16800; the average value of plough was Rs. 910, the average value of tractor was Rs. 500000, the average value of sprayer was Rs. 3500, the average value of weeder was Rs. 59 and the average value of chaff cutter was Rs. 2325.*
- *The results indicated that, 45.71 per cent of the households possess bullocks and 28.57 per cent of the households possess local cow. In case of marginal farmers, 25 per cent of the households possess bullock. In case of small farmers, 50 per cent of households possess bullock and 28.57 per cent possess local cow. In case of semi medium farmers, 62.50 per cent of the households possess bullock and 50 per cent of the households possess local cow. 75 medium farmers possess bullock and 50 farmers possess local.*
- *The results indicated that, average own labour men available in the micro watershed was 2.13, average own labour (women) available was 1.65, average hired labour (men) available was 8.35 and average hired labour (women) available was 7.16.*
- *The results indicated that, in case of marginal farmers, average own labour men available was 2, average own labour (women) was also 1.25, average hired labour (men) was 6.50 and average hired labour (women) available was 5.25. In case of small farmers, average own labour men available was 2, average own labour (women) was 1.71, average hired labour (men) was 9.71 and average hired labour (women) available was 8.21. In case of semi medium farmers, average own labour men available was 2.38, average own labour (women) was 1.50, average hired labour (men) was 9.13 and average hired labour (women) available was 7.50. In medium farmers average own labour men available was 2.25, average own labour (women) was 2, average hired labour (men) was 6 and average hired labour (women) available was 6.50.*
- *The results indicated that, 88.57 per cent of the household opined that the hired labour was adequate.*
- *The results indicated that, households of the Timmapur-2 microwatershed possess 20.72 ha (45.57%) of dry land and 24.75 ha (54.43%) of irrigated land. Marginal*

farmers possess 2.51 ha (86.11%) of dry land and 0.40 ha (13.89%) of irrigated land. Small farmers possess 16.19 ha (86.21 %) of dry land and 2.59 ha (13.79 %) of irrigated land. Semi medium farmers possess 0.81 ha (6.97 %) of dry land and 10.81 ha (93.03%) of irrigated land. Medium farmers possess 1.21 ha (9.98%) of dry land and 10.95 ha (90.02%) irrigated land.

- *The results indicated that, the average value of dry land was Rs. 390,761.72 and average value of irrigated was Rs. 501,592.55. In case of marginal famers, the average land value was Rs. 597,580.64 for dry land and Rs. 1,976,000 for irrigated land. In case of small famers, the average land value was Rs. 333,450 for dry land Rs. 810,468.74 for irrigated land. In case of semi medium famers, the average land value was Rs. 741,000 for dry land and Rs. 573,558.06 for irrigated land. In case of medium famers, the average land value was Rs. 494,000 for dry land and Rs. 303,045.09 for irrigated land.*
- *The results indicated that, there were 19 functioning bore wells in the micro watershed.*
- *The results indicated that, bore well was the major irrigation source for 54.29 per cent of the farmers.*
- *The results indicated that on an average the depth of the bore well was 45.37 meters.*
- *The results indicated that, in case of marginal farmers there was 0.40 per cent of irrigated land, in case of small farmers there was 2.59 ha of irrigated land, in case of semi medium farmers there was 12.02 ha of irrigated land and medium farmers were having 6.11 ha of irrigated land. On an average there were 21.13 ha of irrigated land.*
- *The results indicated that, farmers have grown bajra (4.45 ha), chilly (1.21 ha), cotton (2.91 ha), groundnut (8.22 ha), horsegram (1.21 ha), maize (14.40 ha), paddy (4.57 ha), sesamum (0.81 ha), sorghum (1.21 ha), sunflower (0.81 ha) and tomato (1.21 ha) in kharif season. Marginal farmers have grown groundnut, maize and sesamum. Small farmers have grown bajra, cotton, groundnut, horsegram, maize and sorghum. Semi medium farmers have grown chilly, cotton, groundnut, maize, paddy and tomato. Medium farmers have grown cotton, groundnut, maize, paddy and sunflower.*
- *The results indicated that, the cropping intensity in Timmapur-2 microwatershed was found to be 98.07 per cent. In case of marginal farmers, small farmers and medium farmers it was 100 per cent and in semi medium farmers it was 93.03 per cent.*
- *The results indicated that, 94.29 per cent of the households have bank account and 48.57 per cent of the households have savings. 60per cent of the landless farmers have bank account. In marginal farmers 100 per cent of them have bank account and 50 per cent of them had savings. In case of small farmers 100 per cent of them had bank account and 71.43 per cent possess savings. In case of semi medium farmers,*

100 per cent of possess bank account and 62.50 per cent farmer's savings. In Medium farmers, 100 per cent of farmers possess bank account.

- *The results indicated that 54.29 per cent of the farmers have borrowed credit from different sources which includes 75 per cent of marginal, 57.14 per cent of small, 75 per cent of semi medium and 50 per cent of medium farmers.*
- *The results indicated that, 31.58 per cent have availed loan in commercial bank, 15.79 per cent have availed loan in cooperative Bank, 5.26 per cent have availed loan from friends/relatives, 89.47 per cent have availed loan in Grameena bank, 42.11per cent have availed loan from money lender and 10.53 per cent have availed loan in SHGs/CBOs.*
- *The results indicated that, marginal, small, semi medium and medium have availed Rs. 55,000, Rs. 110,062.50, Rs. 74,166.67 and Rs, 195,000 respectively. Overall average credit amount availed by households in the micro watershed was Rs. 108,447.37.*
- *The results indicated that, 100 per cent of the households have borrowed loan for agriculture production.*
- *The results indicated that, 27.27 per cent of the household's barrowed private credit for agriculture production which includes 40 per cent of the small and 50 per cent of the semi medium farmers.*
- *Results indicated that 19.23 per cent of households were partially paid their loan, 61.54 per cent of households were unpaid their loan and 19.23 per cent of households were fully paid their loan.*
- *Results indicated that 63.64 per cent of the households have partially paid their loan, 27.27 per cent have unpaid their private credit and 9.09 per cent of the households have fully paid their loan.*
- *The results indicated that 30.77 per cent of the households were opined that helped to perform timely agricultural operations, 46.15 per cent of the households were opined that higher rate of interest, 7.69 per cent of the households were opined that they were forced to sell the produce at low price to repay loan in time .*
- *The results indicated that, 9.09 per cent of the households were opined that helped to perform timely agricultural operations and higher rate of interest and 36.36 per cent of the households were not given any opinion.*
- *The results indicated that, the total cost of cultivation for maize was Rs. 27597.79. The gross income realized by the farmers was Rs. 29830.49. The net income from maize cultivation was Rs. 2232.71. Thus the benefit cost ratio was found to be 1:1.08.*
- *The results indicated that, the total cost of cultivation for groundnut was Rs. 61186.58. The gross income realized by the farmers was Rs. 75699.47. The net income from groundnut cultivation was Rs. 14512.89. Thus the benefit cost ratio was found to be 1:1.24.*

- *The results indicated that, the total cost of cultivation for paddy was Rs. 62877.74. The gross income realized by the farmers was Rs. 73035.07. The net income from paddy cultivation was Rs. 10157.34. Thus the benefit cost ratio was found to be 1:1.16.*
- *The results indicated that, the total cost of cultivation for bajra was Rs. 17933.64. The gross income realized by the farmers was Rs. 25454.72. The net income from bajra cultivation was Rs. 7521.08. Thus the benefit cost ratio was found to be 1:1.42.*
- *The results indicated that, the total cost of cultivation for tomato was Rs. 28537.03. The gross income realized by the farmers was Rs. 103740. The net income from tomato cultivation was Rs. 75202.97. Thus the benefit cost ratio was found to be 1:3.64.*
- *The results indicated that, the total cost of cultivation for horsegram was Rs. 11451.45. The gross income realized by the farmers was Rs. 26840.67. The net income from horsegram cultivation was Rs. 15389.22. Thus the benefit cost ratio was found to be 1:2.34.*
- *The results indicated that, the total cost of cultivation for cotton was Rs. 28542.16. The gross income realized by the farmers was Rs. 71784.37. The net income from cotton cultivation was Rs. 43242.21. Thus the benefit cost ratio was found to be 1:2.52.*
- *The results indicated that, the total cost of cultivation for sunflower was Rs. 34933.39. The gross income realized by the farmers was Rs. 63232. The net income from sunflower cultivation was Rs. 28298.61. Thus the benefit cost ratio was found to be 1:1.81.*
- *The results indicated that, the total cost of cultivation for chilly was Rs. 23059.20. The gross income realized by the farmers was Rs. 181133.33. The net income from chilly cultivation was Rs. 158074.14. Thus the benefit cost ratio was found to be 1:7.86.*
- *The results indicated that, the total cost of cultivation for sorghum was Rs. 13146.50. The gross income realized by the farmers was Rs. 34382.40. The net income from sorghum cultivation was Rs. 21235.90. Thus the benefit cost ratio was found to be 1:2.62.*
- *The results indicated that, the total cost of cultivation for sesamum was Rs. 15380.78. The gross income realized by the farmers was Rs. 21612.50. The net income from sesamum cultivation was Rs. 6231.72. Thus the benefit cost ratio was found to be 1:1.41.*
- *The results indicated that, 62.86 per cent of the households opined that dry fodder was adequate and 34.29 per cent of the households opined that green fodder was adequate.*
- *The table indicated that, in landless farmers, the average income from wage was Rs. 26000. In marginal farmers the average income from wage was Rs. 26071.43 and agriculture was Rs. 37600. In small farmers the average income from wage was Rs.*

26071.43, agriculture was Rs. 49050 and dairy farm was Rs. 2112.14. In semi medium farmers the average income from wage was Rs. 14,375, agriculture was Rs. 117,562.50 and dairy farm was Rs.625. In medium farmers the average income from wage was Rs. 15000, agriculture was Rs. 71500 and dairy farm was Rs. 750.

- *The results indicated that, in landless farmers, the average expenditure from wage was Rs. 13000, in marginal farmers the average expenditure from wage was Rs.5666.67 and agriculture was Rs.14750. In case of small farmers the average expenditure from wage was Rs. 11111.11, agriculture was Rs. 23285.71 and dairy farm was Rs. 10,000. In case of semi medium farmers the average expenditure from wage was Rs. 5750, agriculture was Rs. 47875 and dairy farm was Rs.1000. In case of medium farmers the average expenditure from wage was Rs. 3,000 and agriculture was Rs. 35,000.*
- *The results indicated that, sampled households have grown 20 coconut and 49 mango trees in their field.*
- *The results indicated that, households have planted 50 neem, 6 tarmind, 1 banyan and 1 peeple trees in their field.*
- *The results indicate that, households have an average investment capacity of Rs.2257.14 for land development, Rs. 1171.43 in irrigation facility, Rs.1314.29 for improved crop production, Rs.600 for improved livestock management and Rs.142.86 for subsidiary enterprises.*
- *The data showed that Marginal households have an average investment capacity of Rs. 2500 for land development, Rs. 1500 for irrigation facility and Rs.1250 for improved crop production. Small farmers have an average investment capacity of Rs. 2357.14 for land development, Rs. 785.71 in irrigation facility, Rs.1642.86 for improved crop production and Rs.357.14 for improved livestock management. Semi medium farmers have an average investment capacity of Rs. 2000 for land development, Rs. 1750 in irrigation facility, Rs.1250 for improved crop production and Rs.750 for improved livestock management. Medium farmers have an average investment capacity of Rs. 5000 for land development, Rs. 2500 for irrigation facility, Rs.2000 for improved crop production, Rs.2500 for improved livestock management and Rs.1250 for subsidiary enterprises.*
- *The results indicated that, for land development, 20 per cent were depending on loan from the bank and 2.86 per cent of the households were depending on soft loan. For irrigation facility 5.71 per cent of the households were dependent on loan from bank and 11.43 per cent were depending on soft loan. Similarly for improved crop production, 5.71 per cent of the households were dependent on loan from the bank, 2.86 per cent were dependent on their own funds and 14.29 per cent of the households were depending on soft loan. For improved livestock management 2.86 per cent were dependent on own funds and 11.43 per cent were dependent on soft loan. For subsidiary enterprises 2.86 per cent of the households were dependent on soft loan.*

