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Land Evaluation of Kalgi South-1 Micro-Watershed in North Eastern Dry Zone of Karnataka for Sustainable Land Use Planning

Maheshkumar, Basavaraj K., Rudramurthy H. V., Rajesh N. L., Sharanbhoopal Reddy

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Abstract A study was undertaken to evaluate five soil series belonging to Kalgi South-1 micro-watershed (Kalaburagi district) in North Eastern Dry Zone of Karnataka (Zone-II) for sustainable land use planning. Five soil series were tentatively identified and mapped into six mapping units using GIS technique. These mapping units were grouped into land capability class II and III with limitations of soil characteristics and erosion. Soil-site suitability evaluation for twenty major agricultural and horticultural crops showed that Kodadur series was highly suitable (S_1) for all crops except jackfruit and cashew. Chimmanboda series was moderately suitable (S_2) for all agricultural crops. Chimmanchod series was not suitable (N) for growing of cashew and Jackfruit.

Keywords Land capability classification, Land forms, Suitability for crops, Dry zone.

Maheshkumar, Basavaraj K.*
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Kalaburagi, UAS Raichur 585102, India

Rudramurthy H. V., Sharanbhoopal Reddy
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Bheemarayanagudi, UAS Raichur 585287, India

Rajesh N. L.
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Raichur, UAS Raichur 584104, India
e-mail: bctidigol@yahoo.co.in
*Corresponding author

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 land in a rational and judicious manner. But what is happening in many areas of the state is a cause for concern to anyone involved in the management of land resources at the grass roots level.

The database required for Farm-Level Planning can be obtained by carrying out detailed characterization and mapping of all the existing land resources like soils, climate, water, minerals and rocks, vegetation, crops, land use pattern, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government. 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 to the farmer and other land users of the area.

Assessing the extent and degree of suitability of

the land resources in the micro watershed for various crops is necessary to choose the right crop and variety suitable for the area. In carrying out this assessment, the specific requirements of a crop (compiled from the existing literature) are compared with the characteristics of land and based on the extent of matching; the suitability of the area for the crop is arrived (Sys et al. 1991). Then by comparing the relative suitability of the resources for different uses, an ideal combination of crops suitable for a particular farm within the micro watershed area can be selected.

Keeping these considerations in view, land evaluation exercise was undertaken in Kalgi South-1 micro watershed of North Eastern Dry Zone of Karnataka (Zone-II).

Materials and Methods

Kalgi South-1 micro watershed is located in Chitapur taluka of Kalaburagi district, Karnataka state and having total area of 621 hectares lies between $17^0 20'$-$17^0 22'$ North latitude and $77^0 08'$ – $77^0 10'$ East longitude and 432 m above mean sea level (MSL). The average rainfall of this region is 624 mm with a large spatial and temporal variability. The location of the study area furnished in Fig. 1. Study area is characterized by Basalt, granites and gneiss complex.

Table 1. Area distribution of soil mapping units of Kalgi South-1 micro-watershed.

Name of the series	Mapping units	Area (ha)	Area cover (%)
Chimmanboda	CMBmB2g0	18	2.84
	CMBmC2g0	47	7.59
Chimmanchod	CMHmB2g0	07	1.06
Kodadur	KDRmB2g0	85	13.70
Nlimhosahalli	NMHmB2g0	198	31.93
Thajalapur	TJPmB2g0	255	41.11
Others*	Waterbody	11	1.76
	Total area	621	100.00

The detailed soil survey was carried out using IRS P6 data.The pedons were exposed and studied for their geomorphological features (slope, surface stoniness, erosion, drainage, gravels) of landscape and morphological features (soil depth, texture, color, structure, consistency, coarse fragments, porosity, soil reaction) of the pedons. The physico-chemical properties (horizon-wise) were estimated by following the standard procedures (Soil Survey Staff 1999). Five soil series were tentatively identified in the study area and mapped into six mapping units as phases of soil series (Fig. 2, Table 1). Weighted mean of each prop-

