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

KALHALLI (4D4A2M3d) MICRO WATERSHED

Koppal Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

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. Thechallenges 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 Kalhalli microwatershed in Koppal Taluk, and 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
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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Kalhalli 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 569 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 99 per cent is covered by soil and 1 per cent by water bodies and others. The salient findings from the land resource inventory are summarized briefly below

- *The soils belong to 17 soil series and 35 soil phases (management units) and 7 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 28 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 16 per cent of the soils are very shallow (<25 cm), 13 per cent shallow (25-50 cm), 29 per cent moderately shallow (50-75 cm), 23 per cent moderately deep (75-100 cm) and 18 per cent is deep to very deep (100->150cm) soils.*
- *About 38 per cent is loamy (sandy loam and sandy clay loam) and 61 per cent has clayey (sandy clay and clay) soils at the surface.*
- *About 32 per cent of the area has non-gravelly (<15%) soils, 27 per cent has gravelly soils (15-35 %), 35 per cent has very gravelly (35-60 %) soils and 5 per cent has extremely gravelly (60-80%).*
- *With respect to available water capacity 58 per cent of the area has very low (<50mm/m), 27 per cent of the area has low (51-100 mm/m), 7 per cent medium (101-*

150 mm/m) and 8 per cent area has very high (>200mm/m) in available water capacity.

- *Entire area in the microwatershed has very gently sloping (3-5%) lands.*
- *An area of about 40 per cent is slightly eroded (e1) and 59 per cent is moderately eroded (e2) lands.*
- *An area of about 39 per cent is slightly alkaline (pH 7.3 to 7.8), 19 per cent moderately alkaline (pH 7.8 to 8.4), 37 per cent strongly alkaline (pH 8.4 to 9.0) and 4 per cent very strongly alkaline (pH >9.0).*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that soils are non saline.*
- *Organic carbon is medium (0.5-0.75%) in 58 per cent and high (>0.75%) in 41 per cent area of the soils.*
- *Available phosphorus is low (<23 kg/ha) in 41 per cent, medium (23-57 kg/ha) in 40 per cent and high (>57 kg/ha) in 18 per cent of the soils.*
- *Available potassium is medium (145-337 kg/ha) in 51 per cent and high (>337 kg/ha) in 48 per cent of the soils.*
- *Available sulphur is low (<10 ppm) in 45 per cent, medium (10-20 ppm) in 33 per cent and high (>20 ppm) in 21 per cent area of the soils.*
- *Available boron is low (<0.5 ppm) in 11 per cent, medium (0.5-1.0) in 85 per cent and high (>1.0 ppm) in 3 per cent area of the microwatershed.*
- *Available iron is deficient in 96 per cent of the area and sufficient (>4.5 ppm) in 2 per cent of the area.*
- *Available zinc is deficient (<0.6 ppm) in 82 per cent and sufficient (>0.6 ppm) in 16 per cent of the microwatershed.*
- *Available manganese and copper are sufficient in the entire area.*
- *The land suitability for 28 major agricultural and horticultural crops grown in the microwatershed was assessed and the areas that are highly suitable (class S1) and moderately suitable (class 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	*44 (8)*	*241 (43)*		*Pomegranate*	*39(7)*	*170(30)*
Maize	*39(7)*	*246 (43)*		*Guava*	*39(7)*	*128(23)*
Bajra	*110(19)*	*266(47)*		*Jackfruit*	*39(7)*	*128 (23)*
Redgram	*39(7)*	*113 (20)*		*Jamun*	-	*209(37)*
Bengal gram	*5(<1)*	*297(52)*		*Musambi*	*44 (7)*	*165(29)*
Groundnut	*71(13)*	*175 (31)*		*Lime*	*44(7)*	*165 (29)*
Sunflower	*44(8)*	*108 (19)*		*Cashew*	*39(7)*	*128(23)*
Cotton	*5(<1)*	*281(49)*		*Custard apple*	*115(20)*	*281(49)*
Chilli	*39(7)*	*204(36)*		*Amla*	*110(19)*	*286 (50)*
Tomato	*39(7)*	*204(36)*		*Tamarind*	-	*81(14)*
Drumstick	*39(7)*	*133 (24)*		*Marigold*	*39(7)*	*246(43)*
Mulbery	*39(7)*	*153(27)*		*Chrysanthemum*	*39(7)*	*246(43)*
Mango	-	*39(7)*		*Jasmine*	*39(7)*	*204(36)*
Sapota	*39 (7)*	*128(23)*		*Crossandra*	*39(7)*	*204(36)*

- *Apart from the individual crop suitability, a proposed crop plan has been prepared for the 7 identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops.*
- *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 to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation and drainage line 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 Kalhalli 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 Kalhalli micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig2.1). It lies between $15^0$11' and $15^0$12' North latitudes and $75^0$56' and $75^0$59' East longitudes and covers an area of about 569 ha. It comprises parts of, Kallahalli, Alavandi and Byrapura villages. It is about 36 km from Koppal town and is bounded by Alavandi on the south and north, Byrapura on the east, Raghunathahalli and Kallahalli on the western side of the microwatershed.

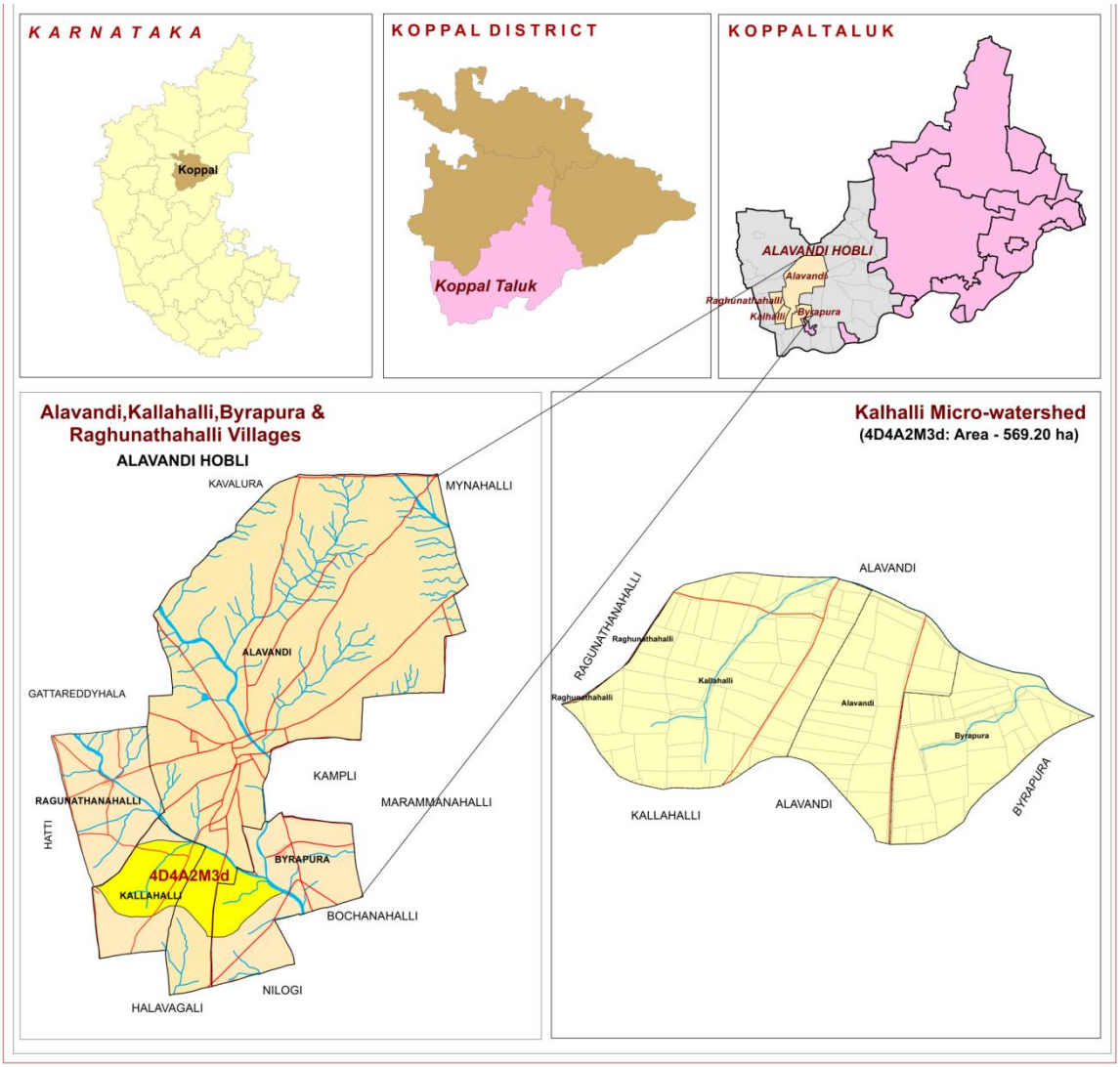


Fig.2.1 Location map of Kalhalli Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Fig.2.2 a 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 Kalhalli 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 paleo 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 mounds/ridges, summits, side slopes and very gently sloping uplands and nearly level

plains based on slope and its relief features. The elevation ranges from 540 to 565 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

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 total annual rainfall of 662 mm (Table 2.1). Of this, a maximum of 424 mm precipitation is received during 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 is received 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 to 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**	

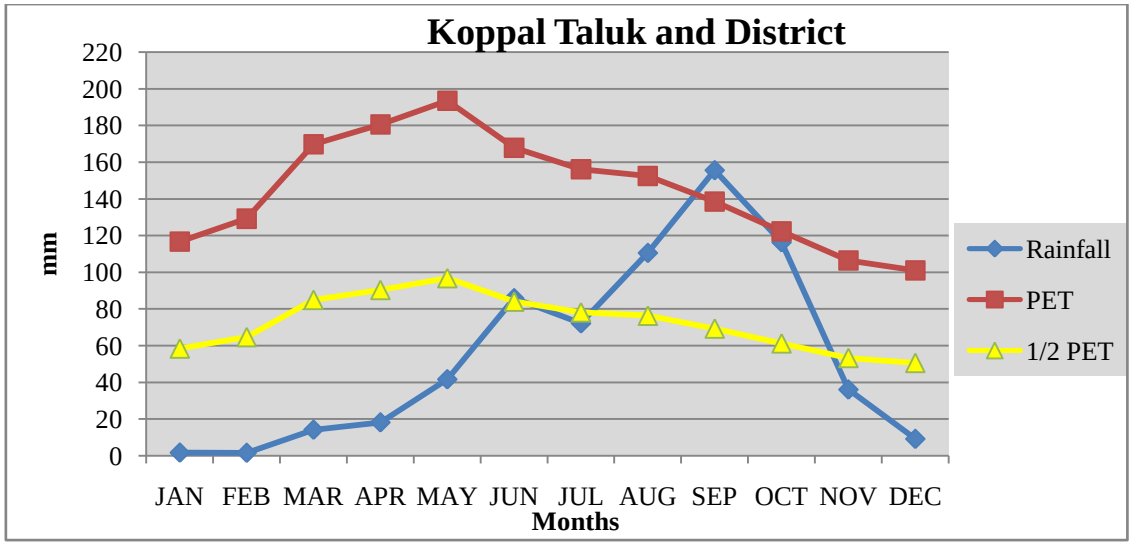


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Kalhalli microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. 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 boulder 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 Kalhalli microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells) and conservation structures is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and conservation structures in Kalhalli microwatershed is given in 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 Kalhalli Microwatershed

Fig.2.5 (b) Different crops and cropping systems in Kalhalli Microwatershed

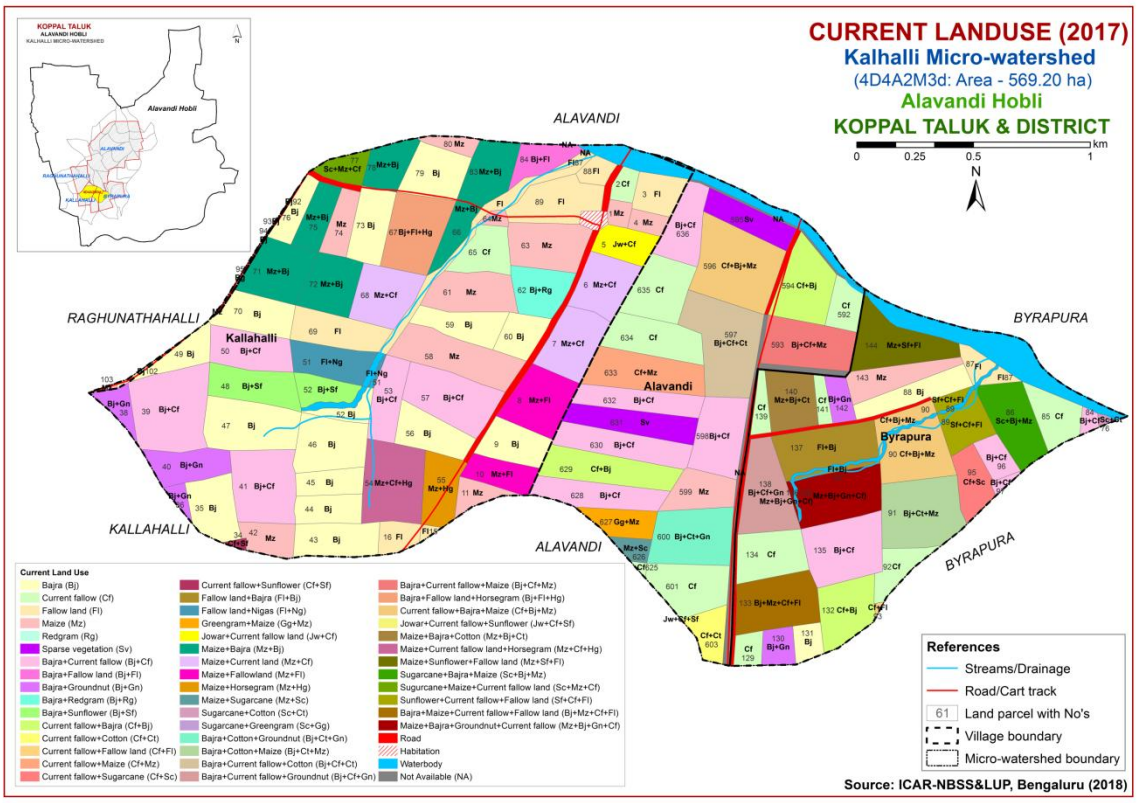


Fig.2.6 Current Land Use – Kalhalli Microwatershed

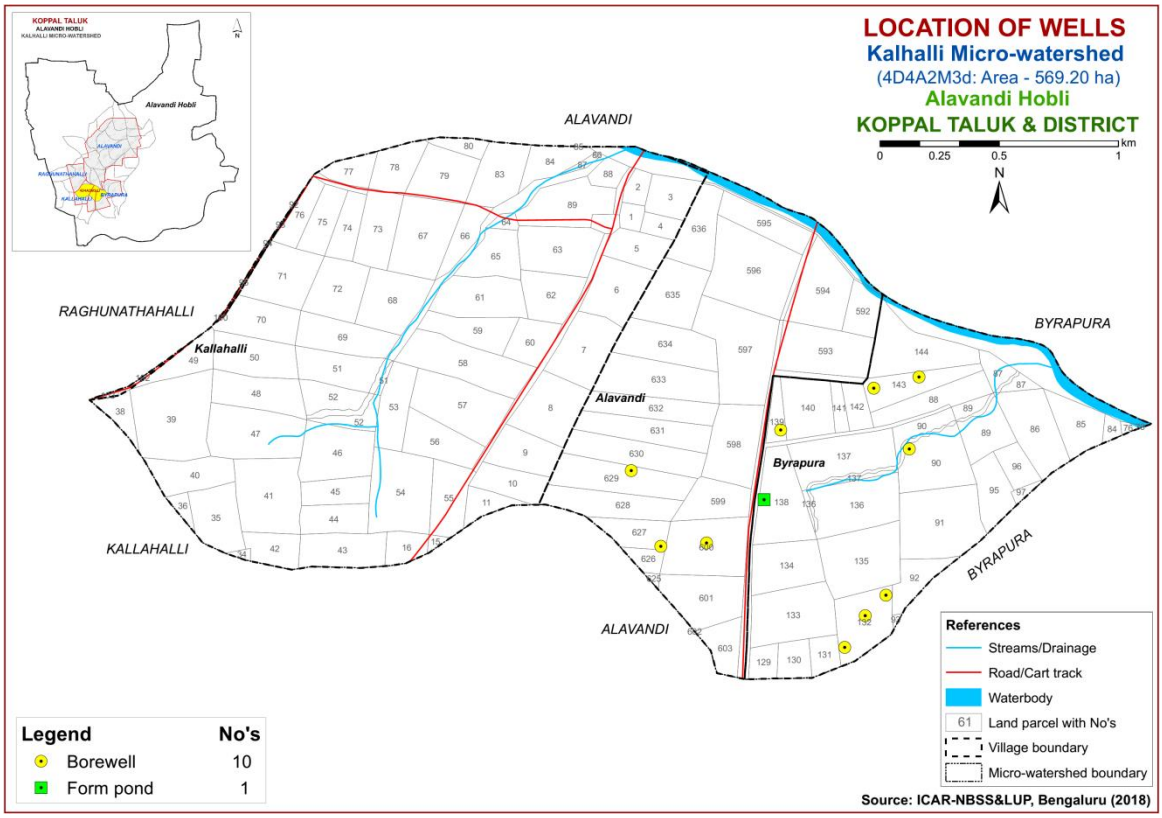


Fig.2.7 Location of wells and conservation structures– Kalhalli Microwatershed

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 Kalhalli 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 569 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

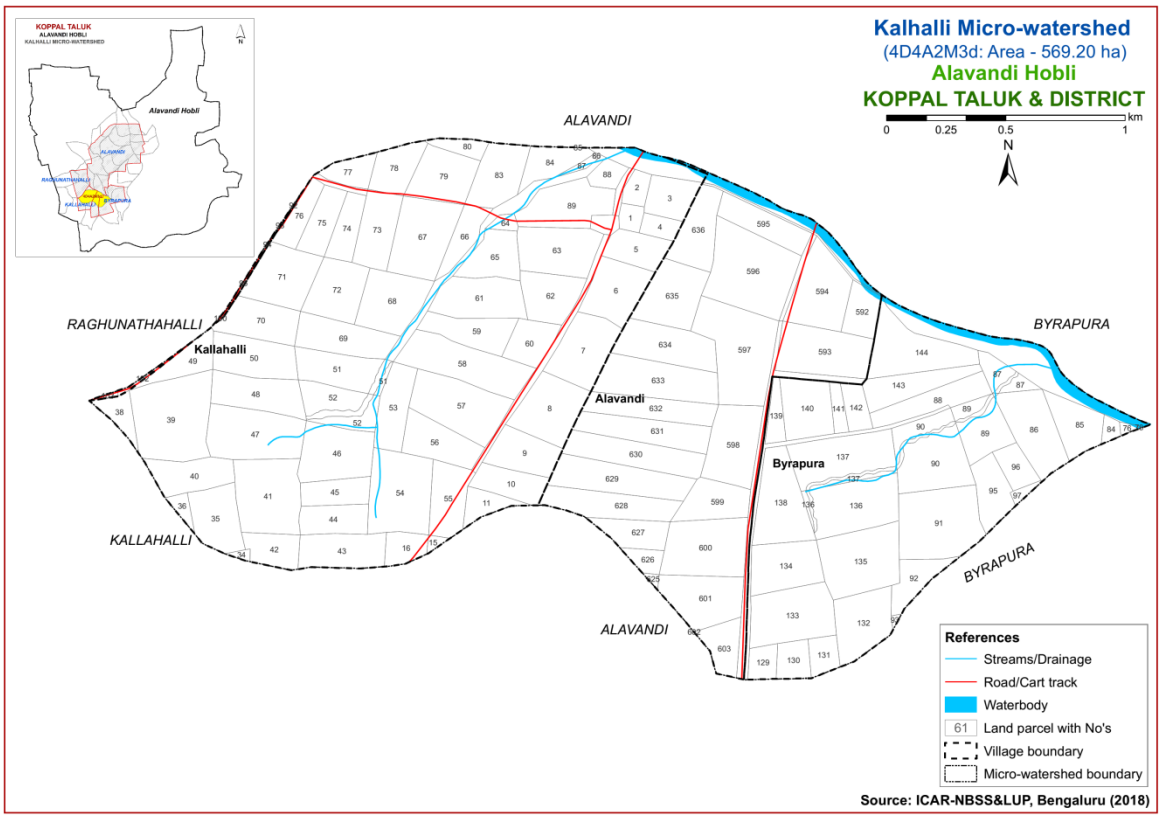


Fig 3.1 Scanned and Digitized Cadastral map of Kalhalli Microwatershed

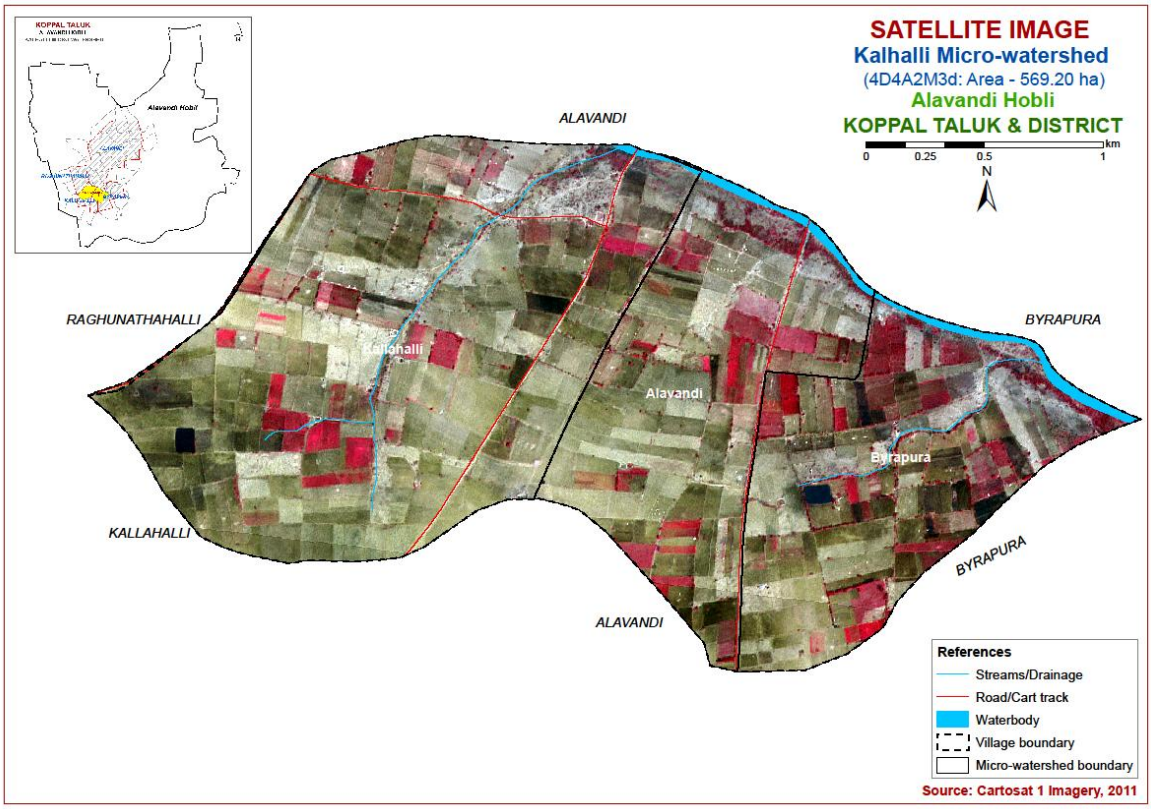


Fig.3.2 Satellite Image of Kalhalli Microwatershed

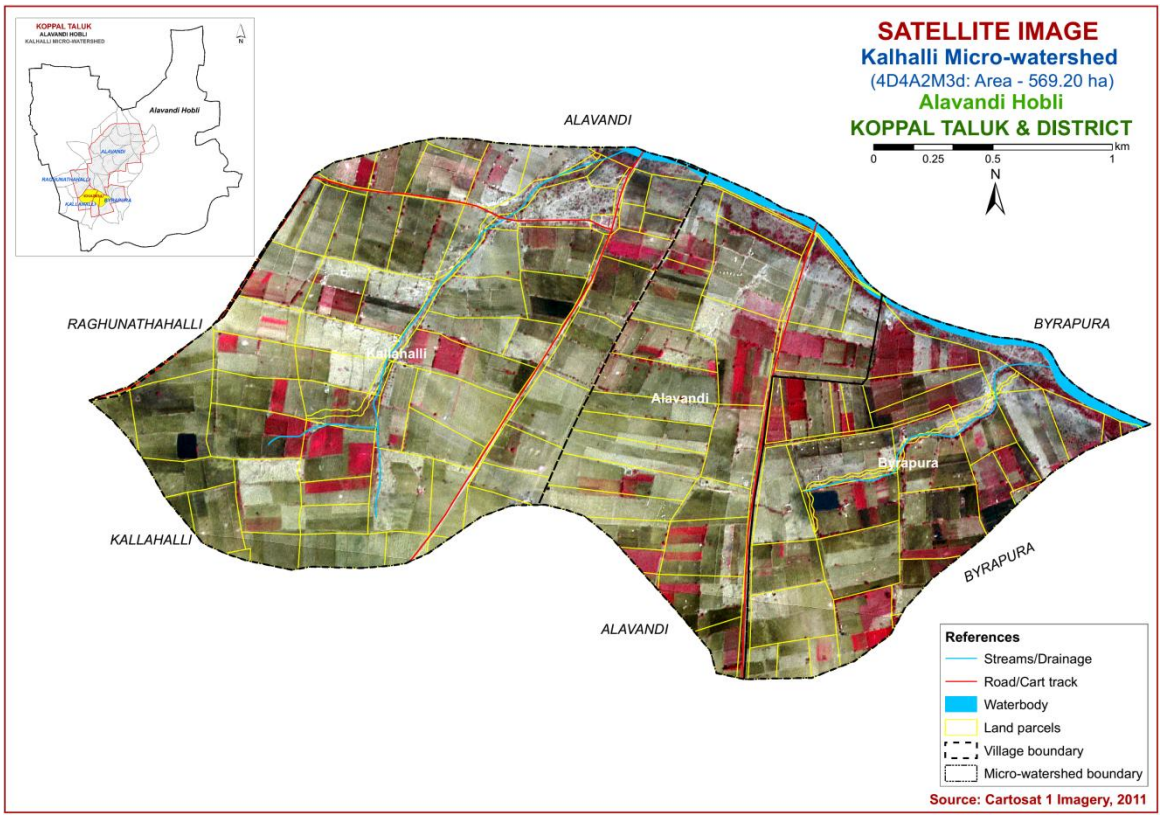


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Kalhalli Microwatershed

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).

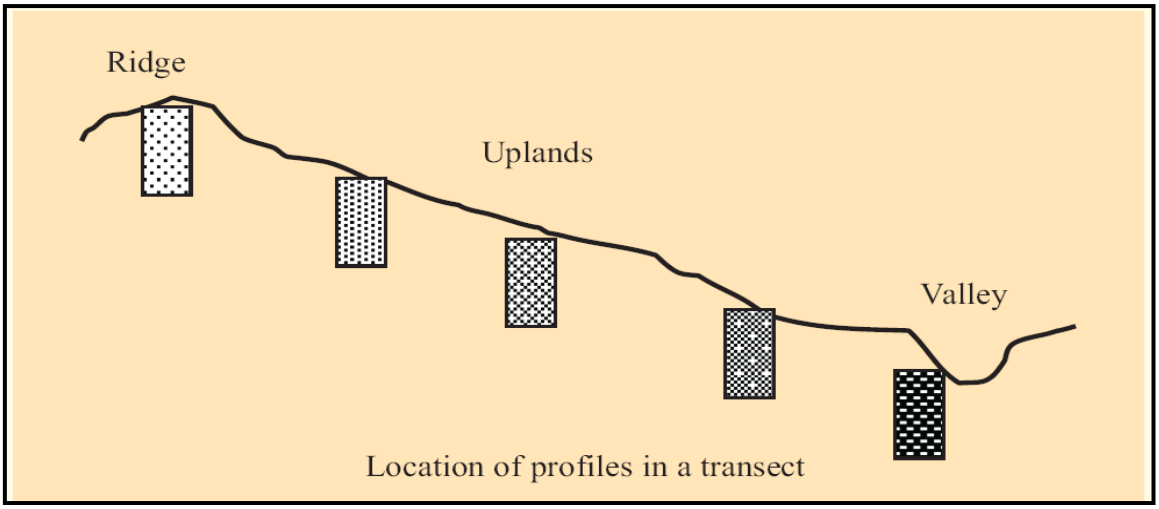


Fig: 3.4. Location of profiles in a transect

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, 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, 17 soil series were identified in Kalhalli 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	**Belagatti (BGT)**	<25	10 YR3/1, 3/2, 4/2	gc	>35	Ap-Crk	es
2	**Devihal (DVH)**	<25	2.5YR2.5/4,3/4 5YR3/4 ,4/6	scl	<15	Ap-Cr	-
3	**Kaggalipura (KGP)**	25-50	2.5YR2.5/4,3/4, 3/6	gsc	15-35	Ap-Bt-Cr	-
4	**Kethanapura**	50-75	2.5YR3/4, 3/6	scl	15-35	Ap-Bt-Cr	-

	(KTP)						
5	**Lakkur (LKR)**	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	-
6	**Mukhadahalli (MKH)**	50-75	5YR3/3,3/4,4/3, 5/4,6/6 2.5YR3/4	gsc	>35	Ap-Bt-Cr	-
7	**Bidanagere (BDG)**	75-100	5YR3/3,3/4,4/3,5/4 2.5YR3/4	gc	35-60	Ap-Bt-Cr	-
8	**Gollarahatti (GHT)**	75-100	2.5YR3/4,3/6, 4/4,4/6	gscl	15-35	Ap-Bt-Cr	-
9	**Hooradhahalli (HDH)**	75-100	2.5YR2.5/4,3/4, 3/6	gsc-gc	>35	Ap-Bt-Cr	-
10	**Balapur (BPR)**	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
11	**Kumchahalli (KMH)**	100-150	2.5YR3/4, 3/6	sc	<15	Bt-Cr	-
12	**Nagalapur (NGP)**	100-150	5YR2.5/2,3/2, 2.5YR3/6,4/6	gsc-gc	>35	Ap-Bt-Cr	-
Soils of Alluvial Landscape							
13	**Muttal (MTL)**	25-50	10YR3/2,3/3,4/2 7.5YR3/2,3/3,6/4	gc	15-35	Ap-Bw-Ck	e-ev
14	**Kyasalapura (KSP)**	50-75	5YR 3/2, 3/3, 3/4	gscl	15-35	Ap-Bt-Ck	e-es
15	**Handrala (HDL)**	100-150	10 YR 2/1, 3/1,4/1,	c	-	Ap-Bss-Ck	es
16	**Murlapur (MLR)**	>150	10YR 2/1, 2/2, 3/1, 3/2, 4/1,	c	10-20	Ap-Bss	e-es
17	**Alawandi (AWD)**	>150	10 YR 2/1, 3/2,	c	<15	Ap-Bss	e-es

3.4 Soil Mapping

The area under each soil series was further separated into 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 map (Fig.3.5) in the form of symbols. During the survey many soil profile pits, few mini pits 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 mini pits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the geographic distribution of 35 mapping units representing 17 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 35 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 soil phase will have similar management needs and have to be treated accordingly.

3.5 Land Management Units

The 35 soil phases identified and mapped in the microwatershed were regrouped into seven 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 chosen for identification and delineation of LMUs. For Kalhalli microwatershed, five soil and site characteristics, namely the 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.

3.5 Laboratory Characterization

Soil samples for each 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 farmer's fields in Kalhalli microwatershed (58 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 Kalhalli Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite gneiss landscape				
	BGT	Belagatti soils are very shallow (<25 cm), well drained, have very dark gray to very dark grayish brown, calcareous gravelly clay black soils occurring on very gently to gently sloping uplands under cultivation		**46(8.07)**
10		BGTmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	18 (3.11)
12		BGTmB2g3	Clay surface, slope 1-3%, moderate erosion, extremely gravelly (60-80%)	28 (4.96)
	DVH	Devihal soils are very shallow (<25 cm), well drained, have dark reddish brown red sandy clay loam soils occurring on very gently sloping uplands under cultivation		**45(8.0)**
1		DVHcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	28 (4.96)
2		DVHhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	17 (3.04)
	KGP	Kaggalipura soils are shallow (25-50 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay		**29(5.18)**

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
		soils occurring on nearly level to moderately sloping uplands under cultivation		
18		KGPhB2g2	Sandy clay loam, slope 1-3%, moderate erosion, very gravelly (35-60%)	20 (3.55)
19		KGPiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	9 (1.63)
	KTP	Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown red sandy clay loam soils occurring on very gently sloping uplands under cultivation		**17 (2.93)**
73		KTPiB1	Sandy clay surface, slope 1-3%, slight erosion	17 (2.93)
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation		**1 (0.13)**
47		LKRhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	1 (0.13)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly red sandy clay soils occurring on very gently to gently sloping uplands under cultivation		**76(13.32)**
78		MKHcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	33 (5.86)
81		MKHhB1	Sandy clay loam surface, slope 1-3%, slight erosion	15 (2.61)
86		MKHhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	18 (3.15)
88		MKHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	10 (1.68)
90		MKHiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	0.10 (0.02)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly clay soils occurring on nearly level to gently sloping uplands under cultivation		**0.07 (0.01)**
185		BDGhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	0.07 (0.01)
	GHT	Gollarahatti soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam soils occurring on nearly level very gently sloping uplands under cultivation		**71(12.57)**
135		GHTcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	23 (4.06)
138		GHTcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	10 (1.78)

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
140		GHThB1	Sandy clay loam surface, slope 1-3%, slight erosion	10 (1.71)
142		GHThB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	3 (0.58)
144		GHTiB1	Sandy clay surface, slope 1-3%, slight erosion	25 (4.44)
	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		**57(9.95)**
121		HDHhB1g2	Sandy clay loam surface, slope 1-3%, slight erosion, very gravelly (35-60%)	25 (4.31)
124		HDHhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	13 (2.31)
125		HDHiB1	Sandy clay surface, slope 1-3%, slight erosion	10 (1.76)
128		HDHiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	9 (1.57)
	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		**20 (3.47)**
239		BPRiB2	Sandy clay surface, slope 1-3%, moderate erosion	20 (3.47)
	KMH	Kumchahalli soils are deep (100-150cm), well drained, have dark reddish brown to dark red sandy clay loam to sandy clay red soils occurring on nearly level to very gently sloping uplands under cultivation		**39 (6.79)**
201		KMHiB2	Sandy clay surface, slope 1-3%, moderate erosion	39 (6.79)
	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		**0.002 (0.0004)**
262		NGPiB1	Sandy clay surface, slope 1-3%, slight erosion	0.002 (0.0004)
Soils of Alluvial Landscape				
	MTL	Muttal soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown, calcareous black gravelly clay soils occurring on nearly level to gently sloping plains under cultivation		**45(7.77)**
303		MTLiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	24 (4.15)
305		MTLiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	7 (1.25)

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
310		MTLmB2	Clay surface, slope 1-3%, moderate erosion	2 (0.33)
311		MTLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	12 (2.04)
	KSP	Kyasalapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown, calcareous red gravelly sandy clay loam to sandy clay soils occurring on very gently sloping plains under cultivation		**74(13)**
322		KSPiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	36 (6.36)
326		KSPiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	38 (6.64)
	HDL	Handrala soils are deep (100-150 cm), moderately well drained, have dark gray to very dark gray, black cracking clay soils occurring on very gently sloping plains under cultivation		**5 (0.93)**
380		HDLmB1	Clay surface, slope 1-3%,slight erosion	5 (0.93)
	MLR	Murlapur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**17 (3.02)**
415		MLRmB1	Clay surface, slope 1-3%, slight erosion	17 (3.02)
	AWD	Alawandi soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to black , calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**20 (3.56)**
424		AWDmB2	Clay surface, slope 1-3%, moderate erosion	20 (3.56)
1000	Others	Waterbody		7 (1.31)

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

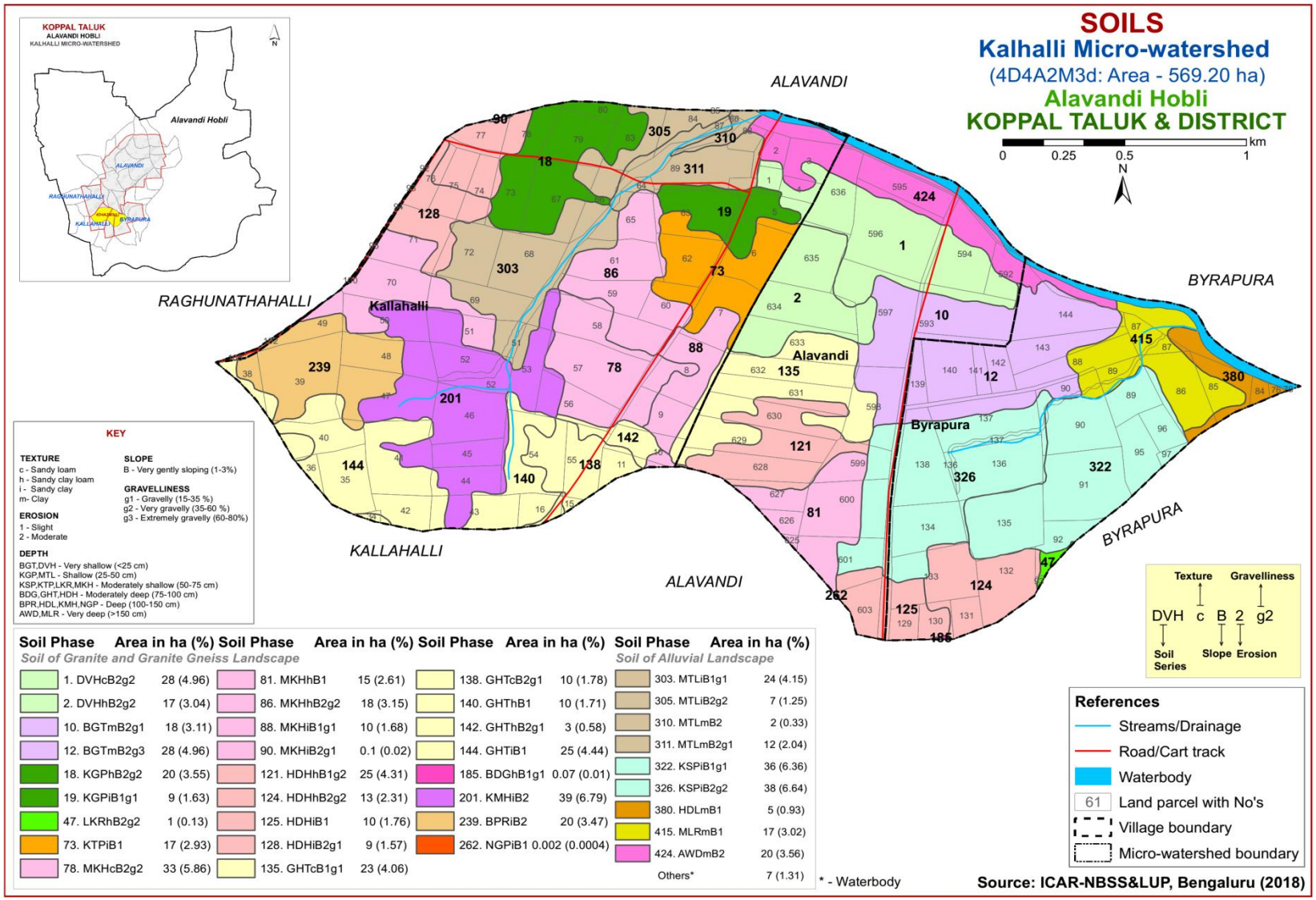


Fig 3.5 Soil Phase or Management Units- Kalhalli Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Kalhalli microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 17 soil series were 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 17 soil series identified followed by 35 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Kalhalli microwatershed are given in Table 4.1 along with soil classification. 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, 12 soil series were identified and mapped. Of these series, Mukhadahalli (MKH) series occupies maximum area of 76 ha (13 %) followed by Gollarahatti (GHT) 71 ha (13 %) and other series occupy small areas. The brief description of the soil series along with the soil phases identified and mapped is given below.

4.1.1 Belagatti (BGT) Series: Belagatti soils are very shallow (< 25 cm), well drained, have dark gray to dark grayish brown calcareous gravelly clay soils. They have developed from granite gneiss and occur on very gently sloping uplands. Belagatti series has been classified as a member of the clayey- skeletal mixed, isohyperthermic family of Lithic Ustorthents.

The thickness of the soil is less than 25 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay with more than 35 per cent gravelly and the available water capacity is very low (<50 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Belagatti (BGT) Series

4.1.2 Devihal (DVH) Series: Devihal soils are very shallow (< 25 cm), well drained, have dark reddish brown to yellowish red sandy clay loam soils. They have developed from granite gneiss and occur on very gently sloping uplands. The Devihal series has been classified as a member of the loamy, mixed, isohyperthermic (paralithic) Ustorthents.

The thickness of the soil ranges from 11 to 25 cm. The thickness of A horizon ranges from 7 to 19 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2.5 to 6 and chroma 3 to 6. The texture varies from clay loam to sandy clay loam. The available water capacity is very low (<50 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Devihal (DVH) Series

4.1.3 Kaggalipura (KGP) Series: Kaggalipurasoils are shallow (25-50 cm), well drained, have brown to dark reddish brown sandy clay soils. They have developed from granite gneiss and occur on very gently sloping uplands. The Kaggalipura series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Paralithic Rhodustalfs.

The thickness of the solum ranges from 30 to 50 cm. The thickness of A-horizon ranges from 10 to 17 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2.5 to 4 and chroma 2 to 6. The texture varies from sandy clay loam to sandy clay with 10 to 25 per cent gravel. The thickness of B horizon ranges from 24 to 50 cm. Its colour is in 2.5 YR hue with value 2.5 and chroma 4. Its texture is sandy clay loam to sandy clay soils with gravel content of 15 to 35 per cent. The available water capacity is low (50-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Kaggalipura (KGP) Series

4.1.4 Kethanapura (KTP) Series: Kethanapura soils are moderately shallow (50-75cm), well drained, have dark reddish brown 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 with 15 to 35 per cent gravel. The available water capacity is low (51-100 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Kethanapura (KTP) Series

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

The thickness of the solum ranges from 51 to 74 cm. The thickness of A horizon ranges from 12 to 18 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 clay loam with 15 to 50 per cent gravel. The thickness of B horizon ranges from 39 to 58 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay with 40 to 60 per cent gravel. The available water capacity is very low (<50 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Lakkur (LKR) Series

4.1.6 Mukhadahalli (MKH) Series: Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly sandy clay 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 very low (<50 mm/m). Five soil phases were identified and mapped.

Landscape and soil profile characteristics of Mukhadahalli (MKH) 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). One soil phase was identified and mapped.

Landscape Soil Profile Characteristics of Bidanagere (BDG) Series

4.1.8 Gollarahatti (GHT) Series: Gollarahatti soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Gollarahatti series has been classified as a member of the fine loamy, mixed, isohyperthermic family of Typic Rhodustalfs.

The thickness of the solum ranges from 78 to 98 cm. The thickness of A-horizon ranges from 12 to 18cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture varies from loamy sand to sandy clay with 15 to 35 per cent gravel. The thickness of B horizon ranges from 66 to 81cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay loam with 15 to 35 per cent gravel. The available water capacity is medium (100-150 mm/m). Five soil phases were identified and mapped.

Landscape and soil profile characteristics of Gollarahatti (GHT) Series

4.1.9 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 (51-100 mm/m). Four soil phases were identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

4.1.10 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. They 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 17cm. 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 low (51-100 mm/m). One soil phase was identified and mapped.

Landscape Soil Profile Characteristics of Balapur (BPR) Series

4.1.11 Kumchahalli (KMH) Series: Kumchahalli soils are deep (100-150cm), well drained, have dark reddish brown to dark red sandy clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands. The Kumchahalli series has been classified as a member of the a fine mixed, isohyperthermic family of Typic Rhodustalfs.

The thickness of the solum ranges from 102 to 150 cm. The thickness of A horizon ranges from 11 to 23 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. The texture is dominantly sandy clay. The thickness of B horizon ranges from 95 to 132 cm. Its colour is in 2.5 YR hue with value 3 and chroma 4 to 6. Its texture is dominantly sandy clay loam to sandy clay. The available water capacity is high (150-200 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Kumchahalli (KMH) Series

4.1.12 Nagalapur (NGP) Series: Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy 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). One soil phase was identified and mapped.