- *The results indicated that, chilli, cotton, horsegram, sesamum, sorghum, sunflower and tomato crops were sold to the extent of 100 per cent. Bajra, groundnut, maize and paddy were sold to the extent of 85.71 per cent, 96.27 per cent, 97.23 per cent and 94.33 per cent respectively.*
- *The results indicated that, 62.86 percent of the households have sold their produce to local/village merchant, 31.43 percent of the households sold their produce in regulated markets and 14.29 percent of the households sold their produce in cooperative marketing society.*
- *The results indicated that 11.43 per cent of the households have used cart as a mode of transport, 57.14 per cent of them have used tractor and 40 per cent have used truck as a mode of transport.*
- *The results indicated that, 42.86 per cent of the households have experienced the soil and water erosion problems i.e. 50 percent of marginal farmers, 42.86 per cent of small farmers, 37.50 per cent of semi medium farmers and 100 percent of medium farmers.*
- *The results indicated that, 82.86 per cent of the households have shown interest in soil testing including 100 per cent of marginal farmers, small farmers and medium farmers and 87.50 per cent of the semi medium farmers respectively.*
- *The results indicated that, 100 percent used fire wood as a source of fuel and 2.86 per cent of the households used LPG.*
- *The results indicated that, piped supply was the source of drinking water for 82.86 per cent of the households and 17.14 per cents of the households were using bore well for drinking water.*
- *The results indicated that, electricity was the major source of light for 100 per cent of the households.*
- *The results indicated that, 31.43 per cent of the households possess sanitary toilet i.e. 20 per cent of landless, 100 per cent of marginal, 21.43 per cent of small, 25 per cent of semi medium and 25 per cent of medium farmers had sanitary toilet facility.*
- *The results indicated that, 100 per cent of the sampled households possessed BPL card.*
- *The results indicated that, 42.86 per cent of the households participated in NREGA programme which included 60 per cent of the landless, 100 percent of the marginal, 21.43 per cent of the small, 12.50 per cent of the semi medium and 100 percent of the medium farmers.*
- *The results indicated that, cereals, pulses, oilseeds, milk, egg and meat were adequate for 94.29 per cent, 60 per cent, 5.71 per cent, 85.71 per cent, 80 per cent, and 65.71 per cent respectively. Vegetables and fruits were adequate for 48.57 per cent of the households.*

- *The results indicated that, cereals, pulses, oilseed, vegetables, fruits, milk, egg and meat were inadequate for 5.71 per cent, 40 per cent, 80 per cent, 42.86 per cent, 40 per cent, 5.71 per cent, 17.14 per cent and 31.43 per cent respectively.*
- *The results indicated that, Lower fertility status of the soil was experienced by 85.71 per cent of the households, wild animal menace on farm field was experienced by 74.29 per cent of the households, frequent incidence of pest and diseases was experienced by 65.71 per cent of the farmers, inadequacy of irrigation water was experienced by 42.86 per cent of the households, high cost of Fertilizers and plant protection chemicals was experienced by 65.71 per cent of the households, high rate of interest on credit was experienced by 60 per cent of the farmers, low price for the agricultural commodities was experienced by 60 per cent of the farmers, lack of marketing facilities in the area was experienced 65.71 per cent of the households, inadequate of extension services experienced by 65.71 per cent of the households, lack of transport for safe transport of the agricultural produce to the market was experienced by 74.29 per cent of the households and less rainfall was experienced by 25.71 per cent of the farmers.*

Chapter 2

INTRODUCTION

Soil and water are the two precious natural resources which are essential for crop production and existence of life on earth. Rainfed agriculture is under severe stress due to various constraints related to agriculture like uneven and erratic distribution of rainfall, indiscriminate use of fertilizers, chemicals and pesticides, adoption of improper land management practices, soil erosion, decline in soil fertility, decline in ground water resources leading to low crop productivity. The area under rainfed agriculture has to be managed effectively using the best available practices to enhance the production of food, fodder and fuel. This is possible if the land resources are characterized at each parcel of land through detailed land resource inventory using the best available techniques of remote sensing, GPS and GIS. The watershed development programs are aimed at the sustainable distribution of its resources and the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal and human communities within a watershed boundary.

World Bank funded KWDP II, SUJALA III project was implemented in with Broad objective of demonstrating more effective watershed management through greater integration of programmes related to rain-fed agriculture, innovative and science based approaches and strengthen institutional capacities and If successful, it is expected that the systems and tools could be mainstreamed into the overall IWMP in the State of Karnataka and in time, throughout other IWMP operations in India. With this background the socio-economic survey has been carried out with following specific objectives:

1. To understand the demographic features of the households in the micro-watershed
2. To understand the extent of family labour available and additional employment opportunities available within the village.
3. To know the status of assets of households in the micro-watershed for suggesting possible improvements.
4. To study the cropping pattern, cropped area and productivity levels of different households in micro-watershed.
5. To determine the type and extent of livestock owned by different categories of HHs
6. Availability of fodder and level of livestock management.

Scope and importance of survey

Survey helps in identification of different socio-economic and resource use-patterns of farmers at the Micro watershed. Household survey provides demographic features, labour force, and levels of education; land ownership and asset position (including livestock and other household assets) of surveyed households; and cropping patterns, input intensities, and average crop yields from farmers' fields. It also discusses crop utilization and the degree of commercialization of production in the areas; farmers' access to and utilization of credit from formal and informal sources; and the level of adoption and use of soil, water,and pest management technologies.

Chapter 3

METHODOLOGY

The description of the methods, components selected for the survey and procedures followed in conducting the baseline survey are furnished under the following heads.

Description of the study area

Koppal district is an administrative district in the state of Karnataka in India. In the past Koppal was referred to as 'Kopana Nagara'. Koppal, now a district headquarters is ancient Kopana a major holy place of the Jains. The district occupies an area of 7,190 km² and has a population of 1,196,089, which 16.58% were urban as of 2001. The Koppal district was formed after split of Raichur district. It consists of four taluks namely Koppal, Gangavathi, Kushtagi and Yelburga.

The undulating topography with black cotton soil shrips, cut across by numerous nalas or streams is the major characteristic feature of the study region. The Koppal district is having partly red sandy and black soil suitable for agriculture and horticulture crops. Majority of Gangavathi taluk is having black soil. The taluk is also having very few hills with xerophilous vegetation. The partly red sandy soil and black soil of mixed geographical origin are found in the Yelburga taluk.

Three physiographic divisions have made considering the local conditions of landforms and crops grown in the district. On the basis of physiographic, Koppal district can be divided into three major divisions. They are (a) Koppal & Yelburga plateau, (b) Maidan division, (c) Tungabhadra valley. The district is part of Krishna basin the main streams draining the area are Maskinala, Ilkal-nadi and Hirenala. These are Ephemeral in nature, these come under Tungabhadra sub-basin. The drainage exhibit dendritic to subdendritic with drainage density varies from 1.4 to7.0kms/sq.km. According to the 2011 census Koppal district has a population of 1,391,292, roughly equal to the nation of Swaziland or the US state of Hawaii. This gives it a ranking of 350th in India (out of a total of 640). The district has a population density of 250 inhabitants per square kilometre (650/sq mi). Its population growth rate over the decade 2001-2011 was 16.32%. Koppal has a sex ratio of 983 females for every 1000 males, and a literacy rate of 67.28%.

Description of the micro-watershed

Timmapura-2 micro-watershed (Ganganal sub-watershed, Koppal Taluk and District) is located at North latitude $15^0$34’18.471’’ to 15^0 32’34.977’’and East longitude 76^0 16’30.148’’ to 76^0 14’36.639’’ covering an area of 500.72 ha and spread across Archara timmapura, Challari, Hiresoolikeri and Chikksoolikeri villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 35 households located in the micro-watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Timmapur-2 microwatershed is presented in Table 1 and it indicated that 35 farmers were sampled in Timmapur-2 microwatershed among them 4 (11.43%) were marginal farmers, 14 (40%) were small farmers, 8 (22.86 %) were semi medium farmers, 4 (11.43%) were medium farmers and 5 (14.29%) landless farmers were also interviewed for the survey.

Table 1: Households sampled for socio economic survey in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	14.29	4	11.43	14	40.00	8	22.86	4	11.43	35	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Timmapur-2 microwatershed is presented in Table 2. The data indicated that there were 191 population households were there in the studied micro watershed. Among them 106 (55.50%) men and 85 (44.50 %) were women. The average family size of landless was 6, marginal farmer was 4, small and semi medium farmers were 5 and medium farmers were 7. On an average the family size was 5.

Table 2: Population characteristics of Timmapur-2 micro-watershed

Sl. No.	Particulars	LL (31)		MF (17)		SF (74)		SMF (39)		MDF (30)		All (191)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Male	16	51.61	9	52.94	43	58.11	24	61.54	14	46.67	106	55.50
2	Female	15	48.39	8	47.06	31	41.89	15	38.46	16	53.33	85	44.50
Total		31	100	17	100	74	100	39	100	30	100	191	100
Average		6		4		5		5		7		5	

Age wise classification of population: The age wise classification of household members in Timmapur-2 microwatershed is presented in Table 3. The data indicated that 40 (20.94%) people were in 0-15 years of age, 91 (47.64 %) were in 16-35 years of age, 47 (24.61 %) were in 36-60 years of age and 13 (6.81%) were above 61 years of age.

Table 3: Age wise classification of household members in Timmapur-2 microwatershed

Sl. No.	Particulars	LL (31)		MF (17)		SF (74)		SMF (39)		MDF (30)		All (191)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years	5	16.13	3	17.65	15	20.27	7	17.95	10	33.33	40	20.94
2	16-35 years	20	64.52	7	41.18	37	50	17	43.59	10	33.33	91	47.64
3	36-60 years	6	19.35	7	41.18	15	20.27	12	30.77	7	23.33	47	24.61
4	> 61 years	0	0	0	0	7	9.46	3	7.69	3	10	13	6.81
Total		31	100	17	100	74	100	39	100	30	100	191	100

Education level of household members: Education level of household members in Timmapur-2 microwatershed is presented in Table 4. The results indicated that the

Timmapur-2 had 37.17 per cent illiterates, 35.08 per cent of them had primary school education, 8.38 per cent of them had middle school, 11.52 per cent of them had high school education, 5.76 per cent of them had PUC education, 0.52 had diploma education and 1.05 per cent of them had degree education.

Table 4: Education level of household members in Timmapur-2 microwatershed

Sl. No.	Particulars	LL (31)		MF (17)		SF (74)		SMF (39)		MDF (30)		All (191)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	18	58.06	5	29.41	23	31.08	14	35.90	11	36.67	71	37.17
2	Primary School	7	22.58	7	41.18	29	39.19	12	30.77	12	40.00	67	35.08
3	Middle School	2	6.45	0	0.00	7	9.46	6	15.38	1	3.33	16	8.38
4	High School	3	9.68	4	23.53	7	9.46	3	7.69	5	16.67	22	11.52
5	PUC	1	3.23	1	5.88	5	6.76	3	7.69	1	3.33	11	5.76
6	Diploma	0	0.00	0	0.00	1	1.35	0	0.00	0	0.00	1	0.52
7	Degree	0	0.00	0	0.00	2	2.70	0	0.00	0	0.00	2	1.05
8	Others	0	0.00	0	0.00	0	0.00	1	2.56	0	0.00	1	0.52
Total		31	100	17	100	74	100	39	100	30	100	191	100

Occupation of household heads: The data regarding the occupation of the household heads in Timmapur-2 microwatershed is presented in Table 5. The results indicated that, 80 per cent of households practicing agriculture, 17.14 per cent of the household heads were agricultural labour and 5.71 per cent of the household heads were general labour.

Table 5: Occupation of household heads in Timmapur-2 microwatershed

Sl. No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	3	75	14	100	8	100	2	50	28	80
2	Agricultural Labour	3	60	1	25	0	0	0	0	2	50	6	17.14
3	General Labour	2	40	0	0	0	0	0	0	0	0	2	5.71
Total		5	100	4	100	14	100	9	100	4	100	36	100

Occupation of the household members: The data regarding the occupation of the household members in Timmapur-2 microwatershed is presented in Table 6. The results indicated that agriculture was the major occupation for 45.55 per cent of the household members, 24.61 per cent were agricultural labourers, 4.71 per cent were general labours and 23.56 per cent of them were students. In case of landless farmers 54.84 per cent of them were agriculture labours, 29.03 per cent of them were general labour and 12.90 per cent of them were students.

In case of marginal farmers 58.82 per cent of them were doing agriculture, 17.65 per cent of them were agriculture labour and 23.53 per cent of them were students. In small farmers 51.35 per cent of them were doing agriculture, 20.27 per cent of them were agriculture labour and 28.38 per cent of them were student. In case of semi medium farmers, 76.92 per cent of them were agriculturist, 10.26 per cent of them were agriculture labour and students. In medium farmers 30 per cent of them were agriculturist, 26.67 per cent of them were agricultural labour and 40 per cent of them were students.