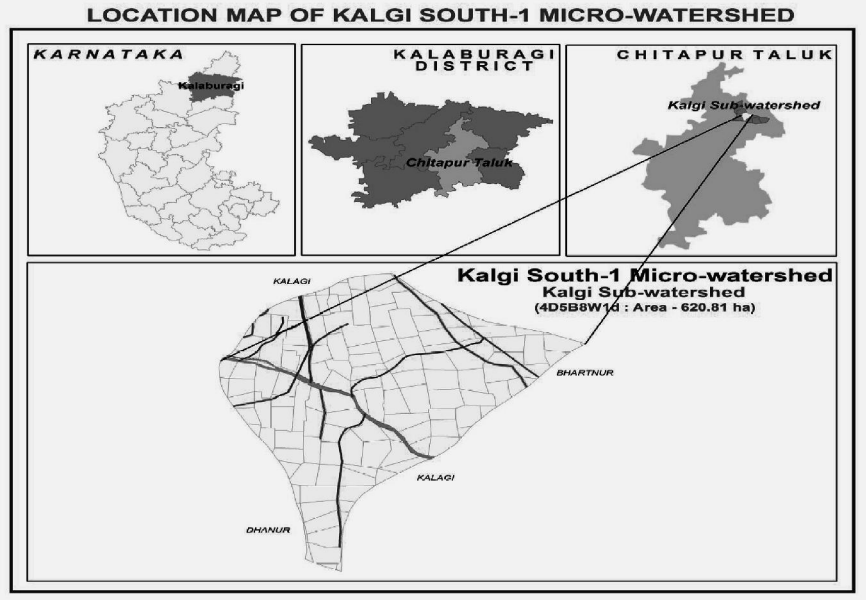

Fig. 1. Location map of Kalgi South-1 Micro-watershed.

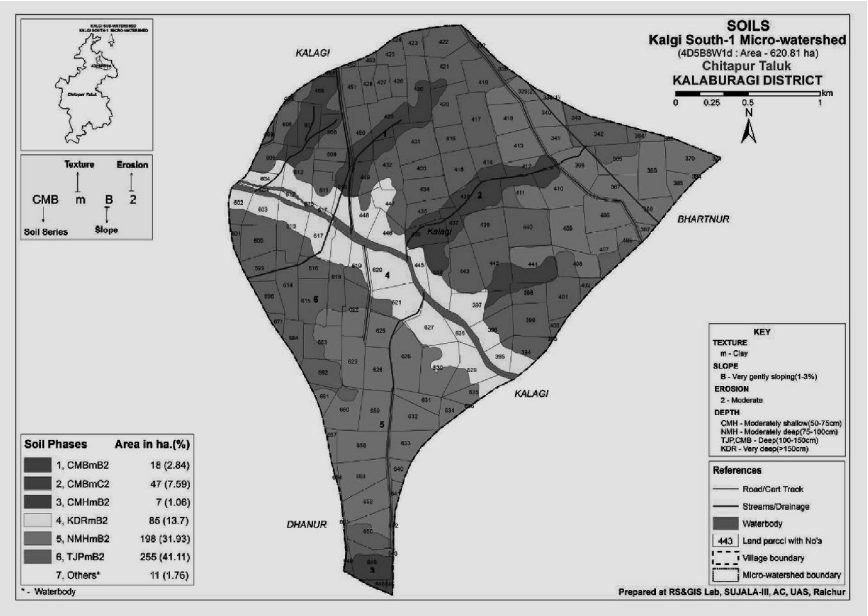

Fig. 2. Soil series mapping unit of Kalgi South-1 micro-watershed.

erty was calculated and soil-site characteristics of different soil units were obtained as shown in Table 2. These weighted average data have been used to evaluate the land capability classification and soil-site suitability. Land capability map and soil- site suitability maps were prepared from ArcGIS 10.3 soft-

Table 2. Soil-site characteristics of Kalgi South-1 micro-watershed for land evaluation.