Landscape Soil Profile Characteristics of Nagalapur (NGP) Series

4.2 Soils of Alluvial Landscape

In this landscape, 5 soil series were identified and mapped. Of these series, Kyasalapura (KSP) series occupies maximum area of 74 ha (13%) followed by Muttal (MTL) 45 ha (8%) and other series occupies small areas. The brief description of the soil series along with the soil phases identified and mapped is given below.

4.2.1 Muttal (MTL) Series: Muttal soils are shallow (25-50 cm), well drained, have dark brown to very dark grayish brown, calcareous gravelly clay soils. They have developed from alluvium and occur on nearly level to very gently sloping uplands. The Muttal series has been classified as a member of the clayey, mixed, isohyperthermic (calc) family of (Paralithic) Haplustepts.

The thickness of the solum ranges from 30 to 48 cm. The thickness of A horizon ranges from 15 to 18 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel.

The thickness of B horizon ranges from 18 to 32 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 6 and chroma 2 to 4. Its texture is sandy clay to clay and are calcareous. The available water capacity is low (51-100 mm/m). Four soil phases were identified and mapped.

Landscape and soil profile characteristics of Muttal (MTL) Series

4.2.2 Kyasalapura (KSP) Series: Kyasalapura soils are moderately shallow (50-75cm), well drained, have dark reddish brown gravelly sandy clay loam to sandy clay soils. They are developed from alluvium and occur on very gently sloping uplands under cultivation. The Kyasalapura series has been classified as a member of the fine loamy, isohyperthermic family of Typic Haplustalfs.

The thickness of the solum ranges from 53 to 75 cm. The thickness of A-horizon ranges from 17 to 23 cm. Its colour is in 2.5YR, 5 YR and 7.5 YR hue with value 3 to 5 and chroma 2 to 4. The texture varies from sandy clay loam to sand clay with 15 to 30 per cent gravel. The thickness of B-horizon varies from 33 to 55 cm. Its colour is in 2.5 YR and 5 YR hue with value 3 and chroma 2 to 4. Texture is sandy clay loam to sandy clay with 15 to 35 per cent gravel. The available water capacity is very low (<50mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Kyasalapura (KSP) Series

4.2.3 Handrala (HDL) Series: Handrala soils are deep (100-150 cm), moderately well drained, have black, very dark brown to dark gray cracking clay soils. They are developed from weathered alluvium and occur on very gently to gently sloping uplands. Handrala series has been classified as a member of the very fine, smectitic, isohyperthermic (calc) family of Typic Haplusterts.

The thickness of the solum ranges from 102 to 149 cm. The thickness of A horizon ranges from 14 to 26 cm. Its colour is in 10 YR hue with value 3 and chroma 1. The texture is clay. The thickness of B horizon ranges from 103 to 127 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 2. Texture is dominantly clay. The available water capacity is very high (>200 mm/m).One soil phase was identified and mapped.

Landscape and Soil Profile Characteristics of Handrala (HDL) Series

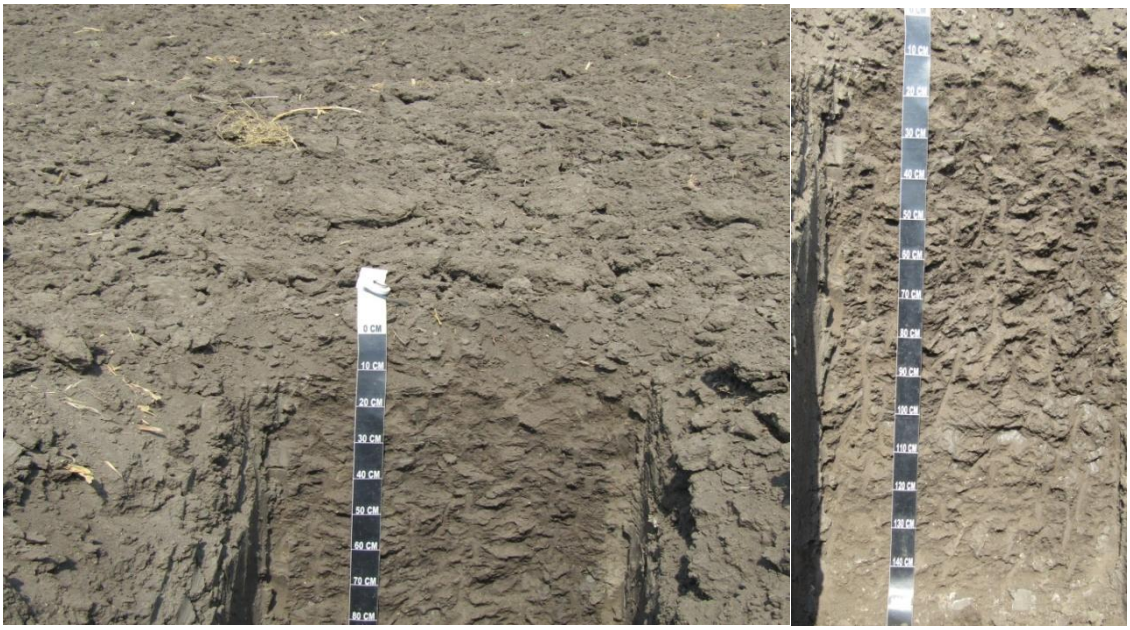
4.2.4 Murlapur (MLR) series: Murlapur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous black cracking clay soils. They have developed from alluvium and occur on nearly level to very gently sloping uplands. The Murlapur series has been classified as a member of the very fine, smectitic, isohyperthermic (calc) family of Typic Haplusterts.

The thickness of the solum is >150 cm. The thickness of A horizon ranges from 20 to 25 cm. Its colour is in 10 YR hue with value 3 and chroma 1.The texture is clay with no gravel. The thickness of B horizon ranges from 150 to 190 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. Its texture is clay. The available water capacity is very high (>200 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Murlapur (MLR) series

4.2.5 Alawandi (AWD) Series: Alawandi soils are very deep (>150 cm), moderately well drained, have black to very dark grayish brown, calcareous cracking clay soils. They have developed from alluvium and occur on nearly level to very gently sloping plains under cultivation Alawandi series has been classified as a member of the fine smectitic, isohyperthermic (calc) family of Typic Haplusterts.

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 10 YR hue with value 2 to 3 and chroma 1 to 2. The texture varies from sandy clay to clay. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is very high (>200 mm/m). One soil phase was identified and mapped.



Landscape and Soil Profile Characteristics of Alawandi (AWD) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Kalhalli microwatershed

Series Name: Belagatti (BGT), **Pedon:** A2/RM-5
Location: $15^0$19'10.8"N, $75^0$57'48.1"E, Kavalura village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Clayey-skeletal, mixed, isohyperthermic Lithic Ustorthents

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
0-23	Ap	36.14	20.34	43.52	10.87	6.93	5.97	8.42	3.94	40	c	29.53	17.97

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}							%	%
0-23	8.4			0.157	0.12	18.24			0.73	0.50		44.84	1.03		1.11

Contd…

Soil Series: Devihal (DVH), **Pedon:** RM-18
Location: $15^0$07'44.5"N, $75^0$36'38.3"E, (4D4A3L2b), Devihal village, Shirahatti taluk, Gadag district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Loamy, mixed, isohyperthermic (paralithic) Ustorthents.

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	A1	57.33	10.82	31.85	5.33	9.03	12.41	18.77	11.79	10	scl	-	-
12-25	A2	52.46	12.78	34.76	6.97	6.76	10.45	15.27	13.01	10	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	6.71	-	-	0.08	0.72	0.00	11.10	2.40	0.27	0.14	13.92	13.91	0.44	100.00	1.01
12-25	7.22	-	-	0.07	0.72	0.00	11.07	2.26	0.22	0.17	13.73	14.59	0.42	94.00	1.17

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…

Soil Series: Lakkur (LKR), **Pedon:** RM-8.
Location: $15^0$04'26.3"N, $75^0$37'84.1"E, (4D4A3I1f), Belhatti village, Shirahatti taluk, Gadag distrtict
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
0-21	Ap	74.00	8.34	17.66	9.62	11.57	15.76	23.13	13.92	20	sl	-	-
21-35	Bt	54.37	10.48	35.14	16.33	8.64	9.69	11.59	8.11	40	sc	-	-
35-56	Bc	48.37	13.46	38.17	10.96	7.69	9.17	11.28	9.27	60	sc	-	-

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}							%	%
0-21	8.18	-	-	0.30	0.56	0.94	-	-	0.31	0.55	0.86	12.19	0.69	100.00	4.51
21-35	8.17	-	-	0.30	0.52	1.29	-	-	0.19	0.84	1.03	22.18	0.63	100.00	3.79
35-56	7.95	-	-	0.46	0.48	1.99	-	-	0.24	0.58	0.82	22.94	0.60	100.00	2.53

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…

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…

Soil Series: Gollarahatti (GHT), **Pedon:** RM-2
Location: $50^0$04'88.8"N, $75^0$37'65.2"E, (4D4A3I1f), Belhatti village, Shirahatti taluk, Gadag district.
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine loamy, 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
0-26	Ap	83.22	5.74	11.05	9.71	11.73	16.68	27.10	16.58	30	ls	-	-
26-63	Bt1	55.91	13.36	30.73	13.05	9.66	11.10	14.29	7.81	20	scl	-	-
63-84	Bt2	57.17	11.38	31.45	10.53	10.11	12.28	13.83	10.42	20	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}							%	%
0-26	5.70	-	-	0.06	0.20	0.00	1.50	0.60	0.09	0.13	2.32	3.17	0.29	73.00	4.10
26-63	6.26	-	-	0.04	0.24	0.00	7.35	1.55	0.09	0.17	9.15	9.89	0.32	93.00	1.72
63-84	6.50	-	-	0.05	0.20	0.47	-	-	0.09	0.21	0.30	10.18	0.32	100.00	2.06

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…

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…

S**eries Name:** Kumchahalli (KMH), **Pedon:** RM-9
Location: $15^0$20'05"N, $76^0$13'21"E, Basapura village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Fine 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
0-13	Ap	51.76	9.05	39.19	7.99	8.84	13.42	14.38	7.14	-	sc	20.08	13.69
13-27	A21	53.50	8.12	38.38	7.00	11.05	15.21	14.33	5.91	-	sc	17.05	12.32
27-43	A22	63.60	5.01	31.40	3.85	11.56	24.52	18.52	5.14	-	scl	11.76	9.09
43-64	Bt1	48.74	5.91	45.35	8.87	9.31	12.49	12.27	5.81	10	sc	16.68	13.35
64-84	Bt2	45.13	8.90	45.97	9.86	7.12	10.95	10.62	6.57	20	sc	17.45	13.42
84-114	BC	65.04	6.94	28.02	10.49	16.21	17.80	13.88	6.67	40	scl	13.20	9.75

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}							%	%
0-13	7.2	-	-	0.193	0.81	3.00	9.69	3.93	1.41	0.08	15.10	15.07	0.38	100	0.54
13-27	7.13	-	-	0.161	0.7	3.00	8.69	3.57	1.29	0.16	13.70	13.75	0.36	100	1.14
27-43	7.31	-	-	0.096	0.89	2.64	5.19	2.36	1.07	0.24	8.86	9.46	0.30	94	2.51
43-64	7.65	-	-	0.089	1.16	2.52	8.25	2.88	0.72	0.35	12.20	12.65	0.28	96	2.79
64-84	7.98	-	-	0.1	0.38	3.12	10.49	2.88	0.26	0.41	14.04	14.63	0.32	96	2.78
84-114	8.23	-	-	0.121	0.58	2.88	8.02	1.87	0.09	0.43	10.41	10.67	0.38	98	4.02

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

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Series Name: Muttal (MTL), **Pedon:** RM-13
Location: $15^0$14'30.8"N, $75^0$56'50.6"E, Gatareddihalla village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Clayey, mixed, isohyperthermic (calc) (Paralithic) 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
0-20	Ap	39.05	13.74	47.21	3.05	5.05	8.21	14.63	8.11	15-30	c	29.95	17.94
20-34	Bwk	28.77	19.57	51.66	4.81	4.71	4.92	9.09	5.24	10	c	33.44	21.56

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	8.27	-	-	0.202	0.79	6.10	-	-	0.62	0.25	-	36.64	0.78	-	0.69
20-34	8.36	-	-	0.177	0.99	23.04	-	-	0.29	0.38	-	39.60	0.77	-	0.96

Contd…

Series Name: Handrala (HDL), **Pedon:** A2/RM-1
Location: $15^0$19'69.8"N, $75^0$58'00"E, Kavalura village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Very fine, smectitic, isohyperthermic (calc) 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
0-25	Ap	21.68	16.62	61.70	4.42	3.98	3.43	5.64	4.20	10	c	41.36	31.27
25-50	Bss1	14.93	15.76	69.32	2.64	2.53	2.99	3.33	3.44	05	c	48.92	39.19
50-82	Bss2	23.11	16.60	60.29	4.51	3.61	6.31	4.74	3.95	05	c	42.46	33.85
82-117	Bss3	10.50	18.38	71.12	1.98	1.98	1.63	2.57	2.33	05	c	52.95	42.82

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}							%	%
0-25	9.06	-	-	0.371	0.16	4.80	-	-	0.80	7.93	-	62.33	1.01	-	5.09
25-50	9.09	-	-	0.719	0.2	7.20	-	-	0.42	14.94	-	67.10	0.97	-	8.90
50-82	9.28	-	-	0.47	0.19	9.36	-	-	0.47	11.59	-	60.21	1.00	-	7.70
82-117	8.76	-	-	1.55	0.36	8.64	-	-	0.11	2.28	-	25.33	0.36	-	3.61

Contd…

Series Name: Murlapur (MLR), **Pedon:** R-A1/16

Location: $15^0$19'42.9"N, $75^0$55'84.7"E, Kavalura village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, isohyperthermic (calc) 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
0-30	Ap	27.97	13.96	58.07	4.22	4.77	6.66	8.10	4.22	10	c	36.24	25.90
30-53	BA	26.34	17.48	56.17	4.17	5.05	6.04	7.24	3.84	05	c	38.55	28.98
53-83	Bss1	19.35	19.55	61.10	3.13	3.91	4.03	5.48	2.80	05	c	44.48	33.69
83-105	Bss2	16.63	17.47	65.90	2.70	3.93	2.92	3.93	3.15	<5	c	50.55	38.11
105-160	Bss3	14.69	20.34	64.97	0.79	2.26	4.07	4.18	3.39	<5	c	51.54	40.19

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}							%	%
0-30	9.19	-	-	0.313	0.57	10.08	-	-	0.64	5.67	-	42.08	0.72	-	5.39
30-53	9.22	-	-	0.449	0.24	13.08	-	-	0.35	8.23	-	41.02	0.73	-	8.02
53-83	9.17	-	-	0.377	0.82	16.92	-	-	0.39	14.28	-	51.20	0.84	-	11.16
83-105	9.18	-	-	0.477	0.61	15.48	-	-	0.35	13.19	-	53.11	0.81	-	9.94
105-160	9.01	-	-	1.17	0.24	16.92	-	-	0.43	19.61	-	53.95	0.83	-	14.54

Contd…

Series Name: Alawandi (AWD) **Pedon:** R-16

Location: : $15^0$13'08.2"N, $76^0$15'27.3" E Neeralagi village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine smectitic, isohyperthermic (calc) 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
0-17	Ap	20.88	25.75	53.37	3.31	4.31	4.31	5.19	3.76	-	c	33.11	25.58
17-39	Bss1	25.99	19.79	54.22	5.04	5.48	5.04	5.92	4.50	-	c	33.11	26.23
39-70	Bss2	26.76	17.80	55.44	2.93	5.31	5.53	7.37	5.63	-	c	36.15	28.67
70-111	Bss3	23.83	20.25	55.93	4.15	4.81	4.92	6.01	3.93	-	c	43.60	33.71
111-139	Bss4	21.21	20.40	58.40	2.79	4.80	4.91	5.25	3.46	-	c	46.92	36.28
139-162	Bss5	13.15	20.96	65.90	1.69	2.47	2.36	3.37	3.26	-	c	54.96	41.81

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}							%	%
0-17	8.10	-	-	0.37	0.52	9.48	-	-	0.40	1.56	-	51.30	0.96	100.00	1.22
17-39	8.60	-	-	0.24	0.52	9.60	-	-	0.14	4.60	-	52.60	0.97	100.00	3.50
39-70	8.89	-	-	0.27	0.52	9.48	-	-	0.16	2.41	-	53.90	0.97	100.00	1.78
70-111	9.10	-	-	0.35	0.54	11.28	-	-	0.15	8.95	-	54.10	0.97	100.00	6.61
111-139	9.15	-	-	0.41	0.58	10.80	-	-	0.15	7.36	-	56.10	0.96	100.00	5.24
139-162	9.16	-	-	0.50	0.50	15.48	-	-	0.19	10.19	-	61.66	0.94	100.00	6.61

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 recognized 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 35 soil map units identified in the Kalhalli microwatershed are grouped under three land capability classes and seven land capability subclasses (Fig. 5.1).

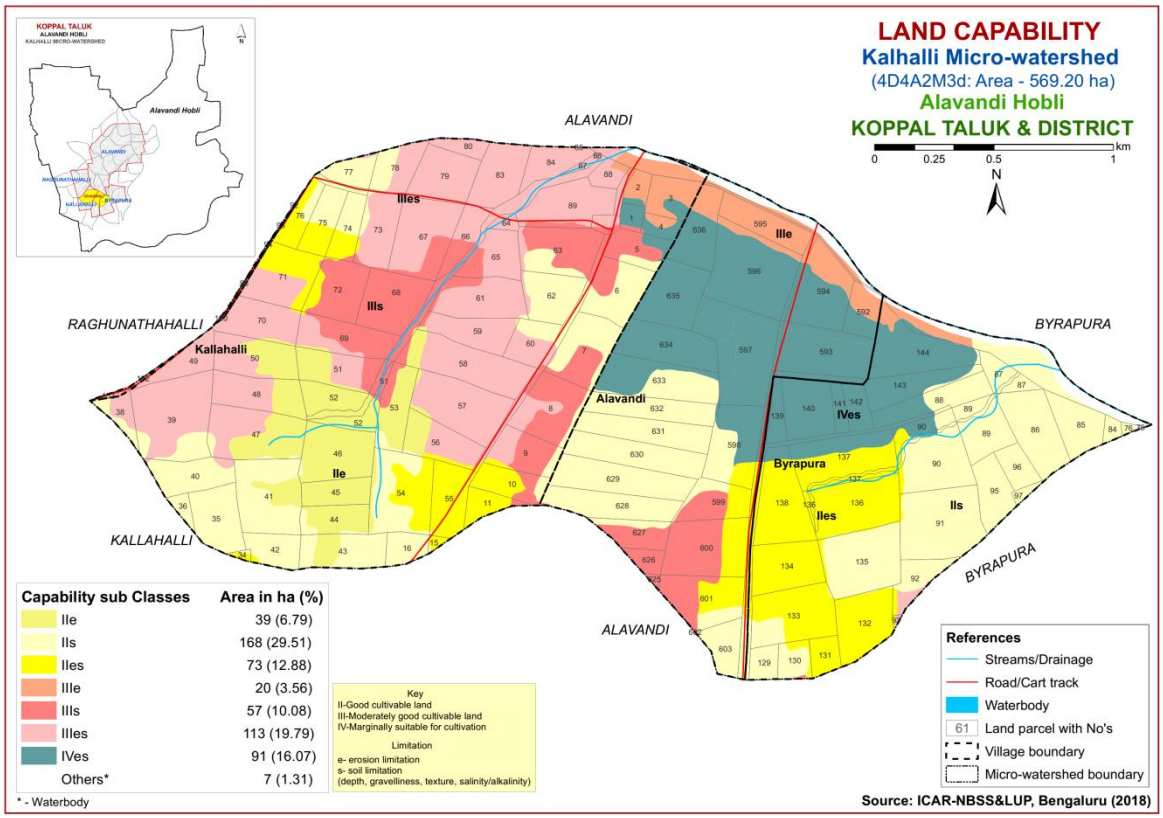

Fig. 5.1 Land Capability map of Kalhalli Microwatershed

Entire area in the microwatershed is suitable for agriculture. Good lands (Class II) cover an area of about 280 ha (49%) and distributed in the major part of the microwatershed with minor problems of soil and erosion. Moderately good lands (Class III) occupy an area of about 190 ha (33%) and distributed in the northern, central and western part of the microwatershed with severe limitations of soil and erosion. Fairly good lands cover an area of about 91 ha (16 %) and distributed in the northern and central part of the microwatershed with very severe limitations of soil and erosion. An area of about 7 ha (1%) is covered by habitation and water body.

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). The area extent and their geographical distribution in the microwatershed is given in Fig. 5.2.

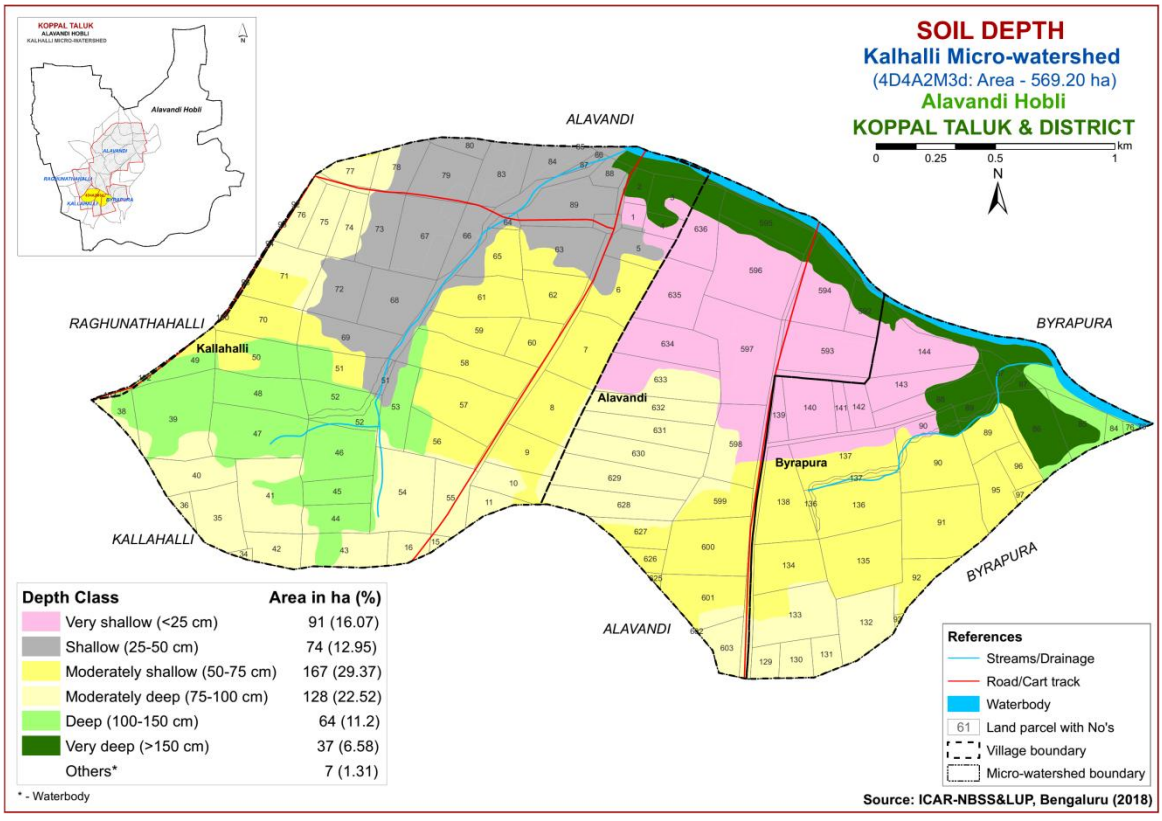

Fig. 5.2 Soil Depth map of Kalhalli Microwatershed

Very shallow (<25 cm) soils cover an area of about 91 ha (16%) and distributed in the northern part of the microwatershed. An area of about 74 ha (13%) is shallow (25-50 cm) and distributed in the northern part of the microwatershed. Moderately shallow (50-75 cm) occupy an area of about 167 ha (29 %) and distributed in the eastern, central and western part of the microwatershed. Moderately deep soils (75-100 cm) cover an area of about 128 ha (23%) and distributed in the southern part of the microwatershed. Deep to very deep (100- >150 cm) soils occupy a maximum area of about 101 ha (18%) and distributed in the western, northern and northeastern part of the microwatershed.

The most productive lands cover about 101 ha (18%) where all climatically adopted long duration crops be grown. The problem lands cover about 165 ha (18%) where only short duration crops can be grown. The probability of crop failure is very high.

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 behavior, microbial activity and crop suitability. The textural classes used for LRI were used to classify and a surface soil texture map was generated. The area extent and their geographical distribution in the microwatershed is shown in Fig 5.3.

An area of about 217 ha (38 %) is loamy (sandy loam and sandy clay loam) at the surface and distributed in the southern, central and northern part of the microwatershed. Clayey (sandy clay and clay soils) cover a maximum area of about 345 ha (61%) and are distributed in the major part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils that (61%) 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 productive lands are loamy (38%) soils which also have high potential for soil- water retention and nutrient availability but have no drainage or other physical problems.

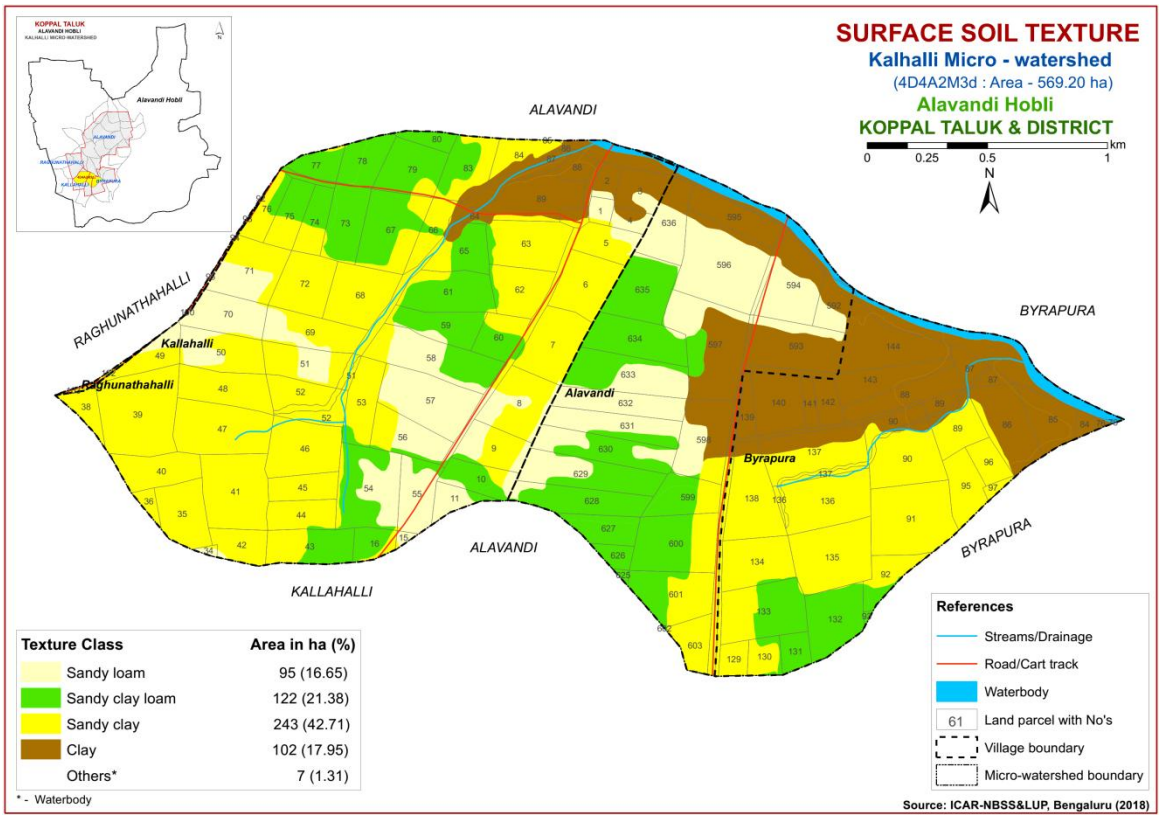

Fig. 5.3 Surface Soil Texture map of Kalhalli Microwatershed

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 geographic distribution in the microwatershed is shown in Fig. 5.4.

The soils that are non-gravelly (<15% gravel) cover an area of about 180 ha (32 %) and distributed in the western, northern and southern part of the microwatershed. An area of about 154 ha (27 %) is covered by gravelly (15-35% gravel) soils and are distributed in the central, eastern and western part of the microwatershed. Very gravelly (35-60%) soils cover an area of about 200 ha (35%) and distributed in the major part of the microwatershed (Fig. 5.4). Extremely gravelly (60-80%) soils cover about 28 ha (5%) and distributed in the northeastern part of the microwatershed.

The most productive lands with respect to gravelliness are found to be 32 per cent. 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 very gravelly to extremely gravelly (35-80%) cover about 40 per cent where only short duration crops can be grown.

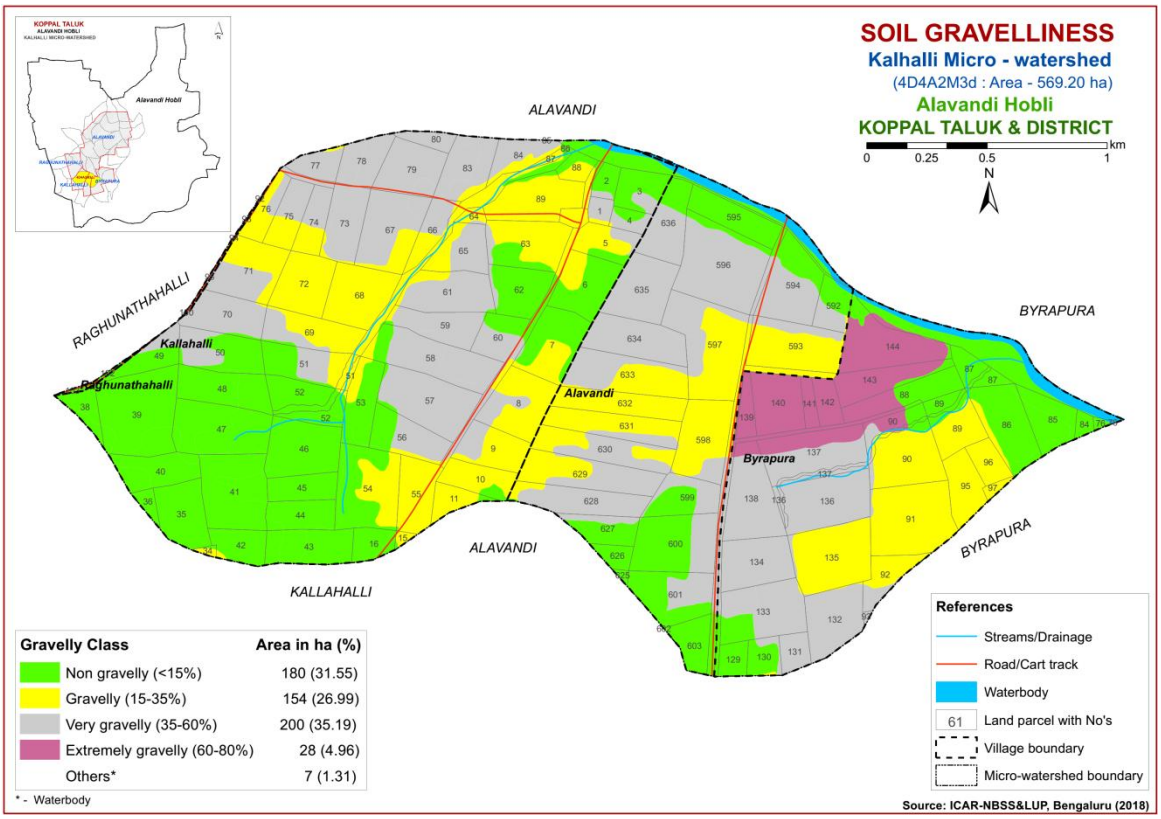

Fig. 5.4 Soil Gravelliness map of Kalhalli Microwatershed

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. The area extent and their geographic distribution of different AWC classes in the microwatershed is shown in Fig. 5.5.

Maximum area of about 328 ha (58 %) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the major part of the microwatershed. An area of about 152 ha (27 %) has soils that are low (51 to 100 mm/m) in available water capacity and are distributed in the western, central and southern part of the microwatershed. An area of about 39 ha (7 %) has soils that are medium (101-150 mm/m) in available water capacity and are distributed in the western part of the microwatershed. An area of about 43 ha (8 %) is very high (151- >200 mm/min) in available water capacity and distributed in the northern part of the microwatershed.

An area of about 328 ha (58%) 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. An area of about 43 ha (8 %) has soils that have high potential (>200 mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

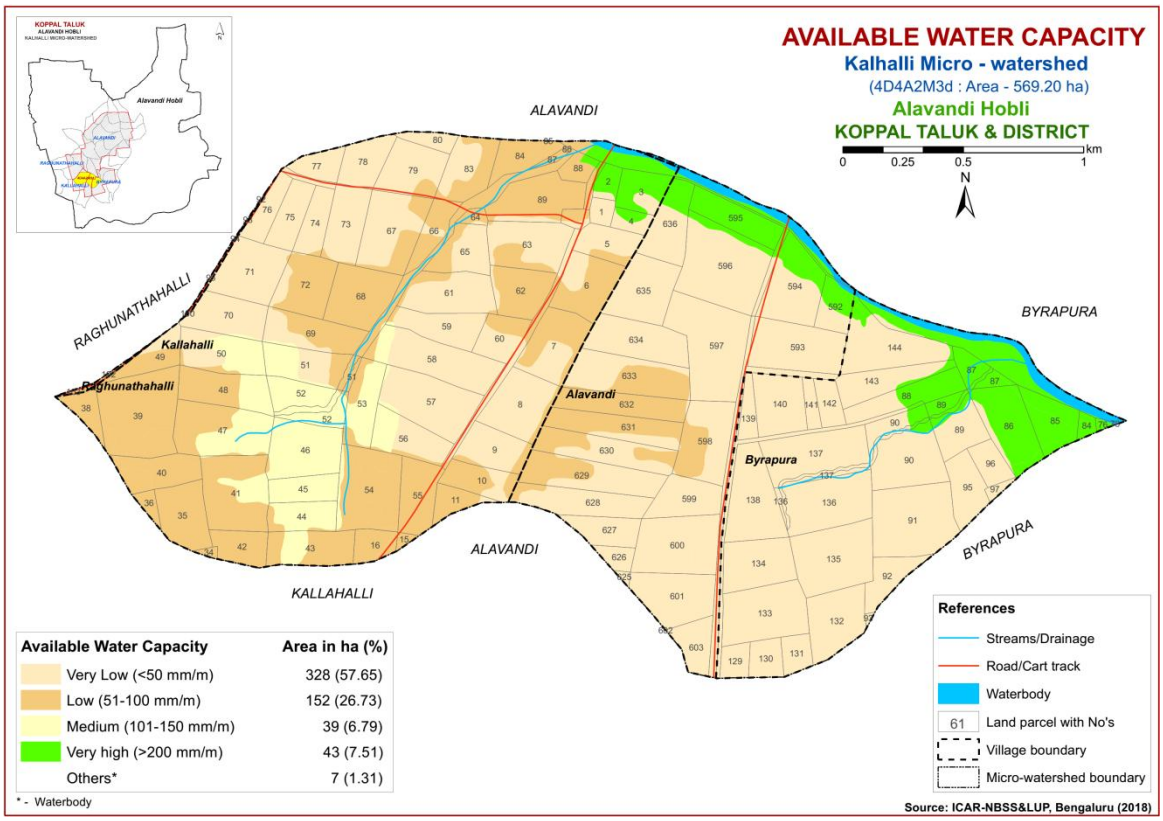

Fig. 5.5 Soil Available Water Capacity map of Kalhalli Microwatershed

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 three 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).

Entire area in the microwatershed is very gently sloping (1-3%) lands. In all these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

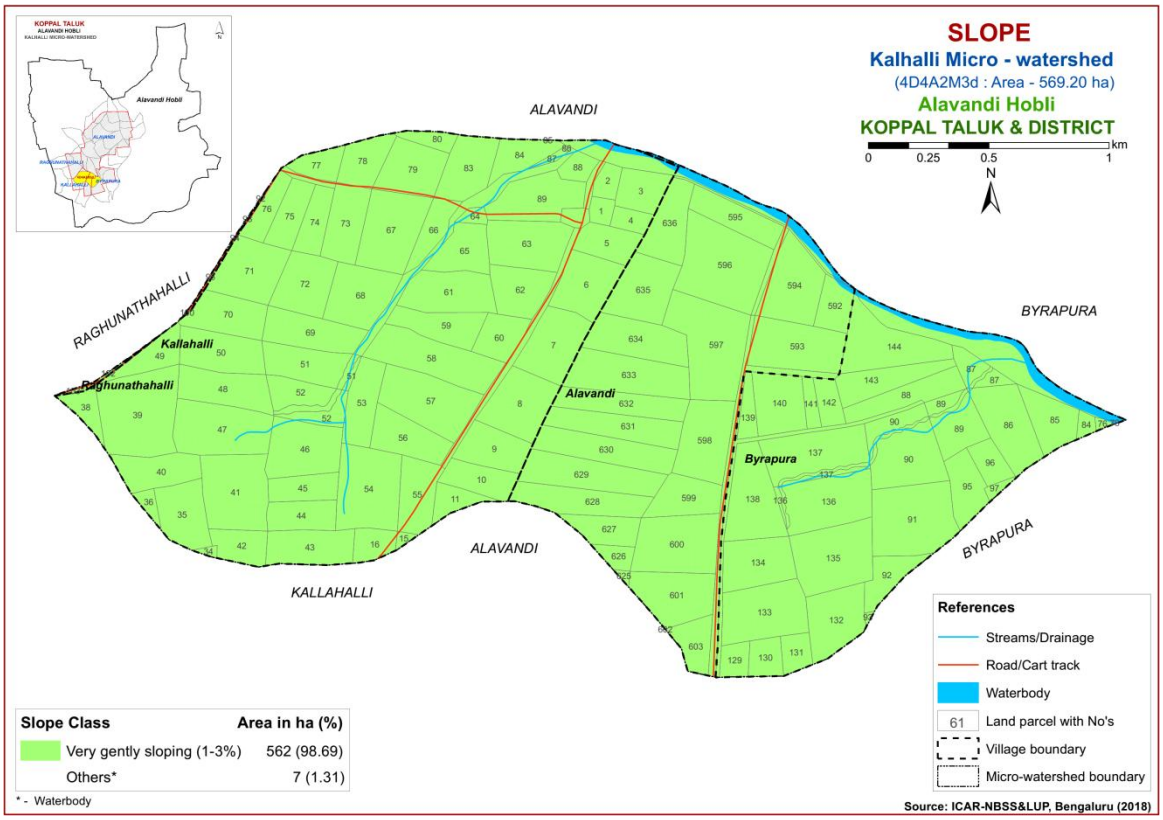

Fig. 5.6 Soil Slope map of Kalhalli Microwatershed

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.

Slightly eroded lands cover an area of about 225 ha (40 %) and distributed in the southern, central and eastern part of the microwatershed. Maximum area of about 336 ha (59%) is moderately eroded (e2 class) and distributed in the major part of the microwatershed. Moderately eroded lands are problematic and need appropriate soil and water conservation and other land development measures.

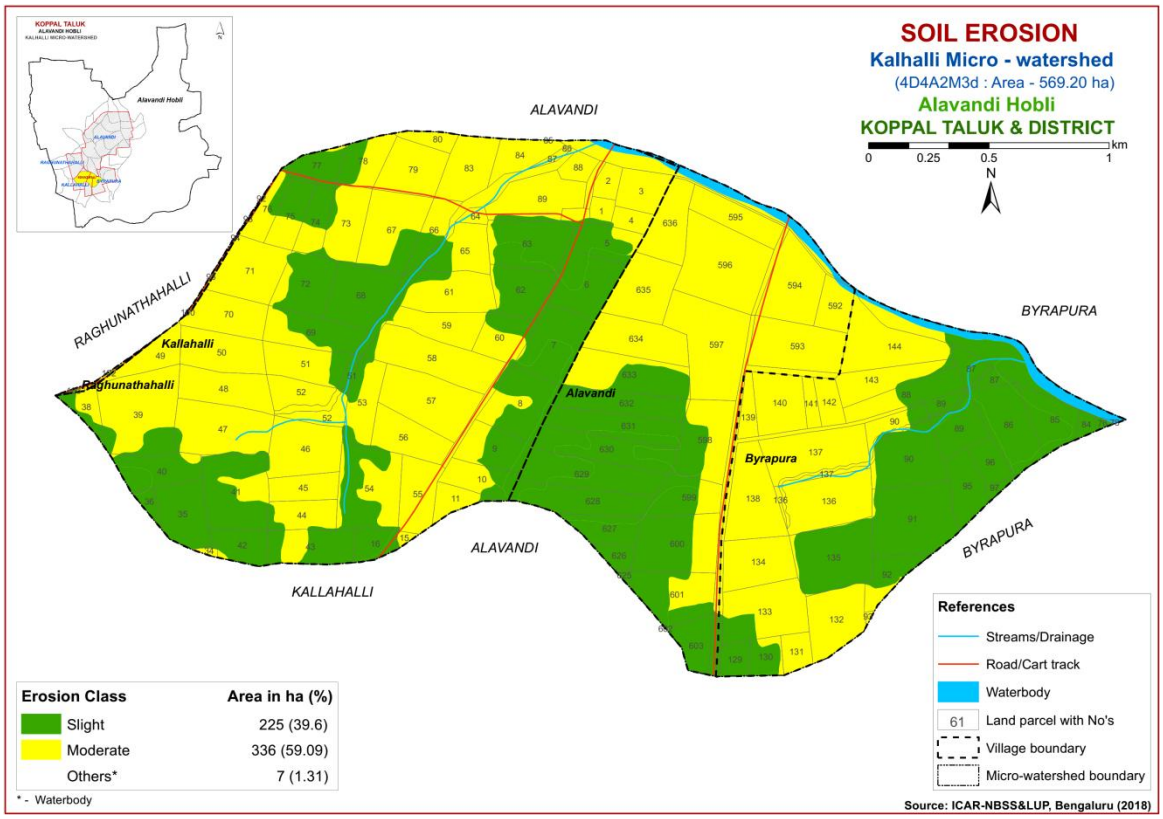

Fig. 5.7 Soil Erosion map of Kalhalli Microwatershed

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 characterized 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 analyzed 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 Kalhalli microwatershed for soil reaction (pH) showed that an area of about 222 ha (39%) is slightly alkaline (pH 7.3-7.8) and distributed in the western and southern part of the microwatershed. Moderately alkaline (pH 7.8-8.4) soils cover about 106 ha (19%) and are distributed in the central, eastern and western part of the microwatershed (Fig.6.1). Strongly alkaline to very strongly alkaline (pH 8.4->9.0) soils cover about 234 ha (41%) and distributed in the major part of the microwatershed. Entire part of the microwatershed is alkaline in reaction.

6.2 Electrical Conductivity (EC)

The Electrical Conductivity of the soils of the entire microwatershed area is <2 dSm^{-1} (Fig 6.2) and as such the soils are non-saline.

6.3 Organic Carbon

An area of about 329 ha (58 %) is medium (0.5-0.75%) in organic carbon content and distributed in the major part of the microwatershed. An area of about 233 ha (41%) is high (>0.75%) in OC and distributed in the northern, eastern and western part of the microwatershed (Fig.6.3).