Table 6: Occupation of family members in Timmapur-2 microwatershed

Sl. No.	Particulars	LL (31)		MF (17)		SF (74)		SMF (39)		MDF (30)		All (191)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	10	58.82	38	51.35	30	76.92	9	30	87	45.55
2	Agricultural Labour	17	54.84	3	17.65	15	20.27	4	10.26	8	26.67	47	24.61
3	General Labour	9	29.03	0	0	0	0	0	0	0	0	9	4.71
4	Student	4	12.90	4	23.53	21	28.38	4	10.26	12	40	45	23.56
5	Housewife	1	3.23	0	0	0	0	0	0	1	3.33	2	1.05
6	Children	0	0	0	0	0	0	1	2.56	0	0	1	0.52
Total		31	100	17	100	74	100	39	100	30	100	191	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Timmapur-2 micro-watershed is presented in Table 7. The results showed that 100 per cent of them have not participated in any local institutions.

Table 7: Institutional Participation of household members in Timmapur-2 microwatershed

S. N.	Particulars	LL (31)		MF (17)		SF (74)		SMF (39)		MDF (30)		All (191)		LL (31)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	31	100	17	100	74	100	39	100	30	100	191	100	31	100
Total		31	100	17	100	74	10	39	100	30	100	191	100	31	100

Type of house owned: The data regarding the type of house owned by the households in Timmapur-2 microwatershed is presented in Table 8. The results indicated that 45.71 per cent of the households possess thatched house, 42.86 per cent of the households possess Katcha house and 11.43 per cent of the households possess Pucca house.

Table 8: Type of house owned by households in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	5	100	1	25	5	35.71	4	50	1	25	16	45.71
2	Katcha	0	0	3	75	8	57.14	3	37.50	1	25	15	42.86
3	Pucca/RCC	0	0	0	0	1	7.14	1	12.50	2	50	4	11.43
Total		5	100	4	100	14	100	8	100	4	100	35	100

Table 9: Durable Assets owned by households in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	5	100	4	100	14	100	8	100	4	100	35	100
2	Mixer/Grinder	5	100	4	100	12	85.71	7	87.50	4	100	32	91.43
3	Bicycle	0	0	4	100	10	71.43	1	12.50	0	0	15	42.86
4	Motor Cycle	3	60	1	25	3	21.43	3	37.50	3	75	13	37.14
5	Mobile Phone	5	100	4	100	13	92.86	8	100	4	100	34	97.14

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Timmapur-2 microwatershed is presented in Table 9. The results showed that, 100 per cent of the households possess TV, 91.43 per cent of the households possess mixer/grinder, 42.86 per cent of the households possess bicycle,

37.14 per cent of the households possess motor cycle and 97.14 per cent of the households possess mobile phones.

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Timmapur-2 microwatershed is presented in Table 10. The results showed that the average value of television was Rs. 6800, mixer/grinder was Rs. 1656, bicycle was Rs.1750, motor cycle was Rs.29230 and mobile phone was Rs.1544.

Table 10: Average value of durable assets owned by households in Timmapur-2 microwatershed

Average (Rs)

Sl.No.	Particulars	LL (5)	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
1	Television	7,200	5,500	6,928	7,000	6,750	6,800
2	Mixer/Grinder	1,700	1,375	1,750	1,642	1,625	1,656
3	Bicycle	0	1,750	1,818	1,000	0	1,750
4	Motor Cycle	28,333	30,000	28,333	28,333	31,666	29,230
5	Mobile Phone	1,900	1,666	1,605	1,400	1,210	1,544

Farm Implements owned: The data regarding the farm implements owned by the households in Timmapur-2 microwatershed is presented in Table 11. About 28.57 per cent of the households possess bullock cart, 45.71 per cent of them possess plough, 2.86 per cent of the households possess tractor, 25.71 per cent of the households possess sprayer, 94.29 per cent of the households possess weeder and 11.43 per cent of the households possess chaff cutter.

Table 11: Farm Implements owned by households in Timmapur-2 microwatershed

Sl. No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	0	0	4	28.57	3	37.50	3	75	10	28.57
2	Plough	0	0	1	25	7	50	5	62.50	3	75	16	45.71
3	Tractor	0	0	0	0	0	0	1	12.50	0	0	1	2.86
4	Sprayer	0	0	1	25	3	21.43	2	25	3	75	9	25.71
5	Weeder	3	60	4	100	14	100	8	100	4	100	33	94.29
6	Chaff Cutter	0	0	1	25	2	14.29	1	12.50	0	0	4	11.43
7	Blank	2	40	0	0	0	0	0	0	0	0	2	5.71

Table 12: Average value (Rs) of farm implements owned by households in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
1	Bullock Cart	0	0	14500	18000	18666	16800
2	Plough	0	666	733	1071	1666	910
3	Tractor	0	0	0	500000	0	500000
4	Sprayer	0	5000	500	5000	5000	3500
5	Weeder	50	83	63	56	43	59
6	Chaff Cutter	0	300	3000	3000	0	2325

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Timmapur-2 microwatershed is presented in Table 12. The results showed that the average value of bullock cart was Rs.16800; the

average value of plough was Rs. 910, the average value of tractor was Rs. 500000, the average value of sprayer was Rs. 3500, the average value of weeder was Rs. 59 and the average value of chaff cutter was Rs. 2325.

Livestock possession by the households: The data regarding the Livestock possession by the households in Timmapur-2 microwatershed is presented in Table 13. The results indicated that, 45.71 per cent of the households possess bullocks and 28.57 per cent of the households possess local cow.

Table 13: Livestock possession by households in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	1	25	7	50	5	62.50	3	75	16	45.71
2	Local cow	0	0	0	0	4	28.57	4	50	2	50	10	28.57
3	blank	5	100	3	75	5	35.71	2	25	1	25	16	45.71

Average Labour availability: The data regarding the average labour availability in Timmapur-2 microwatershed is presented in Table 14. The results indicated that, average own labour men available in the micro watershed was 2.13, average own labour (women) available was 1.65, average hired labour (men) available was 8.35 and average hired labour (women) available was 7.16.

Table 14: Average Labour availability in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
		N	N	N	N	N
1	Own labour Male	2.00	2.00	2.38	2.25	2.13
2	Own Labour Female	1.25	1.71	1.50	2.00	1.65
3	Hired labour Male	6.50	9.71	9.13	6.00	8.35
4	Hired labour Female	5.25	8.21	7.50	6.50	7.16

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Timmapur-2 microwatershed is presented in Table 15. The results indicated that, 88.57 per cent of the household opined that the hired labour was adequate.

Table 15: Adequacy of Hired Labour in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	1	20	4	100	14	100	8	100	4	100	31	88.57

Distribution of land (ha): The data regarding the distribution of land (ha) in Timmapur-2 microwatershed is presented in Table 16. The results indicated that, households of the Timmapur-2 microwatershed possess 20.72 ha (45.57%) of dry land and 24.75 ha (54.43%) of irrigated land. Marginal farmers possess 2.51 ha (86.11%) of dry land and 0.40 ha (13.89%) of irrigated land. Small farmers possess 16.19 ha (86.21 %) of dry land and 2.59 ha (13.79 %) of irrigated land. Semi medium farmers possess 0.81 ha (6.97 %) of dry land and 10.81 ha (93.03%) of irrigated land. Medium farmers possess 1.21 ha (9.98%) of dry land and 10.95 ha (90.02%) irrigated land.

Table 16: Distribution of land (Ha) in Timmapur-2 microwatershed

Sl. No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	2.51	86.11	16.19	86.21	0.81	6.97	1.21	9.98	20.72	45.57
2	Irrigated	0.40	13.89	2.59	13.79	10.81	93.03	10.95	90.02	24.75	54.43
Total		2.91	100	18.78	100	11.61	100	12.17	100	45.47	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Timmapur-2 microwatershed is presented in Table 17. The results indicated that, the average value of dry land was Rs. 390,761.72 and average value of irrigated was Rs. 501,592.55. In case of marginal famers, the average land value was Rs. 597,580.64 for dry land and Rs. 1,976,000 for irrigated land. In case of small famers, the average land value was Rs. 333,450 for dry land Rs. 810,468.74 for irrigated land. In case of semi medium famers, the average land value was Rs. 741,000 for dry land and Rs. 573,558.06 for irrigated land. In case of medium famers, the average land value was Rs. 494,000 for dry land and Rs. 303,045.09 for irrigated land.

Table 17: Average land value (Rs. /ha) in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
		N	N	N	N	N
1	Dry	597,580.64	333,450.00	741,000.00	494,000.00	390,761.72
2	Irrigated	1,976,000.00	810,468.74	573,558.06	303,045.09	501,592.55

Status of bore wells: The data regarding the status of bore wells in Timmapur-2 microwatershed is presented in Table 18. The results indicated that, there were 19 functioning bore wells in the micro watershed.

Table 18: Status of bore wells in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
		N	N	N	N	N	N
1	Functioning	0	1	4	8	6	19

Source of irrigation: The data regarding the source of irrigation in Timmapur-2 microwatershed is presented in Table 19. The results indicated that, bore well was the major irrigation source for 54.29 per cent of the farmers.

Table 19: Source of irrigation in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Bore Well	1	25	4	28.57	8	100	4	100	19	54.29

Table 20: Depth of water in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
		N	N	N	N	N
1	Bore Well	28.96	19.59	102.87	93.73	45.37

Depth of water: The data regarding the depth of water in Timmapur-2 microwatershed is presented in Table 20.The results indicated that on an average the depth of the bore well was 45.37 meters.

Irrigated Area (ha): The data regarding the irrigated area in Timmapur-2 microwatershed is presented in Table 21. The results indicated that, in case of marginal farmers there was 0.40 per cent of irrigated land, in case of small farmers there was 2.59 ha of irrigated land, in case of semi medium farmers there was 12.02 ha of irrigated land and medium farmers were having 6.11 ha of irrigated land. On an average there were 21.13 ha of irrigated land.

Table 21: Irrigated Area (ha) in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
1	Kharif	0.40	2.59	10.00	6.11	19.11
2	Rabi	0.00	0.00	2.02	0.00	2.02
Total		0.40	2.59	12.02	6.11	21.13

Cropping pattern: The data regarding the cropping pattern in Timmapur-2 microwatershed is presented in Table 22. The results indicated that, farmers have grown bajra (4.45 ha), chilly (1.21 ha), cotton (2.91 ha), groundnut (8.22 ha), horsegram (1.21 ha), maize (14.40 ha), paddy (4.57 ha), sesamum (0.81 ha), sorghum (1.21 ha), sunflower (0.81 ha) and tomato (1.21 ha) in kharif season. Marginal farmers have grown groundnut, maize and sesamum. Small farmers have grown bajra, cotton, groundnut, horsegram, maize and sorghum. Semi medium farmers have grown chilly, cotton, groundnut, maize, paddy and tomato. Medium farmers have grown cotton, groundnut, maize, paddy and sunflower.

Table 22: Cropping pattern in Timmapur-2 microwatershed Area (ha)

Sl. No.	Particulars	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
1	Kharif - Bajra	0	4.45	0	0	4.45
2	Kharif - Chilly	0	0	1.21	0	1.21
3	Kharif - Cotton	0	0.81	1.3	0.81	2.91
4	Kharif - Groundnut	0.4	4.49	1.7	1.62	8.22
5	Kharif - Horsegram	0	1.21	0	0	1.21
6	Kharif - Maize	1.7	8.62	1.62	2.45	14.4
7	Kharif - Paddy	0	0	3.77	0.81	4.57
8	Kharif - Sesamum	0.81	0	0	0	0.81
9	Kharif - Sorghum	0	1.21	0	0	1.21
10	Kharif - Sunflower	0	0	0	0.81	0.81
11	Kharif - Tomato	0	0	1.21	0	1.21
	Total	2.91	20.81	10.81	6.5	41.04

Cropping intensity: The data regarding the cropping intensity in Timmapur-2 microwatershed is presented in Table 23. The results indicated that, the cropping intensity in Timmapur-2 microwatershed was found to be 98.07 per cent. In case of marginal farmers, small farmers and medium farmers it was 100 per cent and in semi medium farmers it was 93.03 per cent.

Table 23: Cropping intensity (%) in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
1	Cropping Intensity	100	100	93.03	100	98.07

Possession of Bank account: The data regarding the possession of Bank account and savings in Timmapur-2 microwatershed is presented in Table 24. The results indicated that, 94.29 per cent of the households have bank account and 48.57 per cent of the households have savings. 60per cent of the landless farmers have bank account. In marginal farmers 100 per cent of them have bank account and 50 per cent of them had savings. In case of small farmers 100 per cent of them had bank account and 71.43 per cent possess savings. In case of semi medium farmers, 100 per cent of possess bank account and 62.50 per cent farmer's savings. In Medium farmers, 100 per cent of farmers possess bank account.

Table 24: Possession of Bank account and savings in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	3	60	4	100	14	100	8	100	4	100	33	94.29
2	Savings	0	0	2	50	10	71.43	5	62.50	0	0	17	48.57

Borrowing status: The data regarding the possession of borrowing status in Timmapur-2 microwatershed is presented in Table 25. The results indicated that 54.29 per cent of the farmers have borrowed credit from different sources which includes 75 per cent of marginal, 57.14 per cent of small, 75 per cent of semi medium and 50 per cent of medium farmers.