Mapping unit	Climate (c)				Land form characteristics		
	Rainfall (mm)	Max temp (^{0}C)	Min temp (^{0}C)	RH (%)	Slope (t)	Erosion (e)	Drainage (w)
CMBmB2g0	624	40.91	29.6	74.1	1-3	Moderate	Moderately well
CMBmC2g0	624	40.91	29.6	74.1	3-5	Moderate	Moderately well
CMHmB2g0	624	40.91	29.6	74.1	1-3	Moderate	Moderately well
KDRmB2g0	624	40.91	29.6	74.1	1-3	Moderate	Moderately well
NMHmB2g0	624	40.91	29.6	74.1	1-3	Moderate	Moderately well
TJPmB2g0	624	40.91	29.6	74.1	1-3	Moderate	Moderately well

Table 2. Continued.

Depth (cm)	Texture	Physico-chemical characteristics (f) pH (1:2.5) (soil:water)	EC (dS/m)	OC (g/kg)
100-150	clay	Moderately alkaline	Non saline	High
100-150	clay	Strongly alkaline	Non saline	High
50-75	clay	Slightly alkaline	Non saline	High
>150	clay	Strongly alkaline	Non saline	High
75-100	clay	Slightly alkaline	Non saline	High
100-150	clay	Slightly alkaline	Non saline	High

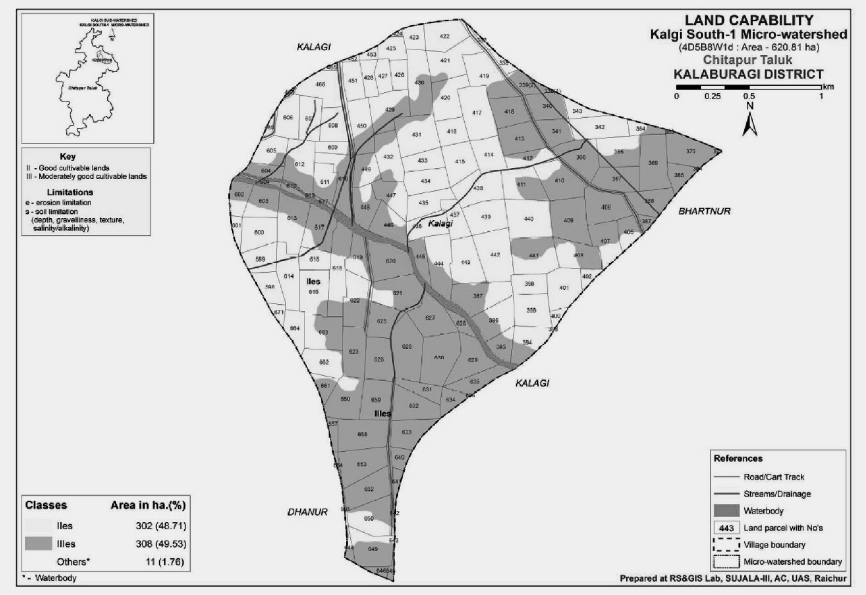

Fig. 3. Land capability classification map of Kalgi South-1 micro-watershed.

ware.

Results and Discussion

Land capability classification

Land capability classification is an interpretive grouping of soils mainly based on the inherent soil characteristics, external land features and environmental factors that limits the use of the land. Soil site characteristics of soil units (Table 2) are matched with the criteria fore land capability classification (Sehgal 1996). The land capability classification of mapping units and their extent in watershed is presented in Fig. 3.

Based on soil properties, the soils of Kalgi South-1micro-watershed of Kalaburagi taluk have been classified into two land capability classes viz. II and III (Fig. 3). The Nimahosahalli, Chimmanboda and Kodadur series were grouped under land capability sub-class IIIes. These soils were marginally cultivable lands due to severe limitations of erosion, slope, texture, soil depth limitations. Whereas, Thajalapur and Chimmanboda were classified into IIes which are moderately cultivable lands with limitations of depth, erosion, slope and texture limitations. The area under IIIes and IIes was 308 and 302 ha, respectively (Fig.3). Major proportion of the area belongs to class IIIes and least portion of the area belongs to class IIes. Similar findings were also reported by Leelavathi et al. (2009).