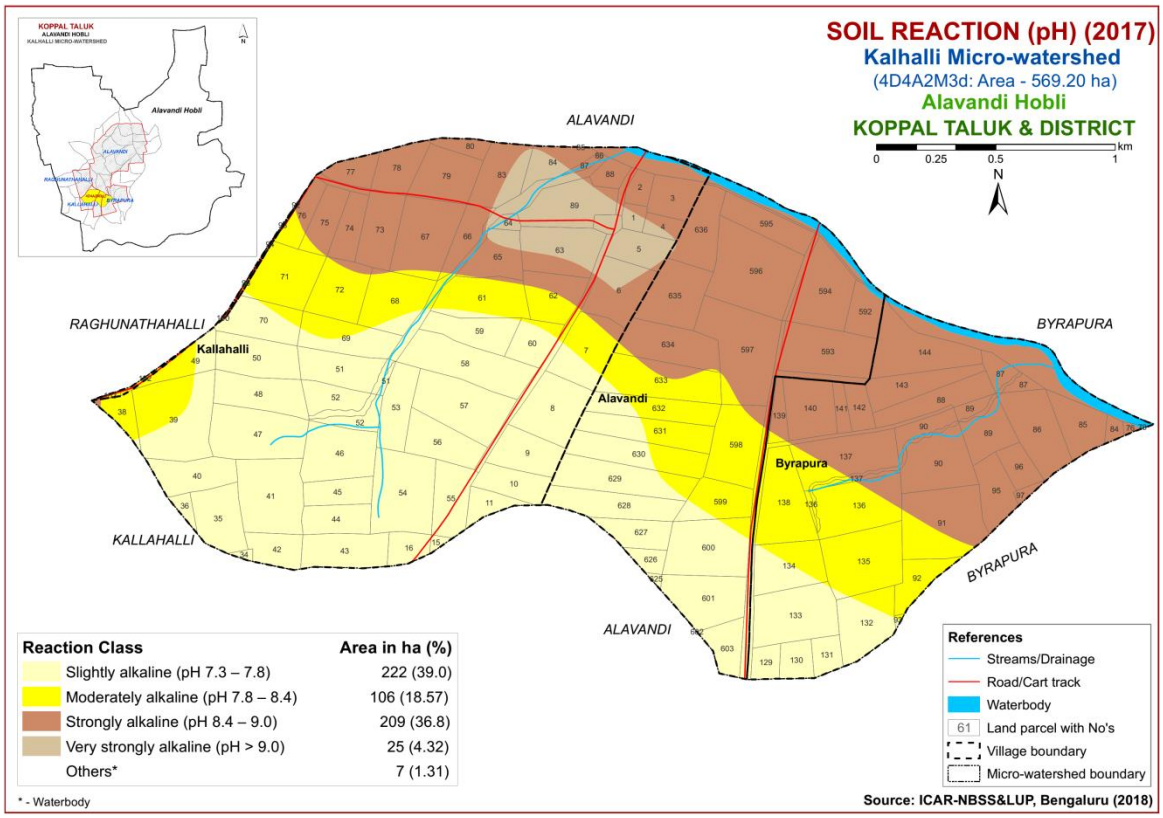

Fig.6.1 Soil Reaction (pH) map of Kalhalli Microwatershed

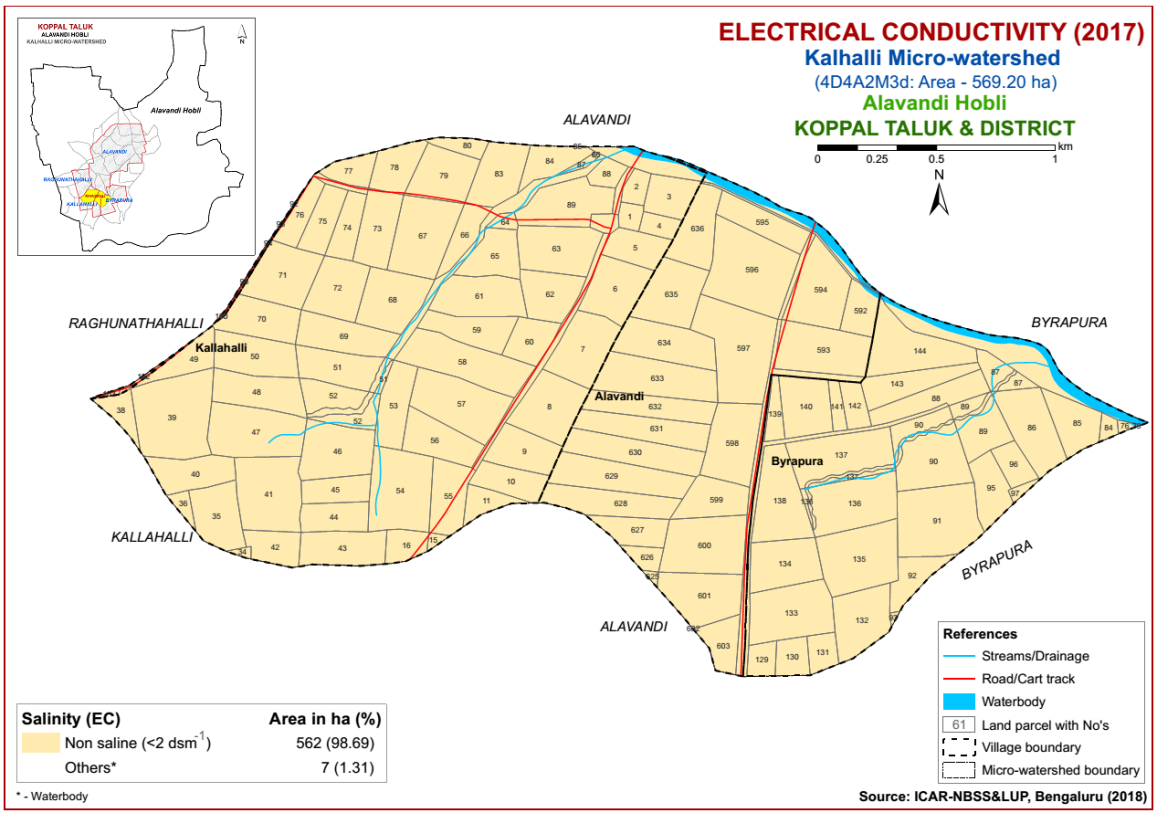

Fig.6.2 Electrical Conductivity (EC) map of Kalhalli Microwatershed

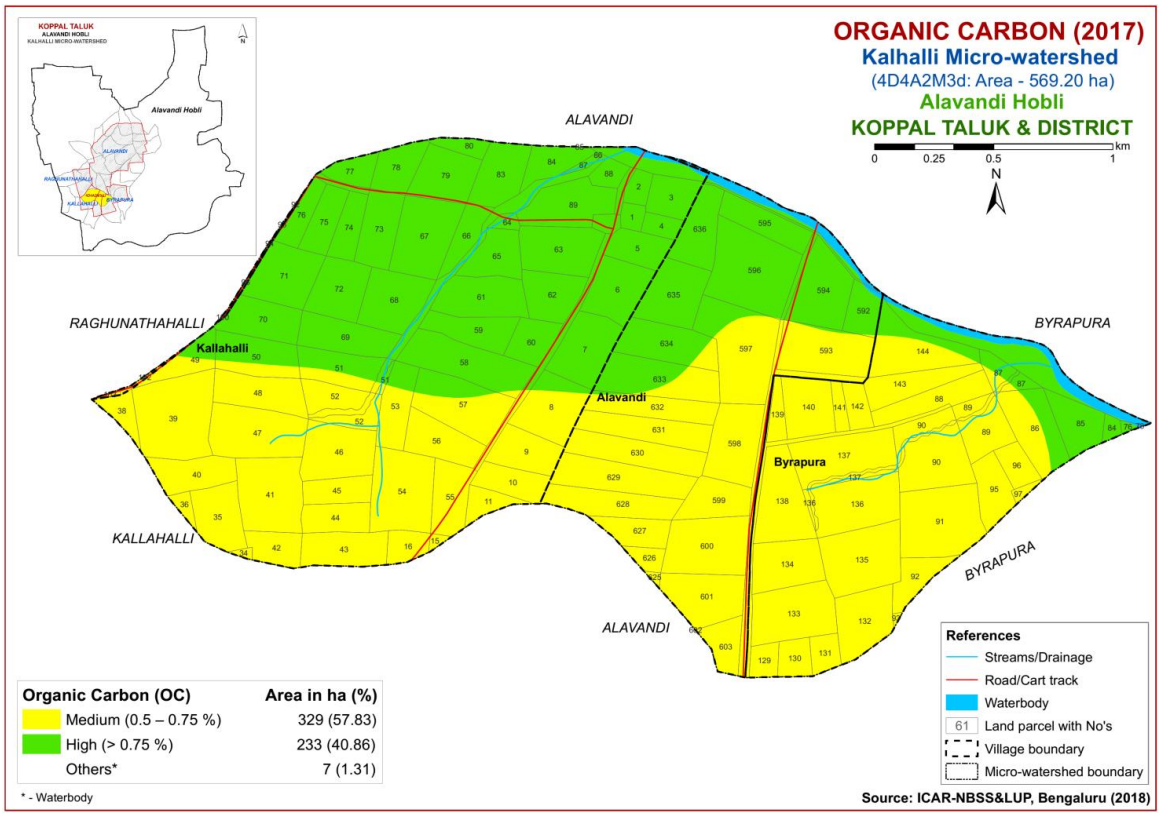

Fig.6.3 Soil Organic Carbon map of Kalhalli Microwatershed

6.4 Available Phosphorus

Maximum area of about 232 ha (41%) is low (<23 kg/ha) in available phosphorus and distributed in the major part of the microwatershed. An area of about 227 ha (40%) is medium (23-57 kg/ha) and distributed in the northern and eastern part of the microwatershed. An area of about 103 ha (18%) is high (>57 kg/ha) and distributed in the western part of the microwatershed. The areas with high phosphorus content reduce 25 per cent from the recommended dose to avoid the excess application of fertilizer and apply additional 25% phosphorus in areas where it is low and medium (Fig 6.4).

6.5 Available Potassium

Maximum area of about 288 ha (51 %) is medium (145-337 kg/ha) and distributed in the major part of the microwatershed. An area of about 274 ha (48 %) is high in available potassium content and distributed in the eastern, northern and central part of the microwatershed. The areas with high potassium content reduce 25 per cent from the recommended dose to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is medium (Fig 6.5).

6.6 Available Sulphur

Soil analysis of available sulphur content in Kalhalli microwatershed showed that a maximum area of about 257 ha (45 %) is low and distributed in the major part of the microwatershed. An area of about 186 ha (33 %) is medium (10-20 ppm) in available sulphur content and distributed in the northern, central and southern part of the microwatershed. An area of about 119 ha (21%) is high distributed in the western and northern 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 in Kalhalli microwatershed is low (< 0.5ppm) in 61 ha (11%) and distributed in the northern and southern part of the microwatershed. Maximum area of about 481 ha (85%) is medium (0.5-1.0 ppm) and distributed in the major part of the microwatershed. An area of about 19 ha (3 %) is high (>1.0 ppm) and distributed in the northern part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content in the soils of the Kalhalli microwatershed is deficient (<4.5 ppm) in a maximum area of about 549 ha (96 %) and distributed in the major part of the microwatershed. An area of about 13 ha (2%) showed sufficiency (>4.5 ppm) with respect to iron content and distributed in the western 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).

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in an area of about 469 ha (82 %) and distributed in the major part of the microwatershed (Fig 6.11). An area of about 92 ha (16 %) is sufficient and distributed in the eastern part of the microwatershed.

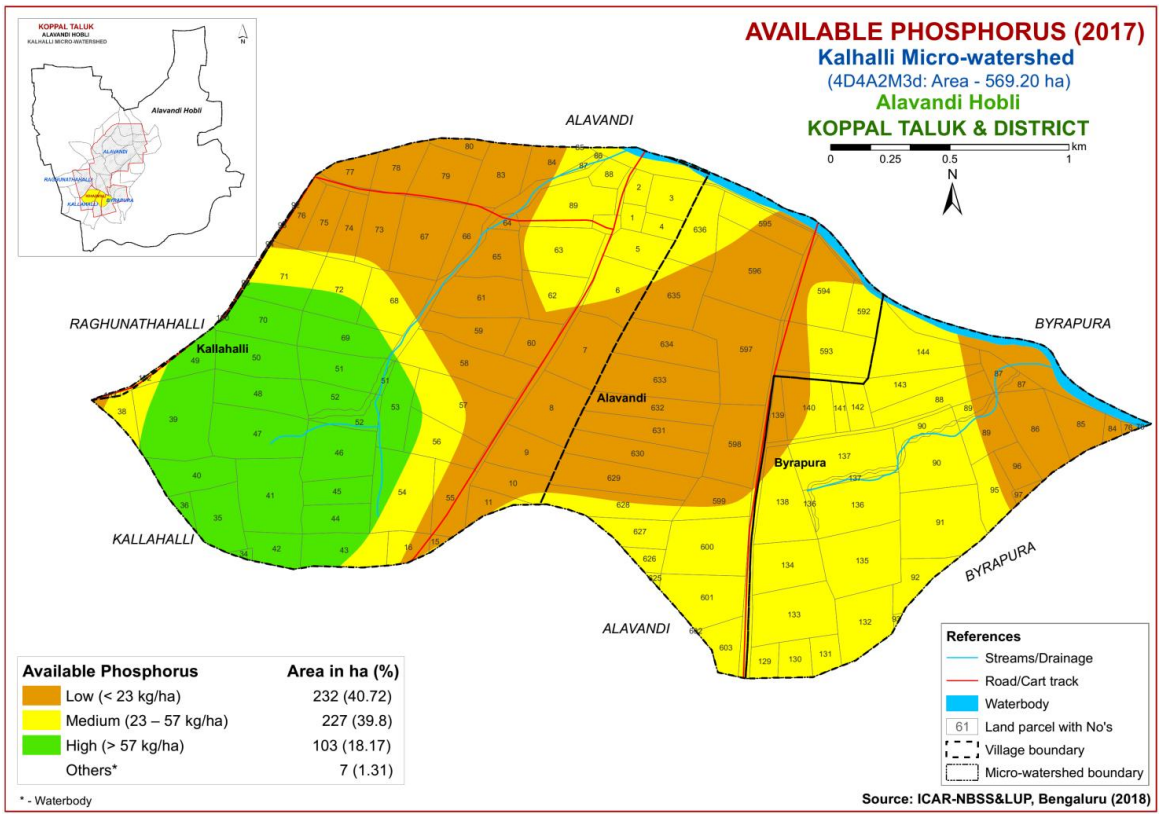

Fig.6.4 Soil Available Phosphorus map of Kalhalli Microwatershed

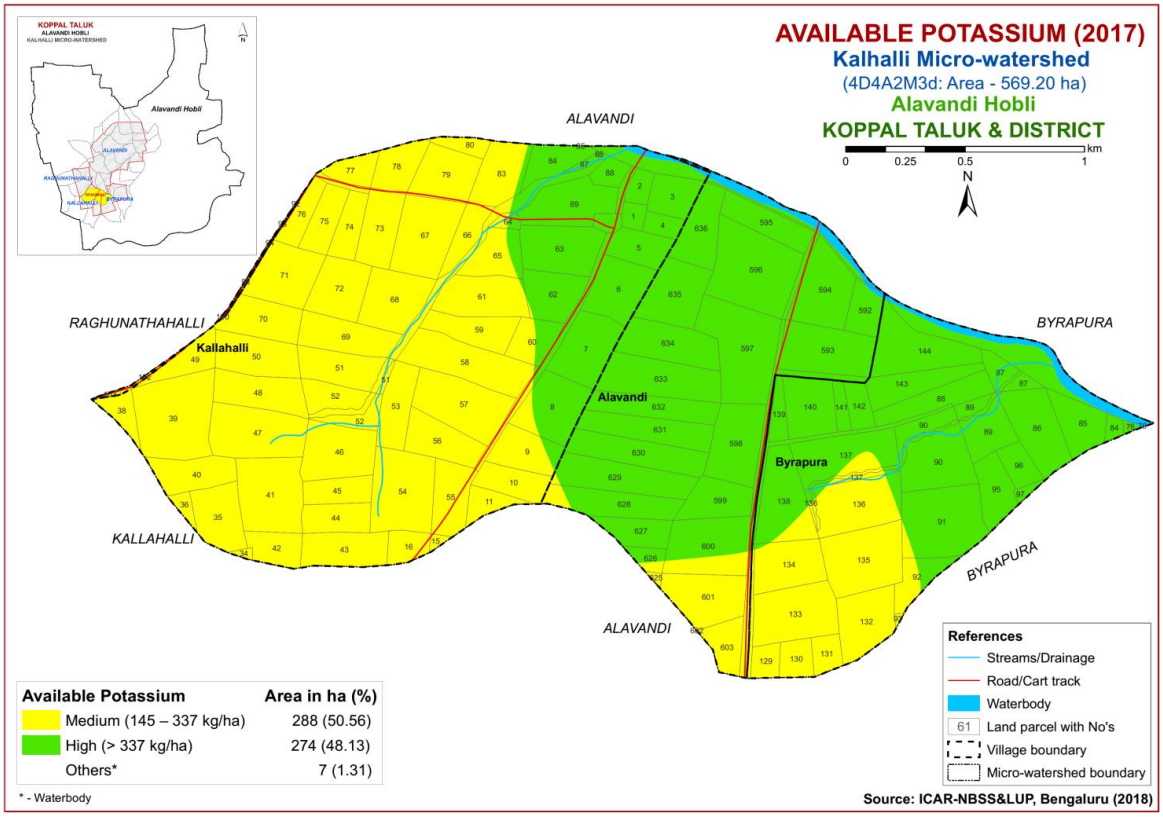

Fig.6.5 Soil Available Potassium map of Kalhalli Microwatershed

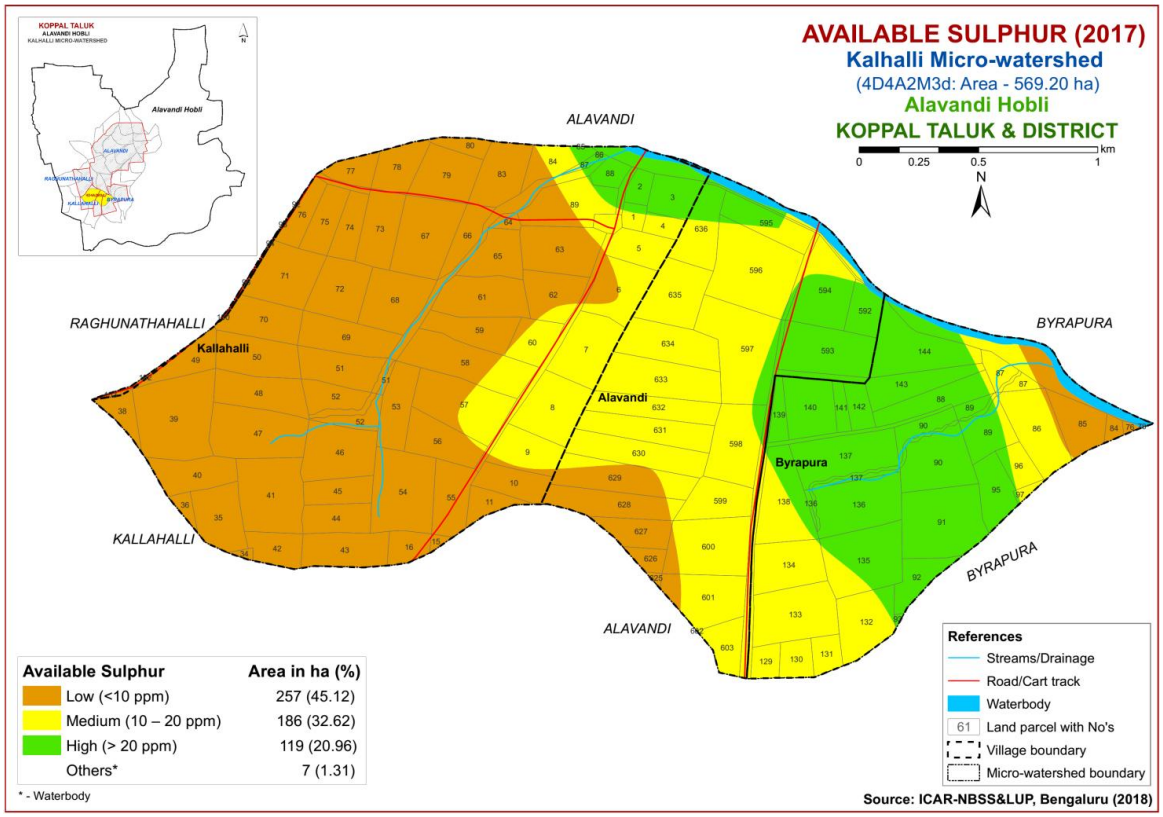

Fig.6.6 Soil Available Sulphur map of Kalhalli Microwatershed

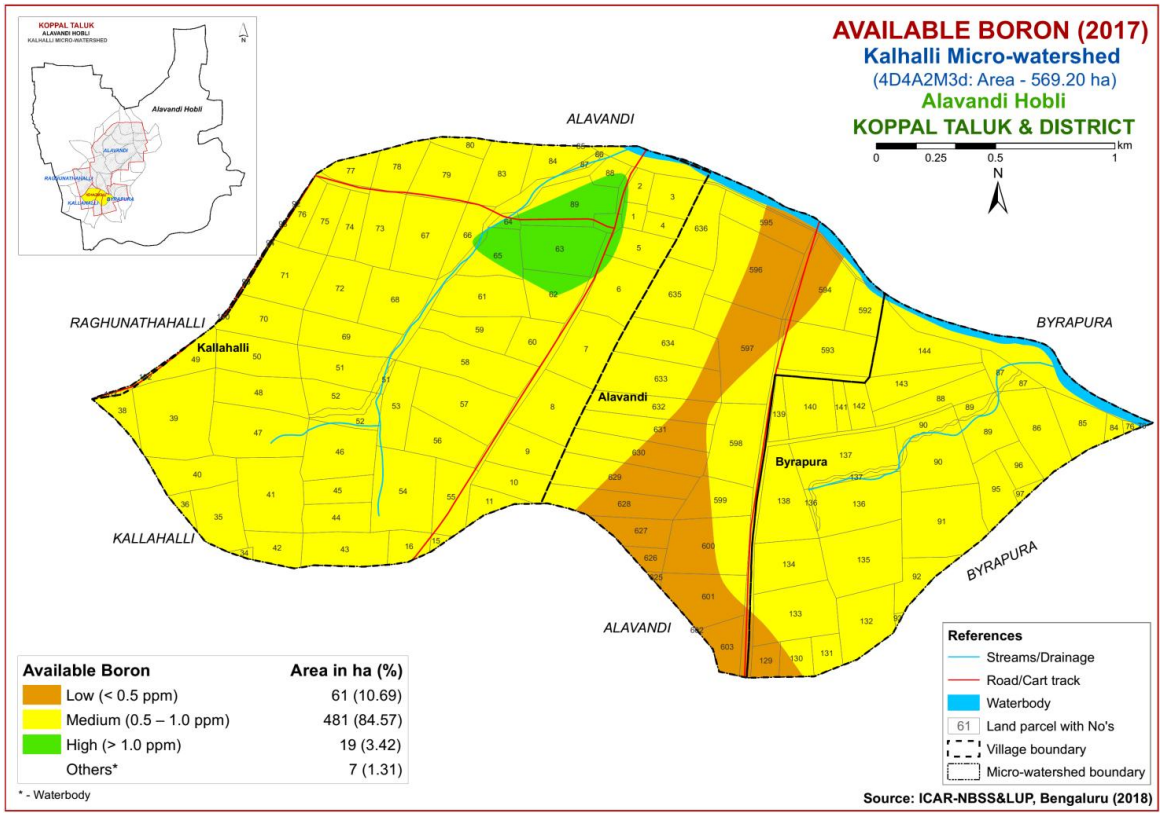

Fig.6.7 Soil Available Boron map of Kalhalli Microwatershed

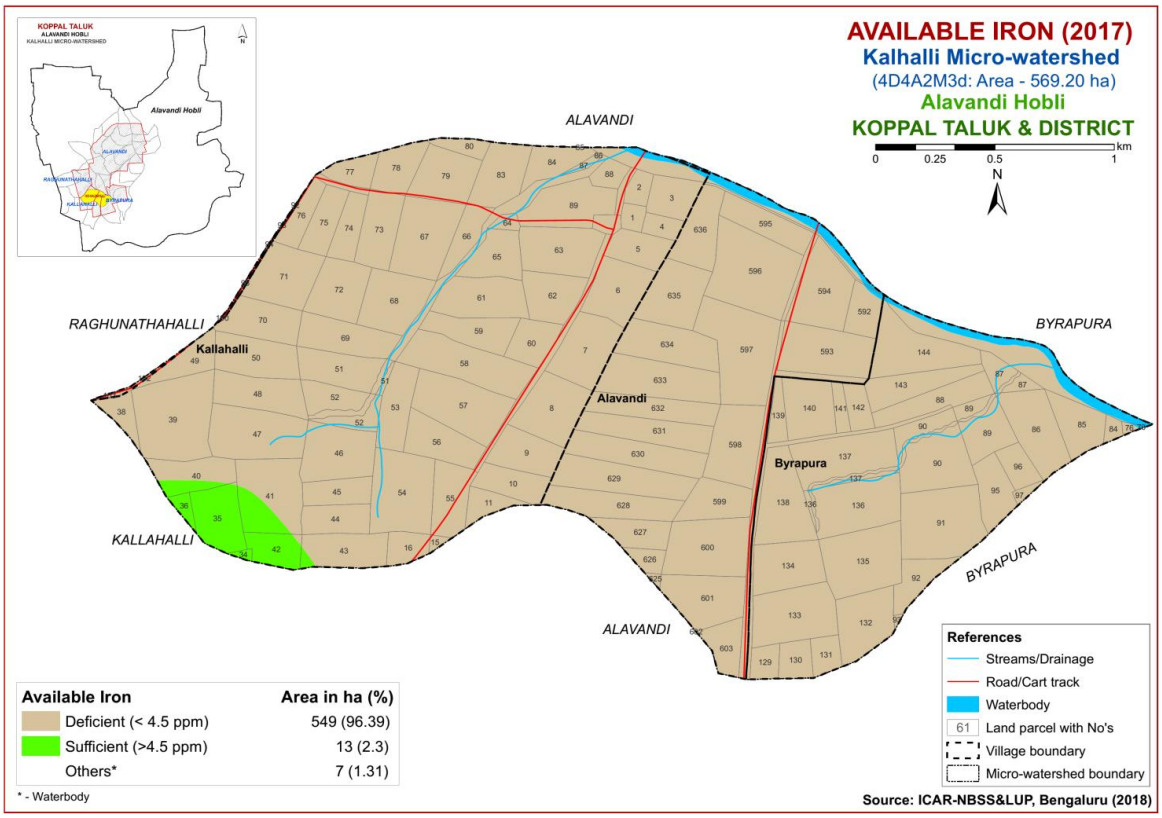

Fig.6.8 Soil Available Iron map of Kalhalli Microwatershed

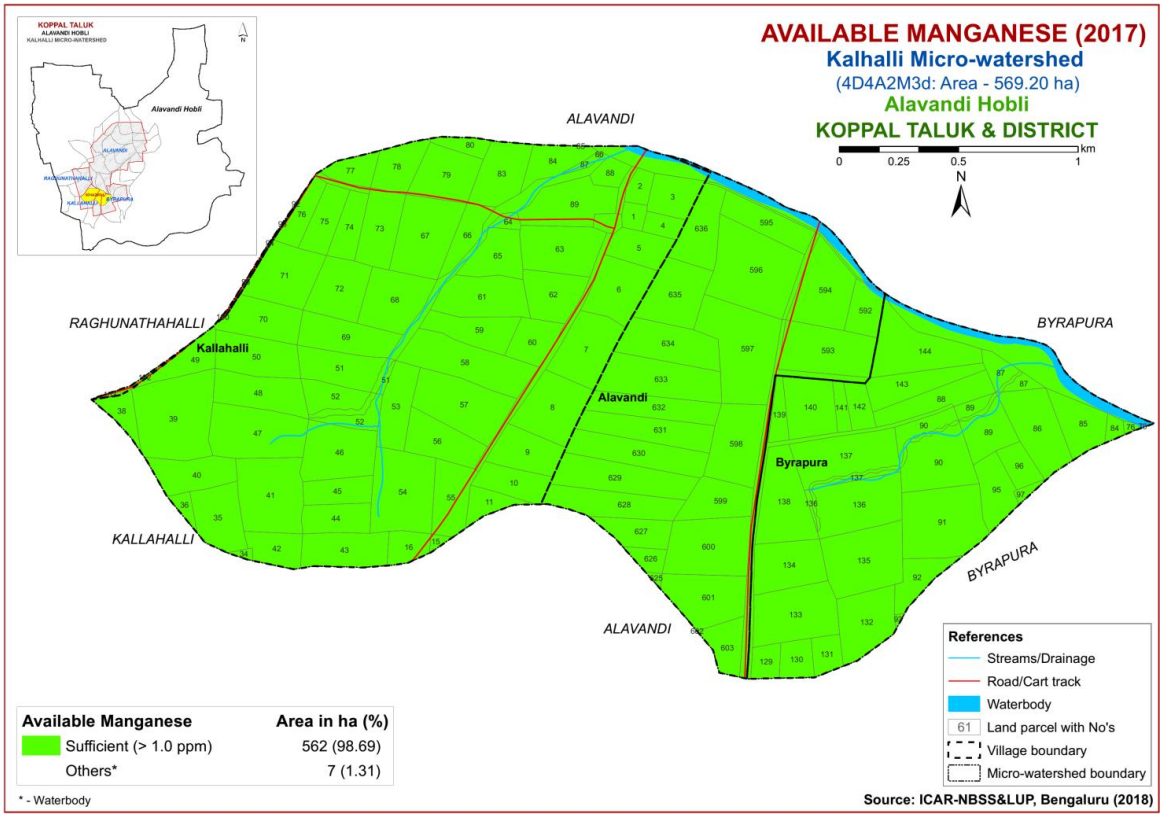

Fig.6.9 Soil Available Manganese map of Kalhalli Microwatershed

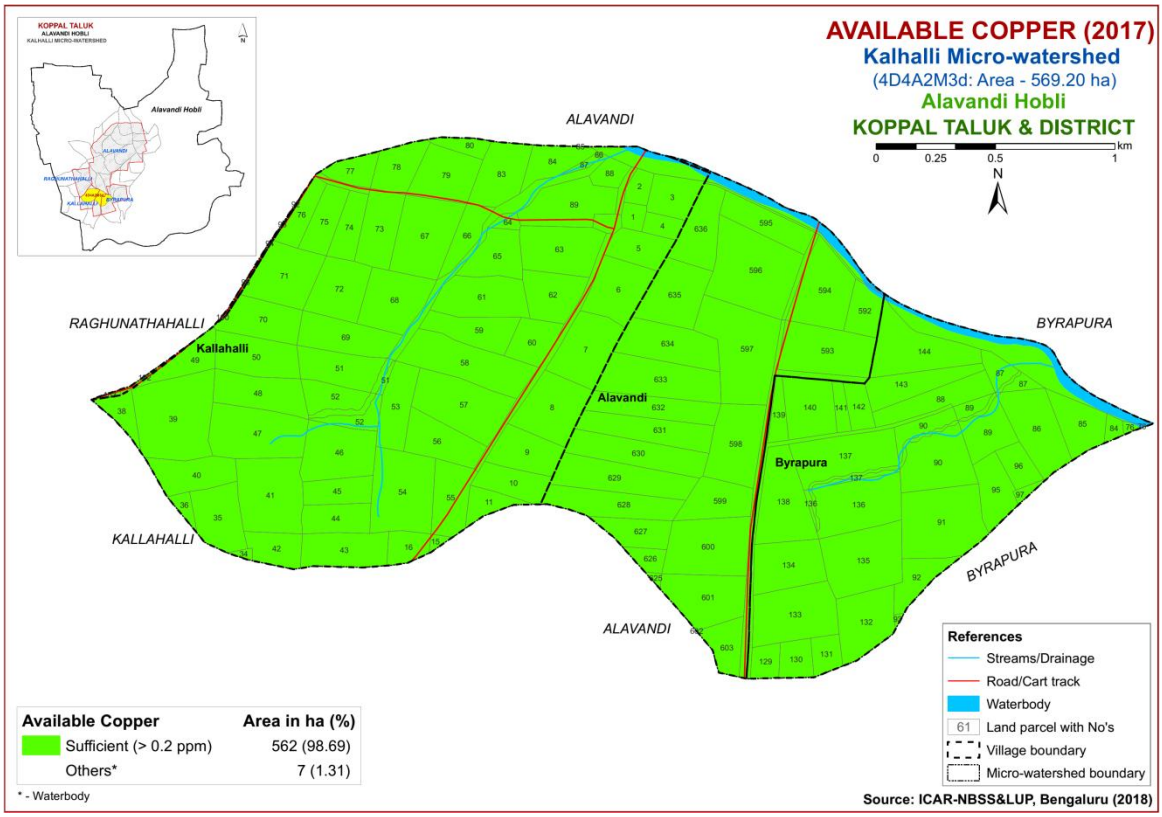

Fig.6.10 Soil Available Copper map of Kalhalli Microwatershed

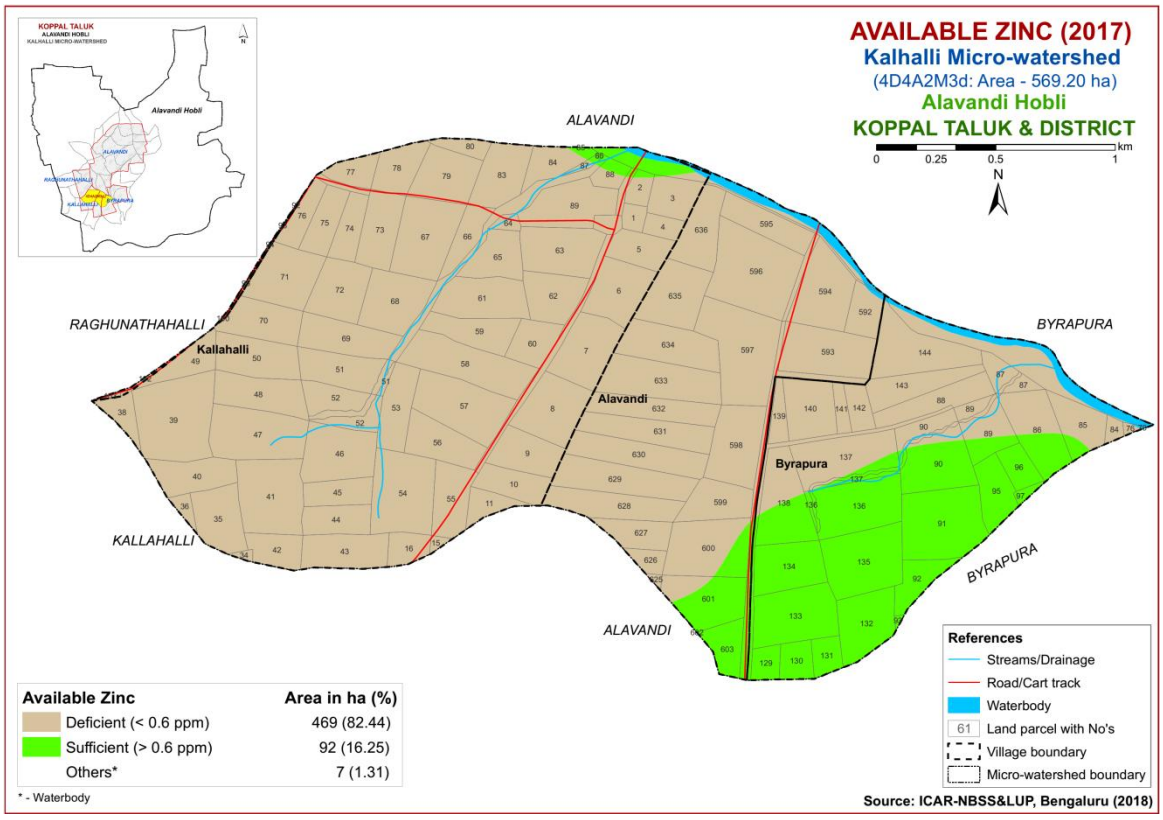

Fig.6.11 Soil Available Zinc map of Kalhalli Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Kalhalli 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 soil and land characteristics were matched with the crop requirements to arrive at the crop suitability. The soil and land characteristics table (Table 7.1) were matched with the crop requirements (Tables 7.2-7.29) 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 and N1 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, 's' for sodium 'z' for calcareousness 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 28 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 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.

Highly suitable (Class S1) lands occupy an area of about 44 ha (8 %) for growing sorghum and occur in the eastern and western part of the microwatershed. An area of about 241 ha (43%) is moderately suitable (Class S2) for growing sorghum and

distributed in the major part of the microwatershed with minor limitations of calcareousness, rooting depth and gravelliness. An area of about 185 ha (32%) is marginally suitable for growing sorghum and distributed in the northern, western and southern part of the microwatershed. They have moderate limitations of gravelliness, calcareousness and rooting depth. Area currently not suitable (Class N1) for growing sorghum cover about 91 ha (16 %) and distributed in the northern part of the microwatershed with severe limitations of rooting depth and gravelliness.

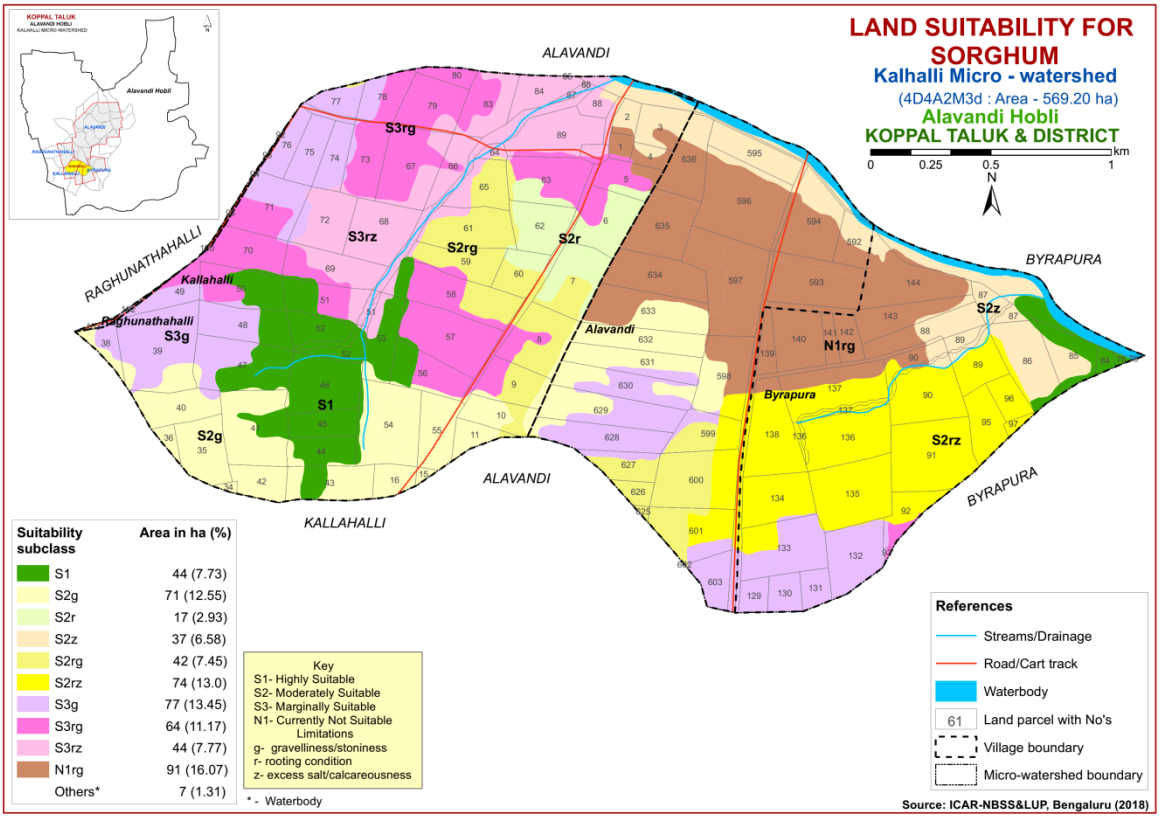

Fig. 7.1 Land Suitability map of Sorghum

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 are given in Figure 7.2.

Highly suitable (Class S1) lands occupy an area of about 39 ha (7 %) for growing maize and distributed in the southwestern part of the microwatershed. Maximum area of about 246 ha (43%) is moderately suitable (Class S2) and distributed in the major part of the microwatershed with minor limitations of calcareousness, texture, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 185 ha (32%) and occur in the eastern, central and western part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. Area

currently not suitable (Class N1) for growing maize cover about 91 ha (16 %) and distributed in the northeastern and central part of the microwatershed with severe limitations of gravelliness and rooting depth.

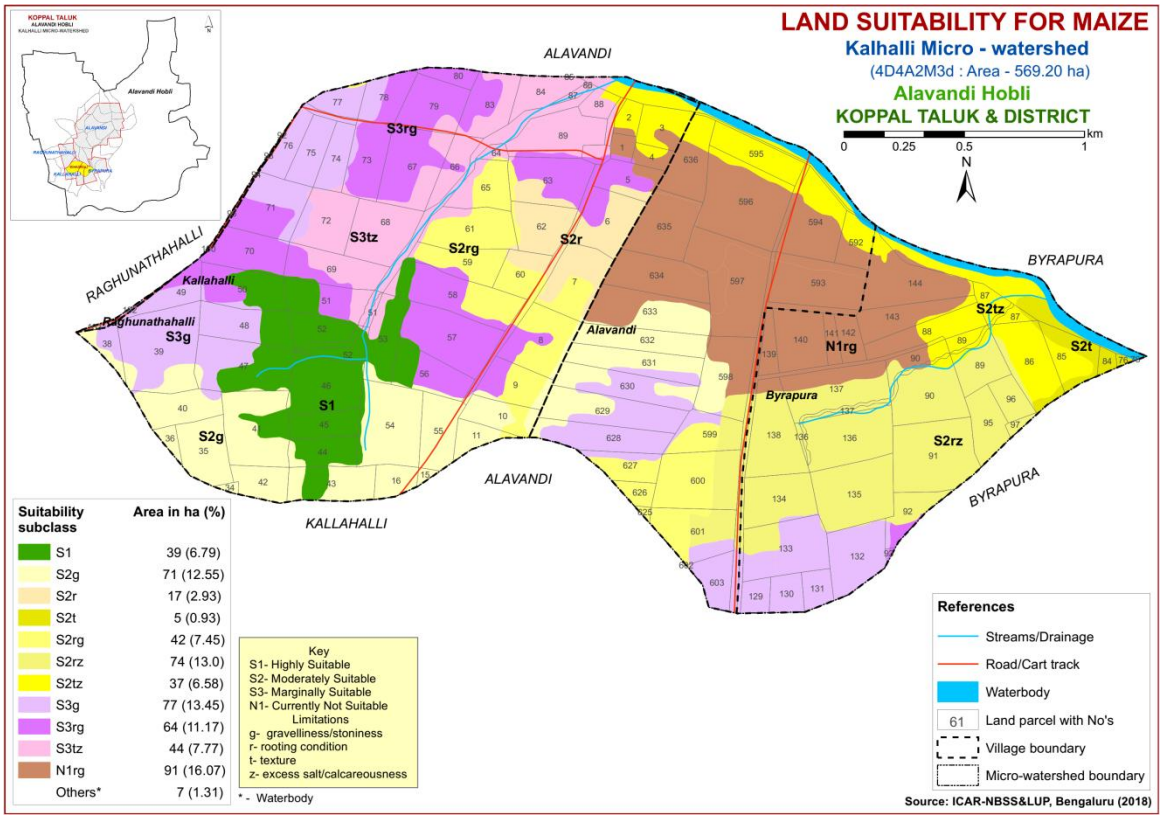

Fig. 7.2 Land Suitability map of Maize

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 Karnataka in the northern districts. The crop requirements (Table 7.4) for growing bajra 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.

Highly suitable (Class S1) lands occupy an area of about 110 ha (19%) for growing bajra and occur in the southern and southwestern part of the microwatershed. Maximum area of about 266 ha (47 %) is moderately suitable (Class S2) for growing bajra and distributed in the major part of the microwatershed with minor limitations of texture, calcareousness, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 93 ha (9%) and occur in the northern and northwestern part of the microwatershed. They have moderate limitations of gravelliness, calcareousness and rooting depth. Area currently not suitable (Class N1) for growing bajra cover about 91 ha (16 %) and distributed in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

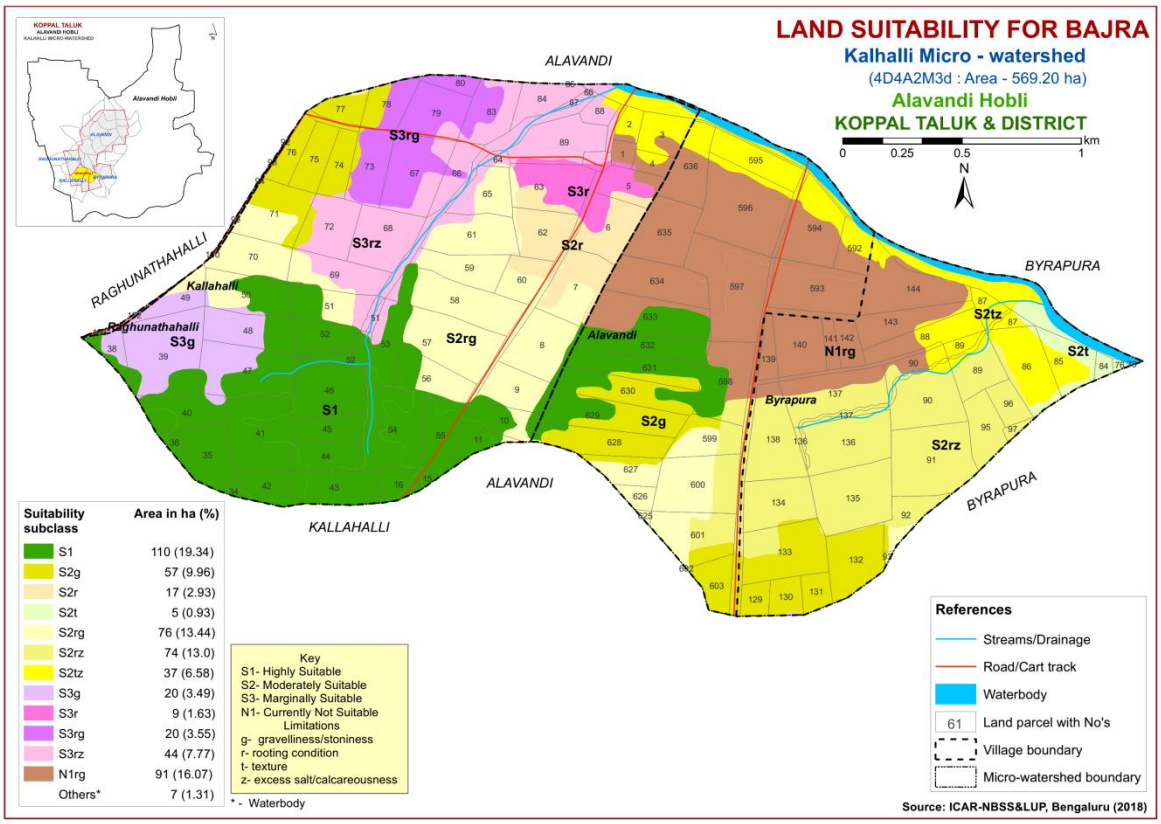

Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Redgram (*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 7.5) 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 7.4.