Table 25: Borrowing status in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Credit Availed	3	75	8	57.14	6	75	2	50	19	54.29

Source of credit: The data regarding the source of credit availed by households in Timmapur-2 microwatershed is presented in Table 26. The results indicated that, 31.58 per cent have availed loan in commercial bank, 15.79 per cent have availed loan in cooperative Bank, 5.26 per cent have availed loan from friends/relatives, 89.47 per cent have availed loan in Grameena bank, 42.11per cent have availed loan from money lender and 10.53 per cent have availed loan in SHGs/CBOs.

Table 26: Source of credit availed by households in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (3)		SF (8)		SMF (6)		MDF (2)		All (19)	
		N	%	N	%	N	%	N	%	N	%
1	Commercial Bank	0	0.00	5	62.50	1	16.67	0	0.00	6	31.58
2	Cooperative Bank	2	66.67	0	0.00	0	0.00	1	50.00	3	15.79
3	Friends/Relatives	0	0.00	0	0.00	0	0.00	0	0.00	1	5.26
4	Grameena Bank	2	66.67	8	100.00	5	83.33	2	100	17	89.47
5	Money Lender	1	33.33	3	37.50	2	33.33	0	0.00	8	42.11
6	SHGs/CBOs	0	0.00	2	25.00	0	0.00	0	0.00	2	10.53

Average credit amount: The data regarding the average credit amount availed by households in Timmapur-2 microwatershed is presented in Table 27. The results indicated that, marginal, small, semi medium and medium have availed Rs. 55,000, Rs. 110,062.50,

Rs. 74,166.67 and Rs, 195,000 respectively. Overall average credit amount availed by households in the micro watershed was Rs. 108,447.37.

Table 27: Average Credit amount availed by households in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (3)	SF (8)	SMF (6)	MDF (2)	All (19)
		N	N	N	N	N
1	Average Credit	55,000	110,062.50	74,166.67	195,000.00	108,447.37

Purpose of credit borrowed (institutional Source): The data regarding the purpose of credit borrowed from institutional sources by households in Timmapur-2 microwatershed is presented in Table 28. The results indicated that, 100 per cent of the households have borrowed loan for agriculture production.

Table 28: Purpose of credit borrowed (institutional Source) by households in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)		SF (13)		SMF (6)		MDF (3)		All (26)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture production	4	100	13	100	6	100	3	100	26	100

Purpose of credit borrowed (Private Credit): The data regarding the purpose of credit borrowed from private sources by households in Timmapur-2 microwatershed is presented in Table 29. The results indicated that, 27.27 per cent of the household's barrowed private credit for agriculture production which includes 40 per cent of the small and 50 per cent of the semi medium farmers.

Table 29: Purpose of credit borrowed (Private Credit) by households in Timmapur-2 microwatershed

Sl.No.	Particulars	SF (5)		SMF (2)		All (11)	
		N	%	N	%	N	%
1	Agriculture production	2	40.00	1	50.00	3	27.27

Repayment status of households (Institutional): The data regarding the repayment status of credit borrowed from institutional sources by households in Timmapur-2 microwatershed is presented in Table 30. Results indicated that 19.23 per cent of households were partially paid their loan, 61.54 per cent of households were unpaid their loan and 19.23 per cent of households were fully paid their loan.

Table 30: Repayment status of households (Institutional) in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)		SF (13)		SMF (6)		MDF (3)		All (26)	
		N	%	N	%	N	%	N	%	N	%
1	Partially paid	0	0.00	4	30.77	1	16.67	0	0.00	5	19.23
2	Un paid	2	50.00	9	69.23	3	50.00	2	66.67	16	61.54
3	Fully paid	2	50.00	0	0.00	2	33.33	1	33.33	5	19.23

Repayment status of households (Private): The data regarding the repayment status of credit borrowed from private sources by households in Timmapur-2 microwatershed is presented in Table 31. Results indicated that 63.64 per cent of the households have

partially paid their loan, 27.27 per cent have unpaid their private credit and 9.09 per cent of the households have fully paid their loan.

Table 31: Repayment status of households (Private) in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (3)		MF (1)		SF (5)		SMF (2)		All (11)	
		N	%	N	%	N	%	N	%	N	%
1	Partially paid	1	33.33	0	0.00	4	80.00	2	100.00	7	63.64
2	Un paid	2	66.67	1	100.00	0	0.00	0	0.00	3	27.27
3	Fully paid	0	0.00	0	0.00	1	20.00	0	0.00	1	9.09

Opinion on institutional sources of credit: The data regarding opinion on institutional sources of credit by households in Timmapur-2 microwatershed is presented in Table 32. The results indicated that 30.77 per cent of the households were opined that helped to perform timely agricultural operations, 46.15 per cent of the households were opined that higher rate of interest, 7.69 per cent of the households were opined that they were forced to sell the produce at low price to repay loan in time .

Table 32: Opinion on institutional sources of credit in Timmapur-2 microwatershed

S. N.	Particulars	MF (4)		SF (13)		SMF (6)		MDF (3)		All (26)	
		N	%	N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural operations	0	0	7	53.85	1	16.67	0	0	8	30.77
2	Higher rate of interest	1	25	6	46.15	3	50	2	66.67	12	46.15
3	None	1	25	0	0	1	16.67	0	0	2	7.69
4	Forced to sell the produce at low price t repay loan in time	0	0	0	0	1	16.67	1	33.33	2	7.69

Opinion on non-institutional sources of credit: The data regarding opinion on non-institutional sources of credit by households in Timmapur-2 microwatershed is presented in Table 33. The results indicated that, 9.09 per cent of the households were opined that helped to perform timely agricultural operations and higher rate of interest and 36.36 per cent of the households were not given any opinion.

Table 33: Opinion on non-institutional sources of credit in Timmapur-2 microwatershed

Sl.No.	Particulars	SF (5)		SMF (2)		All (11)	
		N	%	N	%	N	%
1	Helped to perform timely agricultural operations	3	60	1	50	4	36.36
2	Higher rate of interest	1	20	0	0	1	9.09
3	None	1	20	0	0	1	9.09

Cost of Cultivation of Maize: The data regarding the cost of cultivation of maize in Timmapur-2 microwatershed is presented in Table 34. The results indicated that, the total cost of cultivation for maize was Rs. 27597.79. The gross income realized by the farmers was Rs. 29830.49. The net income from maize cultivation was Rs. 2232.71. Thus the benefit cost ratio was found to be 1:1.08.

Table 34: Cost of Cultivation of Maize in Timmapur-2 microwatershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	27.39	4346.11	15.75
2	Bullock		Pairs/day	1.94	1025.14	3.71
3	Tractor		Hours	2.52	1815.60	6.58
4	Machinery		Hours	0.09	74.85	0.27
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	15.44	1930.69	7.00
6	FYM		Quintal	13.94	1817.17	6.58
7	Fertilizer + micronutrients		Quintal	6.99	6872.26	24.90
8	Pesticides (PPC)		Kgs / liters	1.00	1000.96	3.63
9	Irrigation		Number	1.24	0.00	0.00
10	Depreciation charges			0.00	228.09	0.83
11	Land revenue and Taxes			0.00	4.04	0.01
II	**Cost B1**					
12	Interest on working capital				1394.60	5.05
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				20509.51	74.32
III	**Cost B2**					
14	Rental Value of Land				418.18	1.52
15	**Cost B2 = (Cost B1 + Rental value)**				20927.69	75.83
IV	**Cost C1**					
16	Family Human Labour			20.99	4160.66	15.08
17	**Cost C1 = (Cost B2 + Family Labour)**				25088.35	90.91
V	**Cost C2**					
18	Risk Premium				0.55	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				25088.90	90.91
VI	**Cost C3**					
20	Managerial Cost				2508.89	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				27597.79	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		22.53	26727.38	
		b) Main Crop Sales Price (Rs.)			1186.36	
	By Product	e) Main Product (q)		15.95	3103.11	
		f) Main Crop Sales Price (Rs.)			194.55	
b.	Gross Income (Rs.)				29830.49	
c.	Net Income (Rs.)				2232.71	
d.	Cost per Quintal (Rs./q.)				1225.00	
e.	Benefit Cost Ratio (BC Ratio)				1:1.08	

Cost of Cultivation of Groundnut: The data regarding the cost of cultivation of groundnut in Timmapur-2 microwatershed is presented in Table 35. The results indicated that, the total cost of cultivation for groundnut was Rs. 61186.58. The gross income realized by the farmers was Rs. 75699.47. The net income from groundnut cultivation was Rs. 14512.89. Thus the benefit cost ratio was found to be 1:1.24.

Table 35: Cost of Cultivation of Groundnut in Timmapur-2 microwatershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	45.53	6791.50	11.10
2	Bullock		Pairs/day	3.03	1691.58	2.76
3	Tractor		Hours	2.79	1966.02	3.21
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	174.33	22735.23	37.16
6	FYM		Quintal	14.24	2037.75	3.33
7	Fertilizer + micronutrients		Quintal	7.32	7058.40	11.54
8	Pesticides (PPC)		Kgs / liters	1.25	1253.71	2.05
9	Irrigation		Number	5.19	0.00	0.00
10	Depreciation charges			0.00	1656.63	2.71
11	Land revenue and Taxes			0.00	4.03	0.01
II	**Cost B1**					
12	Interest on working capital				3970.28	6.49
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				49165.12	80.35
III	**Cost B2**					
14	Rental Value of Land				370.37	0.61
15	**Cost B2 = (Cost B1 + Rental value)**				49535.49	80.96
IV	**Cost C1**					
16	Family Human Labour			29.46	6088.11	9.95
17	**Cost C1 = (Cost B2 + Family Labour)**				55623.61	90.91
V	**Cost C2**					
18	Risk Premium				0.56	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				55624.16	90.91
VI	**Cost C3**					
20	Managerial Cost				5562.42	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				61186.58	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		22.39	72381.19	
		b) Main Crop Sales Price (Rs.)			3233.33	
	By Product	e) Main Product (q)		15.72	3318.28	
		f) Main Crop Sales Price (Rs.)			211.11	
b.	Gross Income (Rs.)				75699.47	
c.	Net Income (Rs.)				14512.89	
d.	Cost per Quintal (Rs./q.)				2733.26	
e.	Benefit Cost Ratio (BC Ratio)				1:1.24	

Cost of Cultivation of Paddy: The data regarding the cost of cultivation of paddy in Timmapur-2 microwatershed is presented in Table 36. The results indicated that, the total cost of cultivation for paddy was Rs. 62877.74. The gross income realized by the farmers was Rs. 73035.07. The net income from paddy cultivation was Rs. 10157.34. Thus the benefit cost ratio was found to be 1:1.16.

Table 36: Cost of Cultivation of Paddy in Timmapur-2 microwatershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	41.38	6775.66	10.78
2	Bullock		Pairs/day	2.68	1337.92	2.13
3	Tractor		Hours	5.74	3575.26	5.69
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	90.69	16414.27	26.11
6	FYM		Quintal	45.28	5557.50	8.84
7	Fertilizer + micronutrients		Quintal	5.57	4581.29	7.29
8	Pesticides (PPC)		Kgs / liters	1.84	1840.03	2.93
9	Irrigation		Number	8.68	0.00	0.00
10	Depreciation charges			0.00	4540.91	7.22
11	Land revenue and Taxes			0.00	4.67	0.01
II	**Cost B1**					
12	Interest on working capital				3407.19	5.42
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				48034.69	76.39
III	**Cost B2**					
14	Rental Value of Land				577.78	0.92
15	**Cost B2 = (Cost B1 + Rental value)**				48612.47	77.31
IV	**Cost C1**					
16	Family Human Labour			40.39	8548.94	13.60
17	**Cost C1 = (Cost B2 + Family Labour)**				57161.41	90.91
V	**Cost C2**					
18	Risk Premium				0.17	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				57161.58	90.91
VI	**Cost C3**					
20	Managerial Cost				5716.16	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				62877.74	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		54.76	66173.34	
		b) Main Crop Sales Price (Rs.)			1208.33	
	By Product	e) Main Product (q)		36.11	6861.73	
		f) Main Crop Sales Price (Rs.)			190.00	
b.	Gross Income (Rs.)				73035.07	
c.	Net Income (Rs.)				10157.34	
d.	Cost per Quintal (Rs./q.)				1148.16	
e.	Benefit Cost Ratio (BC Ratio)				1:1.16	

Cost of Cultivation of Bajra: The data regarding the cost of cultivation of bajra in Timmapur-2 microwatershed is presented in Table 37. The results indicated that, the total cost of cultivation for bajra was Rs. 17933.64. The gross income realized by the farmers was Rs. 25454.72. The net income from bajra cultivation was Rs. 7521.08. Thus the benefit cost ratio was found to be 1:1.42.