Soil-site suitability evaluation for crops

The optimum requirements of a crop are always region specific. Climate and soil-site parameters play significant role to maximize the crop yields. The soil-site properties from the study area (Table 2) were matched with soil-site suitability criteria for different crops (Sehgal 1996).

Land suitability of horticultural crops

The sustainability assessment for horticultural crops

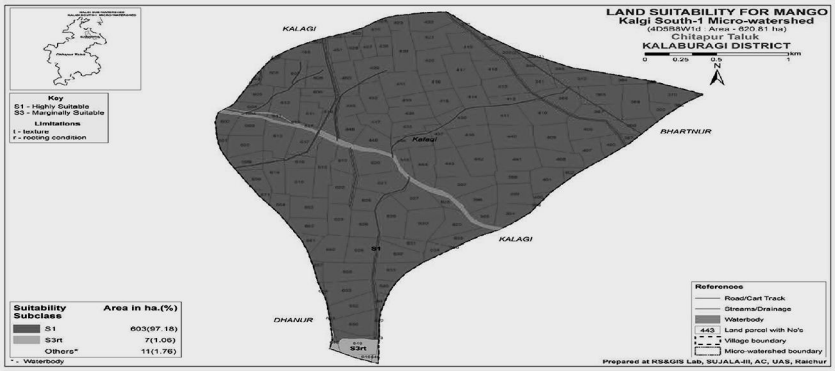

Fig.4 Land suitability map for Mango in Kalgi South-1 micro-watershed

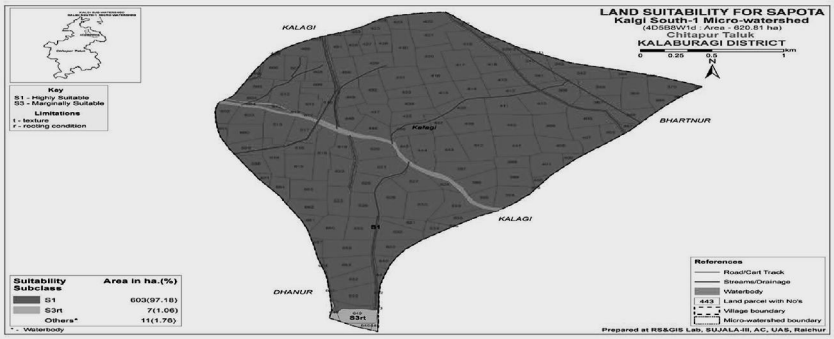

Fig.5 Land suitability map for Sapota in Kalgi South-1 micro-watershed

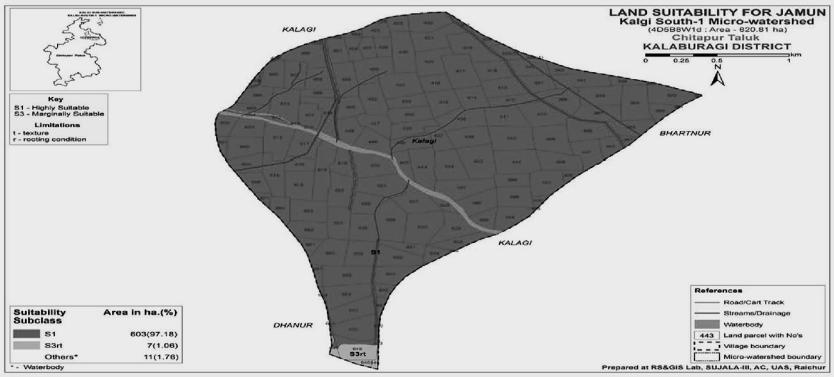

Fig.6 Land suitability map for Jamun in Kalgi South-1 micro-watershed

Fig. 4. Land suitability map for Mango in Kalgi South-1 micro-watershed. **Fig. 5.** Land suitability map for Sapota in Kalgi South-1 micro-watershed. **Fig. 6.** Land suitability map for Jamun in Kalgi South-1 micro-watershed.

in Kalgi South-1 MWS showed that an area of 603 ha (97.18%) was highly suitable for growing mango, sapota, jamun, guava and custard apple and an area of 7 ha (1.06%) found to be marginally suitable for growing mango, sapota, jamun, guava and custard apple with limitations of rooting condition and topography.