An area of about 39 ha (7%) is highly suitable (Class S1) for growing redgram and distributed in the southwestern part of the microwatershed. An area of about 113 ha (20%) is moderately suitable (Class S2) for growing redgram and occur in the southwestern, southern and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and calcareousness. Marginally suitable lands (Class S3) occupy a maximum area of about 244 ha (43 %) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and calcareousness. Area currently not suitable (Class N1) for growing redgram cover about 165 ha (29%) and distributed in the northern and central part of the microwatershed with severe limitations of gravelliness, rooting depth and calcareousness.

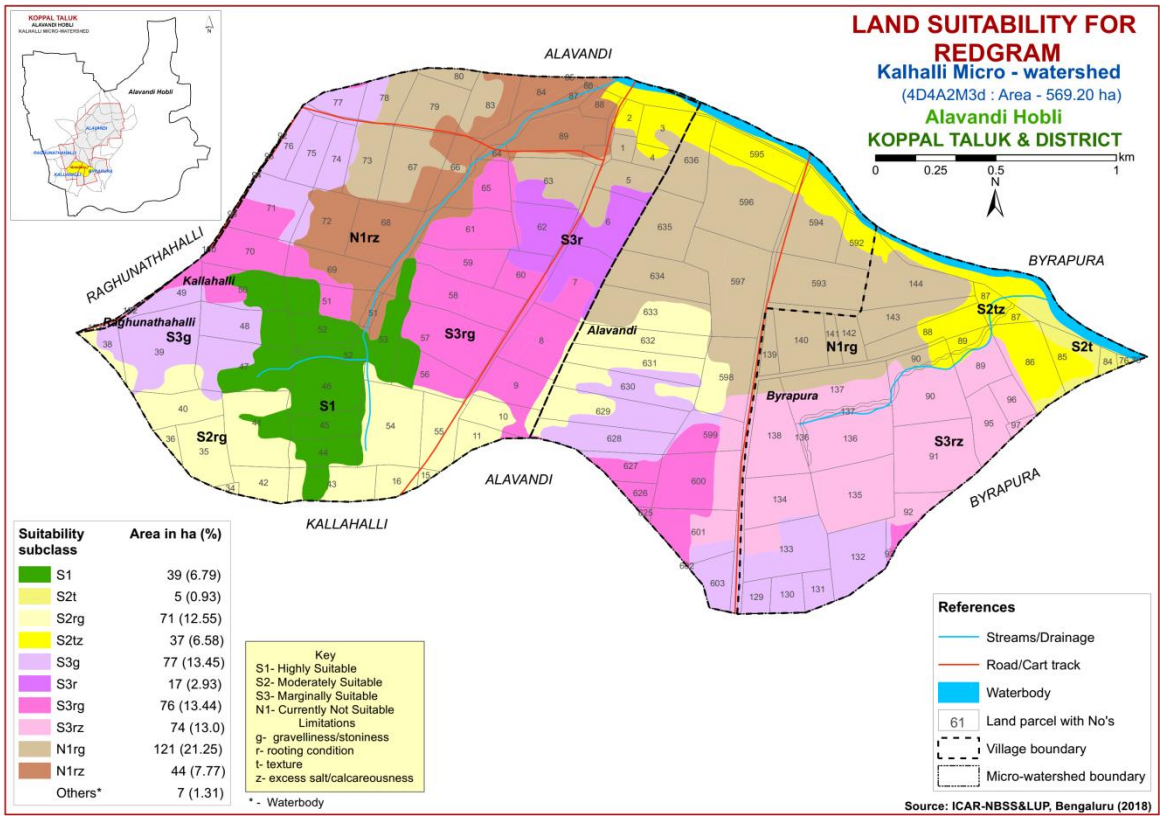

Fig. 7.4 Land Suitability map of Redgram

7.5 Land Suitability for Bengal gram (*Cicer arietinum*)

Bengal gram 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 Bell ary districts. The crop requirements for growing Bengal gram (Table 7.6) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing Bengal gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.5.

An area of about 5 ha (<1%) in the microwatershed has soils that are highly suitable (Class S1) for growing Bengal gram and are distributed in the eastern part of the microwatershed. An area of about 297 ha (52%) is moderately suitable (Class S2) for growing bengalgram and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness, texture and gravelliness. Marginally suitable (Class S3) lands cover an area of about 167 ha (29%) and are distributed in the northwestern, central and southeastern part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, calcareousness and texture. Area currently not suitable (Class N1) for growing Bengal gram cover about 91 ha (16 %) and distributed in the northeastern and central part of the microwatershed with severe limitations of rooting depth and gravelliness.

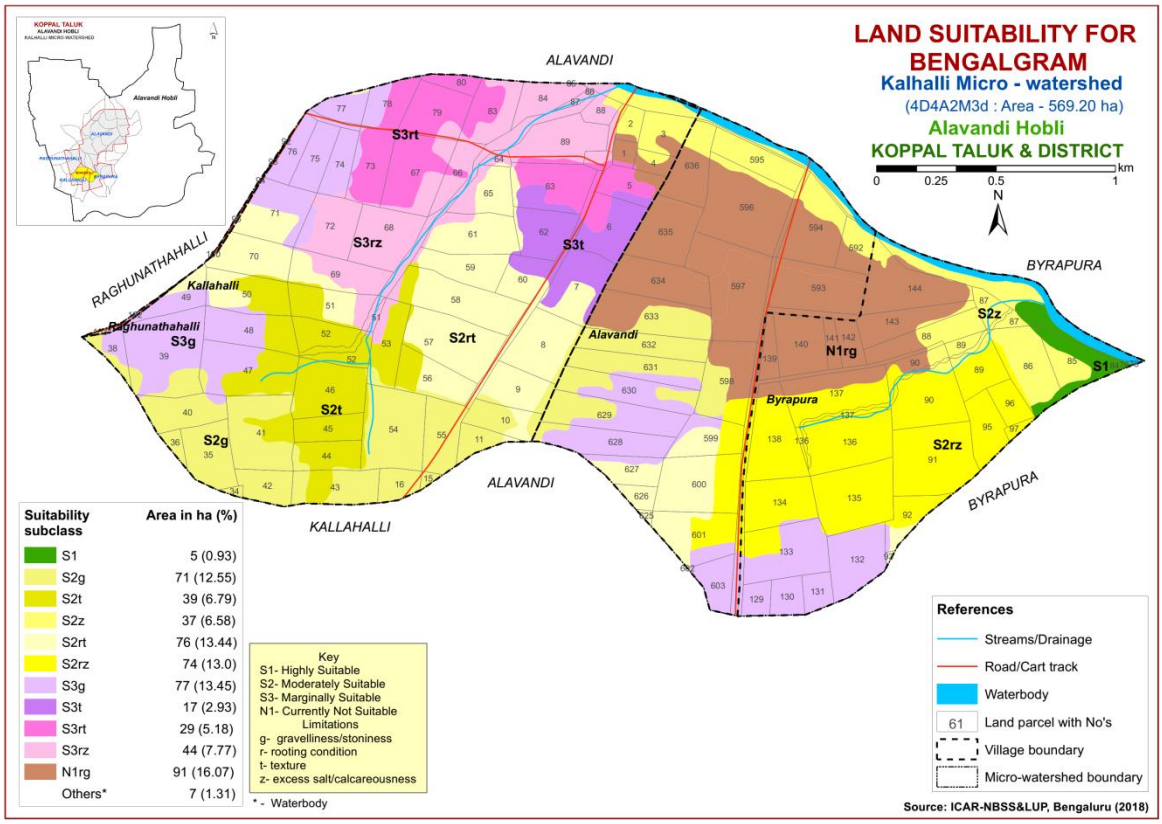

Fig. 7.5 Land Suitability map of Bengal gram

7.6 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 7.7) 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 7.6.

An area of about 71 ha (13%) is highly suitable (S1) for growing groundnut crop and distributed in the southern part. An area of about 175 ha (31 %) is moderately suitable (Class S2) for growing groundnut and distributed in the western, central and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and texture. An area of about 225 ha (39 %) is marginally suitable (Class S3) for growing groundnut and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness. Area currently not suitable (Class N1) for growing groundnut cover about 91 ha (16%) and distributed in the central and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

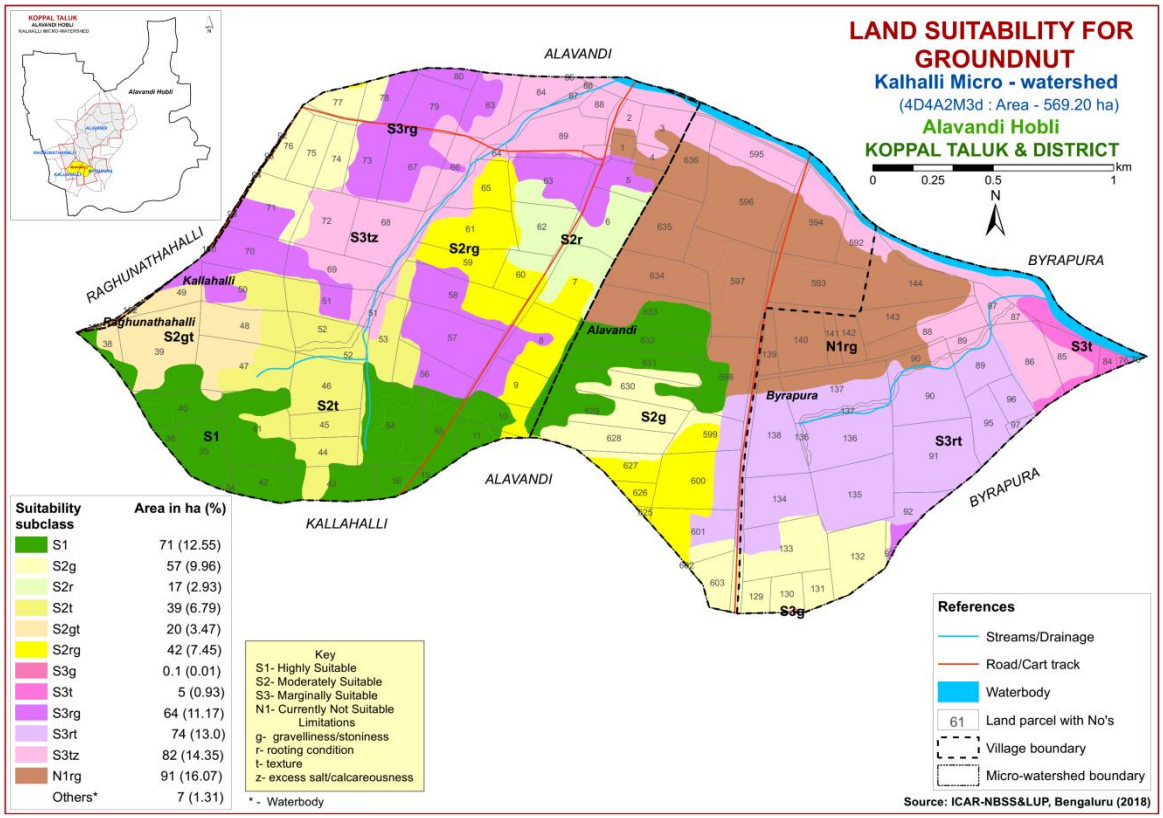

Fig. 7.6 Land Suitability map of Groundnut

7.7 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 7.8) 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 7.7.

An area of about 44 ha (8%) is highly suitable (Class S1) for growing sunflower and are distributed in the southwestern part of the microwatershed. An area of about 108 ha (19%) is moderately suitable (Class S2) and are distributed in the southwestern and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 274 ha (48%) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth, calcareousness and gravelliness. An area of about 135 ha (24%) is currently not suitable (Class N1) and are distributed in the northern, eastern and central part with severe limitations of rooting depth, gravelliness and calcareousness.

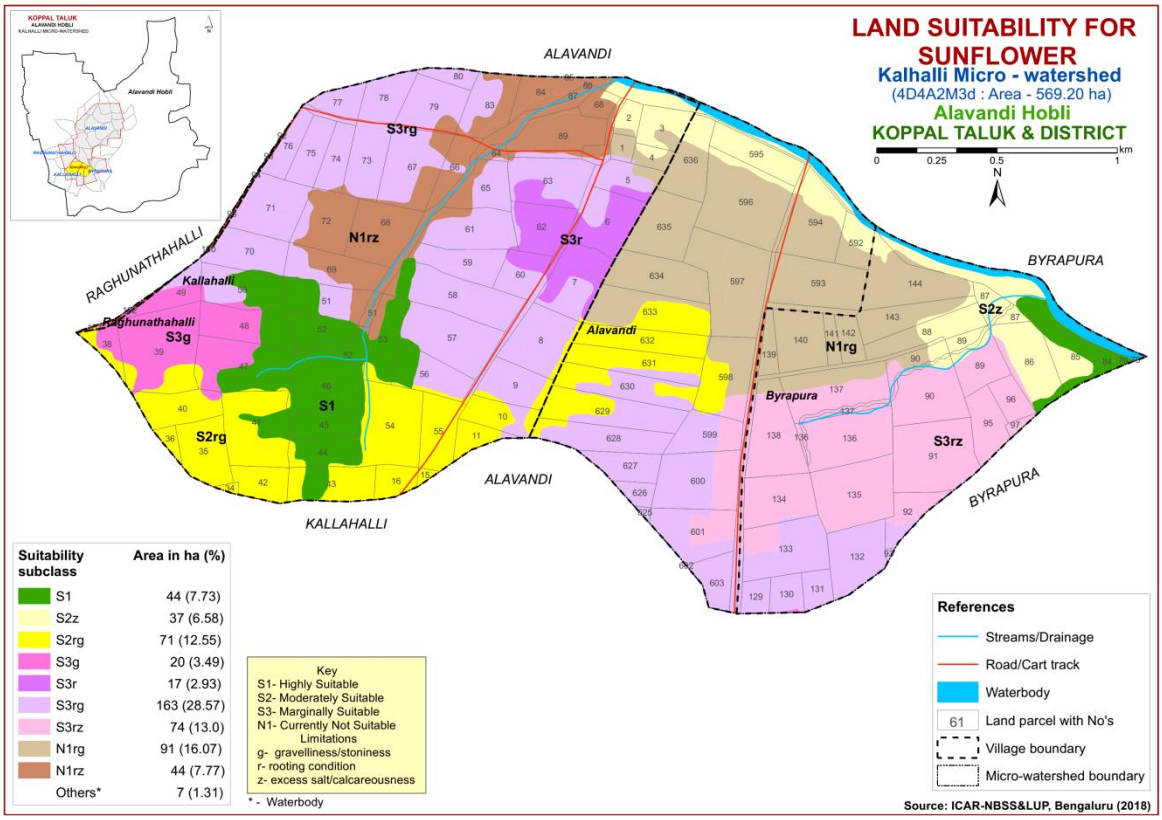

Fig. 7.7 Land Suitability map of Sunflower

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.

An area of about 5 ha (<1%) is highly suitable (Class S1) for growing cotton and are distributed in the eastern part of the microwatershed. Maximum area of about 281 ha (49%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, gravelliness and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 184 ha (32%) and are distributed in the western, central and southern part of the microwatershed with moderate limitations of rooting depth, texture, calcareousness and gravelliness. An area of about 91 ha (16 %) is currently not suitable (Class N1) and are distributed in the northeastern and central part with severe limitations of rooting depth and gravelliness.

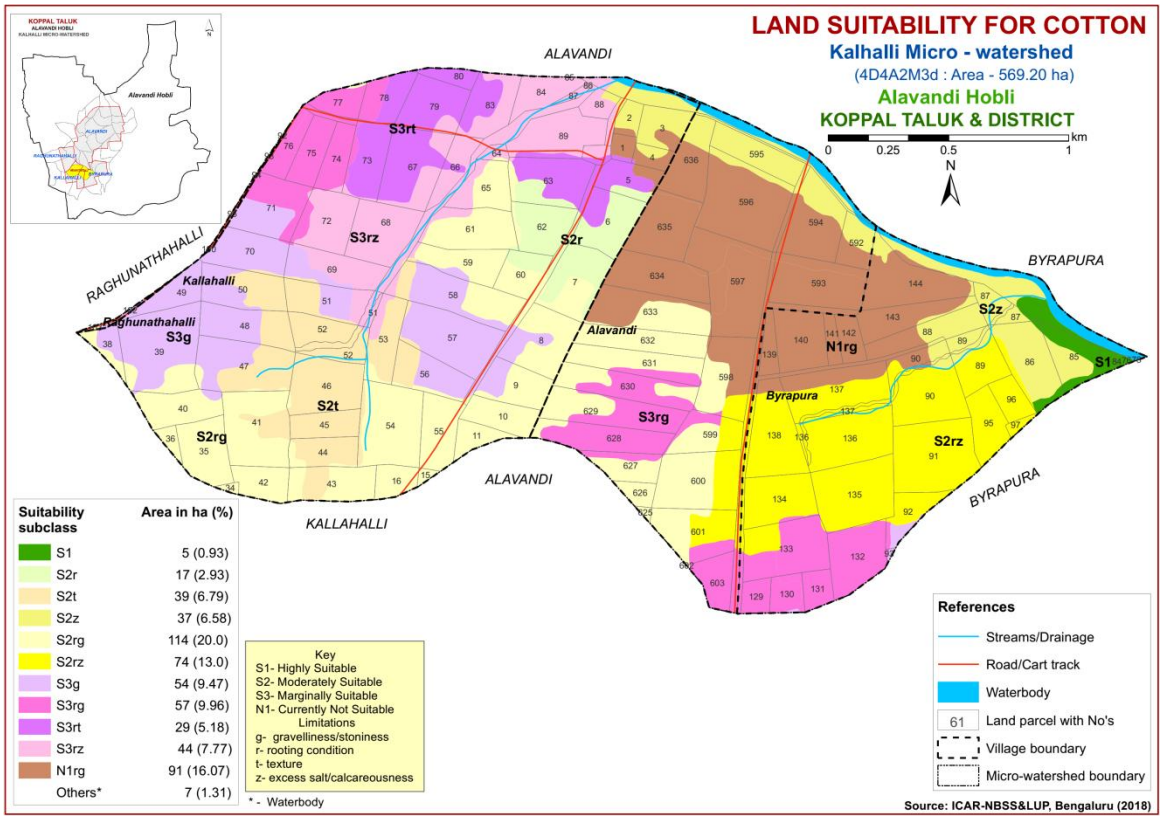

Fig. 7.8 Land Suitability map of Cotton

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

Chilli is one of the most important spice crop grown in an area of 0.42 lakh ha in 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.

An area of about 39 ha (7%) in the microwatershed has soils that are highly suitable (Class S1) for growing chilli and are distributed in the southwestern part of the microwatershed. An area of about 204 ha (36 %) is moderately suitable (Class S2) for growing chilli and are distributed in the southwestern, central and eastern part of the microwatershed. They have minor limitations of gravelliness, calcareousness and rooting depth. Marginally suitable (Class S3) lands cover a maximum area of about 226 ha (40%) and distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, texture and calcareousness. An area of about 91 ha (16%) is currently not suitable (Class N1) and are distributed in the northern and northeastern part with severe limitations of rooting depth and gravelliness.

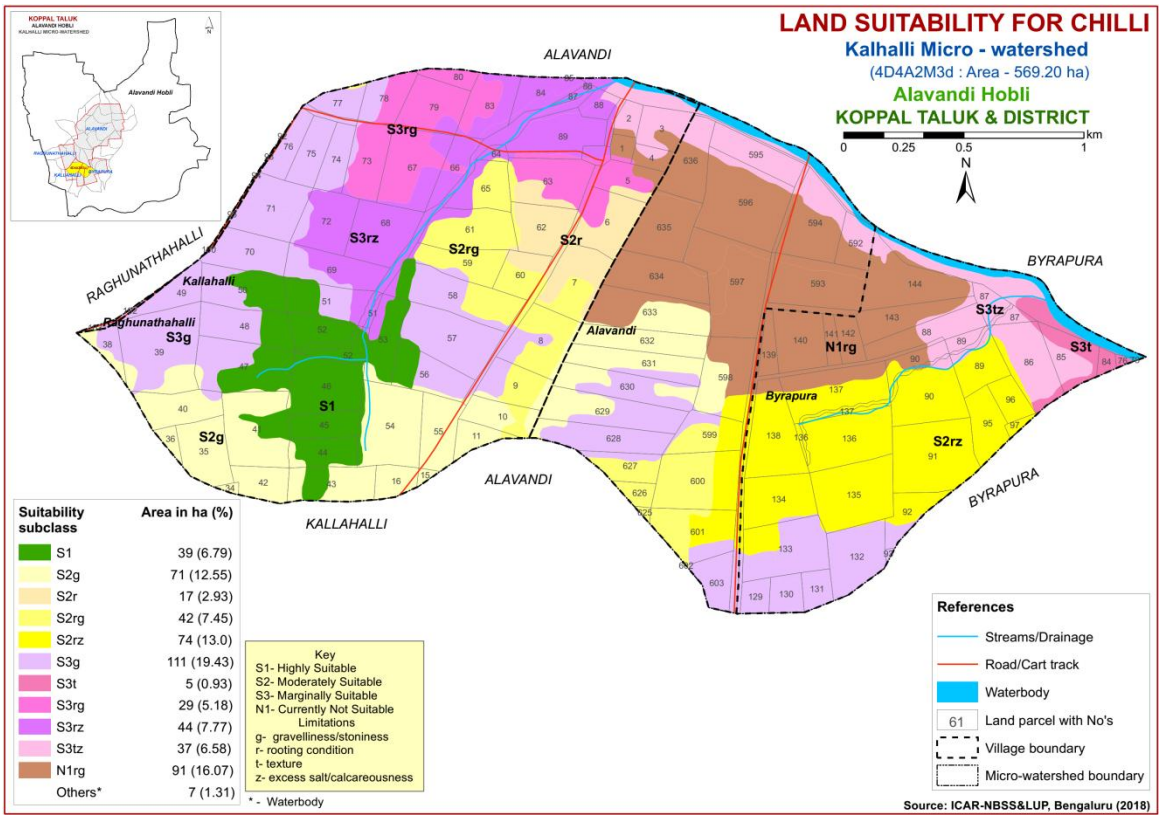

Fig. 7.9 Land Suitability map of Chilli

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 7.1) 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.

An area of about 39 ha (7%) in the microwatershed has soils that are highly suitable (Class S1) for growing tomato and are distributed in the southwestern part of the microwatershed. An area of about 204 ha (36 %) is moderately suitable (Class S2) for growing tomato and are distributed in the southwestern, central and eastern part of the microwatershed. They have minor limitations of gravelliness, calcareousness and rooting depth. Marginally suitable (Class S3) lands cover a maximum area of about 226 ha (40%) and distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, texture and calcareousness. An area of about 91 ha (16%) is currently not suitable (Class N1) and are distributed in the northern and northeastern part with severe limitations of rooting depth and gravelliness.

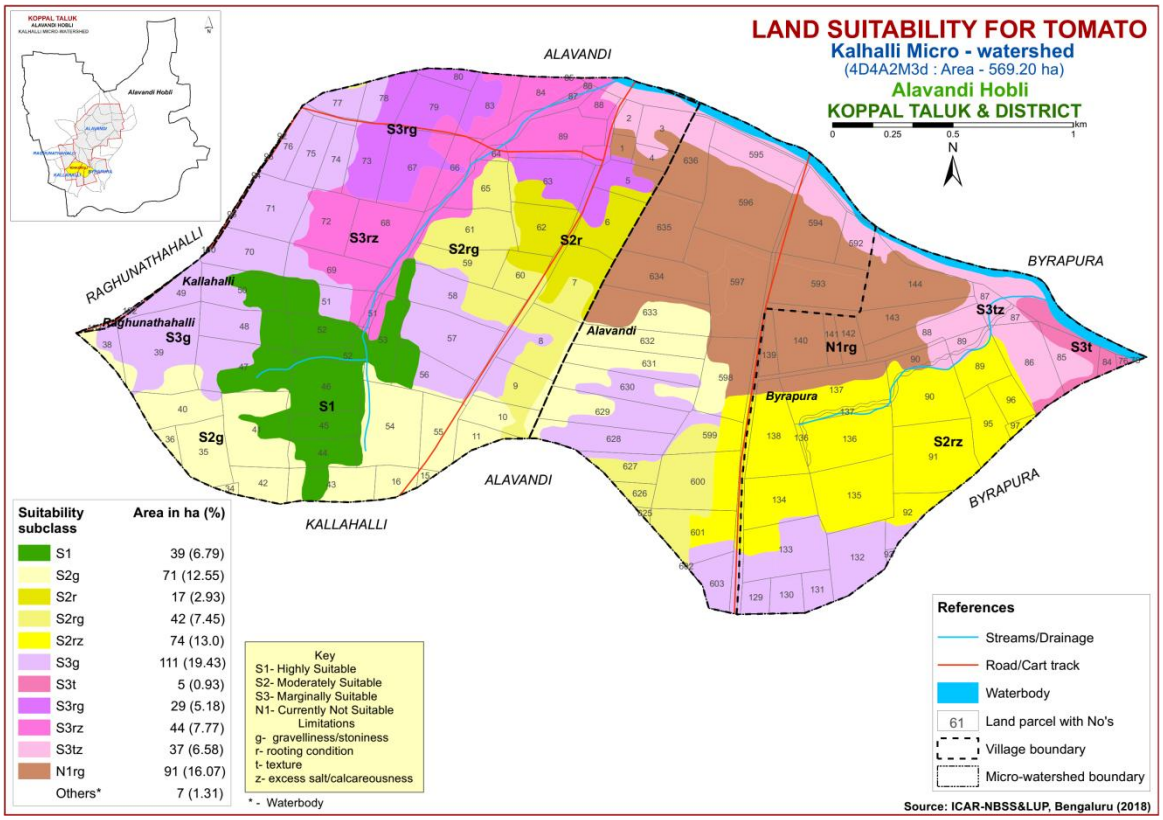

Fig. 7.10 Land Suitability map of Tomato

7.11 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 7.12) 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 are given in Figure 7.11.

An area of about 39 ha (7%) in the microwatershed has soils that are highly suitable (Class S1) for growing drumstick and are distributed in the southwestern part of the microwatershed. Moderately suitable (Class S2) lands cover an area of about 133 ha (24%) and are distributed in the southern, northern and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 224 ha (39%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth and calcareousness. Area currently not suitable (Class N1) cover about 165 ha (29 %) and distributed in the northern, northeastern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

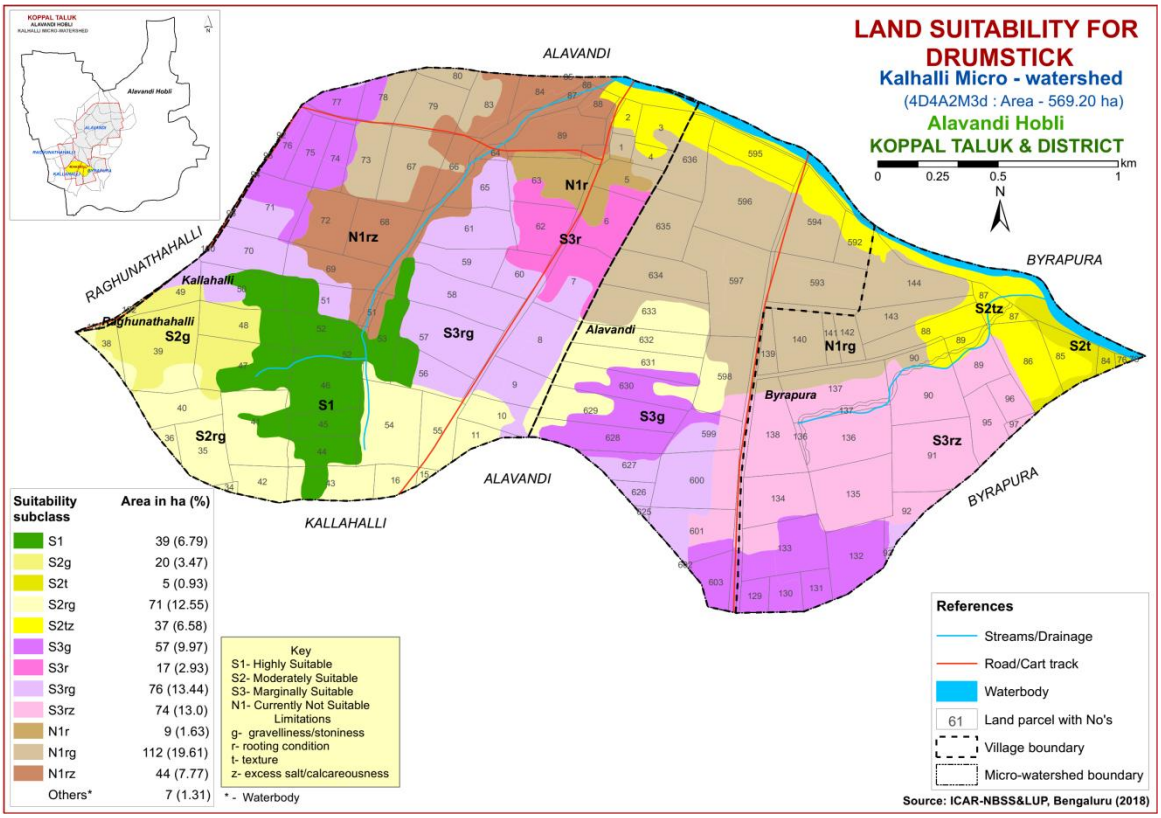

Fig. 7.11 Land Suitability map of Drumstick

7.12 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 7.13) 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 7.12.

An area of about 39 ha (7 %) in the microwatershed has soils that are highly suitable (Class S1) for growing mulberry and are distributed in the southwestern part of the microwatershed. An area of about 153 ha (27%) is moderately suitable (Class S2) for growing mulberry and distributed in the western and southern part of the microwatershed. They have minor limitations of texture, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 204 ha (36%) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, calcareousness texture and gravelliness. Area currently not suitable (Class N1) cover about 165 ha (29%) and distributed in the central and northern part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

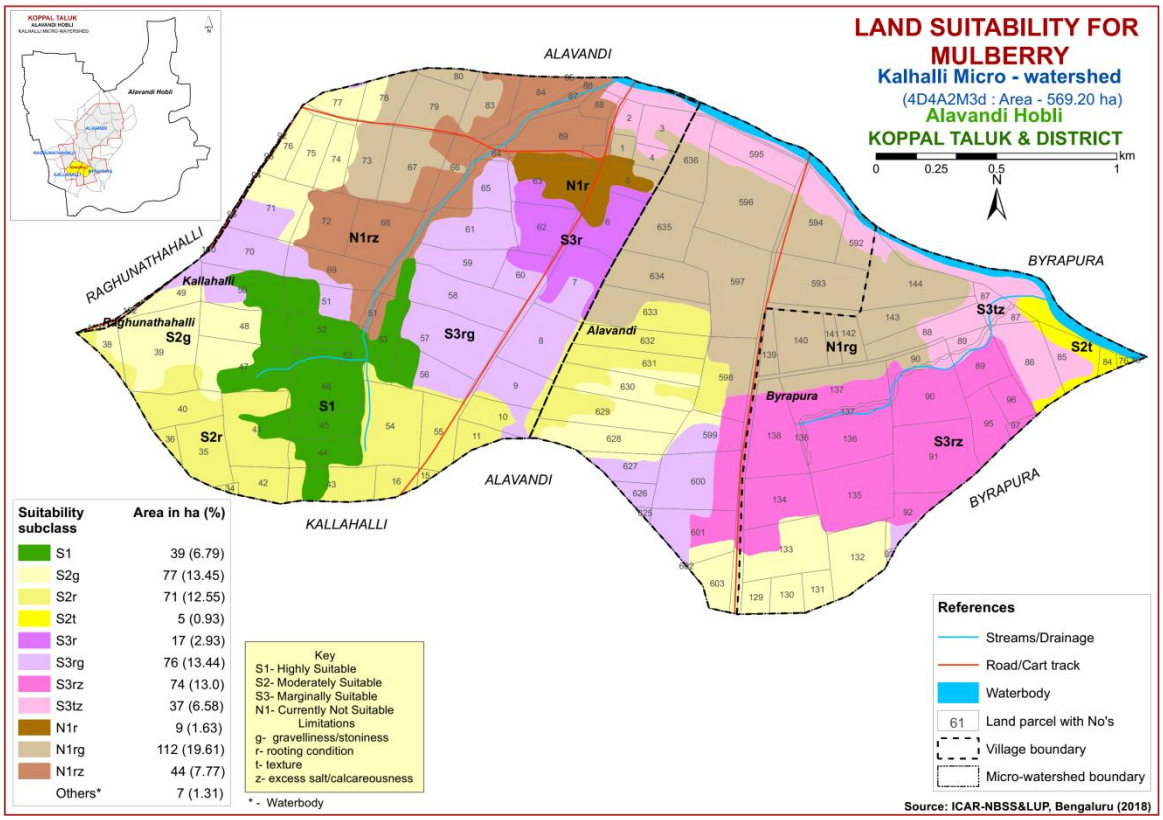

Fig. 7.12 Land Suitability map of Mulberry

7.13 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 7.14) 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 7.13.

Moderately suitable (S2) lands cover an area of about 39 ha (7%) and distributed in the southwestern part of the microwatershed. They have minor limitation of rooting depth. Marginally suitable (Class S3) lands cover an area of about 189 ha (33%) and occur in the southern, central and northeastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, texture and calcareousness. Area currently not suitable (Class N1) for growing mango cover about 332 ha (58%) and distributed in the major part of the microwatershed with severe limitations of rooting depth, gravelliness, calcareousness and texture.

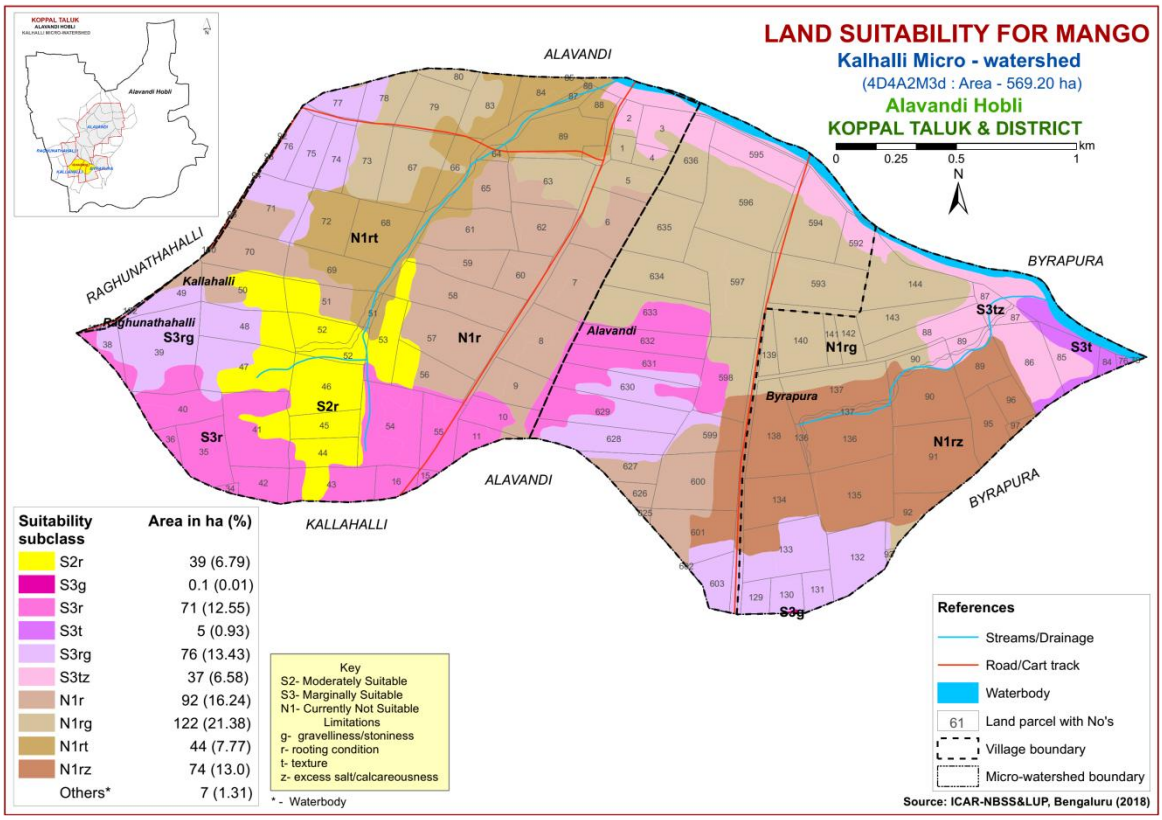

Fig. 7.13 Land Suitability map of Mango

7.14 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 7.15) 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 7.14.

An area of about 39 ha (7%) in the microwatershed has soils that are highly suitable (Class S1) for growing sapota and are distributed in the southwestern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 128 ha (23%) and are distributed in the western and southern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 229 ha (40%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, texture and calcareousness. Area currently not suitable (Class N1) for growing sapota cover about 165 ha (29%) and distributed in the northern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

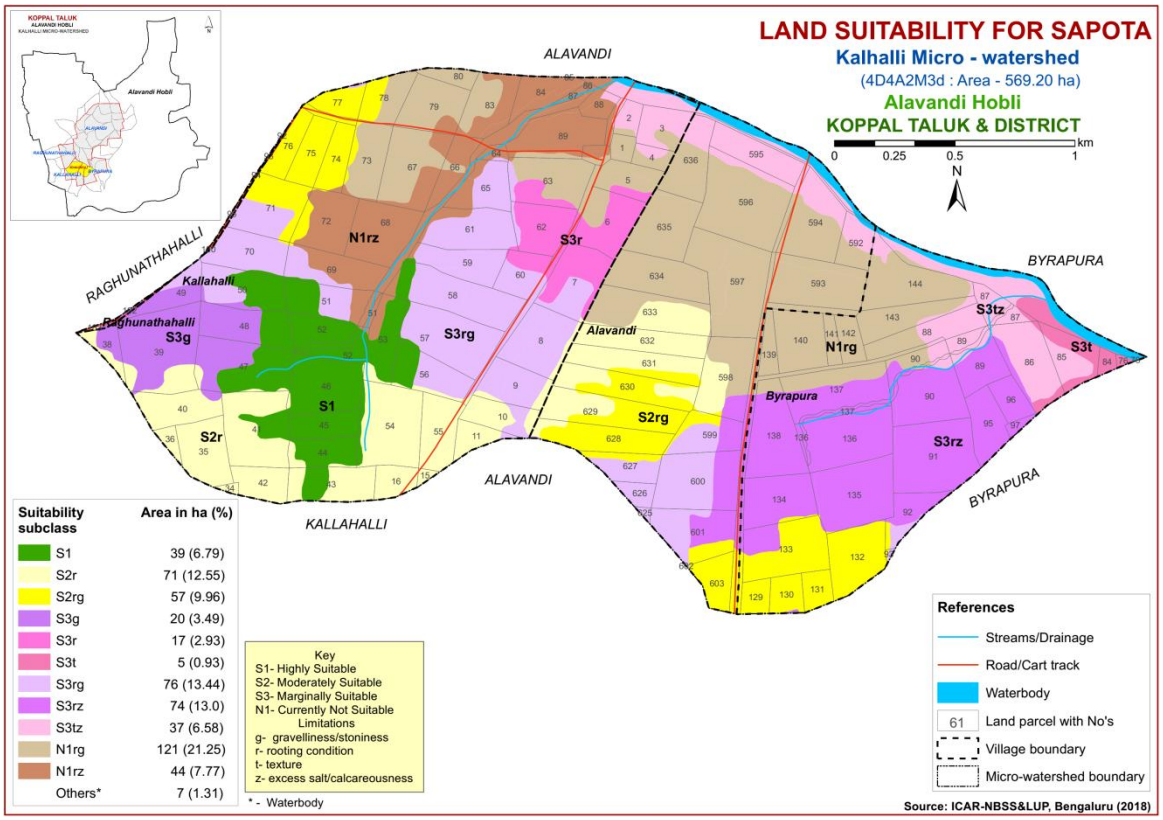

Fig. 7.14 Land Suitability map of Sapota

7.15 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 7.16) 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 7.15.

An area of about 39 ha (7%) in the microwatershed has soils that are highly suitable (Class S1) for growing pomegranate and are distributed in the southwestern part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of about 170 ha (30%) and are distributed in the southern and northwestern part of the microwatershed. They have minor limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands for growing pomegranate occupy an area of about 187 ha (33%) and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, rooting depth and calcareousness. Area currently not suitable (Class N1) for growing pomegranate cover about 165 ha (29%) and are distributed in the northeastern, northern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

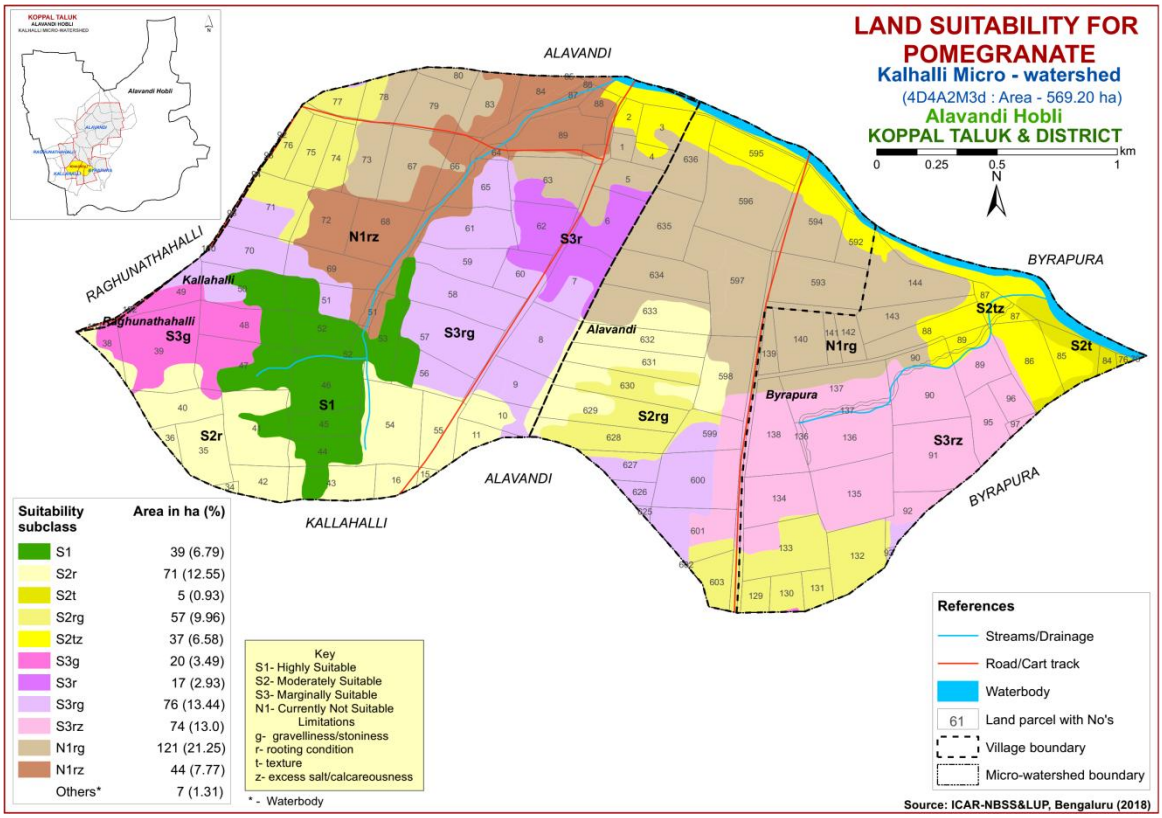

Fig. 7.15 Land Suitability map of Pomegranate

7.16 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 6558 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.