Table 37: Cost of Cultivation of Bajra in Timmapur-2 microwatershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	25.59	3913.58	21.82
2	Bullock		Pairs/day	2.13	1084.06	6.04
3	Tractor		Hours	2.47	1687.83	9.41
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.35	1482.00	8.26
6	FYM		Quintal	10.63	1358.50	7.58
7	Fertilizer + micronutrients		Quintal	2.74	2314.25	12.90
8	Pesticides (PPC)		Kgs / liters	0.00	0.00	0.00
9	Irrigation		Number	0.00	0.00	0.00
10	Depreciation charges			0.00	82.88	0.46
11	Land revenue and Taxes			0.00	4.39	0.02
II	**Cost B1**					
12	Interest on working capital				618.61	3.45
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				12546.10	69.96
III	**Cost B2**					
14	Rental Value of Land				377.78	2.11
15	**Cost B2 = (Cost B1 + Rental value)**				12923.88	72.07
IV	**Cost C1**					
16	Family Human Labour			16.40	3379.10	18.84
17	**Cost C1 = (Cost B2 + Family Labour)**				16302.98	90.91
V	**Cost C2**					
18	Risk Premium				0.33	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				16303.31	90.91
VI	**Cost C3**					
20	Managerial Cost				1630.33	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				17933.64	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.78	20514.72	
		b) Main Crop Sales Price (Rs.)			1300.00	
	By Product	e) Main Product (q)		24.70	4940.00	
		f) Main Crop Sales Price (Rs.)			200.00	
b.	Gross Income (Rs.)				25454.72	
c.	Net Income (Rs.)				7521.08	
d.	Cost per Quintal (Rs./q.)				1136.44	
e.	Benefit Cost Ratio (BC Ratio)				1:1.42	

Cost of Cultivation of Tomato: The data regarding the cost of cultivation of tomato in Timmapur-2 microwatershed is presented in Table 38. The results indicated that, the total cost of cultivation for tomato was Rs. 28537.03. The gross income realized by the farmers was Rs. 103740. The net income from tomato cultivation was Rs. 75202.97. Thus the benefit cost ratio was found to be 1:3.64.

Table 38: Cost of Cultivation of Tomato in Timmapur-2 microwatershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	30.46	4297.80	15.06
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	2.47	1976.00	6.92
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.12	4034.33	14.14
6	FYM		Quintal	4.12	823.33	2.89
7	Fertilizer + micronutrients		Quintal	7.41	7294.73	25.56
8	Pesticides (PPC)		Kgs / liters	0.82	823.33	2.89
9	Irrigation		Number	3.29	0.00	0.00
10	Depreciation charges			0.00	88.92	0.31
11	Land revenue and Taxes			0.00	3.29	0.01
II	**Cost B1**					
12	Interest on working capital				1557.21	5.46
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				20898.95	73.23
III	**Cost B2**					
14	Rental Value of Land				333.33	1.17
15	**Cost B2 = (Cost B1 + Rental value)**				21232.29	74.40
IV	**Cost C1**					
16	Family Human Labour			21.41	4709.47	16.50
17	**Cost C1 = (Cost B2 + Family Labour)**				25941.75	90.91
V	**Cost C2**					
18	Risk Premium				1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				25942.75	90.91
VI	**Cost C3**					
20	Managerial Cost				2594.28	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				28537.03	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		14.82	103740.00	
		b) Main Crop Sales Price (Rs.)			7000.00	
b.	Gross Income (Rs.)				103740.00	
c.	Net Income (Rs.)				75202.97	
d.	Cost per Quintal (Rs./q.)				1925.58	
e.	Benefit Cost Ratio (BC Ratio)				1:3.64	

Cost of Cultivation of Horsegram: The data regarding the cost of cultivation of horsegram in Timmapur-2 microwatershed is presented in Table 39. The results indicated that, the total cost of cultivation for horsegram was Rs. 11451.45. The gross income realized by the farmers was Rs. 26840.67. The net income from horsegram cultivation was Rs. 15389.22. Thus the benefit cost ratio was found to be 1:2.34.

Table 39: Cost of Cultivation of horsegram in Timmapur-2 microwatershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	11.53	1852.50	16.18
2	Bullock		Pairs/day	0.82	494.00	4.31
3	Tractor		Hours	2.47	1976.00	17.26
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	8.23	988.00	8.63
6	FYM		Quintal	0.00	0.00	0.00
7	Fertilizer + micronutrients		Quintal	2.47	2964.00	25.88
8	Pesticides (PPC)		Kgs / liters	0.00	0.00	0.00
9	Irrigation		Number	0.00	0.00	0.00
10	Depreciation charges			0.00	6.59	0.06
11	Land revenue and Taxes			0.00	3.29	0.03
II	**Cost B1**					
12	Interest on working capital				474.36	4.14
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				8758.74	76.49
III	**Cost B2**					
14	Rental Value of Land				333.33	2.91
15	**Cost B2 = (Cost B1 + Rental value)**				9092.07	79.40
IV	**Cost C1**					
16	Family Human Labour			7.41	1317.33	11.50
17	**Cost C1 = (Cost B2 + Family Labour)**				10409.41	90.90
V	**Cost C2**					
18	Risk Premium				1.00	0.01
19	**Cost C2 = (Cost C1 + Risk Premium)**				10410.41	90.91
VI	**Cost C3**					
20	Managerial Cost				1041.04	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				11451.45	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		11.53	26511.33	
		b) Main Crop Sales Price (Rs.)			2300.00	
	By Product	e) Main Product (q)		3.29	329.33	
		f) Main Crop Sales Price (Rs.)			100.00	
b.	Gross Income (Rs.)				26840.67	
c.	Net Income (Rs.)				15389.22	
d.	Cost per Quintal (Rs./q.)				993.47	
e.	Benefit Cost Ratio (BC Ratio)				1:2.34	

Cost of cultivation of cotton: The data regarding the cost of cultivation of cotton in Timmapur-2 microwatershed is presented in Table 40. The results indicated that, the total cost of cultivation for cotton was Rs. 28542.16. The gross income realized by the farmers was Rs. 71784.37. The net income from cotton cultivation was Rs. 43242.21. Thus the benefit cost ratio was found to be 1:2.52.

Table 40: Cost of Cultivation of cotton in Timmapur-2 microwatershed

Sl. No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	27.48	4670.87	16.36
2	Bullock	Pairs/day	3.19	1873.08	6.56
3	Tractor	Hours	1.34	905.67	3.17
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	2.83	1665.81	5.84
6	Seed Inter Crop	Kgs.	0.00	0.00	0.00
7	FYM	Quintal	5.02	1003.44	3.52
8	Fertilizer + micronutrients	Quintal	9.01	8120.12	28.45
9	Pesticides (PPC)	Kgs / liters	1.08	1080.62	3.79
10	Irrigation	Number	4.48	0.00	0.00
11	Depreciation charges		0.00	315.95	1.11
12	Land revenue and Taxes		0.00	3.84	0.01
II	**Cost B1**				
13	Interest on working capital			1424.48	4.99
14	**Cost B1 = (Cost A1 + sum of 15 and 16)**			21063.90	73.80
III	**Cost B2**				
15	Rental Value of Land			355.56	1.25
16	**Cost B2 = (Cost B1 + Rental value)**			21419.45	75.04
IV	**Cost C1**				
17	Family Human Labour		22.08	4527.30	15.86
18	**Cost C1 = (Cost B2 + Family Labour)**			25946.76	90.91
V	**Cost C2**				
19	Risk Premium			0.67	0.00
20	**Cost C2 = (Cost C1 + Risk Premium)**			25947.42	90.91
VI	**Cost C3**				
21	Managerial Cost			2594.74	9.09
22	**Cost C3 = (Cost C2 + Managerial Cost)**			28542.16	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	23.93	71784.37	
		b) Main Crop Sales Price (Rs.)		3000.00	
b.	Gross Income (Rs.)			71784.37	
c.	Net Income (Rs.)			43242.21	
d.	Cost per Quintal (Rs./q.)			1192.83	
e.	Benefit Cost Ratio (BC Ratio)			1:2.52	

Cost of cultivation sunflower: The data regarding the cost of cultivation of sunflower in Timmapur-2 microwatershed is presented in Table 41. The results indicated that, the total cost of cultivation for sunflower was Rs. 34933.39. The gross income realized by the farmers was Rs. 63232. The net income from sunflower cultivation was Rs. 28298.61. Thus the benefit cost ratio was found to be 1:1.81.

Table 41: Cost of Cultivation of sunflower in Timmapur-2 microwatershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	30.88	4186.65	11.98
2	Bullock		Pairs/day	3.71	2223.00	6.36
3	Tractor		Hours	2.47	1976.00	5.66
4	Machinery		Hours	2.47	1976.00	5.66
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.35	123.50	0.35
6	FYM		Quintal	6.18	1235.00	3.54
7	Fertilizer + micronutrients		Quintal	9.88	9583.60	27.43
8	Pesticides (PPC)		Kgs / liters	1.24	1235.00	3.54
9	Irrigation		Number	3.71	0.00	0.00
10	Depreciation charges			0.00	553.28	1.58
11	Land revenue and Taxes			0.00	3.29	0.01
II	**Cost B1**					
12	Interest on working capital				1461.37	4.18
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				24556.70	70.30
III	**Cost B2**					
14	Rental Value of Land				333.33	0.95
15	**Cost B2 = (Cost B1 + Rental value)**				24890.03	71.25
IV	**Cost C1**					
16	Family Human Labour			35.82	6866.60	19.66
17	**Cost C1 = (Cost B2 + Family Labour)**				31756.63	90.91
V	**Cost C2**					
18	Risk Premium				1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				31757.63	90.91
VI	**Cost C3**					
20	Managerial Cost				3175.76	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				34933.39	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		19.76	63232.00	
		b) Main Crop Sales Price (Rs.)			3200.00	
b.	Gross Income (Rs.)				63232.00	
c.	Net Income (Rs.)				28298.61	
d.	Cost per Quintal (Rs./q.)				1767.88	
e.	Benefit Cost Ratio (BC Ratio)				1:1.81	

Cost of cultivation of chilly: The data regarding the cost of cultivation of chilly in Timmapur-2 microwatershed is presented in Table 42. The results indicated that, the total cost of cultivation for chilly was Rs. 23059.20. The gross income realized by the farmers was Rs. 181133.33. The net income from chilly cultivation was Rs. 158074.14. Thus the benefit cost ratio was found to be 1:7.86.

Table 42: Cost of Cultivation of chilly in Timmapur-2 microwatershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	32.93	5145.83	22.32
2	Bullock	Pairs/day	0.82	494.00	2.14
3	Tractor	Hours	2.47	1976.00	8.57
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	2.47	1111.50	4.82
6	FYM	Quintal	0.00	0.00	0.00
7	Fertilizer + micronutrients	Quintal	8.23	7689.93	33.35
8	Pesticides (PPC)	Kgs / liters	0.82	823.33	3.57
9	Irrigation	Number	6.59	0.00	0.00
10	Depreciation charges		0.00	6.59	0.03
11	Land revenue and Taxes		0.00	3.29	0.01
II	**Cost B1**				
12	Interest on working capital			1155.09	5.01
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**			18405.57	79.82
III	**Cost B2**				
14	Rental Value of Land			333.33	1.45
15	**Cost B2 = (Cost B1 + Rental value)**			18738.91	81.26
IV	**Cost C1**				
16	Family Human Labour		12.35	2223.00	9.64
17	**Cost C1 = (Cost B2 + Family Labour)**			20961.91	90.90
V	**Cost C2**				
18	Risk Premium			1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**			20962.91	90.91
VI	**Cost C3**				
20	Managerial Cost			2096.29	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**			23059.20	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	90.57	181133.33	
		b) Main Crop Sales Price (Rs.)		2000.00	
b.	Gross Income (Rs.)			181133.33	
c.	Net Income (Rs.)			158074.14	
d.	Cost per Quintal (Rs./q.)			254.61	
e.	Benefit Cost Ratio (BC Ratio)			1:7.86	

Cost of cultivation of sorghum: The data regarding the cost of cultivation of sorghum in Timmapur-2 microwatershed is presented in Table 43. The results indicated that, the total cost of cultivation for sorghum was Rs. 13146.50. The gross income realized by the farmers was Rs. 34382.40. The net income from sorghum cultivation was Rs. 21235.90. Thus the benefit cost ratio was found to be 1:2.62.