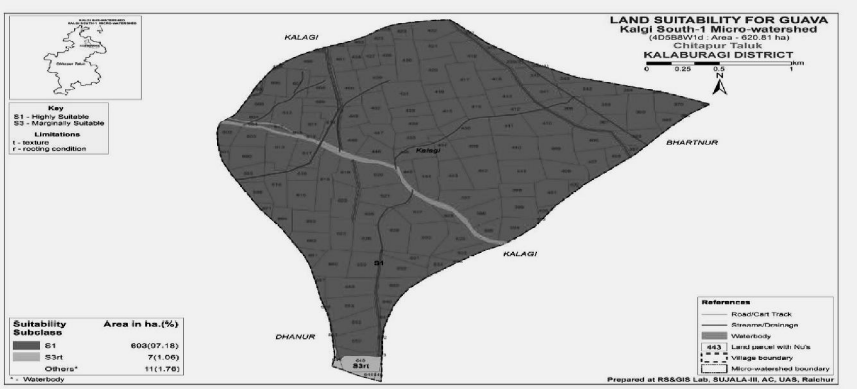

Fig.7 Land suitability map for Guava in Kalgi South-1 micro-watershed

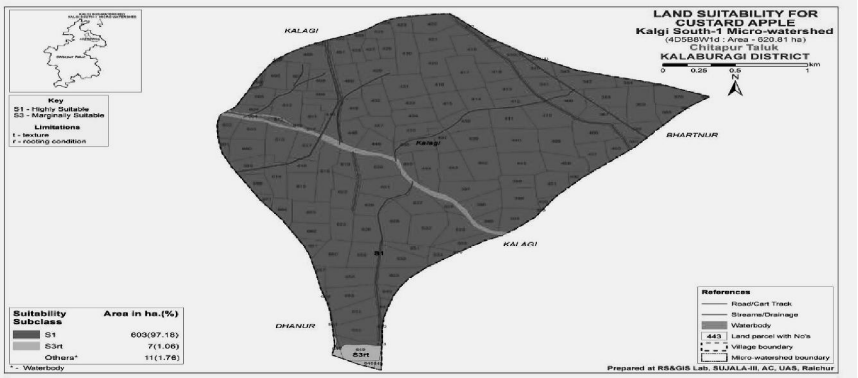

Fig.8 Land suitability map for Custard Apple in Kalgi South-1 micro-watershed

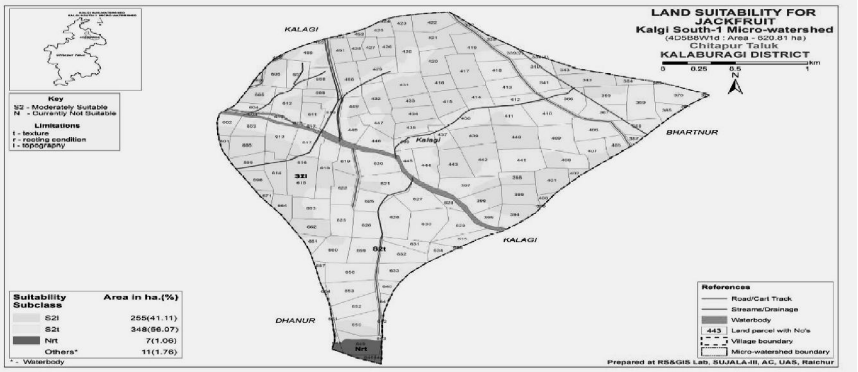

Fig.9 Land suitability map for Jackfruit in Kalgi South-1 micro-watershed

Fig. 7. Land suitability map for Guava in Kalgi South-1 micro-watershed. **Fig. 8.** Land suitability map for Custard Apple in Kalgi South-1 micro-watershed. **Fig. 9.** Land suitability map for Jackfruit in Kalgi South-1 micro-watershed.