An area of about 39 ha (7%) in the microwatershed has soils that are highly suitable (Class S1) for growing guava and are distributed in the southwestern part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of about 128 ha (23%) and are distributed in the southern and northwestern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands for growing guava occupy a maximum area of about 229 ha (40%) and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, rooting depth, calcareousness and texture. Area currently not suitable (Class N1) for growing guava cover about 165 ha (29%) and are distributed in the northeastern, northern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and texture.

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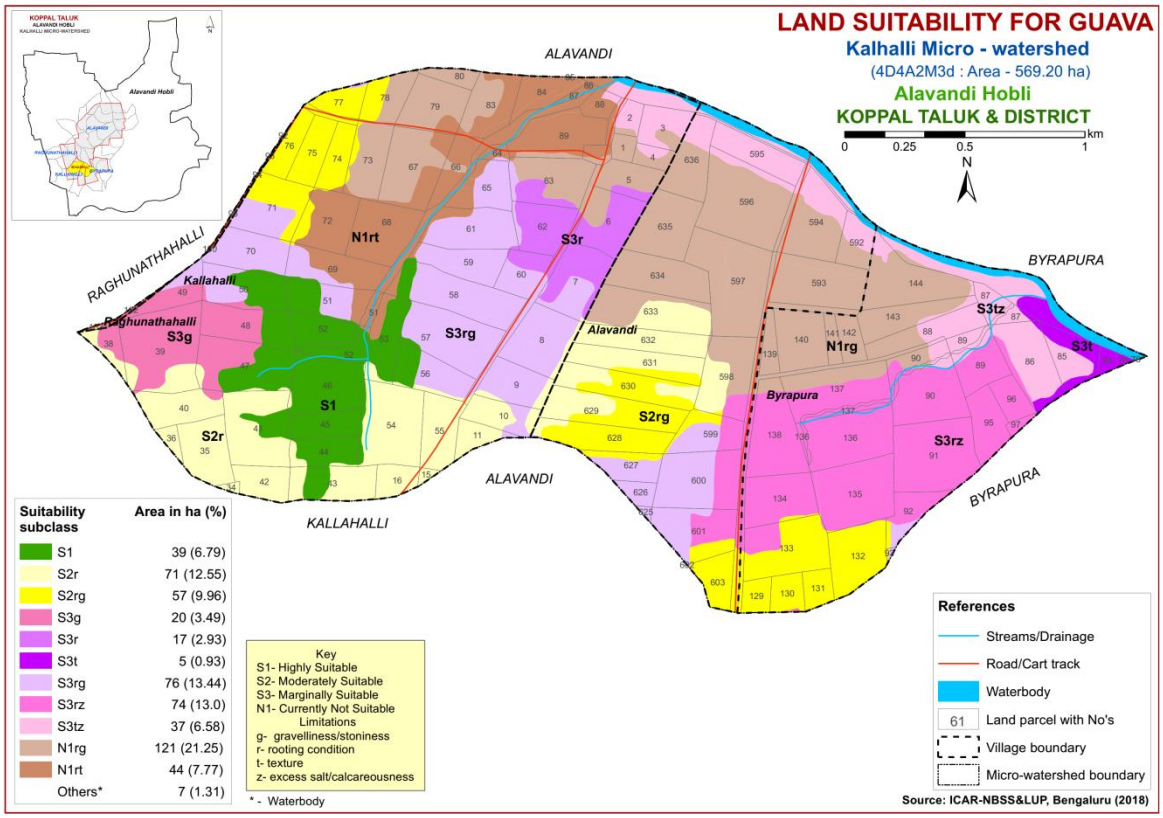


Fig. 7.16 Land Suitability map of Guava

7.17 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 (Table.7.18) for growing jackfruit 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 7.17.

An area of about 39 ha (7%) is highly suitable (Class S1) for growing jackfruit and distributed in the southwestern part of the microwatershed. Moderately suitable (Class S2) lands cover an area of about 128 ha (23%) and are distributed in the southern and northwestern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 229 ha (40 %) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, texture and calcareousness. Area currently not suitable (Class N1) for growing jackfruit cover about 165 ha (29 %) and distributed in the northeastern, northern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and texture.

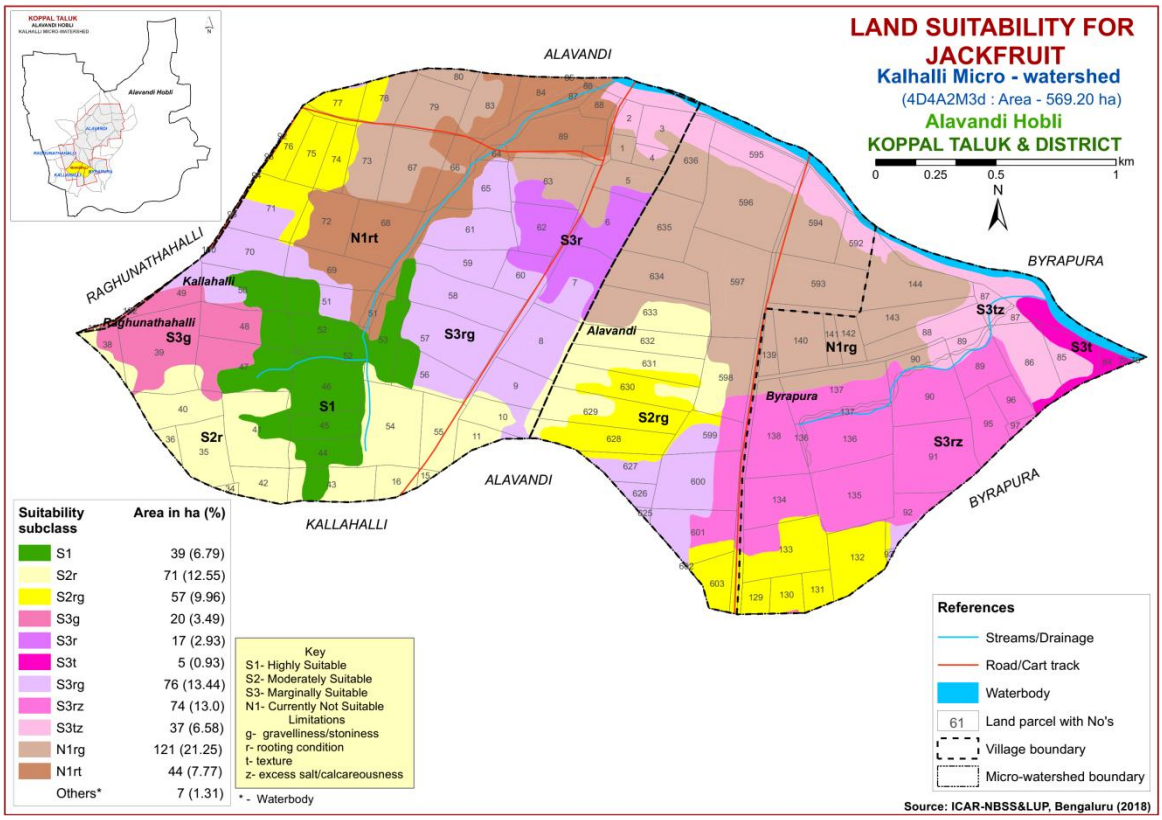


Fig. 7.17 Land Suitability map of Jackfruit

7.18 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the state. The crop requirements (Table 7.19) for growing jamun were matched with the soil-site characteristics 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 7.18.

Moderately suitable (Class S2) lands occupy an area of about 209 ha (37 %) and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 187 ha (33%) and are distributed in the western, central and southeastern part of the microwatershed with moderate limitations of rooting depth, gravelliness and calcareousness. Area currently not suitable (Class N1) for growing jamun cover about 165 ha (29 %) and distributed in the northeastern, northern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and texture.

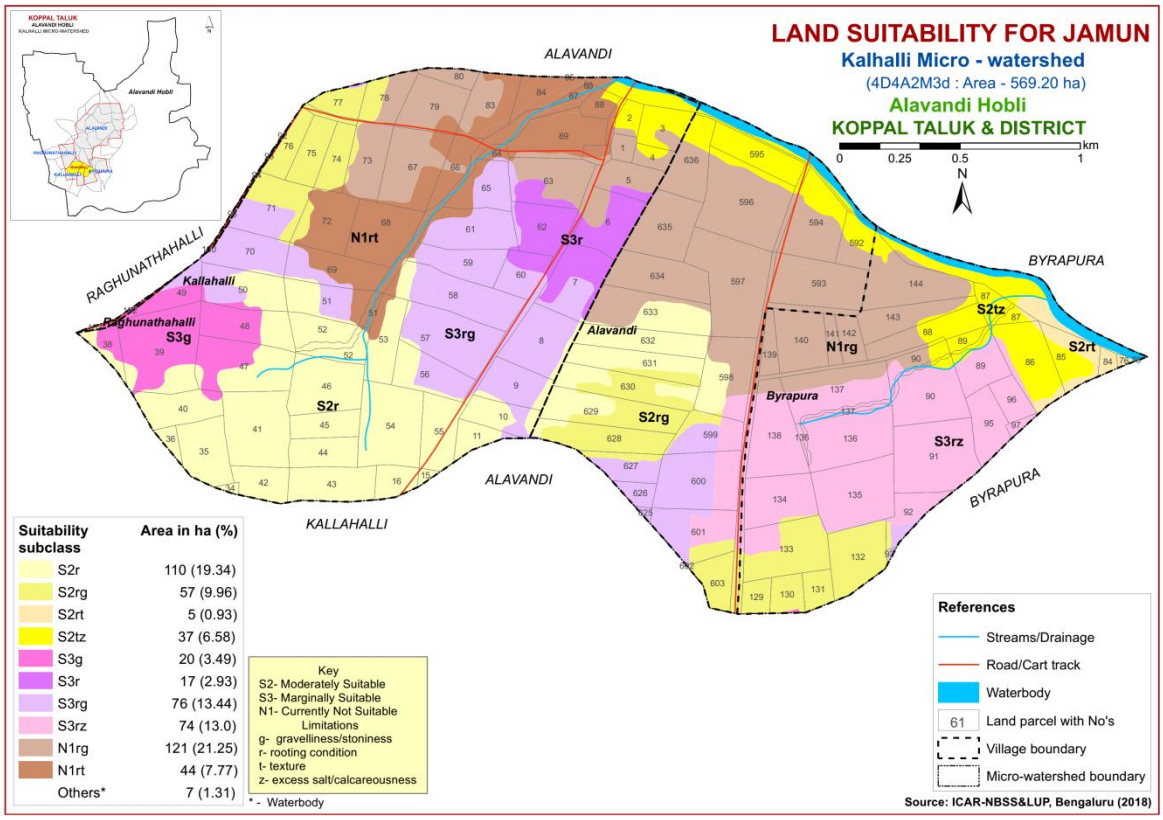


Fig. 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in an area of 5446 ha in almost all the districts of the state. The crop requirements (Table 7.20) for growing musambi 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.

An area of about 44 ha (7%) is highly suitable (Class S1) for growing musambi and are distributed in the southwestern part of the microwatershed. An area of about 165 ha (29 %) is moderately suitable (Class S2) and occur in the southern, northwestern and northeastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Maximum area of about 187 ha (33 %) is marginally suitable (Class S3) for growing musambi and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, rooting depth, calcareousness and texture. Area currently not suitable (Class N1) for growing musambi cover about 165 ha (10%) and distributed in the northeastern, northern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

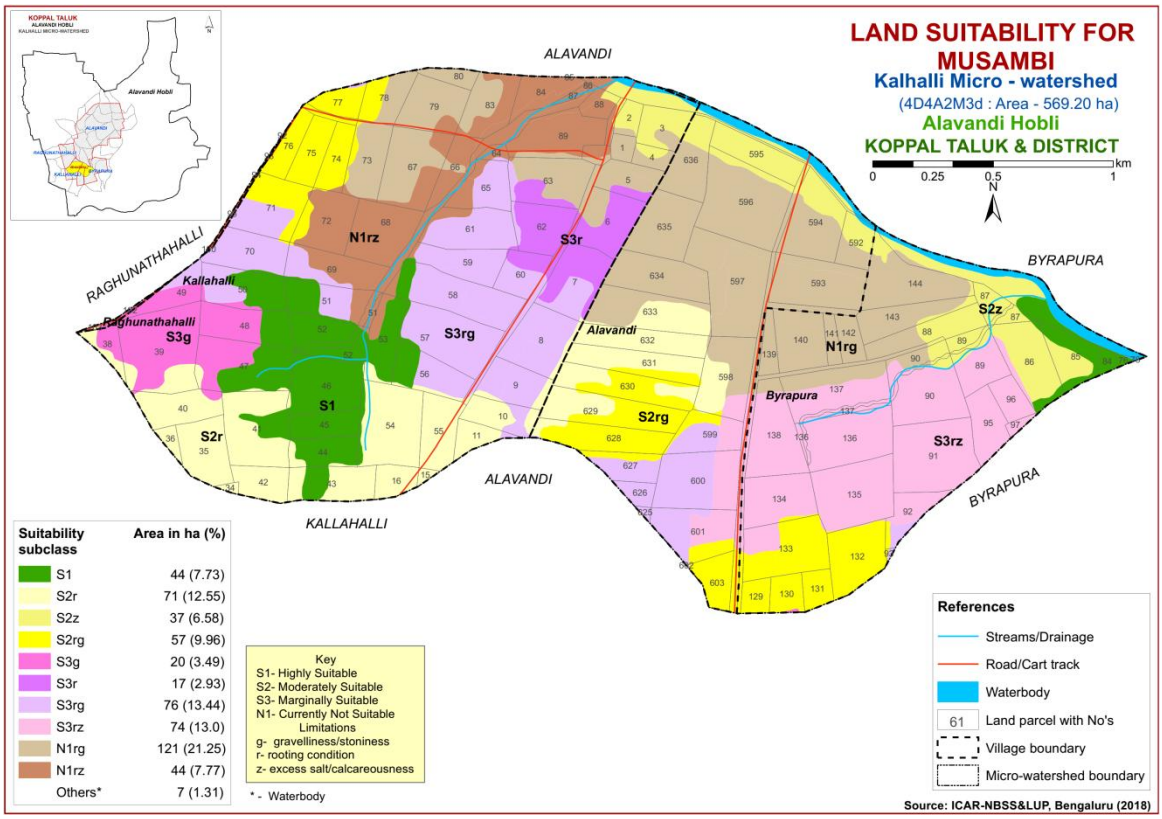


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 11752 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.

An area of about 44 ha (7%) is highly suitable (Class S1) for growing lime and are distributed in the southwestern part of the microwatershed. An area of about 165 ha (29 %) is moderately suitable (Class S2) and occur in the southern, northwestern and northeastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Maximum area of about 187 ha (33 %) is marginally suitable (Class S3) for growing lime and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, rooting depth and calcareousness . Area currently not suitable (Class N1) for growing lime cover about 165 ha (10 %) and distributed in the northeastern, northern and central part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

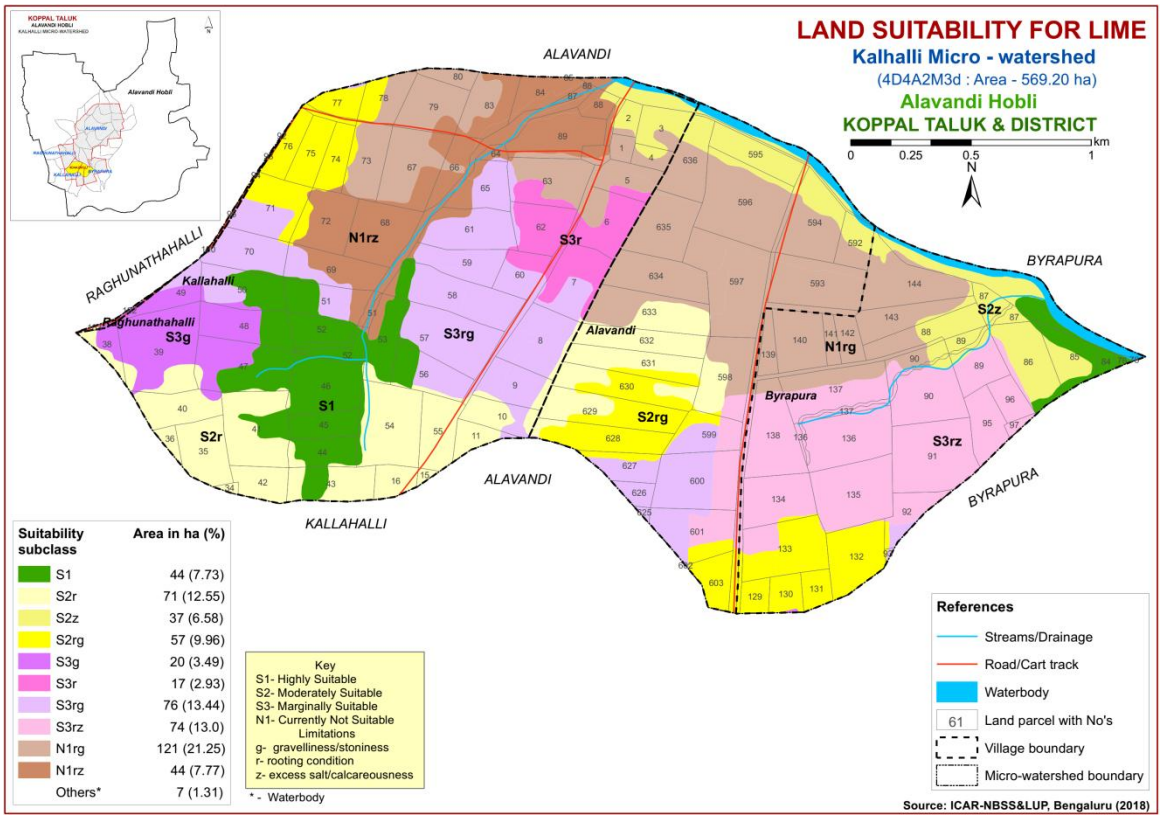


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important nut crop grown in an area of 7052 ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.22) 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 7.21.

An area of about 39 ha (7%) is highly suitable (Class S1) for growing cashew and are distributed in the southwestern part of the microwatershed. An area of about 128 ha (23%) is moderately suitable (Class S2) and occur in the southern and western part of the microwatershed. They have minor limitations of gravelliness and rooting depth. An area of about 113 ha (20%) is marginally suitable (Class S3) for growing cashew and are distributed in the central and western part of the microwatershed with moderate limitations of gravelliness and rooting depth. Maximum area of about 281 ha (50%) is currently not suitable (Class N1) for growing cashew and distributed in the major part of the microwatershed with severe limitations of rooting depth, texture, nutrient availability, gravelliness and calcareousness.

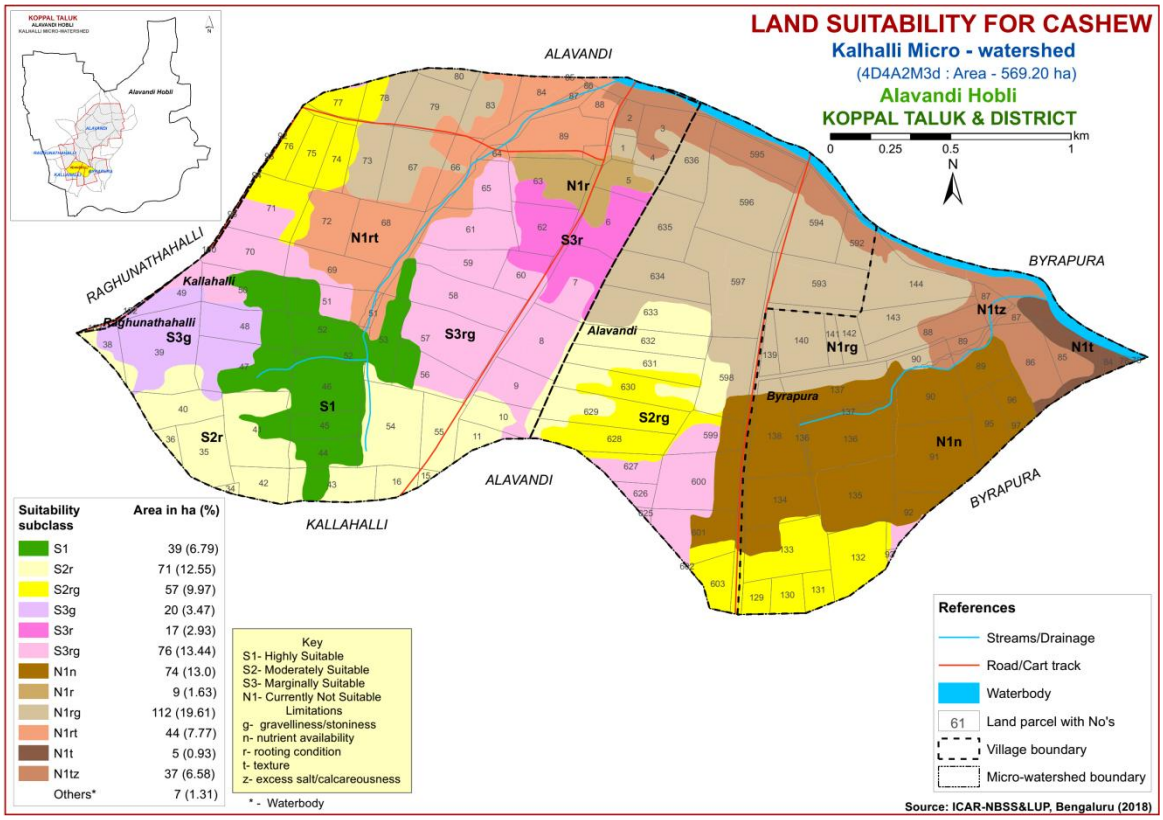


Fig. 7.21 Land Suitability map of Cashew

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the State. The crop requirements(Table 7.23) for growing custard apple 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 7.22.

An area of about 115 ha (20%) is highly suitable (Class S1) for growing custard apple and are distributed in the central and southwestern part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 281 ha (49%) and occur in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 73 ha (13%) is marginally suitable (Class S3) for growing custard apple and are distributed in the northern and central part of the microwatershed with moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 91 ha (16%) is currently not suitable (Class N1) for growing custard apple and distributed in the northeastern and central part of the microwatershed with severe limitations of rooting depth and gravelliness.

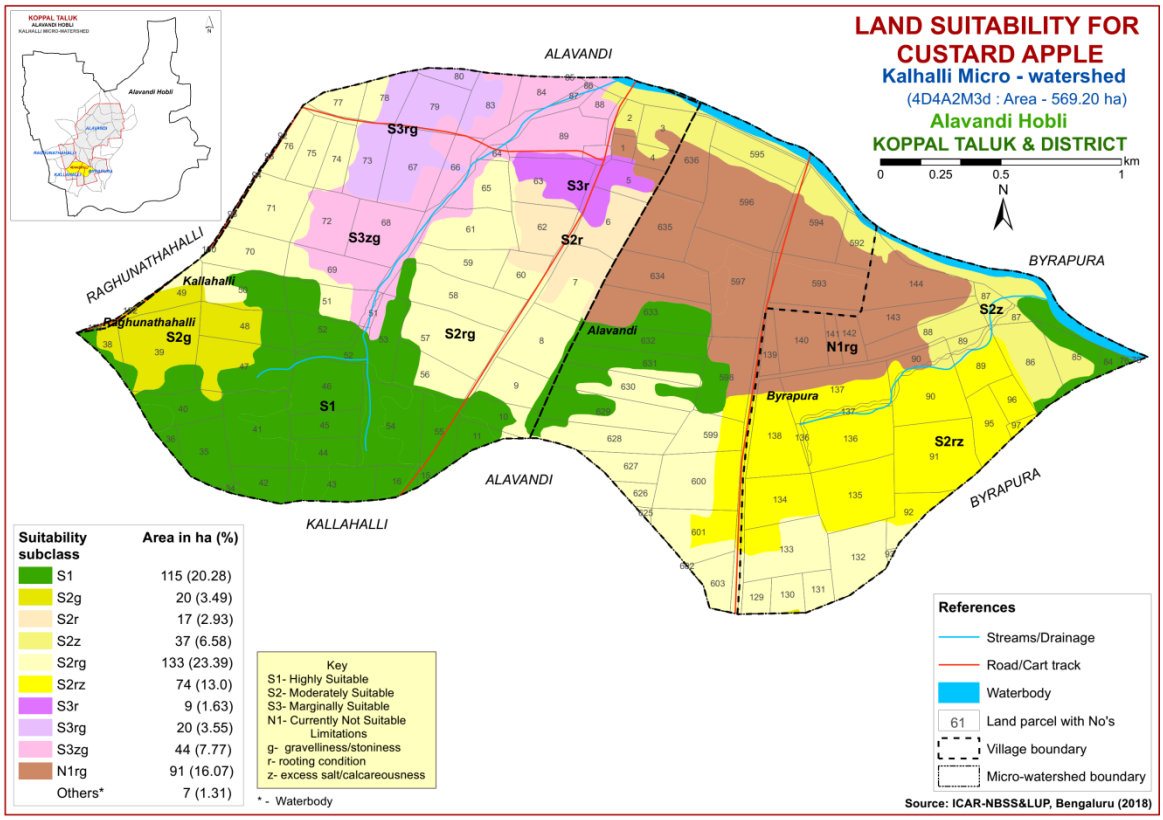


Fig. 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in an area of 151 ha and distributed in almost all the districts of the state. The crop requirements (Table 7.24) for growing amla 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 7.23.

An area of about 110 ha (19%) is highly suitable (Class S1) for growing amla and are distributed in the central and northwestern part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 286 ha (50%) and occur in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. An area of about 73 ha (13%) is marginally suitable (Class S3) for growing amla and are distributed in the northern and central part of the microwatershed with moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 91 ha (16 %) is currently not suitable (Class N1) for growing amla and distributed in the northeastern and central part of the microwatershed with severe limitations of rooting depth and gravelliness.

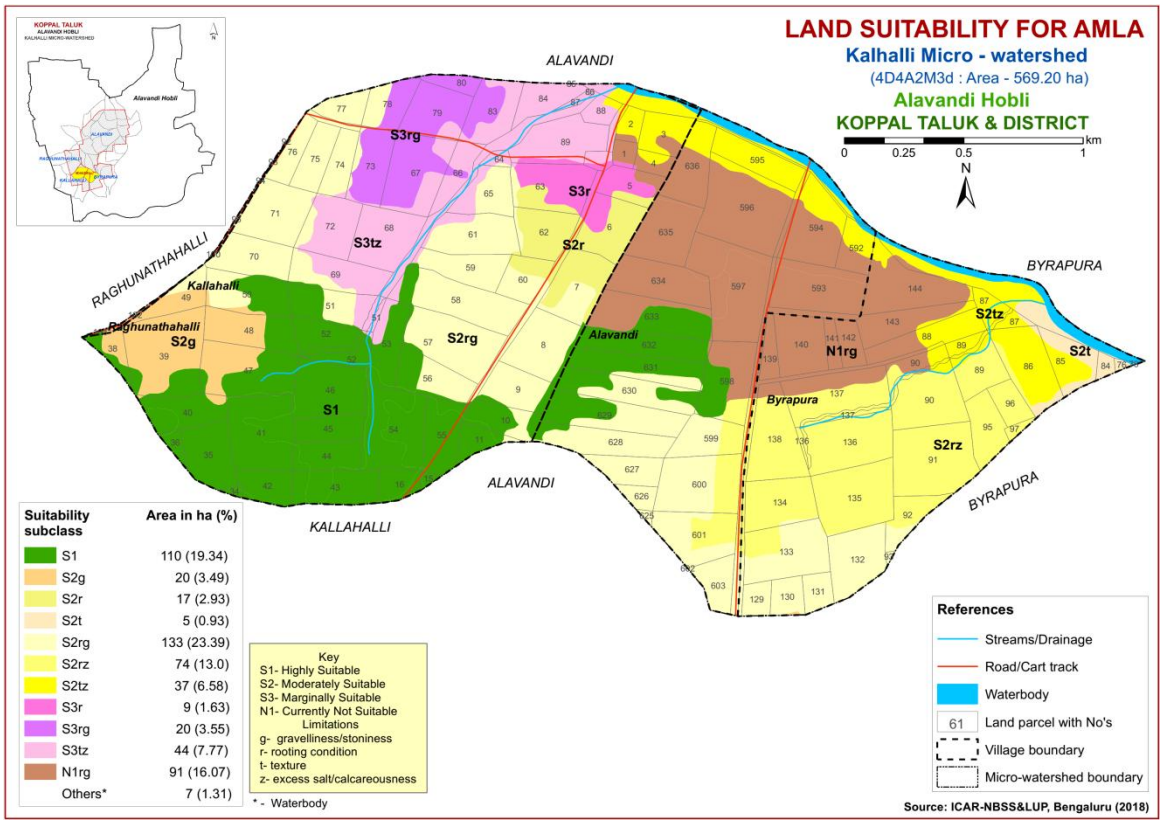


Fig. 7.23 Land Suitability map of Amla

7.24 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 (Table 7.25) for growing tamarind 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 are given in Figure 7.24.

An area of about 81 ha (14%) is moderately suitable (Class S2) and occur in the southwestern, northern and northeastern part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. An area of about 147 ha (26 %) is marginally suitable (Class S3) for growing tamarind and are distributed in the western and southern part of the microwatershed with moderate limitations of gravelliness and rooting depth. Maximum area of about 332 ha (58%) is currently not suitable (Class N1) for growing tamarind and distributed in the major part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

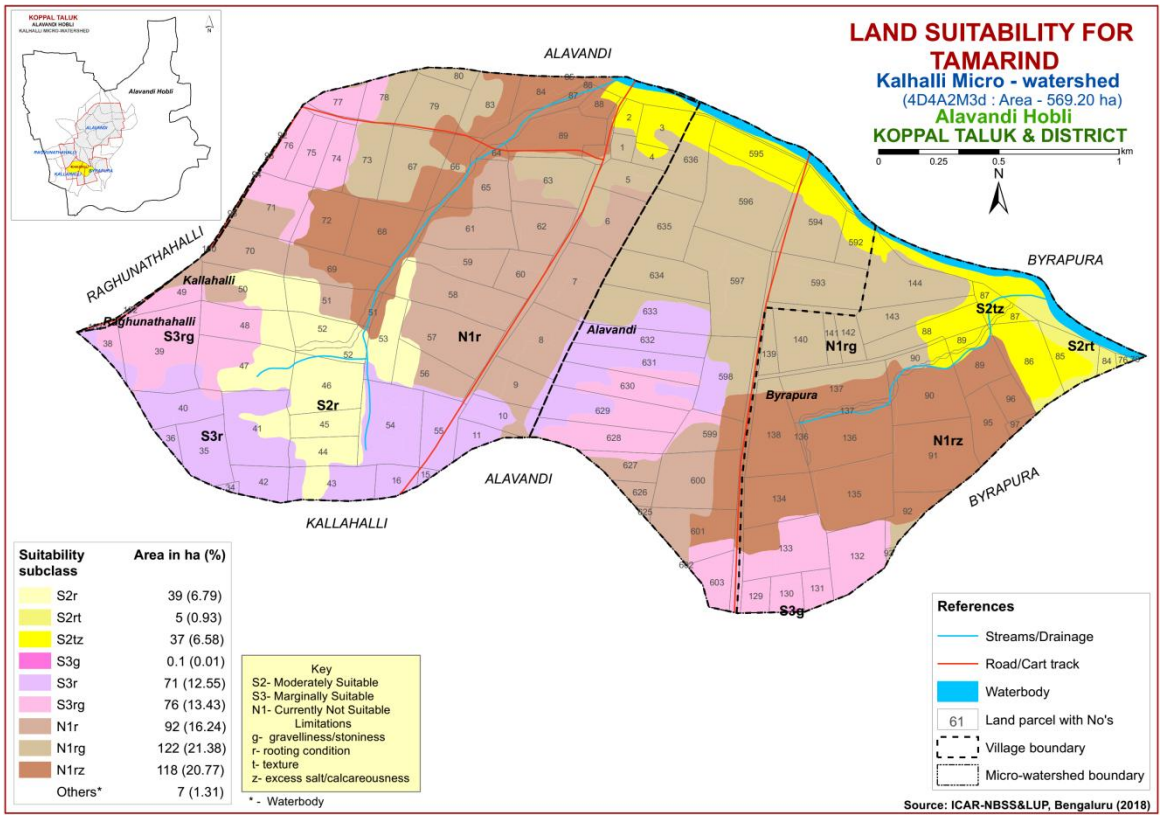


Fig. 7.21 Land Suitability map of Tamarind

7.25 Land Suitability for Marigold (*Tagetes erecta*)

Marigold is one of the most important flower crop grown in an area of 9108 ha in almost all the districts of the state. The crop requirements (Table 7.26) for growing marigold were matched with the soil-site characteristics 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 7.25.

An area of about 39 ha (7%) is highly suitable (Class S1) for growing marigold and are distributed in the southwestern part of the microwatershed. Maximum area of about 246 ha (43 %) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and calcareousness. An area of about 184 ha (32%) is marginally suitable (Class S3) for growing marigold and are distributed in the northern, southern and western part of the microwatershed with moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 91 ha (16%) is currently not suitable (Class N1) for growing marigold and distributed in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

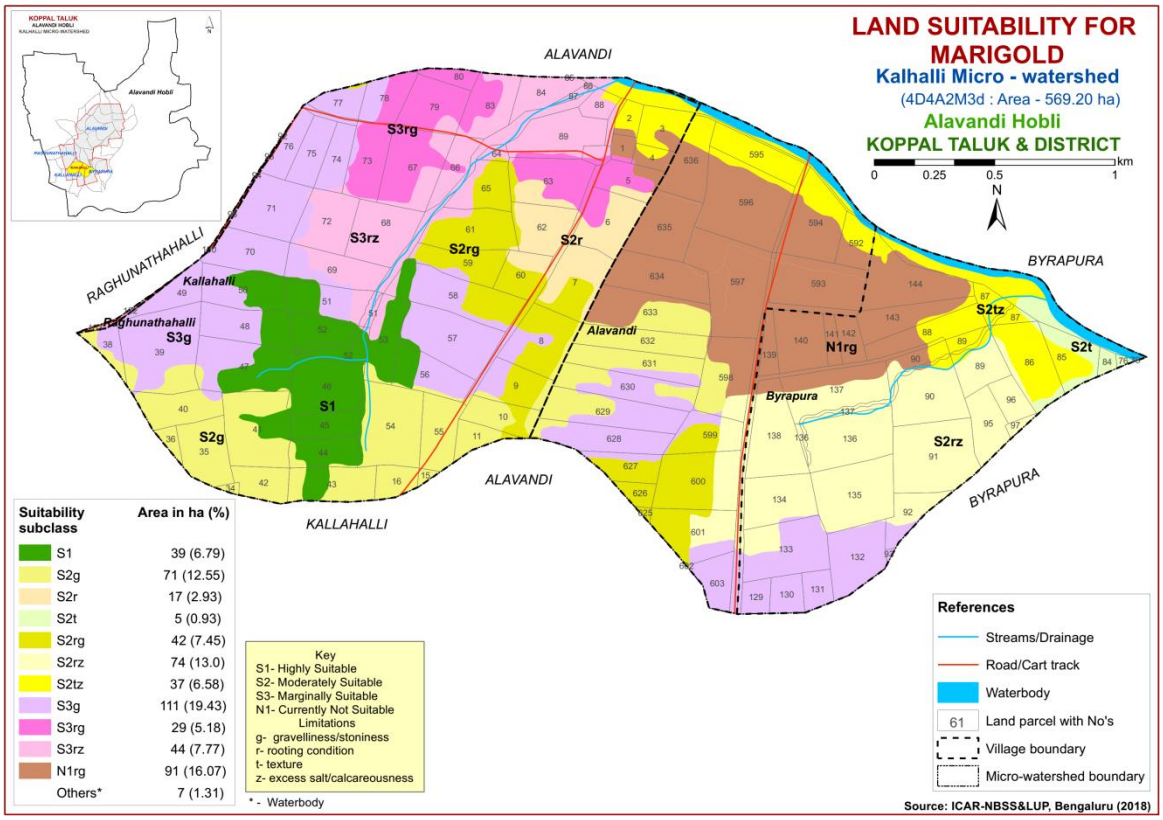


Fig. 7.25 Land Suitability map of Marigold

7.26 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 (Table 7.27) for growing chrysanthemum 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 7.26.

An area of about 39 ha (7%) is highly suitable (Class S1) for growing chrysanthemum and are distributed in the southwestern part of the microwatershed. Maximum area of about 246 ha (43 %) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and calcareousness. An area of about 184 ha (32%) is marginally suitable (Class S3) for growing chrysanthemum and are distributed in the northern, southern and western part of the microwatershed with moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 91 ha (16%) is currently not suitable (Class N1) for growing chrysanthemum and distributed in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

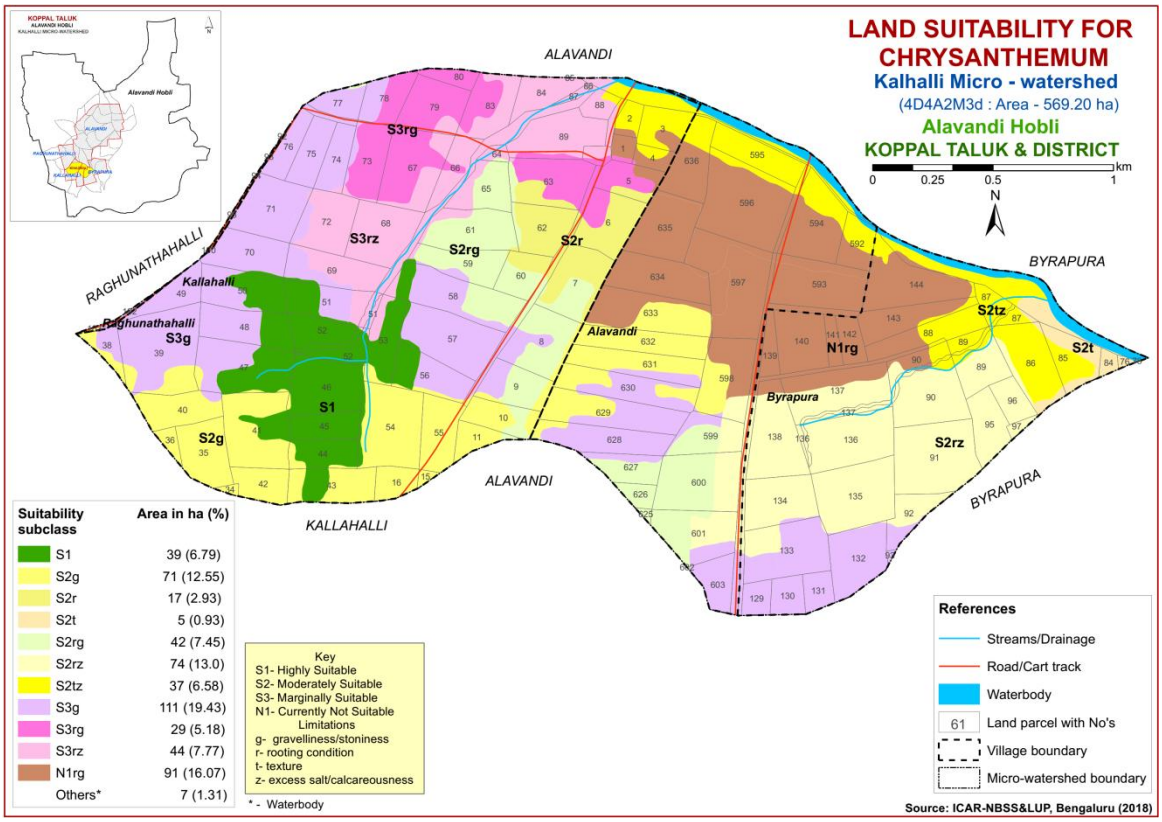


Fig. 7.26 Land Suitability map of Chrysanthemum

7. 27 Land Suitability for Jasmine *(Jasminum sp.)*

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.28) 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 7.27.

An area of about 39 ha (7 %) is highly suitable (Class S1) for growing jasmine and are distributed in the southwestern part of the microwatershed. An area of about 204 ha (36%) is moderately suitable (Class S2) and occur in the southern, central and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Maximum area of about 226 ha (40 %) is marginally suitable (Class S3) for growing jasmine and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 91 ha (16 %) is currently not suitable (Class N1) for growing jasmine and distributed in the central and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

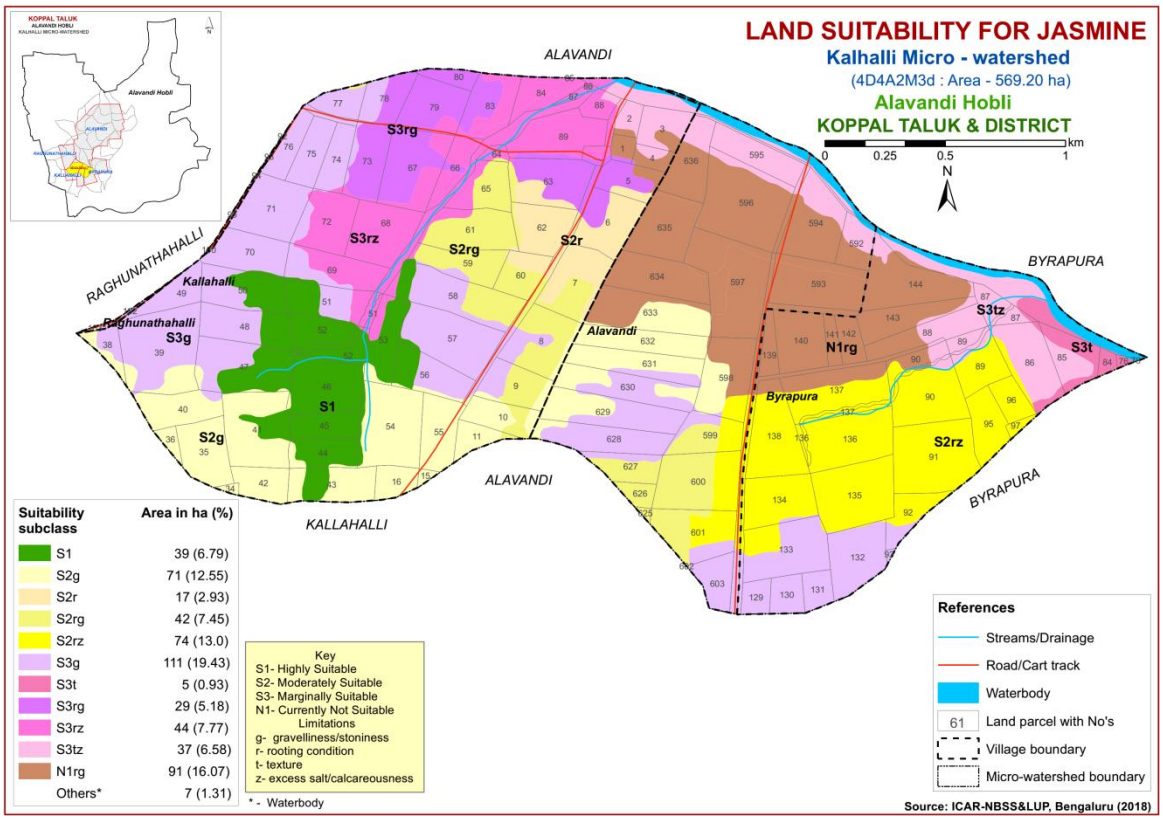


Fig. 7.27 Land Suitability map of Jasmine

7. 28 Land Suitability for Crossandra *(Crossandra infundibuliformis)*

Crossandra is one of the most important flower crop grown in almost all the districts of the State. 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 7.28.