Table 43: Cost of Cultivation of sorghum in Timmapur-2 microwatershed

Sl. No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	14.82	2305.33	17.54
2	Bullock	Pairs/day	0.82	411.67	3.13
3	Tractor	Hours	2.47	1482.00	11.27
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	8.23	576.33	4.38
6	FYM	Quintal	0.00	0.00	0.00
7	Fertilizer + micronutrients	Quintal	3.29	2799.33	21.29
8	Pesticides (PPC)	Kgs / liters	0.00	0.00	0.00
9	Irrigation	Number	0.00	0.00	0.00
10	Depreciation charges		0.00	67.51	0.51
11	Land revenue and Taxes		0.00	4.94	0.04
II	**Cost B1**				
12	Interest on working capital			405.08	3.08
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**			8052.20	61.25
III	**Cost B2**				
14	Rental Value of Land			400.00	3.04
15	**Cost B2 = (Cost B1 + Rental value)**			8452.20	64.29
IV	**Cost C1**				
16	Family Human Labour		17.29	3499.17	26.62
17	**Cost C1 = (Cost B2 + Family Labour)**			11951.37	90.91
V	**Cost C2**				
18	Risk Premium			0.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**			11951.37	90.91
VI	**Cost C3**				
20	Managerial Cost			1195.14	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**			13146.50	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	14.82	34086.00	
		b) Main Crop Sales Price (Rs.)		2300.00	
	By Product	e) Main Product (q)	4.94	296.40	
		f) Main Crop Sales Price (Rs.)		60.00	
b.	Gross Income (Rs.)			34382.40	
c.	Net Income (Rs.)			21235.90	
d.	Cost per Quintal (Rs./q.)			887.08	
e.	Benefit Cost Ratio (BC Ratio)			1:2.62	

Cost of cultivation of sesamum: The data regarding the cost of cultivation of sesamum in Timmapur-2 microwatershed is presented in Table 44. The results indicated that, the total cost of cultivation for sesamum was Rs. 15380.78. The gross income realized by the farmers was Rs. 21612.50. The net income from sesamum cultivation was Rs. 6231.72. Thus the benefit cost ratio was found to be 1:1.41.

Table 44: Cost of Cultivation of sesamum in Timmapur-2 microwatershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	18.53	2704.65	17.58
2	Bullock		Pairs/day	2.47	1235.00	8.03
3	Tractor		Hours	2.47	1482.00	9.64
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.35	988.00	6.42
6	FYM		Quintal	0.00	0.00	0.00
7	Fertilizer + micronutrients		Quintal	2.47	1914.25	12.45
8	Pesticides (PPC)		Kgs / liters	0.00	0.00	0.00
9	Irrigation		Number	0.00	0.00	0.00
10	Depreciation charges			0.00	2.47	0.02
11	Land revenue and Taxes			0.00	4.94	0.03
II	**Cost B1**					
12	Interest on working capital				348.27	2.26
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				8679.58	56.43
III	**Cost B2**					
14	Rental Value of Land				400.00	2.60
15	**Cost B2 = (Cost B1 + Rental value)**				9079.58	59.03
IV	**Cost C1**					
16	Family Human Labour			23.47	4902.95	31.88
17	**Cost C1 = (Cost B2 + Family Labour)**				13982.53	90.91
V	**Cost C2**					
18	Risk Premium				0.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				13982.53	90.91
VI	**Cost C3**					
20	Managerial Cost				1398.25	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				15380.78	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		6.18	21612.50	
		b) Main Crop Sales Price (Rs.)			3500.00	
b.	Gross Income (Rs.)				21612.50	
c.	Net Income (Rs.)				6231.72	
d.	Cost per Quintal (Rs./q.)				2490.82	
e.	Benefit Cost Ratio (BC Ratio)				1:1.41	

Adequacy of fodder: The data regarding the adequacy of fodder in Timmapur-2 microwatershed is presented in Table 45. The results indicated that, 62.86 per cent of the households opined that dry fodder was adequate and 34.29 per cent of the households opined that green fodder was adequate.

Table 45: Adequacy of fodder in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	2	50	9	64.29	7	87.50	4	100	22	62.86
2	Adequate-Green Fodder	1	25	7	50	3	37.50	1	25	12	34.29

Average Annual gross income of households: The results of the overall average annual gross income of the household in Timmapur-2 is presented in table 46. The table indicated that, in landless farmers, the average income from wage was Rs. 26000. In marginal farmers the average income from wage was Rs. 26071.43 and agriculture was Rs. 37600. In small farmers the average income from wage was Rs. 26071.43, agriculture was Rs. 49050 and dairy farm was Rs. 2112.14. In semi medium farmers the average income from wage was Rs. 14,375, agriculture was Rs. 117,562.50 and dairy farm was Rs.625. In medium farmers the average income from wage was Rs. 15000, agriculture was Rs. 71500 and dairy farm was Rs. 750.

Table 46: Average Annual gross income of households in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Wage	26,000	30,000	26,071.43	14,375.00	15,000	22,571.43
2	Agriculture	0.00	37,600	49,050	117,562.50	71,500	58,960.00
3	Dairy Farm	0.00	0.00	2,112.14	625.00	750	1,073.43
Income(Rs.)		26,000	67,600	77,233.57	132,562.50	87,250	82,604.86

Table 47: Average Annual expenditure of households in Timmapur-2 micro watershed

Sl.No.	Particulars	LL (5)	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Wage	13,000	5,666.67	11,111.11	5,750.00	3,000	4,914.29
2	Agriculture	0.00	14,750.00	23,285.71	47,875.00	35,000	25,942.86
3	Dairy Farm	0.00	0.00	10,000	1,000	0.00	314.29
Total		13,000	20,416.67	44,396.83	54,625	38,000	170,438.49
Average		2,600	5,104.17	3,171.20	6,828.13	9,500	4,869.67

Average Annual expenditure of households: The results of the overall average annual expenditure of the households in Timmapur-2 were presented in Table 47. The results indicated that, in landless farmers, the average expenditure from wage was Rs. 13000, in marginal farmers the average expenditure from wage was Rs.5666.67 and agriculture was Rs.14750. In case of small farmers the average expenditure from wage was Rs. 11111.11, agriculture was Rs. 23285.71 and dairy farm was Rs. 10,000. In case of semi medium farmers the average expenditure from wage was Rs. 5750, agriculture was Rs. 47875 and

dairy farm was Rs.1000. In case of medium farmers the average expenditure from wage was Rs. 3,000 and agriculture was Rs. 35,000.

Horticulture species grown: The data regarding horticulture species grown in Timmapur-2 micro watershed is presented in Table 48. The results indicated that, sampled households have grown 20 coconut and 49 mango trees in their field.

Table 48: Horticulture species grown in Timmapur-2 micro watershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	2	0	1	0	3	0	14	0	20	0
2	Mango	0	0	0	0	4	0	3	0	42	0	49	0

***F=Field & *B=Back yard**

Forest species grown: The data regarding forest species grown in Timmapur-2 micro watershed is presented in Table 49. The results indicated that, households have planted 50 neem, 6 tarmind, 1 banyan and 1 peeple trees in their field.

Table 49: Forest species grown in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Neem	0	0	11	0	18	0	13	0	8	0	50	0
2	Tamarind	0	0	1	0	3	0	2	0	0	0	6	0
3	Banyan	0	0	0	0	0	0	1	0	0	0	1	0
4	Peeple Tree	0	0	0	0	0	0	0	0	1	0	1	0

***F=Field & *B=Back yard**

Average additional investment capacity: The data regarding average additional investment capacity in Timmapur-2 micro watershed is presented in Table 50. The results indicate that, households have an average investment capacity of Rs.2257.14 for land development, Rs. 1171.43 in irrigation facility, Rs.1314.29 for improved crop production, Rs.600 for improved livestock management and Rs.142.86 for subsidiary enterprises.

Table 50: Average additional investment capacity of households in Timmapur-2 microwatershed (Rs.)

S.N.	Particulars	MF (4)	SF (14)	SMF (8)	MDF (4)	All (35)
1	Land development	2,500	2,357.14	2,000	5,000	2,257.14
2	Irrigation facility	1,500	785.71	1,750	2,500	1,171.43
3	Improved crop production	1,250	1,642.86	1,250	2,000	1,314.29
4	Improved livestock management	0	357.14	750	2,500	600
5	Subsidiary enterprises	0	0	0	1,250	142.86

Marginal households have an average investment capacity of Rs. 2500 for land development, Rs. 1500 for irrigation facility and Rs.1250 for improved crop production. Small farmers have an average investment capacity of Rs. 2357.14 for land development, Rs. 785.71 in irrigation facility, Rs.1642.86 for improved crop production and Rs.357.14 for improved livestock management. Semi medium farmers have an average investment capacity of Rs. 2000 for land development, Rs. 1750 in irrigation facility, Rs.1250 for improved crop production and Rs.750 for improved livestock management. Medium

farmers have an average investment capacity of Rs. 5000 for land development, Rs. 2500 for irrigation facility, Rs.2000 for improved crop production, Rs.2500 for improved livestock management and Rs.1250 for subsidiary enterprises.

Source of funds for additional investment: The data regarding source of funds for additional investment in Timmapur-2 microwatershed is presented in Table 51. The results indicated that, for land development, 20 per cent were depending on loan from the bank and 2.86 per cent of the households were depending on soft loan. For irrigation facility 5.71 per cent of the households were dependent on loan from bank and 11.43 per cent were depending on soft loan. Similarly for improved crop production, 5.71 per cent of the households were dependent on loan from the bank, 2.86 per cent were dependent on their own funds and 14.29 per cent of the households were depending on soft loan. For improved livestock management 2.86 per cent were dependent on own funds and 11.43 per cent were dependent on soft loan. For subsidiary enterprises 2.86 per cent of the households were dependent on soft loan.

Table 51: Source of funds for additional investment capacity in Timmapur-2 microwatershed

S. N.	Item	Land development		Irrigation facility		Improved crop production		Improved livestock management		Subsidiary enterprises	
		N	%	N	%	N	%	N	%	N	%
1	Loan from bank	7	20.0	2	5.71	2	5.71	0	0.0	0	0.0
2	Own funds	0	0.0	0	0.0	1	2.86	1	2.86	0	0.0
3	Soft loan	1	2.86	4	11.43	5	14.29	4	11.43	1	2.86

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Timmapur-2 micro watershed is presented in Table 52. The results indicated that, chilli, cotton, horsegram, sesamum, sorghum, sunflower and tomato crops were sold to the extent of 100 per cent. Bajra, groundnut, maize and paddy were sold to the extent of 85.71 per cent, 96.27 per cent, 97.23 per cent and 94.33 per cent respectively.

Table 52: Marketing of the agricultural produce in Timmapur-2 microwatershed

S.N.	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained(Rs/q)
1	Bajra	70.0	10.0	60.0	85.71	1300.0
2	Chilly	110.0	0.0	110.0	100.0	2000.0
3	Cotton	50.0	50	50	100	2000.0
4	Groundnut	161.0	6.0	155.0	96.27	3233.33
5	Horsegram	14.0	0.0	14.0	100.0	2300.0
6	Maize	289.0	8.0	281.0	97.23	1186.36
7	Paddy	300.0	17.0	283.0	94.33	1208.33
8	Sesamum	5.0	0.0	5.0	100.0	3500.0
9	Sorghum	18.0	0.0	18.0	100.0	2300.0
10	Sunflower	16.0	0.0	16.0	100.0	3200.0
11	Tomato	18.0	0.0	18.0	100.0	7000.0

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Timmapur-2 microwatershed is presented in Table 53. The results indicated that, 62.86 percent of the households have sold their produce to local/village merchant, 31.43 percent of the households sold their produce in regulated markets and 14.29 percent of the households sold their produce in cooperative marketing society.

Table 53: Marketing Channels used for sale of agricultural produce in Timmapur-2 microwatershed

Sl. No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Local/village Merchant	3	75	7	50	6	75	4	100	22	62.86
2	Regulated Market	1	25	6	42.86	4	50	0	0	11	31.43
3	Cooperative marketing Society	0	0	2	14.29	0	0	3	75	5	14.29

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Timmapur-2 microwatershed is presented in Table 54. The results indicated that 11.43 per cent of the households have used cart as a mode of transport, 57.14 per cent of them have used tractor and 40 per cent have used truck as a mode of transport.

Table 54: Mode of transport of agricultural produce in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Cart	2	50.00	1	7.14	1	12.50	0	0.00	4	11.43
2	Tractor	2	50.00	7	50.00	7	87.50	4	100.00	20	57.14
3	Truck	0	0.00	7	50.00	2	25.00	5	125.00	14	40.00

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Timmapur-2 microwatershed is presented in Table 55. The results indicated that, 42.86 per cent of the households have experienced the soil and water erosion problems i.e. 50 percent of marginal farmers, 42.86 per cent of small farmers, 37.50 per cent of semi medium farmers and 100 percent of medium farmers.