Similar findings were also reported by Maheshkumar et al. (2017) (Figs. 4—8).

The suitability assessment for jackfruit and cashew in Kalgi South-1 village showed that about 603 ha (97.18%) area is moderately suitable with limitation to topography and texture, an area of about 7

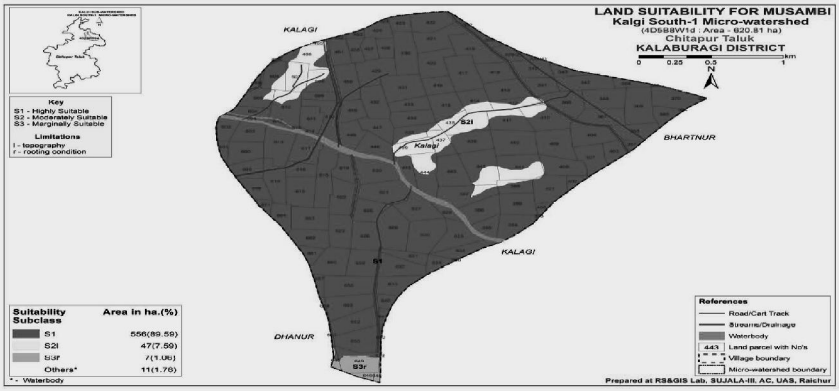

Fig.10 Land suitability map for musambi in Kalgi South-1 micro-watershed

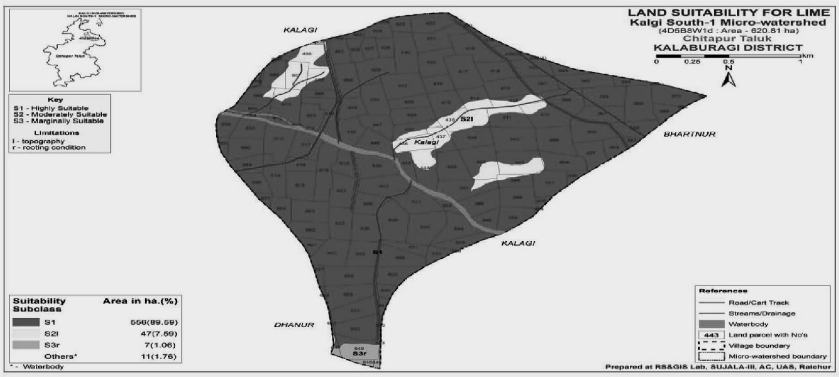

Fig.11 Land suitability map for lime in Kalgi South-1 micro-watershed

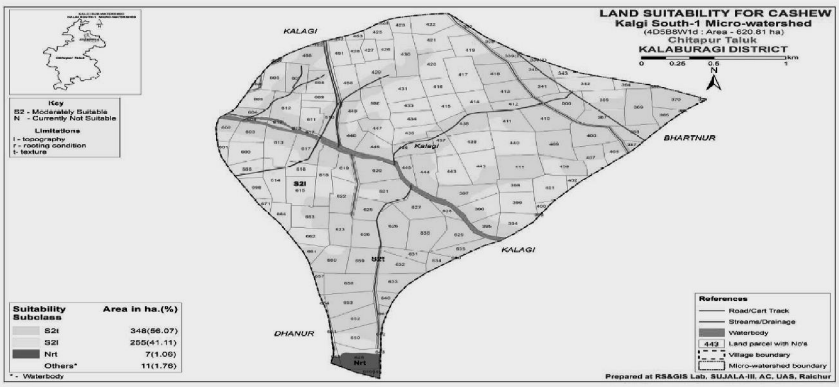

Fig.12 Land suitability map for cashew in Kalgi South-1 micro-watershed

Fig. 10. Land suitability map for musambi in Kalgi South-1 micro-watershed. **Fig. 11.** Land suitability map for lime in Kalgi South-1 micro-watershed. **Fig. 12.** Land suitability map for cashew in Kalgi South-1 micro-watershed.

ha (1.06%) of micro-watershed found not suitable for jackfruit and cashew production with limitation of rooting depth and topography (Fig. 9).