An area of about 39 ha (7 %) is highly suitable (Class S1) for growing crossandra and are distributed in the southwestern part of the microwatershed. An area of about 204 ha (36%) is moderately suitable (Class S2) and occur in the southern, central and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and calcareousness. Maximum area of about 221 ha (40 %) is marginally suitable (Class S3) for growing crossandra and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 91 ha (16 %) is currently not suitable (Class N1) for growing crossandra and distributed in the central and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

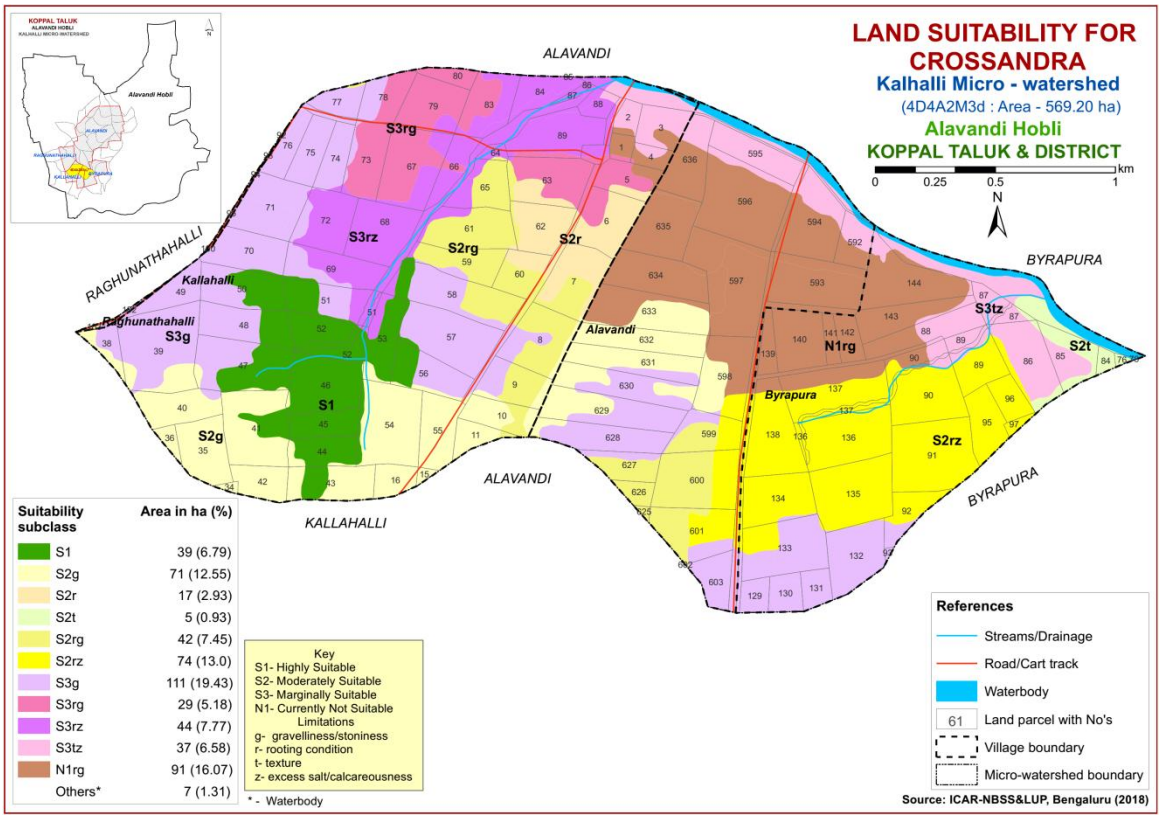


Fig. 7.28 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Kalhalli 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 (dSm^{-1})	ESP	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
BGTmB2g1	662	<90	WD	<25	c	gc	15-35	>35	<50	1-3	moderate	8.4	0.15	1.11	44.84	-
BGTmB2g3	662	<90	WD	<25	c	gc	60-80	>35	<50	1-3	moderate	8.4	0.15	1.11	44.84	-
DVHcB2g2	662	<90	WD	<25	c	scl	35-60	<15	<50	1-3	moderate	6.71	0.08	1.01	13.91	100
DVHhB2g2	662	<90	WD	<25	scl	scl	35-60	<15	<50	1-3	moderate	6.71	0.08	1.01	13.91	100
KGPhB2g2	662	<90	WD	25-50	scl	gscl-gsc	35-60	15-35	<50	1-3	moderate	-	-	-	-	-
KGPiB1g1	662	<90	WD	25-50	sc	gscl-gsc	15-35	15-35	<50	1-3	slight	-	-	-	-	-
KTPiB1	662	<90	WD	50-75	sc	sc	-	15-35	51-100	1-3	slight	6.42	0.07	0.05	4.41	100
LKRhB2g2	662	<90	WD	50-75	scl	gsc	35-60	40-60	<50	1-3	moderate	8.18	0.30	4.51	12.19	100
MKHcB2g2	662	<90	WD	50-75	sl	gscl	35-60	>35	<50	1-3	moderate	7.38	0.09	1.49	14.84	93
MKHhB1	662	<90	WD	50-75	scl	gscl	-	>35	<50	1-3	slight	7.38	0.09	1.49	14.84	93
MKHhB2g2	662	<90	WD	50-75	scl	gscl	35-60	>35	<50	1-3	moderate	7.38	0.09	1.49	14.84	93
MKHiB1g1	662	<90	WD	50-75	sc	gscl	15-35	>35	<50	1-3	slight	7.38	0.09	1.49	14.84	93
MKHiB2g1	662	<90	WD	50-75	sc	gscl	15-35	>35	<50	1-3	moderate	7.38	0.09	1.49	14.84	93
BDGhB1g1	662	<90	WD	75-100	scl	gc	15-35	35-60	51-100	1-3	slight	6.24	0.06	0.35	3.76	53
GHTcB1g1	662	<90	WD	75-100	sl	gscl	15-35	15-35	51-100	1-3	slight	5.70	0.06	4.10	3.17	73
GHTcB2g1	662	<90	WD	75-100	sl	gscl	15-35	15-35	51-100	1-3	moderate	5.70	0.06	4.10	3.17	73
GHThB1	662	<90	WD	75-100	scl	gscl	-	15-35	51-100	1-3	slight	5.70	0.06	4.10	3.17	73
GHThB2g1	662	<90	WD	75-100	scl	gscl	15-35	15-35	51-100	1-3	moderate	5.70	0.06	4.10	3.17	73
GHTiB1	662	<90	WD	75-100	sc	gscl	-	15-35	51-100	1-3	slight	5.70	0.06	4.10	3.17	73
HDHhB1g2	662	<90	WD	75-100	scl	gsc-gc	35-60	>35	51-100	1-3	slight	6.54	0.07	7.11	5.84	85
HDHhB2g2	662	<90	WD	75-100	scl	gsc-gc	35-60	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	85
HDHiB1	662	<90	WD	75-100	sc	gsc-gc	-	>35	51-100	1-3	slight	6.54	0.07	7.11	5.84	85
HDHiB2g1	662	<90	WD	75-100	sc	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	85
BPRiB2	662	<90	WD	100-150	sc	gsc-gc	-	>35	51-100	1-3	moderate	6.64	0.03	0.51	5.45	63

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
KMHiB2	662	<90	WD	100-150	sc	sc	35-60	<15	101-150	1-3	moderate	7.2	0.19	0.54	15.07	100
NGPiB1	662	<90	WD	100-150	sc	gsc-gc	-	>35	51-100	1-3	slight	6.67	0.09	0.46	7.10	83
MTLiB1g1	662	<90	WD	25-50	sc	gc	15-35	15-35	51-100	1-3	slight	8.27	0.20	0.69	36.64	-
MTLiB2g2	662	<90	WD	25-50	sc	gc	35-60	15-35	51-100	1-3	moderate	8.27	0.20	0.69	36.64	-
MTLmB2	662	<90	WD	25-50	c	gc	-	15-35	51-100	1-3	moderate	8.27	0.20	0.69	36.64	-
MTLmB2g1	662	<90	WD	25-50	c	gc	15-35	15-35	51-100	1-3	moderate	8.27	0.20	0.69	36.64	-
KSPiB1g1	662	<90	WD	50-75	sc	gscl	15-35	15-35	51-100	1-3	slight	-	-	-	-	-
KSPiB2g2	662	<90	WD	50-75	sc	gscl	35-60	15-35	51-100	1-3	moderate	-	-	-	-	-
HDLmB1	662	<90	MWD	100-150	c	c	-	-	>200	1-3	slight	9.06	0.37	5.09	62.33	-
MLRmB1	662	<90	MWD	100-150	c	c	-	10-20	>200	1-3	slight	9.19	0.31	5.39	42.08	-
AWDmB2	662	<90	MWD	>150	c	c	-	<15	>200	1-3	moderate	8.10	0.37	1.22	51.30	100

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 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 7.8 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 7.9 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 7.10 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 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 7.13 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 7.14 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 7.15 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 7.16 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 7.17 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 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 7.19 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 7.20 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 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 7.23 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 7.24 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 7.25 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 7.26 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 7.27 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	%				
	$CaCO_3$ 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 7.28 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	%				
	$CaCO_3$ 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

7.29 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	%				
	$CaCO_3$ 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

7.29 Land Management Units (LMUs)

The 35 soil map units identified in Kalhalli microwatershed have been grouped into seven 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 Management Units map (Fig.7.29) 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 seven Land Management Units along with brief description of soil and site characteristics are given below.

LMU	Mapping unit	Soil and site characteristics
1	AWDmB2, MLRmB1, HDLmB1	Deep to Very deep, black calcareous clay soils with slopes of 1-3%, slight to moderate erosion
2	HDHhB1g2, HDHhB2g2, HDHiB1, HDHiB2g1, BPRiB2, BDGhB1g1, NGPiB1	Moderately deep to deep, gravelly red sandy clay to clay soils with slopes of 1-3%, slight to moderate erosion, gravelly to very gravelly (15-60%)
3	GHTcB1g1, GHTcB2g1, GHThB1, GHThB2g1, GHTiB1, KMHiB2	Moderately deep to deep red sandy clay to clay soils with slopes of 1-3%, slight to moderate erosion, gravelly (15-35%)
4	LKRhB2g2, MKHcB2g2, MKHhB1, MKHhB2g2, MKHiB1g1, MKHiB2g1	Moderately shallow, red gravelly sandy clay to sandy clay loam soils with slopes of 1-3%, slight to moderate erosion, gravelly to very gravelly (15-60%)
5	KSPiB1g1, KSPiB2g2, KTPiB1	Moderately shallow, red calcareous to non calcareous sandy clay to sandy clay loam soils with slopes of 1-3%, slight to moderate erosion, gravelly to very gravelly (15-60%)
6	KGPhB2g2, KGPiB1g1 , DVHcB2g2, DVHhB2g2	Very shallow to shallow, red sandy clay to sandy clay loam soils with slopes of 1-3%, slight to moderate erosion, gravelly to very gravelly (15-60%)
7	MTLiB1g1, MTLiB2g2, MTLmB2, MTLmB2g1, BGTmB2g1, BGTmB2g3	Very shallow to shallow, calcareous black gravelly sandy clay to clay soils with slopes of 1-3%, slight to moderate erosion, gravelly to extremely gravelly (15-80%)

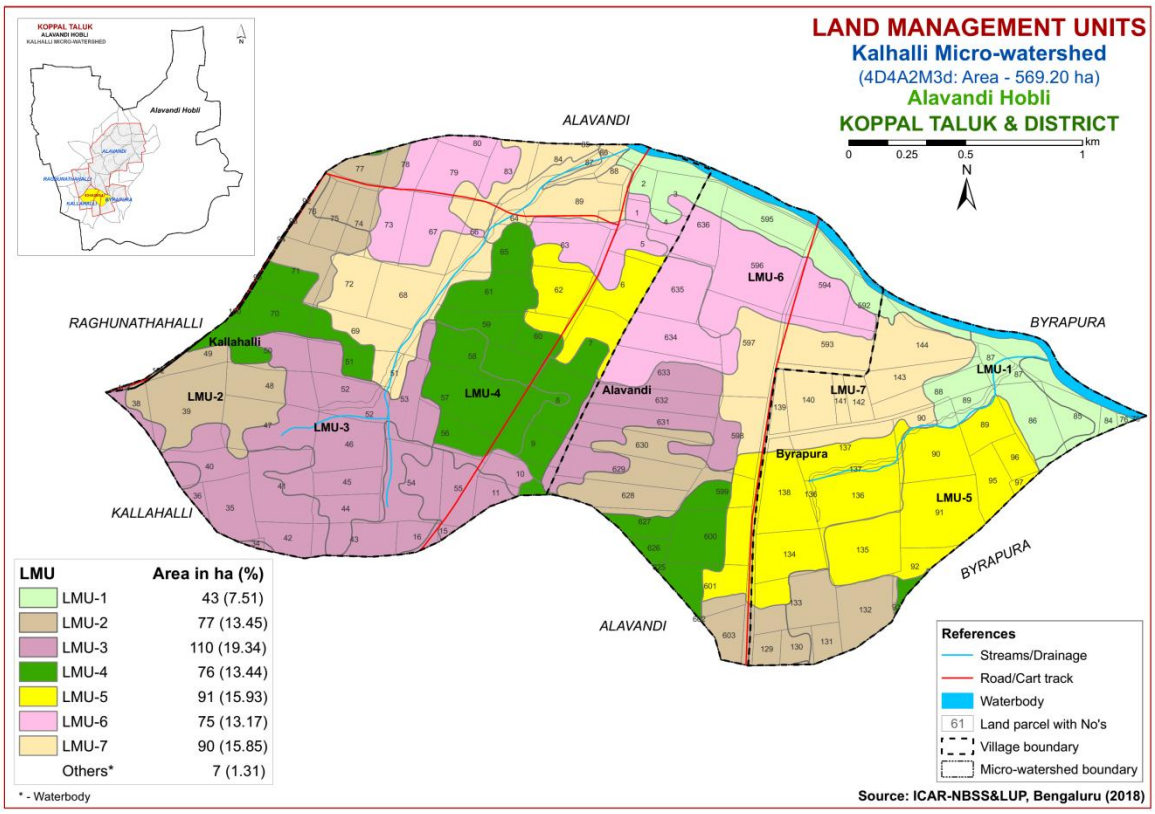


Fig 7.29 Land Management Units map of Kalhalli microwatershed

7.30 Proposed Crop Plan for Kalhalli Microwatershed

After assessing the land suitability for the 28 crops, the proposed crop plan has been prepared for the seven 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 7.29.

Table 7.29 Proposed Crop Plan for Kalhalli Microwatershed

LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	424.AWDmB2 415.MLRmB1 380.HDLmB1 (Deep to Very deep, black calcareous clay soils)	**Alavandi :**592,595 **Byrapura:**76,78,84,85,86, 87,88 **Kallahalli:** 2,3	Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Musambi, Pomegranate, Jamun, Lime, Tamarind, Amla, Custard apple **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
2	121.HDHhB1g2 124.HDHhB2g2 125.HDHiB1 128.HDHiB2g1 239.BPRiB2 185.BDGhB1g1 262.NGPiB1 (Moderately deep to deep, gravelly red sandy clay to clay soils)	**Alavandi:**603,628,629,630 **Byrapura:**129,130,131,13 2, 133 **Kallahalli:**38,39,48,49,71, 74,75, 76,77 **Raghunathahalli:**92,93,94 ,102	Groundnut, Red gram, Bajra, Horse gram, Castor	**Fruit crops:** Lime, Musambi**,** Jackfruit, Jamun, Amla, Cashew, Custard apple **Vegetable crops:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
3	135.GHTcB1g1 138.GHTcB2g1 140.GHThB1 142.GHThB2g1 144.GHTiB1 201.KMHiB2 (Moderately deep to deep red sandy clay to clay soils)	**Alavandi :** 631,632 **Kallahalli:**10,11,15,16,34, 35,36,40,41,42,43,44,45,46 ,47,50,51,52,53,54,55 **Raghunathahalli :**103	Maize, Sorghum, Bajra, Groundnut, Redgram, Castor	**Fruit crops:** Tamarind, Pomegranate, Guava, Sapota, Jackfruit, Jamun, Lime, Musambi, Amla, Custard apple **Vegetable crops:** Brinjal, Drumstick, Tomato, Chilli, **Flower crops:** Marigold, Chrysanthemum, Jasmine	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
4	47.LKRhB2g2 78.MKHcB2g2	**Alavandi:**599,600,601,602 , 625,626,627	Sorghum, Groundnut, Bajra,	**Fruit crops:** Amla, Cashew, Custard apple	Drip irrigation, mulching, suitable soil

LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
	81.MKHhB1 86.MKHhB2g2 88.MKHiB1g1 90.MKHiB2g1 (Moderately shallow, red gravelly sandy clay to sandy clay loam soils)	**Byrapura :** 93 **Kallahalli:**8,9,56,57,58,59, 60,61, 65,70 **Raghunathahalli:**95,100	Castor		and water conservation practices (Crescent Bunding with Catch Pit etc)
5	322.KSPiB1g1 326.KSPiB2g2 73.KTPiB1 (Moderately shallow, red calcareous to non calcareous sandy clay to sandy clay loam soils)	**Byrapura:**89,90,91,92,95, 96,97,134,135,136,137,138 **Kallahalli :**6,7,62	Maize, Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Amla, Custard apple **Flower crops:** Marigold, Chrysanthemum **Vegetable crops:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
6	18.KGPhB2g2 19.KGPiB1g1 1.DVHcB2g2 2.DVHhB2g2 (Very shallow to shallow, red sandy clay to sandy clay loam soils)	**Alavandi:**594,596,633,634 , 635,636 **Kallahalli:**1,4,5,63,67,73,7 8, 79,80	Horse gram	**Agri-Silvi-Pasture:** Custard apple, Hybrid Napier, Styloxanthes hamata, Glyricidia, Styloxanthes scabra	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers
7	303.MTLiB1g1 305.MTLiB2g2 310.MTLmB2 311.MTLmB2g1 10.BGTmB2g1 12.BGTmB2g3 (Very shallow to shallow, calcareous black gravelly sandy clay to clay soils)	**Alavandi :**593,597,598 **Byrapura:**139,140,141,14 2, 143,144 **Kallahalli:**64,66,68,69,72, 83, 84, 85,86,87,88,89	Bengal gram	**Agri-Silvi-Pasture:** Hybrid Napier, Styloxanthes hamata, Styloxanthes scabra	Sowing across the slope, drip irrigation and mulching is recommended

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 Kalhalli Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of MKH (76 ha), KSP(74 ha), GHT (71 ha), HDH(57 ha), BGT(46 ha), DVH (45 ha), MTL(45 ha), KMH (39 ha), KGP (29 ha), BPR(20 ha), AWD (20 ha), MLR(17 ha), KTP (17 ha), (19), HDL(5 ha), LKR(1 ha), BDG (<1 ha) and NGP(<1 ha).
- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II, III and IV). The major limitations identified in the arable lands were soil and erosion.

- On the basis of soil reaction, an area of about 222 ha (39%) is slightly alkaline (pH 7.3-7.8), 106 ha (19 %)is moderately alkaline (pH 7.8-8.4), 209 ha (37%) is strongly alkaline (pH 8.4-9.0) and 25 ha (4%) is very strongly (pH >9.0), 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.

Alkaline soils

Entire area is under alkaline soils. The following actions are recommended.

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).

Soil Degradation

Soil erosion is one of the major factors affecting the soil health in the microwatershed. An area of about 336 ha (59 %) is under moderate erosion. The areas with 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 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, radish, 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 Kalhalli Microwatershed.
- **Organic Carbon:** An area of about 329 ha (58%) is medium (0.5-0.75%) and 233 ha (41%) is high (>0.75) in OC content. 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 329 ha area where OC is less than 0.75 per cent. 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**: Available phosphorus is low (<23 kg/ha) in 232 ha(41%), medium (23-57 kg/ha) in 227 ha (40 %) and high (>57 kg/ha) in 103 ha (18%) of the

soils. The areas with high phosphorus content reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% phosphorus in areas where it is medium.

- **Available Potassium:** Available potassium is medium (145-337 kg/ha) in 288 ha (51%) and high (>337 kg/ha) in 274 ha (48 %) area of the microwatershed. The areas with high potassium content reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 257 ha (45%), medium in 186 ha (33%) and high (>20 ppm) in 119 ha (21%) area of the microwatershed. Areas with 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.
- **Available iron:** It is deficient (<4.5 ppm) in 549 ha (96%) and sufficient (>4.5 ppm) in 13 ha (2%) area of the microwatershed. To manage iron deficiency iron sulphate @ 25 kg/ha needs to be applied for 2-3 years.
- **Available Zinc:** It is deficient (<0.6 ppm) in the 469 ha (82 %) and sufficient (>0.6 ppm) in 92 ha (16 %) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** Available boron is low in (<0.5ppm) 61 ha (11%), medium (0.5-1.0 ppm) in 481 ha (85%) and high (>1.0 ppm) in 19 ha (3%) area in the microwatershed. The areas with low and medium in boron content need to be applied with sodium borate @ 10kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.
- **Available Manganese**: It is sufficient in the entire area of the microwatershed**.**
- **Available Copper:** It is sufficient in the entire area of the microwatershed**.**
- **Soil Alkalinity:** Entire area in the microwatershed has soils that are slightly to very strongly 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.

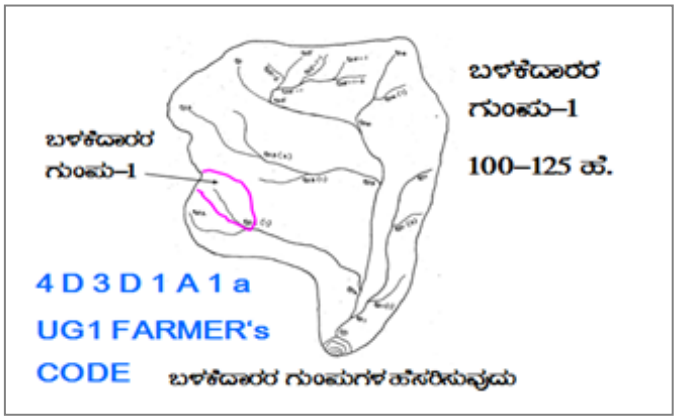
Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, 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 Kalhalli 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.

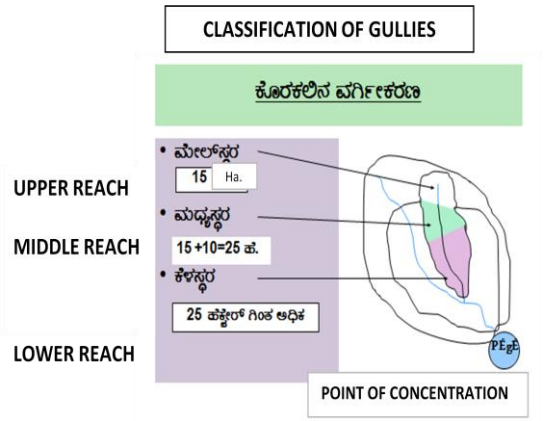
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

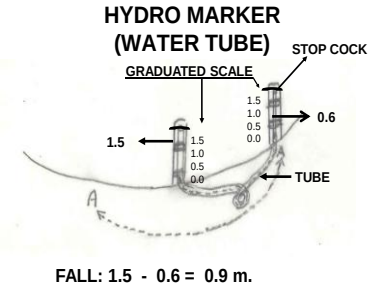
9.1.1 Arable Land Treatment

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.



FALL: 1.5 - 0.6 = 0.9 m.

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.

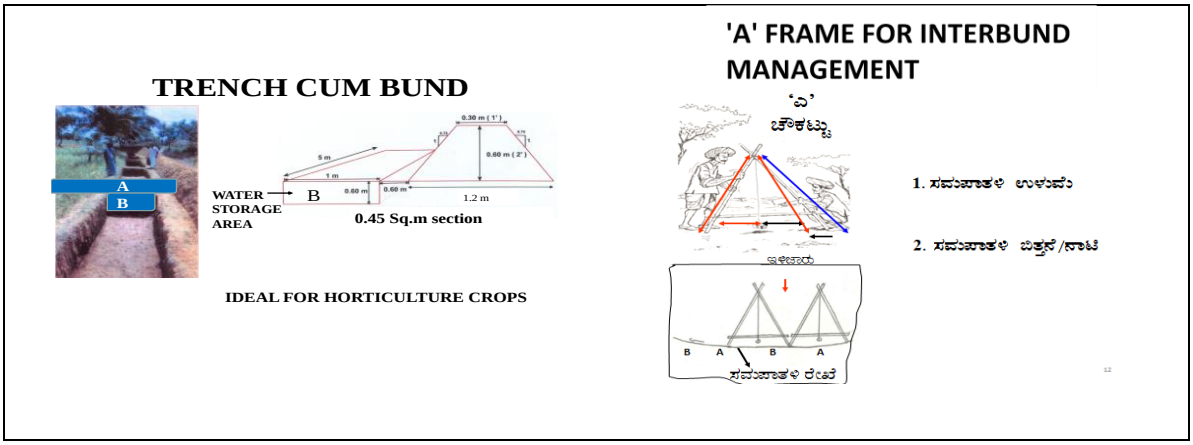
Recommended Bund Section

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 clayey black soils	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow clayey black soils	
0.6	3.1	0.7	1.78:1	1.29	Medium clayey black 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 drainge lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented (Fig.9.1).

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 Levelling 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.

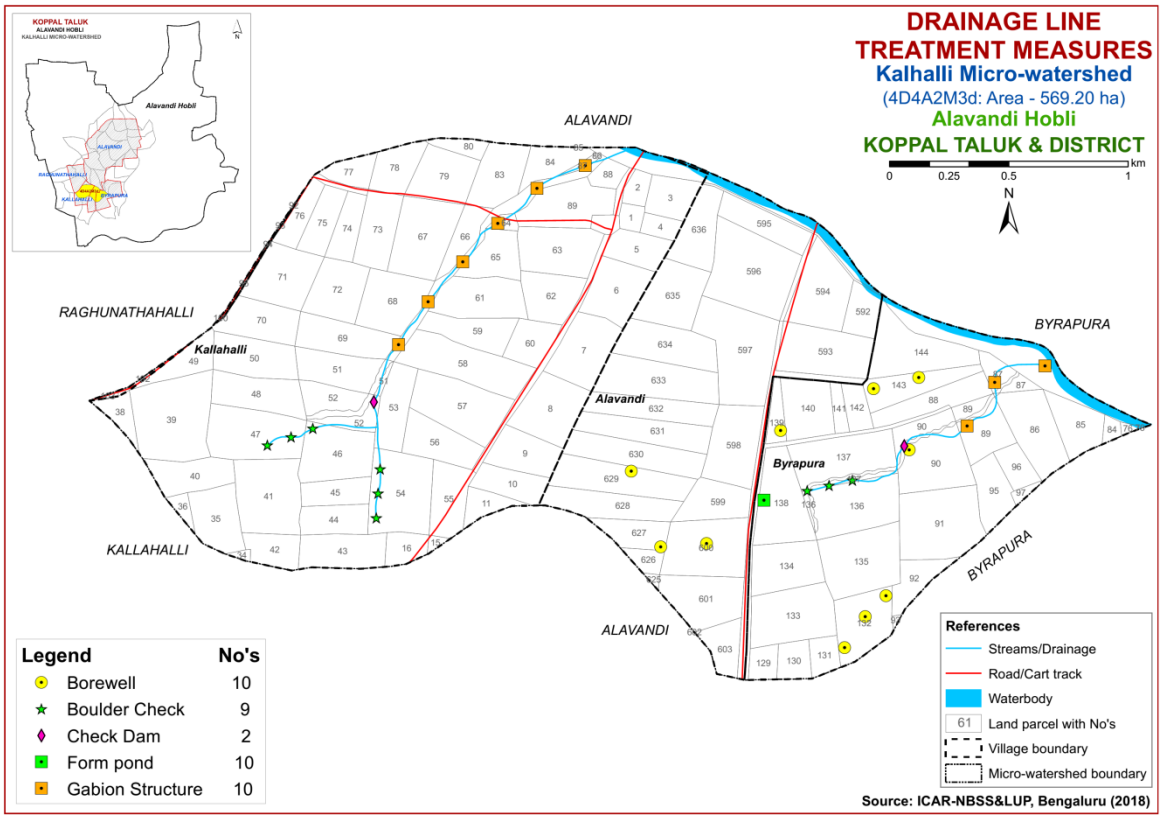


Fig. 9.1 Drainage line treatment map of Kalhalli Microwatershed

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. 9.2) 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 457 ha (80 %) needs trench cum bunding and an area of about 105 ha (18 %) needs graded bunding. The conservation plan prepared may be presented to all the stakeholders including farmers and after considering their suggestions, the conservation plan for the microwatershed may be finalized in a participatory approach.

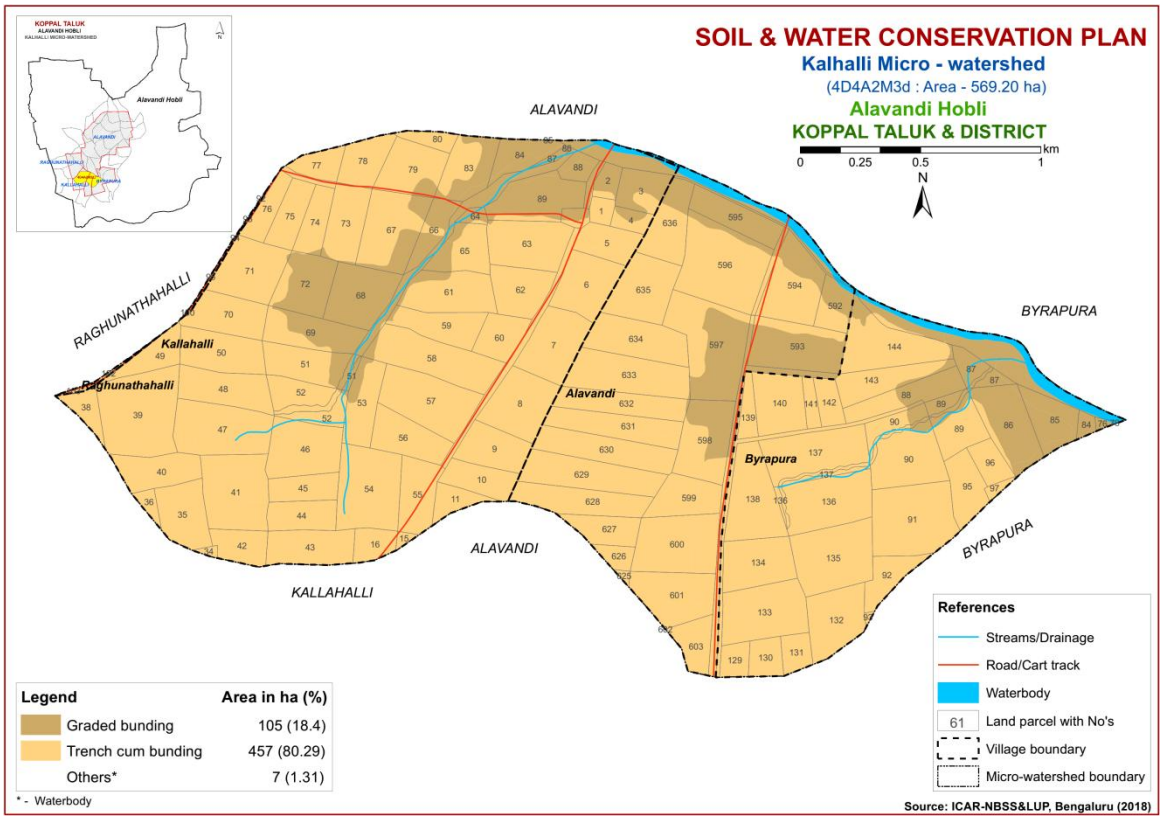


Fig. 9.2 Soil and Water Conservation Plan map of Kalhalli Microwatershed

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 dugout 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

Kalhalli (2M3d) Microwatershed

Soil Phase Information

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Alavandi	592	2.79	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIe	Graded bunding
Alavandi	593	7.41	BGTmB2g1	LMU-7	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow+Maize (Bj+Cf+Mz)	Not Available	IVes	Graded bunding
Alavandi	594	6.95	DVHcB2g2	LMU-6	Very shallow (<25 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Bajra (Cf+Bj)	Not Available	IVes	Trench cum bunding
Alavandi	595	4.19	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	IIIe	Graded bunding
Alavandi	596	11.07	DVHcB2g2	LMU-6	Very shallow (<25 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Bajra+Maize (Cf+Bj+Mz)	Not Available	IVes	Trench cum bunding
Alavandi	597	10.69	BGTmB2g1	LMU-7	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow+Cotton (Bj+Cf+Ct)	Not Available	IVes	Graded bunding
Alavandi	598	6.76	BGTmB2g1	LMU-7	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow (Bj+Cf)	Not Available	IVes	Graded bunding
Alavandi	599	4.27	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Alavandi	600	8.04	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Cotton+Groundnut (Bj+Ct+Gn)	1 Borewell	IIIs	Trench cum bunding
Alavandi	601	6.33	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	602	0	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Current fallow+Sunflower (Jw+Cf+Sf)	Not Available	IIIs	Trench cum bunding
Alavandi	603	2.91	HDHiB1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	Not Available	IIs	Trench cum bunding
Alavandi	625	0.24	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	626	1.3	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Sugarcane (Mz+Sc)	Not Available	IIIs	Trench cum bunding
Alavandi	627	3.2	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Greengram+Maize (Gg+Mz)	1 Borewell	IIIs	Trench cum bunding
Alavandi	628	5.68	HDHhB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Trench cum bunding
Alavandi	629	7.03	HDHhB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Bajra (Cf+Bj)	1 Borewell	IIs	Trench cum bunding
Alavandi	630	6.26	HDHhB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Trench cum bunding
Alavandi	631	5.64	GHTcB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Sparse vegetation (Sv)	Not Available	IIs	Trench cum bunding
Alavandi	632	4.99	GHTcB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Trench cum bunding

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Alavandi	633	7.54	DVHhB2g2	LMU-6	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Maize (Cf+Mz)	Not Available	IVes	Trench cum bunding
Alavandi	634	6.25	DVHhB2g2	LMU-6	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IVes	Trench cum bunding
Alavandi	635	6.23	DVHhB2g2	LMU-6	Very shallow (<25 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IVes	Trench cum bunding
Byrapura	76	0.27	HDLmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Sugarcane+Cotton (Sc+Ct)	Not Available	IIs	Graded bunding
Byrapura	78	0.01	Waterbody	Others	Others	Others	Others	Others	Others	Others	Sugarcane+Greengram (Sc+Gg)	Not Available	Others	Others
Byrapura	84	0.68	HDLmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Graded bunding
Byrapura	85	4.09	HDLmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Byrapura	86	6.49	MLRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Sugarcane+Bajra+Maize (Sc+Bj+Mz)	Not Available	IIs	Graded bunding
Byrapura	87	2.11	MLRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	Graded bunding
Byrapura	88	4.46	MLRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	Graded bunding
Byrapura	89	4.5	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Sunflower+Current fallow+Fallow land (Sf+Cf+Fl)	Not Available	IIs	Trench cum bunding
Byrapura	90	8.41	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Bajra+Maize (Cf+Bj+Mz)	1 Borewell	IIs	Trench cum bunding
Byrapura	91	9.56	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Cotton+Maize (Bj+Ct+Mz)	Not Available	IIs	Trench cum bunding
Byrapura	92	3.02	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Trench cum bunding
Byrapura	93	0.13	LKRhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Fallow land (Cf+Fl)	Not Available	IIIes	Trench cum bunding
Byrapura	95	3.74	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Sugarcane (Cf+Sc)	Not Available	IIs	Trench cum bunding
Byrapura	96	2.17	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Trench cum bunding
Byrapura	97	0.48	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Trench cum bunding
Byrapura	129	1.65	HDHiB1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Trench cum bunding
Byrapura	130	2.16	HDHiB1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Groundnut (Bj+Gn)	Not Available	IIs	Trench cum bunding
Byrapura	131	1.84	HDHhB2g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Byrapura	132	5.9	HDHhB2g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Bajra (Cf+Bj)	3 Borewell	IIes	Trench cum bunding

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Byrapura	133	7.73	HDHhB2g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize+Current fallow+Fallow land (Bj+Mz+Cf+Fl)	Not Available	IIes	Trench cum bunding
Byrapura	134	5.72	KSPiB2g2	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Trench cum bunding
Byrapura	135	8.43	KSPiB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Trench cum bunding
Byrapura	136	7.7	KSPiB2g2	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra+Groundnut+Current fallow (Mz+Bj+Gn+Cf)	Not Available	IIes	Trench cum bunding
Byrapura	137	7.81	KSPiB2g2	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Bajra (Fl+Bj)	Not Available	IIes	Trench cum bunding
Byrapura	138	7.27	KSPiB2g2	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow+Groundnut (Bj+Cf+Gn)	1 Form pond	IIes	Trench cum bunding
Byrapura	139	1.56	BGTmB2g3	LMU-7	Very shallow (<25 cm)	Clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	1 Borewell	IVes	Trench cum bunding
Byrapura	140	5.03	BGTmB2g3	LMU-7	Very shallow (<25 cm)	Clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra+Cotton (Mz+Bj+Ct)	Not Available	IVes	Trench cum bunding
Byrapura	141	1.14	BGTmB2g3	LMU-7	Very shallow (<25 cm)	Clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IVes	Trench cum bunding
Byrapura	142	1.9	BGTmB2g3	LMU-7	Very shallow (<25 cm)	Clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Groundnut (Bj+Gn)	Not Available	IVes	Trench cum bunding
Byrapura	143	4.37	BGTmB2g3	LMU-7	Very shallow (<25 cm)	Clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2 Borewell	IVes	Trench cum bunding
Byrapura	144	7.42	BGTmB2g3	LMU-7	Very shallow (<25 cm)	Clay	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Sunflower+Fallow land (Mz+Sf+Fl)	Not Available	IVes	Trench cum bunding
Kallahalli	1	1.04	DVHcB2g2	LMU-6	Very shallow (<25 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IVes	Trench cum bunding
Kallahalli	2	1.35	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIe	Graded bunding
Kallahalli	3	3.26	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIe	Graded bunding
Kallahalli	4	1.4	DVHcB2g2	LMU-6	Very shallow (<25 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IVes	Trench cum bunding
Kallahalli	5	3.37	KGPiB1g1	LMU-6	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Current fallow land (Jw+Cf)	Not Available	IIIs	Trench cum bunding
Kallahalli	6	5.54	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Current land (Mz+Cf)	Not Available	IIs	Trench cum bunding
Kallahalli	7	6.23	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Current land (Mz+Cf)	Not Available	IIs	Trench cum bunding
Kallahalli	8	6.4	MKHiB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Fallowland (Mz+Fl)	Not Available	IIIs	Trench cum bunding
Kallahalli	9	4.42	MKHiB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIIs	Trench cum bunding
Kallahalli	10	3.5	GHThB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Fallowland (Mz+Fl)	Not Available	IIes	Trench cum bunding
Kallahalli	11	2.04	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Kallahalli	15	0.37	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	Trench cum bunding
Kallahalli	16	2.16	GHThB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	Trench cum bunding
Kallahalli	34	0.29	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Currentfallow+Sunflower (Cf+Sf)	Not Available	IIes	Trench cum bunding
Kallahalli	35	5.07	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	Trench cum bunding
Kallahalli	36	0.86	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Groundnut (Bj+Gn)	Not Available	IIs	Trench cum bunding
Kallahalli	38	1.95	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Groundnut (Bj+Gn)	Not Available	IIIes	Trench cum bunding
Kallahalli	39	10.68	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow (Bj+Cf)	Not Available	IIIes	Trench cum bunding
Kallahalli	40	4.49	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Groundnut (Bj+Gn)	Not Available	IIs	Trench cum bunding
Kallahalli	41	8.27	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIs	Trench cum bunding
Kallahalli	42	3.02	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Kallahalli	43	5.13	GHThB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	Trench cum bunding
Kallahalli	44	3.48	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIe	Trench cum bunding
Kallahalli	45	3.08	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIe	Trench cum bunding
Kallahalli	46	6.62	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIe	Trench cum bunding
Kallahalli	47	8.13	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIe	Trench cum bunding
Kallahalli	48	5.44	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Sunflower (Bj+Sf)	Not Available	IIIes	Trench cum bunding
Kallahalli	49	3.09	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Kallahalli	50	5.5	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow (Bj+Cf)	Not Available	IIe	Trench cum bunding
Kallahalli	51	4.99	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Nigas (Fl+Ng)	Not Available	IIe	Trench cum bunding
Kallahalli	52	4.45	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Sunflower (Bj+Sf)	Not Available	IIe	Trench cum bunding
Kallahalli	53	4.41	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow (Bj+Cf)	Not Available	IIe	Trench cum bunding
Kallahalli	54	8.62	GHThB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Current fallow land+Horsegram (Mz+Cf+Hg)	Not Available	IIs	Trench cum bunding
Kallahalli	55	4.56	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Horsegram (Mz+Hg)	Not Available	IIes	Trench cum bunding
Kallahalli	56	4.78	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Kallahalli	57	8	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Current fallow (Bj+Cf)	Not Available	IIIes	Trench cum bunding
Kallahalli	58	8.16	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kallahalli	59	4.41	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Kallahalli	60	3.2	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Kallahalli	61	6.11	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kallahalli	62	4.56	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Redgram (Bj+Rg)	Not Available	IIs	Trench cum bunding
Kallahalli	63	6.41	KGPiB1g1	LMU-6	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Kallahalli	64	0.68	MTLmB2g1	LMU-7	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Graded bunding
Kallahalli	65	4.05	MKHhB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIes	Trench cum bunding
Kallahalli	66	2.73	MTLiB2g2	LMU-7	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Graded bunding
Kallahalli	67	7.66	KGPhB2g2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Fallow land+Horsegram (Bj+Fl+Hg)	Not Available	IIIes	Trench cum bunding
Kallahalli	68	6.16	MTLiB1g1	LMU-7	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Current land (Mz+Cf)	Not Available	IIIs	Graded bunding
Kallahalli	69	5.39	MTLiB1g1	LMU-7	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIIs	Graded bunding
Kallahalli	70	4.91	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Kallahalli	71	6.3	HDHiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIes	Trench cum bunding
Kallahalli	72	5.33	MTLiB1g1	LMU-7	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Bajra (Mz+Bj)	Not Available	IIIs	Graded bunding
Kallahalli	73	4.83	KGPhB2g2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Kallahalli	74	2.89	HDHhB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Kallahalli	75	3.29	HDHhB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Bajra (Mz+Bj)	Not Available	IIs	Trench cum bunding
Kallahalli	76	2.6	HDHiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Kallahalli	77	2.23	HDHhB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Sugurcane+Maize+Current fallow land (Sc+Mz+Cf)	Not Available	IIs	Trench cum bunding
Kallahalli	78	3.55	KGPhB2g2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Trench cum bunding
Kallahalli	79	5.26	KGPhB2g2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Kallahalli	80	1.41	KGPhB2g2	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Kallahalli	83	5.01	MTLiB2g2	LMU-7	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIIes	Graded bunding
Kallahalli	84	3.11	MTLiB2g2	LMU-7	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Fallow land (Bj+Fl)	Not Available	IIIes	Graded bunding
Kallahalli	85	0	MTLiB2g2	LMU-7	Shallow (25-50 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Kallahalli	86	0.05	MTLmB2	LMU-7	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Kallahalli	87	0.38	MTLmB2g1	LMU-7	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Kallahalli	88	1.44	MTLmB2g1	LMU-7	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Kallahalli	89	6.18	MTLmB2g1	LMU-7	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Raghunathahalli	92	0.02	HDHiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Raghunathahalli	93	0.08	HDHiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Raghunathahalli	94	0.03	HDHiB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	Trench cum bunding
Raghunathahalli	95	0.3	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Trench cum bunding
Raghunathahalli	100	0.03	MKHcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Raghunathahalli	102	0.31	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	Trench cum bunding
Raghunathahalli	103	0.16	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding

Appendix II

Kalhalli (2M3d) Microwatershed

Soil Fertility Information

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Alavandi	592	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	593	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	594	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	595	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	596	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	597	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	598	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	599	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	600	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	601	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	602	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	603	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	625	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	626	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	627	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	628	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	629	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	630	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	631	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	632	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	633	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	634	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Alavandi	635	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	76	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	78	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Byrapura	84	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	85	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	86	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	87	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	88	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	89	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	90	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	91	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	92	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	93	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	95	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	96	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	97	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	129	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	130	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	131	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	132	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	133	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	134	Slightly alkaline (pH 7.3 – 7.8)	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	135	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	136	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	137	Strongly alkaline	Non saline	Medium (0.5	Medium (23 –	High (> 337	High (> 20	Medium (0.5	Deficient (<	Sufficient (>	Sufficient (>	Deficient (<

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 8.4 – 9.0)	(<2 dsm)	– 0.75 %)	57 kg/ha)	kg/ha)	ppm)	– 1.0 ppm)	4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Byrapura	138	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	139	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	140	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	141	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	142	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	143	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	144	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	1	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	2	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	3	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	4	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	5	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	6	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	7	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	8	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	9	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	10	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	11	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	15	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	16	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	34	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	35	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	36	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kallahalli	38	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	39	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	40	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	41	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	42	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	43	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	44	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	45	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	46	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	47	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	48	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	49	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	50	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	51	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	52	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	53	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	54	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	55	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	56	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	57	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	58	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	59	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	60	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	61	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kallahalli	62	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	63	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	64	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	65	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	66	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	67	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	68	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	69	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	70	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	71	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	72	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	73	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	74	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	75	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	76	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	77	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	78	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	79	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	80	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	83	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	84	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	85	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallahalli	86	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kallahalli	87	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kallahalli	88	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	89	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Raghunat hahalli	92	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Raghunat hahalli	93	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Raghunat hahalli	94	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Raghunat hahalli	95	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Raghunat hahalli	100	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Raghunat hahalli	102	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Raghunat hahalli	103	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Appendix III

Kalhalli (2M3d) Microwatershed

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Alavandi	592	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Alavandi	593	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Alavandi	594	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Alavandi	595	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Alavandi	596	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Alavandi	597	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Alavandi	598	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Alavandi	599	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Alavandi	600	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Alavandi	601	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Alavandi	602	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Alavandi	603	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Alavandi	625	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Alavandi	626	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Alavandi	627	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Alavandi	628	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Alavandi	629	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Alavandi	630	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Alavandi	631	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Alavandi	632	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Alavandi	633	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Alavandi	634	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Alavandi	635	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Byrapura	76	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Byrapura	78	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
Byrapura	84	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Byrapura	85	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Byrapura	86	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Byrapura	87	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Byrapura	88	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Byrapura	89	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	90	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	91	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	92	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	93	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Byrapura	95	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	96	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	97	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	129	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Byrapura	130	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Byrapura	131	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Byrapura	132	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Byrapura	133	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Byrapura	134	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	135	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	136	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	137	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	138	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1n	S3rz	S3rz	S3rt	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S3rz
Byrapura	139	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Byrapura	140	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Byrapura	141	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Byrapura	142	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Byrapura	143	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Byrapura	144	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Kallahalli	1	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Kallahalli	2	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Kallahalli	3	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Kallahalli	4	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg
Kallahalli	5	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kallahalli	6	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Kallahalli	7	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Kallahalli	8	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kallahalli	9	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kallahalli	10	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	11	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	15	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	16	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	34	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	35	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	36	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	38	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Kallahalli	39	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Kallahalli	40	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	41	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	42	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	43	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Kallahalli	44	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	45	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	46	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	47	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	48	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Kallahalli	49	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Kallahalli	50	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	51	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	52	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	53	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kallahalli	54	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	55	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Kallahalli	56	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Kallahalli	57	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Kallahalli	58	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Kallahalli	59	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kallahalli	60	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kallahalli	61	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kallahalli	62	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S3t	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Kallahalli	63	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kallahalli	64	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	65	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kallahalli	66	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	67	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Kallahalli	68	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	69	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Kallahalli	70	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Kallahalli	71	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Kallahalli	72	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	73	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Kallahalli	74	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Kallahalli	75	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Kallahalli	76	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Kallahalli	77	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Kallahalli	78	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Kallahalli	79	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Kallahalli	80	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Kallahalli	83	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	84	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	85	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	86	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	87	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	88	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kallahalli	89	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Raghunathahalli	92	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Raghunathahalli	93	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Raghunathahalli	94	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Raghunathahalli	95	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Raghunathahalli	100	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Raghunathahalli	102	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Raghunathahalli	103	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

FINDINGS OF THE SOCIO-ECONOMIC SURVEY

- *The survey was conducted in Kalhalli mciro-watershed is located at $15^0$12'48.492'' to 15^0 11'30.734'' North and East 75^0 59' 24.617'' to $75^0$56'47.418''covering an area of about 569.51 ha coming under Kallahalli, Byrapura and Alavandi villages of Koppal taluk.*
- *Socio-economic analysis indicated that, out of the total sample of 46 houaeholds in the micro watershed, 5 (10.87%) were landless, 12 (26.09%) were marginal, farmers 18 (39.13%) were small farmers, 8 (17.39%) were semi medium and 3 (6.52%) medium farmers.*
- *The population characteristics of households indicated that, there were 135 (58.95%) men and 94 (41.05%) women among the sampled households.*
- *The average family size of landless farmers' was 3.8, marginal farmers' and small farmers' was 4.9, semi medium farmers' was 5.5 and medium farmers were 6.*
- *Majority of the respondents 42 (18.34%) people were in 0-15 years of age, 99 (43.23%) were in 16-35 years of age, 58 (25.33%) were in 36-60 years of age and 30 (13.1%) were above 61 years of age.*
- *Education level of the sample households indicated that, majority there were 37.55 per cent illiterates, 20.52 per cent of them had primary school, 12.66 per cent of them had Middle school education, 18.78 per cent of them had high school, 3.49 per cent of them had PUC and 3.93 per cent of them had degree education.*
- *About, 26.09 per cent of household heads were practicing agriculture, 58.7 per cent of the household heads were agricultural laborers and 2.17 per cent of the household heads were trade and business.*
- *Agriculture was the major occupation for 16.59 per cent of the household members, 48.47 per cent were agricultural laborers, 0.87 per cent were government and trade and business, 17.03 per cent student, 0.44 per cent were housewives and 4.37 per cent were children.*
- *The household possess, 100 per cent of the population in the micro watershed has not participated in local institutions.*
- *In the study area, 21.74 per cent of the households possess thatched house, 63.04 per cent of the households possess katcha house, 8.70 per cent of the households possess pucca/RCC and 6.52 per cent of the households possess semi pacca.*
- *The durable assets owned by the households showed that, 63.04 per cent of the households possess TV, 15.22 per cent of the households possess mixer/grinder, 19.57 per cent of the household's posses bicycle, 47.83 per cent of the households possesses motor cycle and 93.48 per cent of the households possess mobile phones.*
- *Farm implements owned by the households indicated that, 17.39 per cent each of the households possess bullock cart and sprayer, 13.04 per cent of the households possess plough, 4.35 per cent of the households possess seed/fertilizer drill, 2.17 per*

cent of the households possess irrigation pump and tractor, 39.13 per cent of the households possess weeder and 6.52 per cent of the households possess chaff cutter.