Table 55: Incidence of soil and water erosion problems in Timmapur-2 microwatershed

Sl. No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	2	50	6	42.86	3	37.50	4	100	15	42.86

Interest towards soil testing: The data regarding interest shown towards soil testing in Timmapur-2 microwatershed is presented in Table 56. The results indicated that, 82.86 per cent of the households have shown interest in soil testing including 100 per cent of marginal farmers, small farmers and medium farmers and 87.50 per cent of the semi medium farmers respectively.

Table 56: Interest shown towards soil testing in Timmapur-2 microwatershed

Sl.No.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	4	100.00	14	100.00	7	87.50	4	100.00	29	82.86

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Timmapur-2 microwatershed is presented in Table 57. The results indicated that, 100 percent used fire wood as a source of fuel and 2.86 per cent of the households used LPG.

Table 57: Usage pattern of fuel for domestic use in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	5	100	4	100	14	100	8	100	4	100	35	100
2	LPG	0	0	0	0	0	0	0	0	1	25	1	2.86

Source of drinking water: The data regarding source of drinking water in Timmapur-2 microwatershed is presented in Table 58. The results indicated that, piped supply was the source of drinking water for 82.86 per cent of the households and 17.14 per cents of the households were using bore well for drinking water.

Table 58: Source of drinking water in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	4	80	4	100	12	85.71	7	87.50	2	50	29	82.86
2	Bore Well	1	20	0	0	2	14.29	1	12.50	2	50	6	17.14

Source of light: The data regarding source of light in Timmapur-2 microwatershed is presented in Table 59. The results indicated that, electricity was the major source of light for 100 per cent of the households.

Table 59: Source of light in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100	4	100	14	100	8	100	4	100	35	100

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Timmapur-2 microwatershed is presented in Table 60. The results indicated that, 31.43 per cent of the households possess sanitary toilet i.e. 20 per cent of landless, 100 per cent of marginal, 21.43 per cent of small, 25 per cent of semi medium and 25 per cent of medium farmers had sanitary toilet facility.

Table 60: Existence of Sanitary toilet facility in Timmapur-2 microwatershed

S. N.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	1	20	4	100	3	21.43	2	25	1	25	11	31.43

Possession of PDS card: The data regarding possession of PDS card in Timmapur-2 microwatershed is presented in Table 61. The results indicated that, 100 per cent of the sampled households possessed BPL card.

Table 61: Possession of PDS card in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	5	100	4	100	14	100	8	100	4	100	35	100

Participation in NREGA programme: The data regarding participation in NREGA programme in Timmapur-2 microwatershed is presented in Table 62. The results indicated that, 42.86 per cent of the households participated in NREGA programme which included 60 per cent of the landless, 100 percent of the marginal, 21.43 per cent of the small, 12.50 per cent of the semi medium and 100 percent of the medium farmers.

Table 62: Participation in NREGA programme in Timmapur-2 microwatershed

Sl. No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	3	60	4	100	3	21.43	1	12.50	4	100	15	42.86

Adequacy of food items: The data regarding adequacy of food items in Timmapur-2 microwatershed is presented in Table 63. The results indicated that, cereals, pulses, oilseeds, milk, egg and meat were adequate for 94.29 per cent, 60 per cent, 5.71 per cent, 85.71 per cent, 80 per cent, and 65.71 per cent respectively. Vegetables and fruits were adequate for 48.57 per cent of the households.

Table 63: Adequacy of food items in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	4	80	3	75	14	100	8	100	4	100	33	94.29
2	Pulses	3	60	2	50	9	64.29	4	50	3	75	21	60.00
3	Oilseed	0	0	0	0	2	14.29	0	0	0	0	2	5.71
4	Vegetables	0	0	2	50	6	42.86	5	62.50	4	100	17	48.57
5	Fruits	2	40	2	50	6	42.86	5	62.50	2	50	17	48.57
6	Milk	2	40	4	100	13	92.86	7	87.50	4	100	30	85.71
7	Egg	3	60	4	100	12	85.71	7	87.50	2	50	28	80.00
8	Meat	4	80	2	50	9	64.29	6	75	2	50	23	65.71

Table 64: Response on Inadequacy of food items in Timmapur-2 microwatershed

Sl.No.	Particulars	LL (5)		MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	1	20	1	25	0	0	0	0	0	0	2	5.71
2	Pulses	2	40	2	50	5	35.71	4	50	1	25	14	40
3	Oilseed	4	80	4	100	11	78.57	7	87.50	2	50	28	80
4	Vegetables	4	80	2	50	8	57.14	1	12.50	0	0	15	42.86
5	Fruits	1	20	2	50	8	57.14	2	25	1	25	14	40
6	Milk	1	20	0	0	1	7.14	0	0	0	0	2	5.71
7	Egg	2	40	0	0	2	14.29	0	0	2	50	6	17.14
8	Meat	1	20	2	50	5	35.71	1	12.50	2	50	11	31.43

Response on Inadequacy of food items: The data regarding inadequacy of food items in Timmapur-2 microwatershed is presented in Table 64. The results indicated that, cereals, pulses, oilseed, vegetables, fruits, milk, egg and meat were inadequate for 5.71 per cent, 40 per cent, 80 per cent, 42.86 per cent, 40 per cent, 5.71 per cent, 17.14 per cent and 31.43 per cent respectively.

Farming constraints: The data regarding farming constraints experienced by households in Timmapur-2 microwatershed is presented in Table 65. The results indicated that, Lower fertility status of the soil was experienced by 85.71 per cent of the households, wild animal menace on farm field was experienced by 74.29 per cent of the households, frequent incidence of pest and diseases was experienced by 65.71 per cent of the farmers, inadequacy of irrigation water was experienced by 42.86 per cent of the households, high cost of Fertilizers and plant protection chemicals was experienced by 65.71 per cent of the households, high rate of interest on credit was experienced by 60 per cent of the farmers, low price for the agricultural commodities was experienced by 60 per cent of the farmers, lack of marketing facilities in the area was experienced 65.71 per cent of the households, inadequate of extension services experienced by 65.71 per cent of the households, lack of transport for safe transport of the agricultural produce to the market was experienced by 74.29 per cent of the households and less rainfall was experienced by 25.71 per cent of the farmers.

Table 65: Farming constraints Experienced in Timmapur-2 microwatershed

S.N.	Particulars	MF (4)		SF (14)		SMF (8)		MDF (4)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	4	100	14	100	8	100	4	100	30	85.71
2	Wild animal menace on farm field	3	75	13	92.86	6	75	4	100	26	74.29
3	Frequent incidence of pest and diseases	4	100	11	78.57	5	62.50	3	75	23	65.71
4	Inadequacy of irrigation water	2	50	7	50	5	62.50	1	25	15	42.86
5	High cost of Fertilizers and plant protection chemicals	4	100	12	85.71	4	50	3	75	23	65.71
6	High rate of interest on credit	3	75	10	71.43	5	62.50	3	75	21	60
7	Low price for the agricultural commodities	3	75	11	78.57	5	62.50	2	50	21	60
8	Lack of marketing facilities in the area	4	100	12	85.71	5	62.50	2	50	23	65.71
9	Inadequate extension services	2	50	11	78.57	6	75	4	100	23	65.71
10	Lack of transport for safe transport of the Agril produce to the market.	4	100	12	85.71	6	75	4	100	26	74.29
11	Less rainfall	2	50	4	28.57	1	12.50	2	50	9	25.71

Chapter 5

SUMMARY

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 35 households located in the micro watershed were interviewed for the survey.

The results indicated that 35 farmers were sampled in Timmapur-2 microwatershed among them 4 (11.43%) were marginal farmers, 14 (40%) were small farmers, 8 (22.86 %) were semi medium farmers, 4 (11.43%) were medium farmers and 5 (14.29%) landless farmers were also interviewed for the survey. The data indicated that there were 191 population households were there in the studied micro watershed. Among them 106 (55.50%) men and 85 (44.50 %) were women. The average family size of landless was 6, marginal farmer was 4, small and semi medium farmers were 5 and medium farmers were 7. On an average the family size was 5. The data indicated that 40 (20.94%) people were in 0-15 years of age, 91 (47.64 %) were in 16-35 years of age, 47 (24.61 %) were in 36-60 years of age and 13 (6.81%) were above 61 years of age.

The results indicated that the Timmapur-2 had 37.17 per cent illiterates, 35.08 per cent of them had primary school education, 8.38 per cent of them had middle school, 11.52 per cent of them had high school education, 5.76 per cent of them had PUC education, 0.52 had diploma education and 1.05 per cent of them had degree education. The results indicated that, 80 per cent of households practicing agriculture, 17.14 per cent of the household heads were agricultural labour and 5.71 per cent of the household heads were general labour. The results indicated that agriculture was the major occupation for 45.55 per cent of the household members, 24.61 per cent were agricultural labourers, 4.71 per cent were general labours and 23.56 per cent of them were students. In case of landless farmers 54.84 per cent of them were agriculture labours, 29.03 per cent of them were general labour and 12.90 per cent of them were students.

The results indicated that, in case of marginal farmers 58.82 per cent of them were doing agriculture, 17.65 per cent of them were agriculture labour and 23.53 per cent of them were students. In small farmers 51.35 per cent of them were doing agriculture, 20.27 per cent of them were agriculture labour and 28.38 per cent of them were student. In case of semi medium farmers, 76. 92 per cent of them were agriculturist, 10.26 per cent of them were agriculture labour and students. In medium farmers 30 per cent of them were agriculturist, 26.67 per cent of them were agricultural labour and 40 per cent of them

were students. The results showed that 100 per cent of them have not participated in any local institutions.

The results indicated that 45.71 per cent of the households possess thatched house, 42.86 per cent of the households possess Katcha house and 11.43 per cent of the households possess Pucca house. The results showed that, 100 per cent of the households possess TV, 91.43 per cent of the households possess mixer/grinder, 42.86 per cent of the households possess bicycle, 37.14 per cent of the households possess motor cycle and 97.14 per cent of the households possess mobile phones. The results showed that the average value of television was Rs. 6800, mixer/grinder was Rs. 1656, bicycle was Rs.1750, motor cycle was Rs.29230 and mobile phone was Rs.1544. The data showed that about 28.57 per cent of the households possess bullock cart, 45.71 per cent of them possess plough, 2.86 per cent of the households possess tractor, 25.71 per cent of the households possess sprayer, 94.29 per cent of the households possess weeder and 11.43 per cent of the households possess chaff cutter.

The results showed that the average value of bullock cart was Rs.16800; the average value of plough was Rs. 910, the average value of tractor was Rs. 500000, the average value of sprayer was Rs. 3500, the average value of weeder was Rs. 59 and the average value of chaff cutter was Rs. 2325. The results indicated that, 45.71 per cent of the households possess bullocks and 28.57 per cent of the households possess local cow. In case of marginal farmers, 25 per cent of the households possess bullock. In case of small farmers, 50 per cent of households possess bullock and 28.57 per cent possess local cow. In case of semi medium farmers, 62.50 per cent of the households possess bullock and 50 per cent of the households possess local cow. 75 medium farmers possess bullock and 50 farmers possess local.

The results indicated that, average own labour men available in the micro watershed was 2.13, average own labour (women) available was 1.65, average hired labour (men) available was 8.35 and average hired labour (women) available was 7.16. The results indicated that, in case of marginal farmers, average own labour men available was 2, average own labour (women) was also 1.25, average hired labour (men) was 6.50 and average hired labour (women) available was 5.25. In case of small farmers, average own labour men available was 2, average own labour (women) was 1.71, average hired labour (men) was 9.71 and average hired labour (women) available was 8.21. In case of semi medium farmers, average own labour men available was 2.38, average own labour (women) was 1.50, average hired labour (men) was 9.13 and average hired labour (women) available was 7.50. In medium farmers average own labour men available was 2.25, average own labour (women) was 2, average hired labour (men) was 6 and average hired labour (women) available was 6.50. The results indicated that, 88.57 per cent of the household opined that the hired labour was adequate.

The results indicated that, households of the Timmapur-2 microwatershed possess 20.72 ha (45.57%) of dry land and 24.75 ha (54.43%) of irrigated land. Marginal farmers possess 2.51 ha (86.11%) of dry land and 0.40 ha (13.89%) of irrigated land. Small farmers possess 16.19 ha (86.21 %) of dry land and 2.59 ha (13.79 %) of irrigated land. Semi medium farmers possess 0.81 ha (6.97 %) of dry land and 10.81 ha (93.03%) of irrigated land. Medium farmers possess 1.21 ha (9.98%) of dry land and 10.95 ha (90.02%) irrigated land. The results indicated that, the average value of dry land was Rs. 390,761.72 and average value of irrigated was Rs. 501,592.55. In case of marginal famers, the average land value was Rs. 597,580.64 for dry land and Rs. 1,976,000 for irrigated land. In case of small famers, the average land value was Rs. 333,450 for dry land Rs. 810,468.74 for irrigated land. In case of semi medium famers, the average land value was Rs. 741,000 for dry land and Rs. 573,558.06 for irrigated land. In case of medium famers, the average land value was Rs. 494,000 for dry land and Rs. 303,045.09 for irrigated land.