The suitability assessment for musambi, lime,

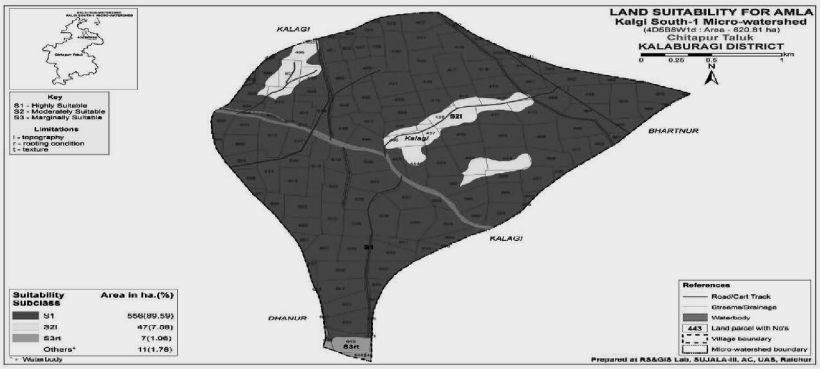

Fig.13 Land suitability map for amla in Kalgi South-1 micro-watershed

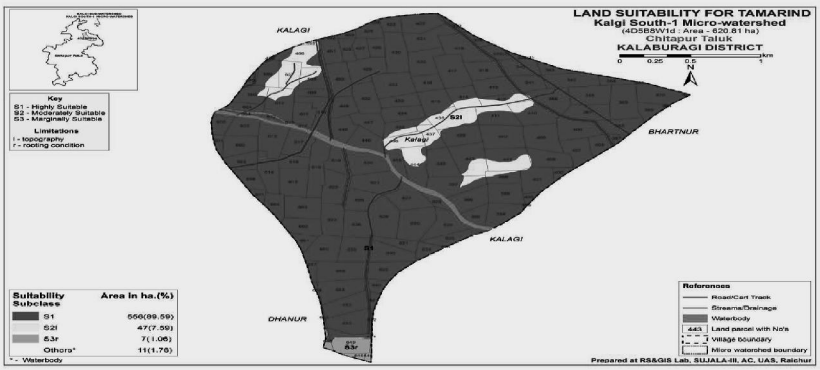

Fig.14 Land suitability map for tamarind in Kalgi South-1 micro-watershed

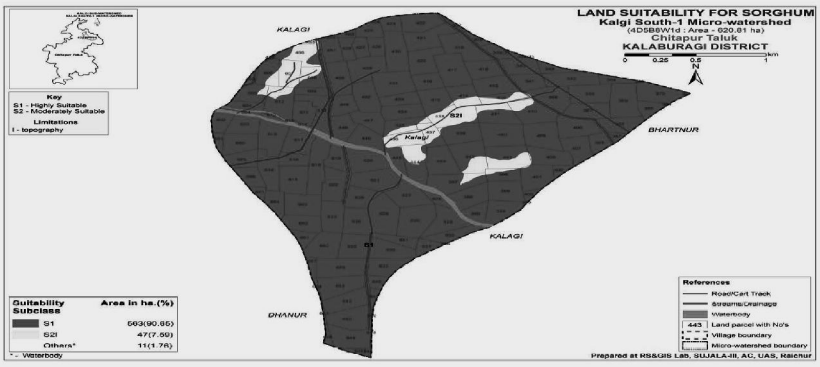

Fig.15 Land suitability map for sorghum in Kalgi South-1 micro-watershed

Fig. 13. Land suitability map for amla in Kalgi South-1 micro-watershed. **Fig. 14.** Land suitability map for tamarind in Kalgi South-1 micro-wastershed. **Fig. 15.** Land suitability map for sorghum in Kalgi South-1 micro-watershed.

amla and tamarind in Kalgi South-1 village showed that an area of about 556 ha (89.59%) was highly suitable. An area of about 47 ha (7.59%) was moderately suitable with limitation to texture and an area of about 7 ha (1.06%) found to be marginally suitable with limitation of rooting depth (Figs. 10—14).