- *Regarding livestock possession by the households, 15.22 per cent of the households possess bullocks and sheep, 19.57 per cent of the households possess local cow, 4.35 per cent of the households possess buffalo and 2.17 per cent of the households possess goat and poultry birds.*
- *The average own labour men available in the micro watershed was 2.15, average own labour (women) available was 1.26, average hired labour (men) available was 10.5 and average hired labour (women) available was 7.8.*
- *Out of the total land holding of the sample respondents 54.44 ha (83.65%) of dry land and 10.64 ha (16.35%) of irrigated land.*
- *Marginal farmers possess 8.75 ha (100%) of dry land.*
- *Small farmers possess 22.25 ha (93.22%) of dry land and 1.62 ha (6.78%) of irrigated land.*
- *Semi medium farmers possess 16.35 ha (88.86%)of dry land and 2.07 ha (11.14%) of irrigated land.*
- *Medium farmers possess 6.91 ha (49.84%) of dry land and 6.95 ha (50.16%) of irrigated land.*
- *There were 12 functioning and 22 de-functioning bore wells in the micro watershed.*
- *Bore well was the major irrigation source in the micro water shed for 26.09 per cent of the farmers.*
- *The major crops have grown sunflower (22.1 ha), bajra (10.68 ha), maize (12.94 ha), sorghum (6.77 ha), groundnut (6.64 ha), Bengal gram (3.66 ha), cotton (1.69 ha), pea (2.84 ha), sugarcane (1.26 ha), sajje and sunflower (0.92 ha), red gram (0.81 ha), chick pea (0.61 ha) and horse gram (0.4 ha).*
- *The cropping intensity in Kalhalli Micro-watershed was found to be 93.29 per cent.*
- *The sample households possessed 58.7 per cent of the households have bank and 10.87 per cent have savings account.*
- *About 4.35 per cent of the households have availed credit from different sources.*
- *The sample households possessed, 38 per cent of the households have borrowed from commercial bank, 6 per cent of the households have borrowed from cooperative bank, 56 per cent of the households have borrowed from grameena bank and 19 per cent of the households have borrowed from SHGs/CBOs.*
- *The household posess, the average credit amount borrowed by households in micro-watershed was Rs, 35000.*
- *The households possessed, 100 per cent of the households borrowed from institutional sources for the purpose of agricultural production.*
- *The households possess, 100 per cent of the households do not repay their loan from institutional sources.*
- *The households possess, 100 per cent of the households do not repay their loan from private sources.*

- *The households possess, 68.75 per cent opined that the loan amount borrowed from helped to perform timely agricultural operations and 31.25 per cent opined that the loan amount borrowed from forced to sell the produce at low price to repay loan in time.*
- *The per hectare cost of cultivation for Maize, Pea, Groundnut, Sugarcane, Bajra, Sunflower, Bengal gram, Red gram, Horse gram, sorghum and cotton was Rs. 35497.48, 28205.39, 93696.92, 90775.21, 39299.87, 27402.59, 31256.71, 69552.02, 14999.24, 38286.97 and 19850.01 with benefit cost ratio of 1:1.44, 1:5.13, 1:0.96, 1:5.03, 1:0.64, 1:1.33, 1:1.21, 1:1.43, 1:0.99, 1:0.97 and 1:1.92 respectively.*
- *Further, 15.22 per cent of the households opined that dry fodder was adequate, 21.74 per cent of the households opined that dry fodder was inadequate, 13.04 per cent of the households opined that green fodder was adequate and 23.91 per cent of the households opined that green fodder was inadequate.*
- *The average annual gross income was Rs. 108,850 for marginal farmers, for small farmers it was Rs. 78,211.11, semi medium farmers it was Rs. 155,330 and medium farmers it was Rs. 290,083.33.*
- *The average annual expenditure is Rs. 15,002.26. For marginal farmers it was Rs. 14,208.33, for small farmers it was Rs. 4,408.56, for semi medium farmers it was Rs. 13,156.25 and for medium farmers it was Rs. 111,666.67.*
- *Sampled households have planted 94 coconut and 1 mango trees in their field to cultivate horticultural crops.*
- *Households have planted 1 teak, acacia and peepul tree, 53 neem and 3 banyan trees in their field and also 1 neem trees in their backyard in their field to cultivate forest species.*
- *Households have an average investment capacity of of Rs. 3,760.87 for land development, Rs. 282.61 for irrigation facility, Rs. 1,717.39 for improved crop production and Rs.1,108.7 for improved livestock management.*
- *Source of funds for additional investment is concerned; loan from bank was the source of additional investment for 30.43 per cent for land development, 6.52 per cent for irrigation facility, 19.57 per cent for improved crop production and 8.7 per cent for improved livestock management.*
- *Own funds was the source of additional investment for 23.91 per cent for land development, 21.74 per cent for improved crop production and 8.7 per cent for improved livestock management.*
- *Regarding marketing channels, 52.17 per cent of the farmers sold their produce to agent/traders, 56.52 per cent of the farmers sold their produce to local/village merchant and 2.17 per cent of the farmers sold their produce to regulated market.*
- *Further, 10.87 per cent of the households have used cart and 100 per cent of the households used tractor as a mode of transportation.*
- *Majority of the households 26.09 per cent have incidence of soil and water erosion problems.*

- *The household possess, (67.39%) were interested towards soil testing.*
- *The households possess, 13.04 per cent of households adopted field bunding structure was adopted.*
- *The households possess, 16.67 per cent have field bunding condition was good and severely damaged and 66.67 per cent of the field bunding condition was slightly damaged.*
- *The households possess, 8.7 per cent of the NGOs are involved in soil and water conservation structure and 4.35 per cent of the farmers are involved in soil and water conservation structure.*
- *The households possess, 91.3 per cent of the households used fire wood and 8.7 per cent of the households used LPG as a source of fuel.*
- *Piped supply was the major source of drinking water for 45.65 per cent, 54.35 per cent of the households used bore well and 2.17 per cent of the households used lake/tank in the micro watershed.*
- *Kerosene lamp was the major source of light for 100 per cent of the households.*
- *In the study area, 28.26 per cent of the households possess sanitary toilet facility.*
- *Regarding possession of PDS card, 100 per cent of the households possess BPL cards and 2.17 per cent of the sampled households does not possessed PDS cards.*
- *Cereals were adequate for 60.87 per cent of the households, pulses were adequate for 43.48 per cent, oilseeds and meat were adequate for 26.09 per cent, vegetables were adequate for 58.7 per cent, fruits were adequate for 13.04 per cent, milk were adequate for 56.52 per cent and egg were adequate for 28.26 per cent of the households.*
- *Cereals were inadequate for 13.04 per cent of the households, pulses were inadequate for 26.09 per cent, oilseed were inadequate for 30.43 per cent, vegetables were inadequate for 4.35 per cent, fruits were inadequate for 28.26 per cent, milk and egg were inadequate for 15.22 per cent, and meat were inadequate for 8.7 per cent of the households.*
- *Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil was the constraint experienced by 63.04 per cent of the households, wild animal menace on farm field (80.43%), frequent incidence of pest and diseases (73.91%), Inadequacy of irrigation water (69.75%), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (76.09%), lack of marketing facilities in the area (43.48%), inadequate extension service (32.61%), Lack of transport for safe transport of the Agril produce to the market (30.43%), less rainfall (13.04%) and Source of Agri-technology information (6.52%).*

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.

1. 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 Jainas. 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.

Geographers are very particular about the physiography or relief of a region. It plays a very important role in the spatial analysis of agricultural situation of the study area. The undulating topography with black cotton soil shrips, cut across by numerous nalas or streams is the major characteristic feature of the study region. Three physiographic divisions have made considering the local conditions of landforms and crops grown in the district. On the basis of physiography, 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 Ephemaral in nature, these come under Tungabhadra sub-basin. The drainage exhibit dentritic to subdentric 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%.

2. Locale of the survey and description of the micro-watershed

The study was conducted in Kalhalli micro-watershed is located at $15^0$12’48.492’’ to 15^0 11’30.734’’ North and East 75^0 59’ 24.617’’ to $75^0$56’47.418’’covering an area of about 569.51 ha coming under Kallahalli, Byrapura and Alavandi Villages of Koppal taluk.

3. Selection of the respondents for the study

The micro-watershed is marked with 320 square meters grids. One farmer from every alternate grid in the micro-watershed was selected for the study and interviewed for socio-economic data. Totally 46 households were interviewed for the survey.

4. The parameters considered for socio-economic survey of households

Two forms of data were collected from the micro-watershed which includes primary data from the farm households and secondary data about the villages under the micro-watershed jurisdiction.

The following parameters were considered for the primary data collection about the socio-economic data of the households, (1) Demographic information, (2) Farm and durable assets owned by households, (3) Livestock possession, (4) Labour availability, (5) Level of migration in the village, Land holding, (7) Cropping pattern, (8) Source of irrigation, (9) Borrowing status, (10) Cost of cultivation of major crops, (11) Economics of subsidiary activities, (12) Fodder availability, (13) Family annual income from different sources, (14) Horticulture and forestry species grown, (15) Additional investment capacity, (16) Marketing practices, (17) Status of soil and water conservation structure, (18) Access to basic needs and (19) Constraints and suggestion.

The following parameters were considered for the secondary data regarding the villages under the micro-watershed jurisdiction, (1) Number of villages in each micro-watershed jurisdiction, (2) Village wise number of households, (3) Geographical area of the villages, (4) Cultivable are a including rainfed and irrigated, (5) Number and type of house in each village, (6) Human and livestock population, (7) Facilities in the village such as roads, transport facility for conveyance, drinking water supply, street light and (8) Community based organizations in the villages.

5. Development of interview schedule and data collection

Taking into the consideration the objectives of the survey, an interview schedule was prepared after thorough consultation with the experts in the field of social sciences. A comprehensive interview schedule covering all the major parameters for measuring the socio-economic situation was developed.

6. Tools used to analyze the data

The statistical components such as frequency and percentage were used to analyze the data.

Abbreviations used in the report

LL=Landless
MF=Marginal Farmers
SF=Small farmers
SMF=Semi medium farmers
MDF=Medium farmers
LF=Large Farmers

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Kalhalli Micro-watershed is presented in Table 1 and it indicated that 46 farmers were sampled in micro-watershed among them 5 (10.87%) were landless, 12 (26.09%) were marginal, farmers 18 (39.13%) were small farmers, 8 (17.39%) were semi medium and 3 (6.52%) medium farmers.

Table 1: Households sampled for socio economic survey in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	10.87	12	26.09	18	39.13	8	17.39	3	6.52	46	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Kalhalli Micro-watershed is presented in Table 2. The data indicated that there were 135 (58.95%) men and 94 (41.05%) women among the sampled households. The average family size of landless farmers' was 3.8, marginal farmers'and small farmers' was 4.9, semi medium farmers' was 5.5 and medium farmers were 6.

Table 2: Population characteristics in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (19)		MF (59)		SF (89)		SMF (44)		MDF (18)		All (229)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	10	52.63	31	52.54	53	59.55	32	72.73	9	50	135	58.95
2	Women	9	47.37	28	47.46	36	40.45	12	27.27	9	50	94	41.05
Total		19	100	59	100	89	100	44	100	18	100	229	100
Average		3.8		4.9		4.9		5.5		6		4.9	

Age wise classification of population: The age wise classification of household members in Kalhalli Micro-watershed is presented in Table 3. The data indicated that, 42 (18.34%) people were in 0-15 years of age, 99 (43.23%) were in 16-35 years of age, 58 (25.33%) were in 36-60 years of age and 30 (13.1%) were above 61 years of age.

Table 3: Age wise classification of household members in Kalhalli Micro-watershed

Sl. No.	Particulars	LL (19)		MF (59)		SF (89)		SMF (44)		MDF (18)		All (229)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	3	15.79	13	22.03	19	21.35	2	4.55	5	27.78	42	18.34
2	16-35 years of age	6	31.58	23	38.98	38	42.70	26	59.09	6	33.33	99	43.23
3	36-60 years of age	6	31.58	18	30.51	19	21.35	11	25	4	22.22	58	25.33
4	> 61 years	4	21.05	5	8.47	13	14.61	5	11.36	3	16.67	30	13.10
Total		19	100	59	100	89	100	44	100	18	100	229	100

Education level of household members: Education level of household members in Kalhalli Micro-watershed is presented in Table 4. The results indicated that had 37.55 per cent illiterates, 20.52 per cent of them had primary school, 12.66 per cent of them had Middle school education, 18.78 per cent of them had high school, 3.49 per cent of them had PUC and 3.93 per cent of them had degree education.

Table 4. Education level of household members in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (19)		MF (59)		SF (89)		SMF (44)		MDF (18)		All (229)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	3	15.79	18	30.51	36	40.45	19	43.18	10	55.56	86	37.55
2	Primary School	3	15.79	17	28.81	18	20.22	7	15.91	2	11.11	47	20.52
3	Middle School	5	26.32	8	13.56	12	13.48	3	6.82	1	5.56	29	12.66
4	High School	4	21.05	14	23.73	14	15.73	10	22.73	1	5.56	43	18.78
5	PUC	2	10.53	1	1.69	2	2.25	2	4.55	1	5.56	8	3.49
6	Degree	2	10.53	0	0	3	3.37	3	6.82	1	5.56	9	3.93
7	Others	0	0	1	1.69	4	4.49	0	0	2	11.11	7	3.06
Total		19	100	59	100	89	100	44	100	18	100	229	100

Occupation of household heads: The data regarding the occupation of the household heads in Kalhalli Micro-watershed is presented in Table 5. The results indicate that, 26.09 per cent of household heads were practicing agriculture, 58.7 per cent of the household heads were agricultural laborers and 2.17 per cent of the household heads were trade and business.

Table 5: Occupation of household heads in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	2	16.67	6	33.33	2	25	2	66.67	12	26.09
2	Agricultural Labour	0	0	10	83.33	13	72.22	3	37.50	1	33.33	27	58.70
3	Trade & Business	0	0	0	0	0	0	1	12.50	0	0	1	2.17
4	Others	5	100	0	0	1	5.56	0	0	0	0	6	13.04
Total		5	100	12	100	20	100	6	100	3	100	46	100

Occupation of the household members: The data regarding the occupation of the household members in Kalhalli Micro-watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 16.59 per cent of the household members, 48.47 per cent were agricultural laborers, 0.87 per cent were government and trade and business, 17.03 per cent student, 0.44 per cent were housewives and 4.37 per cent were children.

Table 6: Occupation of family members in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (19)		MF (59)		SF (89)		SMF (44)		MDF (18)		All (229)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	5	8.47	20	22.47	8	18.18	5	27.78	38	16.59
2	Agricultural Labour	0	0	34	57.63	46	51.69	26	59.09	5	27.78	111	48.47
3	Government Service	0	0	0	0	0	0	0	0	2	11.11	2	0.87
4	Trade & Business	0	0	0	0	0	0	2	4.55	0	0	2	0.87
5	Student	4	21.05	15	25.42	14	15.73	4	9.09	2	11.11	39	17.03
6	Others	15	78.95	5	8.47	3	3.37	3	6.82	0	0	26	11.35
7	Housewife	0	0	0	0	0	0	1	2.27	0	0	1	0.44
8	Children	0	0	0	0	6	6.74	0	0	4	22.22	10	4.37
Total		19	100	59	100	89	100	44	100	18	100	229	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Kalhalli Micro-watershed is presented in Table 7. The results show that, 100 per cent of the population in the micro watershed has not participated in local institutions.

Table 7. Institutional Participation of household members in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (19)		MF (59)		SF (89)		SMF (44)		MDF (18)		All (229)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	19	100	59	100	89	100	44	100	18	100	229	100
Total		19	100	59	100	89	100	44	100	18	100	229	100

Type of house owned: The data regarding the type of house owned by the households in Kalhalli Micro-watershed is presented in Table 8. The results indicate that 21.74 per cent of the households possess thatched house, 63.04 per cent of the households possess katcha house, 8.70 per cent of the households possess pucca/RCC and 6.52 per cent of the households possess semi pacca.

Table 8. Type of house owned by households in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	4	80	1	8.33	4	22.22	1	12.50	0	0	10	21.74
2	Katcha	1	20	11	91.67	11	61.11	5	62.50	1	33.33	29	63.04
3	Pucca/RCC	0	0	0	0	2	11.11	1	12.50	1	33.33	4	8.70
4	Semi pacca	0	0	0	0	1	5.56	1	12.50	1	33.33	3	6.52
Total		5	100	12	100	18	100	8	100	3	100	46	100

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Kalhalli Micro-watershed is presented in Table 9. The results show that 63.04 per cent of the households possess TV, 15.22 per cent of the households possess mixer/grinder, 19.57 per cent of the household's posses bicycle, 47.83 per cent of the households possesses motor cycle and 93.48 per cent of the households possess mobile phones.

Table 9. Durable Assets owned by households in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	2	40	10	83.33	8	44.44	6	75	3	100	29	63.04
2	Mixer/Grinder	0	0	2	16.67	2	11.11	2	25	1	33.33	7	15.22
3	Bicycle	0	0	1	8.33	4	22.22	3	37.50	1	33.33	9	19.57
4	Motor Cycle	3	60	5	41.67	8	44.44	4	50	2	66.67	22	47.83
5	Mobile Phone	5	100	11	91.67	17	94.44	7	87.50	3	100	43	93.48

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Kalhalli Micro-watershed is presented in Table 10. The results show that the average value of television was Rs. 8,411, mixer/grinder was Rs. 3,750, motor cycle was Rs. 37,083, tempo was Rs. 5,000 and mobile phone was Rs. 4,441.

Table 10. Average value of durable assets owned by households in Kalhalli Micro-watershed

Average value (Rs.)

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Television	6,500	5,510	4,962	4,516	4,400	5,106
2	Mixer/Grinder	0	1,500	650	850	3,000	1,285
3	Bicycle	0	600	12,450	1,200	800	6,088
4	Motor Cycle	56,666	37,400	27,712	22,000	34,000	33,395
5	Mobile Phone	5,000	2,500	3,310	1,916	1,190	2,770

Farm Implements owned: The data regarding the farm implements owned by the households in Kalhalli Micro-watershed is presented in Table 11. About 17.39 per cent each of the households possess bullock cart and sprayer, 13.04 per cent of the households possess plough, 4.35 per cent of the households possess seed/fertilizer drill, 2.17 per cent of the households possess irrigation pump and tractor, 39.13 per cent of the households possess weeder and 6.52 per cent of the households possess chaff cutter.

Table 11. Farm Implements owned by households in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	3	25	2	11.11	2	25	1	33.33	8	17.39
2	Plough	0	0	1	8.33	1	5.56	3	37.50	1	33.33	6	13.04
3	Seed/Fertilizer Drill	0	0	1	8.33	1	5.56	0	0	0	0	2	4.35
4	Irrigation Pump	0	0	0	0	0	0	1	12.50	0	0	1	2.17
5	Tractor	0	0	0	0	0	0	1	12.50	0	0	1	2.17
6	Sprayer	0	0	2	16.67	3	16.67	3	37.50	0	0	8	17.39
7	Weeder	0	0	5	41.67	7	38.89	4	50	2	66.67	18	39.13
8	Chaff Cutter	0	0	1	8.33	0	0	2	25	0	0	3	6.52

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Kalhalli Micro-watershed is presented in Table 12. The results show that the average value of bullock cart was Rs. 15,250, plough was Rs. 3,885, seed/fertilizer drill was Rs. 8,000, irrigation pump was Rs. 10,000, tractor was Rs. 600,000, sprayer was Rs. 1,727, weeder was Rs.70 and the average value of chaff cutter was Rs. 1,966.

Table 12. Average value of farm implements owned by households in Kalhalli Micro-watershed

Average Value (Rs.)

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Bullock Cart	0	14,000	15,000	15,000	20,000	15,250
2	Plough	0	2,100	8,000	4,700	1,500	3,885
3	Seed/Fertilizer Drill	0	9,000	7,000	0	0	8,000
4	Irrigation Pump	0	0	0	10,000	0	10,000
5	Tractor	0	0	0	600,000	0	600,000
6	Sprayer	0	1,700	1,625	1,850	0	1,727
7	Weeder	0	65	76	70	60	70
8	Chaff Cutter	0	1,800	0	2,050	0	1,966

Livestock possession by the households: The data regarding the Livestock possession by the households in Kalhalli Micro-watershed is presented in Table 13. The results indicate that, 15.22 per cent of the households possess bullocks and sheep, 19.57 per cent of the households possess local cow, 4.35 per cent of the households possess buffalo and 2.17 per cent of the households possess goat and poultry birds.

Table 13. Livestock possession by households in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	2	16.67	2	11.11	2	25	1	33.33	7	15.22
2	Local cow	0	0	1	8.33	4	22.22	3	37.50	1	33.33	9	19.57
3	Buffalo	0	0	1	8.33	1	5.56	0	0	0	0	2	4.35
4	Sheep	0	0	2	16.67	1	5.56	3	37.50	1	33.33	7	15.22
5	Goat	0	0	1	8.33	0	0	0	0	0	0	1	2.17
6	Poultry birds	0	0	0	0	1	5.56	0	0	0	0	1	2.17

Average Labour availability: The data regarding the average labour availability in Kalhalli Micro-watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 2.15, average own labour (women) available was 1.26, average hired labour (men) available was 10.5 and average hired labour (women) available was 7.8.

Table 14. Average Labour availability in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Hired labour Female	0	4.58	7.78	13.13	12.33	7.80
2	Own Labour Female	0	1.33	1.33	1	1.67	1.26
3	Own labour Male	0	1.92	2	3.25	1.67	2.15
4	Hired labour Male	0	6.83	11.06	16.25	12.67	10.50

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Kalhalli Micro-watershed is presented in Table 15. The results indicate that, 73.91 per cent of the households opined that the hired labour was adequate and 26.09 per cent of the households opined that the hired labour was inadequate.

Table 15. Adequacy of Hired Labour in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	1	20	9	75	14	77.78	7	87.50	3	100	34	73.91
2	Inadequate	4	80	3	25	4	22.22	1	12.50	0	0	12	26.09

Table 16. Distribution of land (Ha) in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	0	0	8.75	100	22.25	93.22	16.53	88.86	6.91	49.84	54.44	83.65
2	Irrigated	0	0	0	0	1.62	6.78	2.07	11.14	6.95	50.16	10.64	16.35
Total		0	100	8.75	100	23.87	100	18.60	100	13.86	100	65.08	100

Distribution of land (ha): The data regarding the distribution of land (ha) in Kalhalli Micro-watershed is presented in Table 16. The results indicate that, households of the Kalhalli Micro watershed possess 54.44 ha (83.65%) of dry land and 10.64 ha (16.35%) of irrigated land.

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Kalhalli Micro-watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 198,305.09 and the average value of irrigated land was Rs. 300,532.32.

Table 17. Average land value (Rs./ha) in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Dry	0	365,418.41	222,421.32	136,046.51	57,879.32	198,305.09
2	Irrigated	0	0	741,000	771,875.02	57,508.73	300,532.32

Status of bore wells: The data regarding the status of bore wells in Kalhalli Micro-watershed is presented in Table 18. The results indicate that, there were 12 functioning and 22 de-functioning bore wells in the micro watershed.

Table 18. Status of bore wells in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	De-functioning	0	0	19	0	3	22
2	Functioning	0	0	7	2	3	12

Source of irrigation: The data regarding the source of irrigation in Kalhalli Micro-watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 26.09 per cent of the farmers.

Table 19. Source of irrigation in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0	0	0	7	38.89	2	25	3	100	12	26.09

Depth of Water (Avg. in meters): The data regarding the depth of water in Kalhalli Micro-watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 8.95 meters.

Table 20. Depth of water (Avg in meters) in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Bore Well	0	0	6.43	13.34	62.99	8.95

Irrigated Area (ha): The data regarding the irrigated area (ha) in Kalhalli Micro-watershed is presented in Table 21. The results indicate that, small, semi medium and medium farmers had an irrigated area of 1.62 ha, 2.07 ha and 7.43 ha respectively.

Table 21. Irrigated Area (ha) in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Kharif	0	0	0	0	3.72	3.72
2	Rabi	0	0	1.62	2.07	3.72	7.41
Total		0	0	1.62	2.07	7.43	11.13

Cropping pattern: The data regarding the cropping pattern in Kalhalli Micro-watershed is presented in Table 22. The results indicate that, farmers have grown sunflower (22.1 ha), bajra (10.68 ha), maize (12.94 ha), sorghum (6.77 ha), groundnut (6.64 ha), Bengal gram (3.66 ha), cotton (1.69 ha), pea (2.84 ha), sugarcane (1.26 ha), sajje and sunflower (0.92 ha), red gram (0.81 ha), chick pea (0.61 ha) and horsegram (0.4 ha).

Table 22. Cropping pattern in Kalhalli Micro-watershed (Area in ha)

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Kharif - Sunflower	0	2.17	4.07	5.26	10.6	22.1
2	Kharif - Bajra	0	1.34	4.8	4.05	0	10.19
3	Kharif - Maize	0	2.58	2.83	3.47	0	8.89
4	Rabi - Sorghum	0	0	1.33	0	3.72	5.05
5	Kharif - Groundnut	0	1.21	3.8	0	0	5.02
6	Rabi - Maize	0	0	0.81	0	3.24	4.05
7	Kharif - Bengal gram	0	0	0	2.02	0	2.02
8	Kharif - sorghum	0	0.5	1.21	0	0	1.72
9	Kharif - Cotton	0	0	0	1.69	0	1.69
10	Rabi - Bengal gram	0	0	1.64	0	0	1.64
11	Rabi - Groundnut	0	0	0.81	0.81	0	1.62
12	Kharif - Pea	0	0	1.33	0	0	2.84
13	Rabi - Sugarcane	0	0	0	1.26	0	1.26
14	Rabi - Sajje	0	0	0.92	0	0	0.92
15	Rabi - Sunflower	0	0	0.92	0	0	0.92
16	Kharif - Red gram	0	0	0.81	0	0	0.81
17	Kharif - Chick pea	0	0	0.61	0	0	0.61
18	Rabi - Bajra	0	0.49	0	0	0	0.49
19	Kharif - Horsegram	0	0.4	0	0	0	0.4
Total		0	8.7	27.2	18.57	17.55	72.03

Cropping intensity: The data regarding the cropping intensity in Kalhalli Micro-watershed is presented in Table 23. The results indicate that, the cropping intensity in Kalhalli Micro-watershed was found to be 93.29 per cent.

Table 23. Cropping intensity (%) in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Cropping Intensity	0	100	95	83.32	99.84	93.29

Possession of Bank account and savings: The data regarding the possession of bank account and saving in Kalhalli micro-watershed is presented in Table 24. The results indicate that, 58.7 per cent of the households have bank and 10.87 per cent have savings account.

Table 24. Possession of bank account and savings in Kalhalli micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0	8	66.67	14	77.78	5	62.50	0	0	27	58.70
2	Savings	0	0	3	25	1	5.56	1	12.50	0	0	5	10.87

Borrowing status: The data regarding the borrowing status in Kalhalli micro-watershed is presented in Table 25. The results indicate that, 4.35 per cent of the households have availed credit from different sources.

Table 25. Borrowing status in Kalhalli micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0	1	8.33	1	5.56	0	0	0	0	2	4.35

Source of credit availed by households: The data regarding the source of credit availed by households in Kalhalli micro-watershed is presented in Table 26. The results indicate that, 38 per cent of the households have borrowed from commercial bank, 6 per cent of the households have borrowed from cooperative bank, 56 per cent of the households have borrowed from grameena bank and 19 per cent of the households have borrowed from SHGs/CBOs.

Table 26. Source of credit availed by households in Kalhalli micro-watershed

Sl.No.	Particulars	MF (2)		SF (8)		SMF (4)		All (16)	
		N	%	N	%	N	%	N	%
1	Commercial Bank	0	0	2	25	4	100	6	38
2	Cooperative Bank	1	50	0	0	0	0	1	6
3	Grameena Bank	2	100	7	∞	0	0	9	56
4	SHGs/CBOs	1	50	1	∞	1	25	3	19

Avg. Credit amount: The data regarding the avg. Credit amount in Kalhalli micro-watershed is presented in Table 27. The results indicate that, the average credit amount borrowed by households in micro-watershed was Rs, 35000.

Table 27. Avg. credit amount by household Kalhalli micro-watershed

Sl.No.	Particulars	MF (2)	SF (8)	SMF (4)	All (16)
1	Average Credit	135000	50000	25000	35000

Purpose of credit borrowed - Institutional Credit: The data regarding the purpose of credit borrowed - Institutional Credit in Kalhalli micro-watershed is presented in Table 28. The results indicate that, 100 per cent of the households borrowed from institutional sources for the purpose of agricultural production

Table 28. Purpose of credit borrowed - Institutional Credit by household in Kalhalli micro-watershed

Sl.No.	Particulars	MF (3)		SF (8)		SMF (4)		All (15)	
		N	%	N	%	N	%	N	%
1	Agriculture production	3	100	8	100	4	100	15	100

Repayment status of households – Institutional: The data regarding the repayment status of credit borrowed from institutional sources by households in Kalhalli micro watershed is presented in Table 29. The results indicated that 100 per cent of the households do not repay their loan from institutional sources.

Table 29. Repayment status of households – Institutional Credit in Kalhalli micro-watershed

Sl.No.	Particulars	MF (3)		SF (9)		SMF (4)		All (16)	
		N	%	N	%	N	%	N	%
1	Un paid	3	100	9	100	4	100	16	100

Repayment status of households – Private: The data regarding the repayment status of credit borrowed from private sources by households in Kalhalli micro watershed is presented in Table 30. The results indicated that 100 per cent of the households do not repay their loan from private sources.

Table 30. Repayment status of households – private Credit in Kalhalli micro-watershed

Sl.No.	Particulars	MF (1)		SF (1)		SMF (1)		All (3)	
		N	%	N	%	N	%	N	%
1	Un paid	1	100	1	100	1	100	3	100

Opinion on institutional sources of credit: The data regarding the opinion on institutional sources of credit in Kalhalli micro watershed is presented in Table 31. The results indicate that, 68.75 per cent opined that the loan amount borrowed from helped to perform timely agricultural operations and 31.25 per cent opined that the loan amount borrowed from forced to sell the produce at low price to repay loan in time.

Table 31. Opinion on institutional sources of credit in Kalhalli micro watershed

Sl.No.	Particulars	MF (3)		SF (9)		SMF(4)		All (16)	
		N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural operations	2	66.67	5	55.56	4	100	11	68.75
2	Forced to sell the produce at low price to repay loan in time	1	33.33	4	44.44	0	0	5	31.25

Opinion on non-institutional sources of credit: The data regarding the opinion on non-institutional sources of credit in Kalhalli micro watershed is presented in Table 32. The results indicate that, 66.67 per cent opined that the loan amount borrowed from helped to perform timely agricultural operations and 33.33 per cent opined that the loan amount borrowed from forced to sell the produce at low price to repay loan in time.

Table 32. Opinion on non-institutional sources of credit in Kalhalli micro watershed

Sl.No.	Particulars	MF (1)		SF (1)		SMF (1)		All (3)	
		N	%	N	%	N	%	N	%
1	Forced to sell the produce at low price to repay loan in time	1	100	0	0	1	100	2	66.67
2	Helped to perform timely agricultural operations	0	0	1	100	0	0	1	33.33

Cost of cultivation of Maize: The data regarding the cost of cultivation of Maize in Kalhalli Micro-watershed is presented in Table 33.a. The results indicate that, the total cost of cultivation for Maize was Rs. 35497.48. The gross income realized by the farmers was Rs. 50950.27. The net income from Maize cultivation was Rs. 15452.79. Thus the benefit cost ratio was found to be 1:1.44.

Table 33.a. Cost of Cultivation of Maize in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	34.48	5331.11	15.02
2	Bullock		Pairs/day	1.42	1041.55	2.93
3	Tractor		Hours	1.80	1818.16	5.12
4	Machinery		Hours	0.59	470.48	1.33
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.58	2554.24	7.20
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	5.83	7555.80	21.29
8	Fertilizer + micronutrients		Quintal	6.11	5810.92	16.37
9	Pesticides (PPC)		Kgs / liters	1.07	1148.02	3.23
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	107.40	0.30
14	Land revenue and Taxes			0	1.34	0
II	**Cost B1**					
16	Interest on working capital				2049.18	5.77
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				27888.19	78.56
III	**Cost B2**					
18	Rental Value of Land				187.50	0.53
19	**Cost B2 = (Cost B1 + Rental value)**				28075.69	79.09
IV	**Cost C1**					
20	Family Human Labour			17.26	4187.24	11.80
21	**Cost C1 = (Cost B2 + Family Labour)**				32262.94	90.89
V	**Cost C2**					
22	Risk Premium				7.50	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				32270.44	90.91
VI	**Cost C3**					
24	Managerial Cost				3227.04	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				35497.48	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		32.45	48673.81	
		b) Main Crop Sales Price (Rs.)			1500	
	By Product	e) Main Product (q)		6.50	2276.47	
		f) Main Crop Sales Price (Rs.)			350	
b.	Gross Income (Rs.)				50950.27	
c.	Net Income (Rs.)				15452.79	
d.	Cost per Quintal (Rs./q.)				1093.94	
e.	Benefit Cost Ratio (BC Ratio)				1:1.44	

Cost of Cultivation of Pea: The data regarding the cost of cultivation of Pea in Kalhalli Micro-watershed is presented in Table 33.b. The results indicate that, the total cost of cultivation for Pea was Rs. 28205.39. The gross income realized by the farmers was Rs. 144579.79. The net income from Pea cultivation was Rs. 116374.39. Thus the benefit cost ratio was found to be 1:5.13.

Table 33.b. Cost of Cultivation of Pea in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	4.19	495.52	1.76
2	Bullock		Pairs/day	0	0	0
3	Tractor		Hours	4.15	4527.59	16.05
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.13	1520.97	5.39
6	Seed Inter Crop		Kgs.	3.81	0	0
7	FYM		Quintal	1.51	4532.24	16.07
8	Fertilizer + micronutrients		Quintal	7.92	7599.28	26.94
9	Pesticides (PPC)		Kgs / liters	0.76	1136.55	4.03
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	0.02	0
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				1775.88	6.30
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				21588.06	76.54
III	**Cost B2**					
18	Rental Value of Land				116.67	0.41
19	**Cost B2 = (Cost B1 + Rental value)**				21704.72	76.95
IV	**Cost C1**					
20	Family Human Labour			18.89	3926.55	13.92
21	**Cost C1 = (Cost B2 + Family Labour)**				25631.27	90.87
V	**Cost C2**					
22	Risk Premium				10	0.04
23	**Cost C2 = (Cost C1 + Risk Premium)**				25641.27	90.91
VI	**Cost C3**					
24	Managerial Cost				2564.13	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				28205.39	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		51.01	144109.13	
		b) Main Crop Sales Price (Rs.)			2825	
	By Product	e) Main Product (q)		3.77	470.66	
		f) Main Crop Sales Price (Rs.)			125	
b.	Gross Income (Rs.)				144579.79	
c.	Net Income (Rs.)				116374.39	
d.	Cost per Quintal (Rs./q.)				552.92	
e.	Benefit Cost Ratio (BC Ratio)				1:5.13	

Cost of cultivation of Groundnut: The data regarding the cost of cultivation of Groundnut in Kalhalli Micro-watershed is presented in Table 33.c. The results indicate that, the total cost of cultivation for Groundnut was Rs. 93696.92. The gross income realized by the farmers was Rs. 89972.77. The net income from Groundnut cultivation was Rs. -3724.15. Thus the benefit cost ratio was found to be 1:0.96.

Table 33.c. Cost of Cultivation of Groundnut in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	48.11	21881.96	23.35
2	Bullock		Pairs/day	1.85	1528.31	1.63
3	Tractor		Hours	2.80	2337.18	2.49
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	130.10	27773.17	29.64
7	FYM		Quintal	4.05	10913.37	11.65
8	Fertilizer + micronutrients		Quintal	7.67	6748.44	7.20
9	Pesticides (PPC)		Kgs / liters	1.69	2631.41	2.81
10	Irrigation		Number	1.24	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	1.06	0
14	Land revenue and Taxes			0	0.62	0
II	**Cost B1**					
16	Interest on working capital				5769.03	6.16
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				79584.55	84.94
III	**Cost B2**					
18	Rental Value of Land				187.50	0.20
19	**Cost B2 = (Cost B1 + Rental value)**				79772.05	85.14
IV	**Cost C1**					
20	Family Human Labour			16.63	5398.09	5.76
21	**Cost C1 = (Cost B2 + Family Labour)**				85170.14	90.90
V	**Cost C2**					
22	Risk Premium				8.88	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				85179.02	90.91
VI	**Cost C3**					
24	Managerial Cost				8517.90	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				93696.92	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		24.14	86434.78	
		b) Main Crop Sales Price (Rs.)			3581.25	
	By Product	e) Main Product (q)		5.78	3537.99	
		f) Main Crop Sales Price (Rs.)			612.50	
b.	Gross Income (Rs.)				89972.77	
c.	Net Income (Rs.)				-3724.15	
d.	Cost per Quintal (Rs./q.)				3882.14	
e.	Benefit Cost Ratio (BC Ratio)				1:0.96	

Cost of cultivation of Sugarcane: The data regarding the cost of cultivation of Sugarcane in Kalhalli Micro-watershed is presented in Table 33.d. The results indicate that, the total cost of cultivation for Sugarcane was Rs. 90775.21. The gross income realized by the farmers was Rs. 456791.68. The net income from Sugarcane cultivation was Rs. 366016.47. Thus the benefit cost ratio was found to be 1:5.03.

Table 33.d. Cost of Cultivation of Sugarcane in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1					
1	Hired Human Labour		Man days	7.13	1108.33	1.22
2	Bullock		Pairs/day	0	0	0
3	Tractor		Hours	7.92	6333.33	6.98
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	79.17	7916.67	8.72
7	FYM		Quintal	1.58	4750	5.23
8	Fertilizer + micronutrients		Quintal	38	40850	45
9	Pesticides (PPC)		Kgs / liters	0.79	1187.50	1.31
10	Irrigation		Number	0.79	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	9874.30	10.88
14	Land revenue and Taxes			0	0	0
II	Cost B1					
16	Interest on working capital				6565.70	7.23
17	Cost B1 = (Cost A1 + sum of 15 and 16)				78585.84	86.57
III	Cost B2					
18	Rental Value of Land				166.67	0.18
19	Cost B2 = (Cost B1 + Rental value)				78752.50	86.76
IV	Cost C1					
20	Family Human Labour			19.79	3760.42	4.14
21	Cost C1 = (Cost B2 + Family Labour)				82512.92	90.90
V	Cost C2					
22	Risk Premium				10	0.01
23	Cost C2 = (Cost C1 + Risk Premium)				82522.92	90.91
VI	Cost C3					
24	Managerial Cost				8252.29	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)				90775.21	100
VII	Economics of the Crop					
a.	Main Product	a) Main Product (q)		174.17	452833.35	
		b) Main Crop Sales Price (Rs.)			2600	
	By Product	e) Main Product (q)		39.58	3958.33	
		f) Main Crop Sales Price (Rs.)			100	
b.	Gross Income (Rs.)				456791.68	
c.	Net Income (Rs.)				366016.47	
d.	Cost per Quintal (Rs./q.)				521.20	
e.	Benefit Cost Ratio (BC Ratio)				1:5.03	

Cost of cultivation of Bajra: The data regarding the cost of cultivation of Bajra in Kalhalli Micro-watershed is presented in Table 33.e. The results indicate that, the total cost of cultivation for Bajra was Rs. 39299.87. The gross income realized by the farmers was Rs. 25260.22. The net income from Bajra cultivation was Rs. -14039.66. Thus the benefit cost ratio was found to be 1:0.64.