The results indicated that, there were 19 functioning bore wells in the micro watershed. The results indicated that, bore well was the major irrigation source for 54.29 per cent of the farmers. The results indicated that on an average the depth of the bore well was 45.37 meters. The results indicated that, in case of marginal farmers there was 0.40 per cent of irrigated land, in case of small farmers there was 2.59 ha of irrigated land, in case of semi medium farmers there was 12.02 ha of irrigated land and medium farmers were having 6.11 ha of irrigated land. On an average there were 21.13 ha of irrigated land. The results indicated that, farmers have grown bajra (4.45 ha), chilly (1.21 ha), cotton (2.91 ha), groundnut (8.22 ha), horsegram (1.21 ha), maize (14.40 ha), paddy (4.57 ha), sesamum (0.81 ha), sorghum (1.21 ha), sunflower (0.81 ha) and tomato (1.21 ha) in kharif season.

Marginal farmers have grown groundnut, maize and sesamum. Small farmers have grown bajra, cotton, groundnut, horsegram, maize and sorghum. Semi medium farmers have grown chilly, cotton, groundnut, maize, paddy and tomato. Medium farmers have grown cotton, groundnut, maize, paddy and sunflower. The results indicated that, the cropping intensity in Timmapur-2 microwatershed was found to be 98.07 per cent. In case of marginal farmers, small farmers and medium farmers it was 100 per cent and in semi medium farmers it was 93.03 per cent. The results indicated that, 94.29 per cent of the households have bank account and 48.57 per cent of the households have savings. 60per cent of the landless farmers have bank account. In marginal farmers 100 per cent of them have bank account and 50 per cent of them had savings. In case of small farmers 100 per cent of them had bank account and 71.43 per cent possess savings. In case of semi medium farmers, 100 per cent of possess bank account and 62.50 per cent farmer's savings. In Medium farmers, 100 per cent of farmers possess bank account.

The results indicated that 54.29 per cent of the farmers have borrowed credit from different sources which includes 75 per cent of marginal, 57.14 per cent of small, 75 per cent of semi medium and 50 per cent of medium farmers. The results indicated that, 31.58 per cent have availed loan in commercial bank, 15.79 per cent have availed loan in cooperative Bank, 5.26 per cent have availed loan from friends/relatives, 89.47 per cent have availed loan in Grameena bank, 42.11per cent have availed loan from money lender and 10.53 per cent have availed loan in SHGs/CBOs. The results indicated that, marginal, small, semi medium and medium have availed Rs. 55,000, Rs. 110,062.50, Rs. 74,166.67 and Rs, 195,000 respectively. Overall average credit amount availed by households in the micro watershed was Rs. 108,447.37. The results indicated that, 100 per cent of the households have borrowed loan for agriculture production. The results indicated that, 27.27 per cent of the household's barrowed private credit for agriculture production which includes 40 per cent of the small and 50 per cent of the semi medium farmers. Results indicated that 19.23 per cent of households were partially paid their loan, 61.54 per cent of households were unpaid their loan and 19.23 per cent of households were fully paid their loan. Results indicated that 63.64 per cent of the households have partially paid their loan, 27.27 per cent have unpaid their private credit and 9.09 per cent of the households have fully paid their loan.

The results indicated that 30.77 per cent of the households were opined that helped to perform timely agricultural operations, 46.15 per cent of the households were opined that higher rate of interest, 7.69 per cent of the households were opined that they were forced to sell the produce at low price to repay loan in time .The results indicated that, 9.09 per cent of the households were opined that helped to perform timely agricultural operations and higher rate of interest and 36.36 per cent of the households were not given any opinion.

The results indicated that, the total cost of cultivation for maize was Rs. 27597.79. The gross income realized by the farmers was Rs. 29830.49. The net income from maize cultivation was Rs. 2232.71. Thus the benefit cost ratio was found to be 1:1.08. The results indicated that, the total cost of cultivation for groundnut was Rs. 61186.58. The gross income realized by the farmers was Rs. 75699.47. The net income from groundnut cultivation was Rs. 14512.89. Thus the benefit cost ratio was found to be 1:1.24. The results indicated that, the total cost of cultivation for paddy was Rs. 62877.74. The gross income realized by the farmers was Rs. 73035.07. The net income from paddy cultivation was Rs. 10157.34. Thus the benefit cost ratio was found to be 1:1.16. The results indicated that, the total cost of cultivation for bajra was Rs. 17933.64. The gross income realized by the farmers was Rs. 25454.72. The net income from bajra cultivation was Rs. 7521.08. Thus the benefit cost ratio was found to be 1:1.42. The results indicated that, the total cost of cultivation for tomato was Rs. 28537.03. The gross income realized by the

farmers was Rs. 103740. The net income from tomato cultivation was Rs. 75202.97. Thus the benefit cost ratio was found to be 1:3.64.

The results indicated that, the total cost of cultivation for horsegram was Rs. 11451.45. The gross income realized by the farmers was Rs. 26840.67. The net income from horsegram cultivation was Rs. 15389.22. Thus the benefit cost ratio was found to be 1:2.34. The results indicated that, the total cost of cultivation for cotton was Rs. 28542.16. The gross income realized by the farmers was Rs. 71784.37. The net income from cotton cultivation was Rs. 43242.21. Thus the benefit cost ratio was found to be 1:2.52. The results indicated that, the total cost of cultivation for sunflower was Rs. 34933.39. The gross income realized by the farmers was Rs. 63232. The net income from sunflower cultivation was Rs. 28298.61. Thus the benefit cost ratio was found to be 1:1.81. The results indicated that, the total cost of cultivation for chilly was Rs. 23059.20. The gross income realized by the farmers was Rs. 181133.33. The net income from chilly cultivation was Rs. 158074.14. Thus the benefit cost ratio was found to be 1:7.86. The results indicated that, the total cost of cultivation for sorghum was Rs. 13146.50. The gross income realized by the farmers was Rs. 34382.40. The net income from sorghum cultivation was Rs. 21235.90. Thus the benefit cost ratio was found to be 1:2.62. The results indicated that, the total cost of cultivation for sesamum was Rs. 15380.78. The gross income realized by the farmers was Rs. 21612.50. The net income from sesamum cultivation was Rs. 6231.72. Thus the benefit cost ratio was found to be 1:1.41. The results indicated that, 62.86 per cent of the households opined that dry fodder was adequate and 34.29 per cent of the households opined that green fodder was adequate.

The table indicated that, in landless farmers, the average income from wage was Rs. 26000. In marginal farmers the average income from wage was Rs. 26071.43 and agriculture was Rs. 37600. In small farmers the average income from wage was Rs. 26071.43, agriculture was Rs. 49050 and dairy farm was Rs. 2112.14. In semi medium farmers the average income from wage was Rs. 14,375, agriculture was Rs. 117,562.50 and dairy farm was Rs.625. In medium farmers the average income from wage was Rs. 15000, agriculture was Rs. 71500 and dairy farm was Rs. 750. The results indicated that, in landless farmers, the average expenditure from wage was Rs. 13000, in marginal farmers the average expenditure from wage was Rs.5666.67 and agriculture was Rs.14750. In case of small farmers the average expenditure from wage was Rs. 11111.11, agriculture was Rs. 23285.71 and dairy farm was Rs. 10,000. In case of semi medium farmers the average expenditure from wage was Rs. 5750, agriculture was Rs. 47875 and dairy farm was Rs.1000. In case of medium farmers the average expenditure from wage was Rs. 3,000 and agriculture was Rs. 35,000.

The results indicated that, sampled households have grown 20 coconut and 49 mango trees in their field. The results indicated that, households have planted 50 neem, 6

tarmind, 1 banyan and 1 peeple trees in their field. The results indicate that, households have an average investment capacity of Rs.2257.14 for land development, Rs. 1171.43 in irrigation facility, Rs.1314.29 for improved crop production, Rs.600 for improved livestock management and Rs.142.86 for subsidiary enterprises. The data showed that Marginal households have an average investment capacity of Rs. 2500 for land development, Rs. 1500 for irrigation facility and Rs.1250 for improved crop production. Small farmers have an average investment capacity of Rs. 2357.14 for land development, Rs. 785.71 in irrigation facility, Rs.1642.86 for improved crop production and Rs.357.14 for improved livestock management. Semi medium farmers have an average investment capacity of Rs. 2000 for land development, Rs. 1750 in irrigation facility, Rs.1250 for improved crop production and Rs.750 for improved livestock management. Medium farmers have an average investment capacity of Rs. 5000 for land development, Rs. 2500 for irrigation facility, Rs.2000 for improved crop production, Rs.2500 for improved livestock management and Rs.1250 for subsidiary enterprises.

The results indicated that, for land development, 20 per cent were depending on loan from the bank and 2.86 per cent of the households were depending on soft loan. For irrigation facility 5.71 per cent of the households were dependent on loan from bank and 11.43 per cent were depending on soft loan. Similarly for improved crop production, 5.71 per cent of the households were dependent on loan from the bank, 2.86 per cent were dependent on their own funds and 14.29 per cent of the households were depending on soft loan. For improved livestock management 2.86 per cent were dependent on own funds and 11.43 per cent were dependent on soft loan. For subsidiary enterprises 2.86 per cent of the households were dependent on soft loan.

The results indicated that, chilli, cotton, horsegram, sesamum, sorghum, sunflower and tomato crops were sold to the extent of 100 per cent. Bajra, groundnut, maize and paddy were sold to the extent of 85.71 per cent, 96.27 per cent, 97.23 per cent and 94.33 per cent respectively. The results indicated that, 62.86 percent of the households have sold their produce to local/village merchant, 31.43 percent of the households sold their produce in regulated markets and 14.29 percent of the households sold their produce in cooperative marketing society. The results indicated that 11.43 per cent of the households have used cart as a mode of transport, 57.14 per cent of them have used tractor and 40 per cent have used truck as a mode of transport.

The results indicated that, 42.86 per cent of the households have experienced the soil and water erosion problems i.e. 50 percent of marginal farmers, 42.86 per cent of small farmers, 37.50 per cent of semi medium farmers and 100 percent of medium farmers. The results indicated that, 82.86 per cent of the households have shown interest in soil testing including 100 per cent of marginal farmers, small farmers and medium farmers and 87.50 per cent of the semi medium farmers respectively. The results

indicated that, 100 percent used fire wood as a source of fuel and 2.86 per cent of the households used LPG. The results indicated that, piped supply was the source of drinking water for 82.86 per cent of the households and 17.14 per cents of the households were using bore well for drinking water. The results indicated that, electricity was the major source of light for 100 per cent of the households.

The results indicated that, 31.43 per cent of the households possess sanitary toilet i.e. 20 per cent of landless, 100 per cent of marginal, 21.43 per cent of small, 25 per cent of semi medium and 25 per cent of medium farmers had sanitary toilet facility. The results indicated that, 100 per cent of the sampled households possessed BPL card. The results indicated that, 42.86 per cent of the households participated in NREGA programme which included 60 per cent of the landless, 100 percent of the marginal, 21.43 per cent of the small, 12.50 per cent of the semi medium and 100 percent of the medium farmers.

The results indicated that, cereals, pulses, oilseeds, milk, egg and meat were adequate for 94.29 per cent, 60 per cent, 5.71 per cent, 85.71 per cent, 80 per cent, and 65.71 per cent respectively. Vegetables and fruits were adequate for 48.57 per cent of the households. The results indicated that, cereals, pulses, oilseed, vegetables, fruits, milk, egg and meat were inadequate for 5.71 per cent, 40 per cent, 80 per cent, 42.86 per cent, 40 per cent, 5.71 per cent, 17.14 per cent and 31.43 per cent respectively.

The results indicated that, Lower fertility status of the soil was experienced by 85.71 per cent of the households, wild animal menace on farm field was experienced by 74.29 per cent of the households, frequent incidence of pest and diseases was experienced by 65.71 per cent of the farmers, inadequacy of irrigation water was experienced by 42.86 per cent of the households, high cost of Fertilizers and plant protection chemicals was experienced by 65.71 per cent of the households, high rate of interest on credit was experienced by 60 per cent of the farmers, low price for the agricultural commodities was experienced by 60 per cent of the farmers, lack of marketing facilities in the area was experienced 65.71 per cent of the households, inadequate of extension services experienced by 65.71 per cent of the households, lack of transport for safe transport of the agricultural produce to the market was experienced by 74.29 per cent of the households and less rainfall was experienced by 25.71 per cent of the farmers.