Table 33.e. Cost of Cultivation of Bajra in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	22.88	4056.16	10.32
2	Bullock		Pairs/day	1.75	898.10	2.29
3	Tractor		Hours	3.84	3478.60	8.85
4	Machinery		Hours	0.33	372.13	0.95
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.83	1304.47	3.32
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	3.48	9621.84	24.48
8	Fertilizer + micronutrients		Quintal	5.60	5136.91	13.07
9	Pesticides (PPC)		Kgs / liters	1.73	2922.83	7.44
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	112.55	0.29
14	Land revenue and Taxes			0	0.25	0
II	**Cost B1**					
16	Interest on working capital				2279.43	5.80
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				30183.27	76.80
III	**Cost B2**					
18	Rental Value of Land				156.67	0.40
19	**Cost B2 = (Cost B1 + Rental value)**				30339.93	77.20
IV	**Cost C1**					
20	Family Human Labour			28.21	5378.02	13.68
21	**Cost C1 = (Cost B2 + Family Labour)**				35717.96	90.89
V	**Cost C2**					
22	Risk Premium				9.20	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				35727.16	90.91
VI	**Cost C3**					
24	Managerial Cost				3572.72	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				39299.87	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.30	23175.22	
		b) Main Crop Sales Price (Rs.)			1515	
	By Product	e) Main Product (q)		8.87	2085	
		f) Main Crop Sales Price (Rs.)			235	
b.	Gross Income (Rs.)				25260.22	
c.	Net Income (Rs.)				-14039.66	
d.	Cost per Quintal (Rs./q.)				2569.09	
e.	Benefit Cost Ratio (BC Ratio)				1:0.64	

Cost of cultivation of Sunflower: The data regarding the cost of cultivation of Sunflower in Kalhalli Micro-watershed is presented in Table 33.f. The results indicate that, the total cost of cultivation for Sunflower was Rs. 27402.59. The gross income realized by the farmers was Rs. 36465.57. The net income from Sunflower cultivation was Rs. 9062.98. Thus the benefit cost ratio was found to be 1:1.33.

Table 33.f. Cost of Cultivation of Sunflower in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	25.23	3995.92	14.58
2	Bullock		Pairs/day	1.23	927.72	3.39
3	Tractor		Hours	2.30	2050.35	7.48
4	Machinery		Hours	0.16	182.47	0.67
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	6.33	1883.24	6.87
7	FYM		Quintal	5.36	5462.31	19.93
8	Fertilizer + micronutrients		Quintal	3.95	3617.65	13.20
9	Pesticides (PPC)		Kgs / liters	1.07	1647.81	6.01
10	Irrigation		Number	0.27	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	54.18	0.20
14	Land revenue and Taxes			0	1.57	0.01
II	**Cost B1**					
16	Interest on working capital				1514.04	5.53
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				21337.25	77.87
III	**Cost B2**					
18	Rental Value of Land				236.36	0.86
19	**Cost B2 = (Cost B1 + Rental value)**				21573.62	78.73
IV	**Cost C1**					
20	Family Human Labour			16.37	3331.83	12.16
21	**Cost C1 = (Cost B2 + Family Labour)**				24905.45	90.89
V	**Cost C2**					
22	Risk Premium				6	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				24911.45	90.91
VI	**Cost C3**					
24	Managerial Cost				2491.14	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				27402.59	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.80	36264.59	
		b) Main Crop Sales Price (Rs.)			3358.33	
	By Product	e) Main Product (q)		2.54	200.97	
		f) Main Crop Sales Price (Rs.)			79.17	
b.	Gross Income (Rs.)				36465.57	
c.	Net Income (Rs.)				9062.98	
d.	Cost per Quintal (Rs./q.)				2537.66	
e.	Benefit Cost Ratio (BC Ratio)				1:1.33	

Cost of cultivation of Bengal gram: The data regarding the cost of cultivation of Bengal gram in Kalhalli Micro-watershed is presented in Table 33.g. The results indicate that, the total cost of cultivation for Bengal gram was Rs. 31256.71. The gross income realized by the farmers was Rs. 37815.87. The net income from Bengal gram cultivation was Rs. 6559.16. Thus the benefit cost ratio was found to be 1:1.21.

Table 33.g. Cost of Cultivation of Bengal gram in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	16.04	2274.84	7.28
2	Bullock		Pairs/day	1.36	833.90	2.67
3	Tractor		Hours	1.16	1048.99	3.36
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	73.35	7014.56	22.44
7	FYM		Quintal	6.59	5434	17.39
8	Fertilizer + micronutrients		Quintal	4.40	4241.28	13.57
9	Pesticides (PPC)		Kgs / liters	0.92	1191.29	3.81
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	393.20	1.26
14	Land revenue and Taxes			0	2.47	0.01
II	**Cost B1**					
16	Interest on working capital				2146.22	6.87
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				24580.75	78.64
III	**Cost B2**					
18	Rental Value of Land				288.89	0.92
19	**Cost B2 = (Cost B1 + Rental value)**				24869.64	79.57
IV	**Cost C1**					
20	Family Human Labour			18.25	3541.55	11.33
21	**Cost C1 = (Cost B2 + Family Labour)**				28411.19	90.90
V	**Cost C2**					
22	Risk Premium				4	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				28415.19	90.91
VI	**Cost C3**					
24	Managerial Cost				2841.52	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				31256.71	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.75	37266.98	
		b) Main Crop Sales Price (Rs.)			3466.67	
	By Product	e) Main Product (q)		5.49	548.89	
		f) Main Crop Sales Price (Rs.)			100	
b.	Gross Income (Rs.)				37815.87	
c.	Net Income (Rs.)				6559.16	
d.	Cost per Quintal (Rs./q.)				2907.58	
e.	Benefit Cost Ratio (BC Ratio)				1:1.21	

Cost of cultivation of Red gram: The data regarding the cost of cultivation of Red gram in Kalhalli Micro-watershed is presented in Table 33.h. The results indicate that, the total cost of cultivation for Red gram was Rs. 69552.02. The gross income realized by the farmers was Rs. 99294. The net income from Red gram cultivation was Rs. 29741.98. Thus the benefit cost ratio was found to be 1:1.43.

Table 33.h Cost of Cultivation of Red gram in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	88.92	13585	19.53
2	Bullock		Pairs/day	2.47	2223	3.20
3	Tractor		Hours	4.94	3952	5.68
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	17.29	2074.80	2.98
7	FYM		Quintal	4.94	14820	21.31
8	Fertilizer + micronutrients		Quintal	14.82	13091	18.82
9	Pesticides (PPC)		Kgs / liters	2.47	3705	5.33
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	0.05	0
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				4044.10	5.81
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				57494.95	82.66
III	**Cost B2**					
18	Rental Value of Land				166.67	0.24
19	**Cost B2 = (Cost B1 + Rental value)**				57661.61	82.90
IV	**Cost C1**					
20	Family Human Labour			27.17	5557.50	7.99
21	**Cost C1 = (Cost B2 + Family Labour)**				63219.11	90.89
V	**Cost C2**					
22	Risk Premium				10	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				63229.11	90.91
VI	**Cost C3**					
24	Managerial Cost				6322.91	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				69552.02	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		24.70	98800	
		b) Main Crop Sales Price (Rs.)			4000	
	By Product	e) Main Product (q)		2.47	494	
		f) Main Crop Sales Price (Rs.)			200	
b.	Gross Income (Rs.)				99294	
c.	Net Income (Rs.)				29741.98	
d.	Cost per Quintal (Rs./q.)				2815.87	
e.	Benefit Cost Ratio (BC Ratio)				1:1.43	

Cost of cultivation of Horse gram: The data regarding the cost of cultivation of Horse gram in Kalhalli Micro-watershed is presented in Table 33.i. The results indicate that, the total cost of cultivation for Horse gram was Rs. 14999.24. The gross income realized by the farmers was Rs. 14820. The net income from Horse gram cultivation was Rs. -179.24. Thus the benefit cost ratio was found to be 1:0.99.

Table 33.i. Cost of Cultivation of Horse gram in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	32.11	4199	27.99
2	Bullock		Pairs/day	4.94	2964	19.76
3	Tractor		Hours	0	0	0
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	14.82	2223	14.82
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	2.47	988	6.59
9	Pesticides (PPC)		Kgs / liters	0	0	0
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	14.82	0.10
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				386.52	2.58
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				10775.34	71.84
III	**Cost B2**					
18	Rental Value of Land				133.33	0.89
19	**Cost B2 = (Cost B1 + Rental value)**				10908.67	72.73
IV	**Cost C1**					
20	Family Human Labour			17.29	2717	18.11
21	**Cost C1 = (Cost B2 + Family Labour)**				13625.67	90.84
V	**Cost C2**					
22	Risk Premium				10	0.07
23	**Cost C2 = (Cost C1 + Risk Premium)**				13635.67	90.91
VI	**Cost C3**					
24	Managerial Cost				1363.57	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				14999.24	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		4.94	14820	
		b) Main Crop Sales Price (Rs.)			3000	
b.	Gross Income (Rs.)				14820	
c.	Net Income (Rs.)				-179.24	
d.	Cost per Quintal (Rs./q.)				3036.28	
e.	Benefit Cost Ratio (BC Ratio)				1:0.99	

Cost of cultivation of Sorghum: The data regarding the cost of cultivation of Sorghum in Kalhalli Micro-watershed is presented in Table 33.j The results indicate that, the total cost of cultivation for Sorghum was Rs. 38286.97. The gross income realized by the farmers was Rs. 37021.42. The net income from Sorghum cultivation was Rs. -1265.55. Thus the benefit cost ratio was found to be 1:0.97.

Table 33.j. Cost of Cultivation of Sorghum in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	13.18	1922.20	5.02
2	Bullock		Pairs/day	0.13	80.72	0.21
3	Tractor		Hours	3.82	3771.81	9.85
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	14.36	1901.20	4.97
7	FYM		Quintal	3.81	11022.04	28.79
8	Fertilizer + micronutrients		Quintal	6.99	7255.48	18.95
9	Pesticides (PPC)		Kgs / liters	1.03	1497.32	3.91
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	159.66	0.42
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				2601.75	6.80
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				30212.19	78.91
III	**Cost B2**					
18	Rental Value of Land				250	0.65
19	**Cost B2 = (Cost B1 + Rental value)**				30462.19	79.56
IV	**Cost C1**					
20	Family Human Labour			26.38	4338.90	11.33
21	**Cost C1 = (Cost B2 + Family Labour)**				34801.09	90.90
V	**Cost C2**					
22	Risk Premium				5.25	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				34806.34	90.91
VI	**Cost C3**					
24	Managerial Cost				3480.63	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				38286.97	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.48	29802.29	
		b) Main Crop Sales Price (Rs.)			1925	
	By Product	e) Main Product (q)		11.32	7219.13	
		f) Main Crop Sales Price (Rs.)			637.50	
b.	Gross Income (Rs.)				37021.42	
c.	Net Income (Rs.)				-1265.55	
d.	Cost per Quintal (Rs./q.)				2473.05	
e.	Benefit Cost Ratio (BC Ratio)				1:0.97	

Cost of cultivation of Cotton: The data regarding the cost of cultivation of Cotton in Kalhalli Micro-watershed is presented in Table 33.k. The results indicate that, the total cost of cultivation for Cotton was Rs. 19850.01. The gross income realized by the farmers was Rs. 38172.73. The net income from Cotton cultivation was Rs. 18322.71. Thus the benefit cost ratio was found to be 1:1.92.

Table 33.k. Cost of Cultivation of Cotton in Kalhalli Micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	23.64	3545.45	17.86
2	Bullock		Pairs/day	4.14	2481.82	12.50
3	Tractor		Hours	0	0	0
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	2.36	2836.36	14.29
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	11.82	1181.82	5.95
8	Fertilizer + micronutrients		Quintal	2.36	1890.91	9.53
9	Pesticides (PPC)		Kgs / liters	0.59	590.91	2.98
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	255.98	1.29
14	Land revenue and Taxes			0	4.94	0.02
II	**Cost B1**					
16	Interest on working capital				780	3.93
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				13568.20	68.35
III	**Cost B2**					
18	Rental Value of Land				400	2.02
19	**Cost B2 = (Cost B1 + Rental value)**				13968.20	70.37
IV	**Cost C1**					
20	Family Human Labour			17.73	4077.27	20.54
21	**Cost C1 = (Cost B2 + Family Labour)**				18045.47	90.91
V	**Cost C2**					
22	Risk Premium				0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				18045.47	90.91
VI	**Cost C3**					
24	Managerial Cost				1804.55	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				19850.01	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.05	38172.73	
		b) Main Crop Sales Price (Rs.)			3800	
b.	Gross Income (Rs.)				38172.73	
c.	Net Income (Rs.)				18322.71	
d.	Cost per Quintal (Rs./q.)				1976.02	
e.	Benefit Cost Ratio (BC Ratio)				1:1.92	

Adequacy of fodder: The data regarding the adequacy of fodder in Kalhalli Micro-watershed is presented in Table 34. The results indicate that, 15.22 per cent of the households opined that dry fodder was adequate, 21.74 per cent of the households opined that dry fodder was inadequate, 13.04 per cent of the households opined that green fodder was adequate and 23.91 per cent of the households opined that green fodder was inadequate.

Table 34. Adequacy of fodder in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0	1	8.33	2	11.11	3	37.50	1	33.33	7	15.22
2	Inadequate-Dry Fodder	0	0	2	16.67	5	27.78	3	37.50	0	0	10	21.74
3	Adequate-Green Fodder	0	0	1	8.33	2	11.11	2	25	1	33.33	6	13.04
4	Inadequate-Green Fodder	0	0	2	16.67	5	27.78	4	50	0	0	11	23.91

Annual gross income: The data regarding the annual gross income in Kalhalli Micro-watershed is presented in Table 35. The results indicate that the annual gross income was Rs. 108,850 for marginal farmers, for small farmers it was Rs. 78,211.11, semi medium farmers it was Rs. 155,330 and medium farmers it was Rs. 290,083.33.

Table 35. Annual gross income in Kalhalli Micro-watershed (Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Service/salary	0	2,083.33	3,888.89	10,000	66,666.67	8,152.17
2	Business	0	0	0	3,750	0	652.17
3	Wage	0	0	555.56	0	0	217.39
4	Agriculture	0	35,433.33	72,933.33	136,875	220,083.33	75,940.22
5	Non Farm income	0	4,000	0	0	0	1,043.48
6	Dairy Farm	0	666.67	833.33	4,705	0	1,318.26
7	Goat Farming	0	66,666.67	0	0	3,333.33	17,608.70
Income(Rs.)		0	108,850	78,211.11	155,330	290,083.33	104,932.39

Average annual expenditure: The data regarding the average annual expenditure in Kalhalli Micro-watershed is presented in Table 36. The results indicate that the average annual expenditure is Rs. 15,002.26. For marginal farmers it was Rs. 14,208.33, for small farmers it was Rs. 4,408.56, for semi medium farmers it was Rs. 13,156.25 and for medium farmers it was Rs. 111,666.67.

Table 36. Average annual expenditure in Kalhalli Micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Service/salary	0	10,000	16,666.67	15,000	190,000	6,086.96
2	Business	0	0	0	10,000	0	217.39
3	Wage	0	0	5,000	0	0	108.70
4	Agriculture	0	14,833.33	50,687.50	70,250	105,000	40,565.22
5	Dairy Farm	0	4,000	7,000	10,000	0	673.91
6	Goat Farming	0	141,666.67	0	0	40,000	10,108.70
Total		0	170,500	79,354.17	105,250	335,000	690,104.17
Average		0	14,208.33	4,408.56	13,156.25	111,666.67	15,002.26

Horticulture species grown: The data regarding horticulture species grown in Kalhalli Micro-watershed is presented in Table 37. The results indicate that, households have planted 94 coconut and 1 mango trees in their field.

Table 37: Horticulture species grown in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	12	0	0	0	54	0	28	0	94	0
2	Mango	0	0	0	0	1	0	0	0	0	0	1	0

***F= Field B=Back Yard**

Forest species grown: The data regarding forest species grown in Kalhalli Micro-watershed is presented in Table 38. The results indicate that, households have planted 1 teak, acacia and peepul tree, 53 neem and 3 banyan trees in their field and also 1 neem trees in their backyard.

Table 38: Forest species grown in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	0	0	1	0	0	0	0	0	1	0
2	Neem	0	0	3	0	17	1	3	0	30	0	53	1
3	Acacia	0	0	0	0	1	0	0	0	0	0	1	0
4	Banyan	0	0	0	0	1	0	0	0	2	0	3	0
5	Peepul Tree	0	0	1	0	0	0	0	0	0	0	1	0

***F= Field B=Back Yard**

Average Additional investment capacity: The data regarding average additional investment capacity in Kalhalli Micro-watershed is presented in Table 39. The results indicated that, households have an average investment capacity of Rs. 3,760.87 for land development, Rs. 282.61 for irrigation facility, Rs. 1,717.39 for improved crop production and Rs.1,108.7 for improved livestock management.

Table 39: Average additional investment capacity in Kalhalli Micro-watershed

Sl.No.	Particulars	LL(5)	MF (12)	SF (18)	SMF (8)	MDF (3)	All (46)
1	Land development	0	4,166.67	3,333.33	6,875	2,666.67	3,760.87
2	Irrigation facility	0	500	0	250	1,666.67	282.61
3	Improved crop production	0	2,000	1,777.78	2,875	0	1,717.39
4	Improved livestock management	0	1,583.33	833.33	2,125	0	1,108.70

Source of additional investment: The data regarding source of funds for additional investment in Kalhalli Micro-watershed is presented in Table 40. The results indicated that loan from bank was the source of additional investment for 30.43 per cent for land development, 6.52 per cent for irrigation facility, 19.57 per cent for improved crop production and 8.7 per cent for improved livestock management. Own funds was the source of additional investment for 23.91 per cent for land development, 21.74 per cent for improved crop production and 8.7 per cent for improved livestock management.

Table 40: Source of funds for additional investment capacity in Kalhalli micro – watershed

Sl.No	Item	Land development		Irrigation facility		Improved crop production		Improved livestock management	
		N	%	N	%	N	%	N	%
1	Loan from bank	14	30.43	3	6.52	9	19.57	4	8.7
2	Own funds	11	23.91	0	0.0	10	21.74	4	8.7

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Kalhalli Micro-watershed is presented in Table 41. The results indicated that, cotton, sugarcane and sunflower was sold to the extent of 100 per cent, Bengal gram was sold to the extent of 58.33 per cent, groundnut was sold to extent of 90.51 per cent, horsegram and red gram was sold to the extent of 50 per cent, Jowar was sold to the extent of 77.27, maize was sold to the extent of 99.09, pea was sold to the extent of 85.71 per cent and sorghum was sold to the extent of 90.2 per cent.

Table 41. Marketing of the agricultural produce in Kalhalli Micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	175	50	125	71.43	1477.27
2	Bengalgram	48	20	28	58.33	3466.67
3	Cotton	17	0	17	100	3800.0
4	Groundnut	158	15	143	90.51	3581.25
5	Horsegram	2	1	1	50	3000.0
6	Jowar	22	5	17	77.27	1500.0
7	Maize	441	4	437	99.09	1455.56
8	Pea	14	2	12	85.71	5000.0
9	Redgram	10	5	5	50	4000.0
10	Sorghum	102	10	92	90.20	2675.0
11	Sugarcane	220	0	220	100	2600.0
12	Sunflower	195	0	195	100	3345.45

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Kalhalli Micro-watershed is presented in Table 42. The results indicated that, about 52.17 per cent of the farmers sold their produce to agent/traders, 56.52 per cent of the farmers sold their produce to local/village merchant and 2.17 per cent of the farmers sold their produce to regulated market.

Table 42. Marketing Channels used for sale of agricultural produce in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	0	0	6	50	12	66.67	6	75	0	0	24	52.17
2	Local/village Merchant	0	0	6	50	11	61.11	5	62.50	4	133.33	26	56.52
3	Regulated Market	0	0	1	8.33	0	0	0	0	0	0	1	2.17

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Kalhalli Micro-watershed is presented in Table 43. The results indicated that, 10.87 per cent of the households have used cart and 100 per cent of the households used tractor as a mode of transportation.

Table 43. Mode of transport of agricultural produce in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	0	0	1	8.33	1	5.56	3	37.50	0	0	5	10.87
2	Tractor	0	0	12	100	22	122.22	8	100	4	133.33	46	100

Incidence of soil and water erosion problems: The data regarding incidence of incidence of soil and water erosion problems in Kalhalli Micro-watershed is presented in Table 44. The results indicated that, 26.09 per cent have incidence of soil and water erosion problems.

Table 44. Incidence of soil and water erosion problems in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	5	41.67	5	27.78	1	12.50	1	33.33	12	26.09

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Kalhalli Micro-watershed is presented in Table 45. The results indicated that, 67.39 per cent have shown interest in soil test.

Table 45. Interest shown towards soil testing in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	10	83.33	14	77.78	6	75	1	33.33	31	67.39

Soil and water conservation practices and structures adopted: The data regarding incidence of soil and water erosion problems in Kalhalli micro-watershed is presented in Table 46. The results indicated that, 13.04 per cent of households adopted field bunding structure was adopted.

Table 46. Soil and water conservation practices and structures adopted in Kalhalli micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Field Bunding	0	0	1	8.33	3	16.67	2	25	0	0	6	13.04

Status of soil and water conservation structures: The data regarding incidence of soil and water erosion problems in Kalhalli micro-watershed is presented in Table 47. The results indicated that, 16.67 per cent have field bunding condition was good and severely damaged and 66.67 per cent of the field bunding condition was slightly damaged.

Table 47. Soil and water conservation practices and structures in Kalhalli micro-watershed

Sl.No	Item	Good		Slightly Damaged		Severely Damaged	
		N	%	N	%	N	%
1	Field Bunding	1	16.67	4	66.67	1	16.67

Agencies involved in soil conservation structures: The data regarding incidence of soil and water erosion problems in Kalhalli micro-watershed is presented in Table 48. The results indicated that, 8.7 per cent of the NGOs are invoved in soil and water conservation structure and 4.35 per cent of the farmers are invoved in soil and water conservation structure.

Table 48. Agencies involved in soil conservation structuresin Achala micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	NGO	0	0	1	8.33	2	11.11	1	12.50	0	0	4	8.70
2	Farmer organization	0	0	0	0	1	5.56	1	12.50	0	0	2	4.35

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Kalhalli Micro-watershed is presented in Table49. The results indicated that, 91.3 per cent of the households used fire wood and 8.7 per cent of the households used LPG as a source of fuel.

Table 49. Usage pattern of fuel for domestic use in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		LF (0)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	4	80	12	100	16	88.89	7	87.50	3	100	0	0	42	91.30
2	LPG	1	20	0	0	2	11.11	1	12.50	0	0	0	0	4	8.70

Source of drinking water: The data regarding source of drinking water in Kalhalli Micro-watershed is presented in Table 50. The results indicated that, piped supply was the major source of drinking water for 45.65 per cent, 54.35 per cent of the households used bore well and 2.17 per cent of the households used lake/tank in the micro watershed.

Table 50. Source of drinking water in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	0	0	4	33.33	10	55.56	6	75	1	33.33	21	45.65
2	Bore Well	5	100	7	58.33	9	50	2	25	2	66.67	25	54.35
3	Lake/ Tank	0	0	1	8.33	0	0	0	0	0	0	1	2.17

Table 51. Source of light in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		LF (0)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Kerosene Lamp	5	100	12	100	18	100	8	100	3	100	0	0	46	100

Source of light: The data regarding source of light in Kalhalli Micro-watershed is presented in Table 51. The results indicated that, Kerosene lamp was the major source of light for 100 per cent of the households in Kalhalli Micro-watershed.

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facility in Kalhalli Micro-watershed is presented in Table 52. The results indicated that, 28.26 per cent of the households possess sanitary toilet facility.

Table 52. Existence of Sanitary toilet facility in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	3	60	3	25	4	22.22	2	25	1	33.33	13	28.26

Possession of PDS card: The data regarding possession of PDS card in Kalhalli Micro-watershed is presented in Table 53. The results indicated that, 100 per cent of the households possess BPL cards and 2.17 per cent of the sampled households does not possessed PDS cards.

Table 53. Possession of PDS card in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	5	100	12	100	19	105.56	7	87.50	3	100	46	100
2	Not Possessed	0	0	0	0	0	0	1	12.50	0	0	1	2.17

Participation in NREGA program: The data regarding participation in NREGA programme in Kalhalli Micro-watershed is presented in Table 54. The results indicated that, 54.35 per cent of the households participated in NREGA programme.

Table 54. Participation in NREGA programme in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	2	40	7	58.33	11	61.11	3	37.50	2	66.67	25	54.35

Table 55. Adequacy of food items in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	0	0	9	75	10	55.56	6	75	3	100	28	60.87
2	Pulses	0	0	6	50	6	33.33	6	75	2	66.67	20	43.48
3	Oilseed	0	0	2	16.67	3	16.67	5	62.50	2	66.67	12	26.09
4	Vegetables	0	0	8	66.67	10	55.56	6	75	3	100	27	58.70
5	Fruits	0	0	1	8.33	2	11.11	3	37.50	0	0	6	13.04
6	Milk	0	0	8	66.67	9	50	6	75	3	100	26	56.52
7	Egg	0	0	3	25	4	22.22	5	62.50	1	33.33	13	28.26
8	Meat	0	0	3	25	3	16.67	5	62.50	1	33.33	12	26.09

Adequacy of food items: The data regarding adequacy of food items in Kalhalli Micro-watershed is presented in Table 55. The results indicated that, cereals were adequate for 60.87 per cent of the households, pulses were adequate for 43.48 per cent, oilseeds and

meat were adequate for 26.09 per cent, vegetables were adequate for 58.7 per cent, fruits were adequate for 13.04 per cent, milk were adequate for 56.52 per cent and egg were adequate for 28.26 per cent of the households.

Response on Inadequacy of food items: The data regarding inadequacy of food items in Kalhalli Micro-watershed is presented in Table 56. The results indicated that, cereals were inadequate for 13.04 per cent of the households, pulses were inadequate for 26.09 per cent, oilseed were inadequate for 30.43 per cent, vegetables were inadequate for 4.35 per cent, fruits were inadequate for 28.26 per cent, milk and egg were inadequate for 15.22 per cent, and meat were inadequate for 8.7 per cent of the households.

Table 56. Response on Inadequacy of food items in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	4	80	1	8.33	1	5.56	0	0	0	0	6	13.04
2	Pulses	3	60	3	25	5	27.78	0	0	1	33.33	12	26.09
3	Oilseed	3	60	5	41.67	5	27.78	0	0	1	33.33	14	30.43
4	Vegetables	1	20	1	8.33	0	0	0	0	0	0	2	4.35
5	Fruits	3	60	4	33.33	3	16.67	2	25	1	33.33	13	28.26
6	Milk	3	60	2	16.67	2	11.11	0	0	0	0	7	15.22
7	Egg	3	60	3	25	1	5.56	0	0	0	0	7	15.22
8	Meat	2	40	2	16.67	0	0	0	0	0	0	4	8.70

Response on Market Surplus of food items: The data regarding inadequacy of food items in Kalhalli Micro-watershed is presented in Table 57. The results indicated that, cereals were inadequate for 26.09 per cent of the households, pulses were inadequate for 30.43 per cent, oilseeds were inadequate for 43.48 per cent, vegetables were inadequate for 36.96 per cent, fruits were inadequate for 47.83 per cent, milk were inadequate for 28.26 per cent, egg were inadequate were inadequate for 50 per cent and meat were inadequate for 54.35 per cent of the households.

Table 57. Response on Market Surplus of food items in Kalhalli Micro-watershed

Sl.No.	Particulars	LL (5)		MF (12)		SF (18)		SMF (8)		MDF (3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	1	20	2	16.67	7	38.89	2	25	0	0	12	26.09
2	Pulses	2	40	3	25	7	38.89	2	25	0	0	14	30.43
3	Oilseed	2	40	5	41.67	10	55.56	3	37.50	0	0	20	43.48
4	Vegetables	4	80	3	25	8	44.44	2	25	0	0	17	36.96
5	Fruits	2	40	6	50	10	55.56	3	37.50	1	33.33	22	47.83
6	Milk	2	40	2	16.67	7	38.89	2	25	0	0	13	28.26
7	Egg	2	40	6	50	11	61.11	3	37.50	1	33.33	23	50
8	Meat	3	60	6	50	12	66.67	3	37.50	1	33.33	25	54.35

Farming constraints: The data regarding farming constraints experienced by households in Kalhalli Micro-watershed is presented in Table 58. The results indicated that, lower fertility status of the soil was the constraint experienced by 63.04 per cent of the households, wild animal menace on farm field (80.43%), frequent incidence of pest and

diseases (73.91%), Inadequacy of irrigation water (69.75%), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (76.09%), lack of marketing facilities in the area (43.48%), inadequate extension service (32.61%), Lack of transport for safe transport of the Agril produce to the market (30.43%), less rainfall (13.04%) and Source of Agri-technology information (6.52%).

Table 58. Farming constraints Experienced in Kalhalli Micro-watershed

Sl. No.	Particulars	LL(5)		MF (12)		SF (18)		SMF(8)		MDF(3)		All (46)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	0	0	10	83.33	10	55.56	7	87.50	2	66.67	29	63.04
2	Wild animal menace on farm field	0	0	12	100	14	77.78	8	100	3	100	37	80.43
3	Frequent incidence of pest and diseases	0	0	10	83.33	14	77.78	7	87.50	3	100	34	73.91
4	Inadequacy of irrigation water	0	0	10	83.33	14	77.78	7	87.50	1	33.33	32	69.57
5	High cost of Fertilizers and plant protection chemicals	0	0	8	66.67	18	100	7	87.50	2	66.67	35	76.09
6	High rate of interest on credit	0	0	11	91.67	17	94.44	5	62.50	2	66.67	35	76.09
7	Low price for the agricultural commodities	0	0	11	91.67	16	88.89	6	75	2	66.67	35	76.09
8	Lack of marketing facilities in the area	0	0	4	33.33	9	50	4	50	3	100	20	43.48
9	Inadequate extension services	0	0	3	25	9	50	2	25	1	33.33	15	32.61
10	Lack of transport for safe transport of the Agril produce to the market.	0	0	4	33.33	5	27.78	3	37.50	2	66.67	14	30.43
11	Less rainfall	0	0	1	8.33	3	16.67	1	12.50	1	33.33	6	13.04
12	Source of Agri-technology information	0	0	1	8.33	2	11.11	0	0	0	0	3	6.52

Chapter 5

SUMMARY AND IMPLICATIONS

In order to assess the socio-economic condition of the farmers in the watershed 46 households located in the micro watershed were interviewed for the survey. The survey was conducted in is located at $15^0$12'48.492'' to 15^0 11'30.734'' North and East 75^0 59' 24.617'' to $75^0$56'47.418''covering an area of about 569.51 ha coming under Kallahalli, Byrapura and Alavandi Villages of Koppal taluk.

Socio-economic analysis indicated that, out of the total sample of 46 houaeholds in the micro watershed, 5 (10.87%) were landless, 12 (26.09%) were marginal, farmers 18 (39.13%) were small farmers, 8 (17.39%) were semi medium and 3 (6.52%) medium farmers. The population characteristics of households indicated that, there were 135 (58.95%) men and 94 (41.05%) women among the sampled households. The average family size of landless farmers' was 3.8, marginal farmers'and small farmers' was 4.9, semi medium farmers' was 5.5 and medium farmers were 6. Majority of the respondents 42 (18.34%) people were in 0-15 years of age, 99 (43.23%) were in 16-35 years of age, 58 (25.33%) were in 36-60 years of age and 30 (13.1%) were above 61 years of age. Education level of the sample households indicated that, majority there were 37.55 per cent illiterates, 20.52 per cent of them had primary school, 12.66 per cent of them had Middle school education, 18.78 per cent of them had high school, 3.49 per cent of them had PUC and 3.93 per cent of them had degree education. About, 26.09 per cent of household heads were practicing agriculture, 58.7 per cent of the household heads were agricultural laborers and 2.17 per cent of the household heads were trade and business. Agriculture was the major occupation for 16.59 per cent of the household members, 48.47 per cent were agricultural laborers, 0.87 per cent were government and trade and business, 17.03 per cent student, 0.44 per cent were housewives and 4.37 per cent were children. The household possess, 100 per cent of the population in the micro watershed has not participated in local institutions.

In the study area, 21.74 per cent of the households possess thatched house, 63.04 per cent of the households possess katcha house, 8.70 per cent of the households possess pucca/RCC and 6.52 per cent of the households possess semi pacca. The durable assets owned by the households showed that, 63.04 per cent of the households possess TV, 15.22 per cent of the households possess mixer/grinder, 19.57 per cent of the household's posses bicycle, 47.83 per cent of the households possesses motor cycle and 93.48 per cent of the households possess mobile phones. Farm implements owned by the households indicated that, 17.39 per cent each of the households possess bullock cart and sprayer, 13.04 per cent of the households possess plough, 4.35 per cent of the households possess seed/fertilizer drill, 2.17 per cent of the households possess irrigation pump and tractor, 39.13 per cent of the households possess weeder and 6.52 per cent of the households possess chaff cutter. Regarding livestock possession by the households, 15.22 per cent of

the households possess bullocks and sheep, 19.57 per cent of the households possess local cow, 4.35 per cent of the households possess buffalo and 2.17 per cent of the households possess goat and poultry birds.

The average own labour men available in the micro watershed was 2.15, average own labour (women) available was 1.26, average hired labour (men) available was 10.5 and average hired labour (women) available was 7.8.

Out of the total land holding of the sample respondents 54.44 ha (83.65%) of dry land and 10.64 ha (16.35%) of irrigated land. Marginal farmers possess 8.75 ha (100%) of dry land. Small farmers possess 22.25 ha (93.22%) of dry land and 1.62 ha (6.78%) of irrigated land. Semi medium farmers possess 16.35 ha (88.86%)of dry land and 2.07 ha (11.14%) of irrigated land. Medium farmers possess 6.91 ha (49.84%) of dry land and 6.95 ha (50.16%) of irrigated land. There were 12 functioning and 22 de-functioning bore wells in the micro watershed. Bore well was the major irrigation source in the micro water shed for 26.09 per cent of the farmers. The major crops have grown sunflower (22.1 ha), bajra (10.68 ha), maize (12.94 ha), sorghum (6.77 ha), groundnut (6.64 ha), Bengal gram (3.66 ha), cotton (1.69 ha), pea (2.84 ha), sugarcane (1.26 ha), sajje and sunflower (0.92 ha), red gram (0.81 ha), chick pea (0.61 ha) and horse gram (0.4 ha). The cropping intensity in Kalhalli Micro-watershed was found to be 93.29 per cent.

The sample households possessed 58.7 per cent of the households have bank and 10.87 per cent have savings account. About 4.35 per cent of the households have availed credit from different sources. The sample households possessed, 38 per cent of the households have borrowed from commercial bank, 6 per cent of the households have borrowed from cooperative bank, 56 per cent of the households have borrowed from grameena bank and 19 per cent of the households have borrowed from SHGs/CBOs. The household posess, the average credit amount borrowed by households in micro-watershed was Rs, 35000. The households possessed, 100 per cent of the households borrowed from institutional sources for the purpose of agricultural production. The households possess, 100 per cent of the households do not repay their loan from institutional sources. The households possess, 100 per cent of the households do not repay their loan from private sources. The households possess, 68.75 per cent opined that the loan amount borrowed from helped to perform timely agricultural operations and 31.25 per cent opined that the loan amount borrowed from forced to sell the produce at low price to repay loan in time.

The per hectare cost of cultivation for Maize, Pea, Groundnut, Sugarcane, Bajra, Sunflower, Bengal gram, Red gram, Horse gram, sorghum and cotton was Rs. 35497.48, 28205.39, 93696.92, 90775.21, 39299.87, 27402.59, 31256.71, 69552.02, 14999.24, 38286.97 and 19850.01 with benefit cost ratio of 1:1.44, 1:5.13, 1:0.96, 1:5.03, 1:0.64, 1:1.33, 1:1.21, 1:1.43, 1:0.99, 1:0.97 and 1:1.92 respectively.

Further, 15.22 per cent of the households opined that dry fodder was adequate, 21.74 per cent of the households opined that dry fodder was inadequate, 13.04 per cent of the households opined that green fodder was adequate and 23.91 per cent of the households opined that green fodder was inadequate.

The average annual gross income was Rs. 108,850 for marginal farmers, for small farmers it was Rs. 78,211.11, semi medium farmers it was Rs. 155,330 and medium farmers it was Rs. 290,083.33. The average annual expenditure is Rs. 15,002.26. For marginal farmers it was Rs. 14,208.33, for small farmers it was Rs. 4,408.56, for semi medium farmers it was Rs. 13,156.25 and for medium farmers it was Rs. 111,666.67.

Sampled households have planted 94 coconut and 1 mango trees in their field to cultivate horticultural crops. Households have planted 1 teak, acacia and peepul tree, 53 neem and 3 banyan trees in their field and also 1 neem trees in their backyard in their field to cultivate forest species.

Households have an average investment capacity of of Rs. 3,760.87 for land development, Rs. 282.61 for irrigation facility, Rs. 1,717.39 for improved crop production and Rs.1,108.7 for improved livestock management. Source of funds for additional investment is concerned; loan from bank was the source of additional investment for 30.43 per cent for land development, 6.52 per cent for irrigation facility, 19.57 per cent for improved crop production and 8.7 per cent for improved livestock management. Own funds was the source of additional investment for 23.91 per cent for land development, 21.74 per cent for improved crop production and 8.7 per cent for improved livestock management.

Regarding marketing channels, 52.17 per cent of the farmers sold their produce to agent/traders, 56.52 per cent of the farmers sold their produce to local/village merchant and 2.17 per cent of the farmers sold their produce to regulated market. Further, 10.87 per cent of the households have used cart and 100 per cent of the households used tractor as a mode of transportation.

Majority of the households 26.09 per cent have incidence of soil and water erosion problems. The household possess, (67.39%) were interested towards soil testing. The households possess, 13.04 per cent of households adopted field bunding structure was adopted. The households possess, 16.67 per cent have field bunding condition was good and severly damaged and 66.67 per cent of the field bunding condition was slightly damaged. The households possess, 8.7 per cent of the NGOs are invoved in soil and water conservation structure and 4.35 per cent of the farmers are invoved in soil and water conservation structure. The households possess, 91.3 per cent of the households used fire wood and 8.7 per cent of the households used LPG as a source of fuel. Piped supply was the major source of drinking water for 45.65 per cent, 54.35 per cent of the households used bore well and 2.17 per cent of the households used lake/tank in the micro watershed.

Kerosene was the major source of light for 100 per cent of the households. In the study area, 28.26 per cent of the households possess sanitary toilet facility. Regarding possession of PDS card, 100 per cent of the households possess BPL cards and 2.17 per cent of the sampled households does not possessed PDS cards. Cereals were adequate for 60.87 per cent of the households, pulses were adequate for 43.48 per cent, oilseeds and meat were adequate for 26.09 per cent, vegetables were adequate for 58.7 per cent, fruits were adequate for 13.04 per cent, milk were adequate for 56.52 per cent and egg were adequate for 28.26 per cent of the households. Cereals were inadequate for 13.04 per cent of the households, pulses were inadequate for 26.09 per cent, oilseed were inadequate for 30.43 per cent, vegetables were inadequate for 4.35 per cent, fruits were inadequate for 28.26 per cent, milk and egg were inadequate for 15.22 per cent, and meat were inadequate for 8.7 per cent of the households.

Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil was the constraint experienced by 63.04 per cent of the households, wild animal menace on farm field (80.43%), frequent incidence of pest and diseases (73.91%), Inadequacy of irrigation water (69.75%), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (76.09%), lack of marketing facilities in the area (43.48%), inadequate extension service (32.61%), Lack of transport for safe transport of the Agril produce to the market (30.43%), less rainfall (13.04%) and Source of Agri-technology information (6.52%).

Implications of the survey

- ✓ Result indicated that, there were 37.55 per cent were illiterate hence; extension methodologies such as demonstration, street play, drama, video shows will be effective in dissemination of the technologies in the micro watershed.
- ✓ The data indicate that, 63.04 per cent of the households possess Katcha house. Hence, the development department while implementing the watershed plan should focus on agriculture to enhance the productivity of major crops in the area to increase the income of the farmers.
- ✓ Results indicated that the local institutional participation of the household members in the micro watershed is minimal hence, activities like membership campaign, awareness creation about the benefits of membership in local institutions and strengths of organized groups must be conveyed.
- ✓ Majority of the households in the watershed have experience in use of mobile phones, and television hence, these mass media can be effectively utilized for transfer of technology as well as for information dissemination.
- ✓ The farm machinery/implement possession in the micro watershed was found to be minimum the reasons may lack of knowledge or lack of financial ability which can

be addressed through training on use of different farm implements, providing information on different sources of finance for purchase of farm implements.

- ✓ The possession of livestock such as crossbred cow found is less hence, farmers must be made aware of the benefits of crossbred cow in increased milk production.
- ✓ The possession of livestock such as sheep, goat and poultry was found to be low hence, farmers may be informed the role of subsidiary enterprises in enhancing the income and information on financial support for subsidiary activities.
- ✓ The data indicate that, job/work was the reason for all the migrants hence, farmers may be trained on profitable agriculture or self employment such has animal husbandry, plate making, sheep rearing, goat rearing, rabbit rearing with suitable information on sources of financial support.
- ✓ The results indicate that there was a change in quality of life due to migration hence, the developmental departments should take actions to arrest migration and to improve the quality of the life in rural areas.
- ✓ Households possess 54.44 ha (83.65%) of dry land and 10.64 ha (16.35%) of irrigated land hence, the availability of the dry land agricultural technologies such as short duration crops, high yielding drought resistance crop varieties, drip irrigation technology and subsidy information will be helpful for the farmers to enhance the productivity of land and as well as farmers income.
- ✓ Bore well was source of irrigation for 26.09 per cent of the households. Hence, in order to increase the area under irrigation as well as to increase the water use efficiency farmers may trained on drip irrigation and provides the information on subsidy for drip irrigation equipment's along with the information on different agencies which provides the financial assistance for drip irrigation.
- ✓ Farmers have grown horticulture species, 94 coconut and 1 mango trees in their field. and forest species have planted 1 teak, acacia and peepul tree, 53 neem and 3 banyan trees in their field and also 1 neem trees in their backyard. Hence, production technologies related to these crops can be made available to the farmers for better adoption.
- ✓ The cropping intensity in the micro watershed was found to be (93.29 %) hence; care must be taken by the implementing agency to bring uncultivated land into cultivation through suitable measures.
- ✓ Many of the household members have borrowed loan from cooperative banks which has higher rate of interest hence, farmers may be sensitized on the different sources of credit with lesser interest rate such SHGs etc.
- ✓ The results indicated the non availability of both green and dry fodder throughout the year hence, fodder development activities can be taken up in the micro watershed. The average annual gross income was Rs. 108,850 for marginal farmers, for small farmers it was Rs. 78,211.11, semi medium farmers it was Rs. 155,330 and medium farmers it was Rs. 290,083.33.

- ✓ Agriculture was found to be the major source of income for households hence; the development activities should focus on productivity enhancement, marketing arrangements and agricultural technology dissemination to have a direct impact on the farmers.
- ✓ The cultivation of forest species is found minimal hence; information and production technology related to agro-forestry and integrated farming system.
- ✓ The data indicated that, 67.39 per cent of the households have interest in soil testing hence, farmers must be provided with the information on various institutions which are involved in soil testing for the benefit of the farmers.
- ✓ Except summer ploughing the adoption of other soil and water conservation structures is minimum hence, the farmers in the micro watershed should be sensitized on the use of different conservation structures for soil water conservation.
- ✓ Cereals and pulses found be adequate for per cent of the households respectively hence, farm households and the farm women must be trained on importance of balanced nutrition and role of vegetable, milk, egg, meat in balanced diet.
- ✓ lower fertility status of the soil was the constraint experienced by 63.04 per cent of the households, wild animal menace on farm field (80.43%), frequent incidence of pest and diseases (73.91%), Inadequacy of irrigation water (69.75%), high cost of fertilizer and plant protection chemicals, high rate of interest on credit and Low price for the agricultural commodities (76.09%), lack of marketing facilities in the area (43.48%), inadequate extension service (32.61%), Lack of transport for safe transport of the Agril produce to the market (30.43%), less rainfall (13.04%) and Source of Agri-technology information (6.52%) were the major farming constraints experienced hence, these constraints must be addressed immediately for the welfare of the farmers. Awareness to be created among the farmers to approach nearest KVKs/RSKs and other developmental departments for technical and for subsidized inputs and utilize the well established regulated markets, approaching the contract firms, direct markets to avoid the involvement of middlemen.