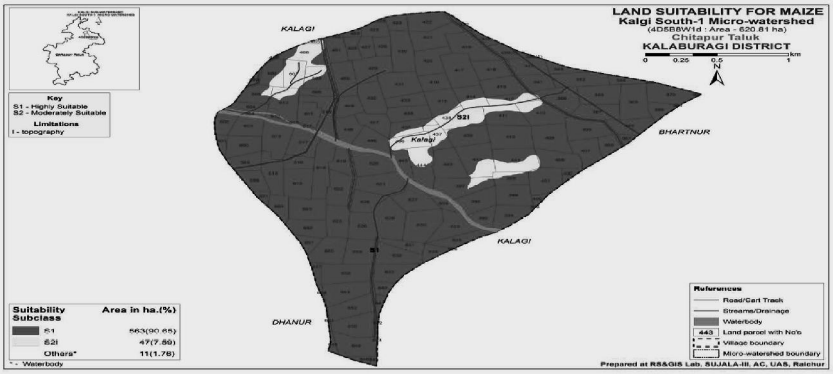

Fig.16 Land suitability map for maize in Kalgi South-1 micro-watershed

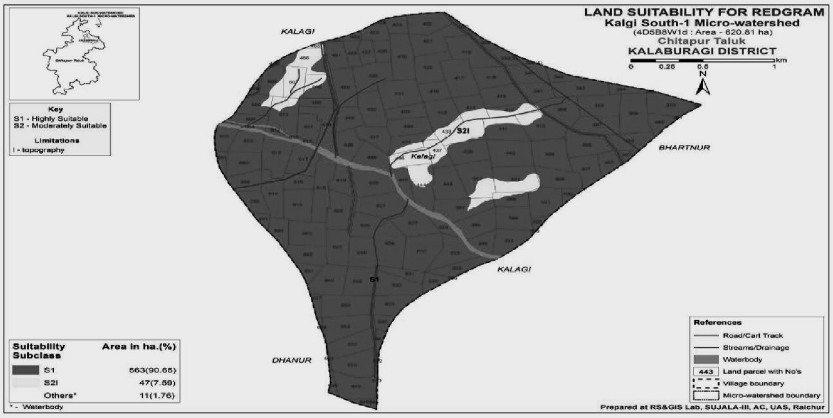

Fig.17 Land suitability map for redgram in Kalgi South-1 micro-watershed

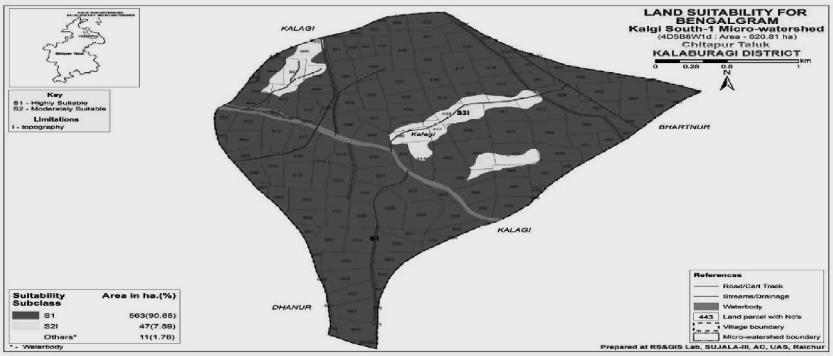

Fig. 18 Land suitability map for bengalgram in Kalgi South-1 micro-watershed

Fig. 16. Land suitability map for maize in Kalgi South-1 micro-watershed. **Fig. 17.** Land suitability map for redgram in Kalgi South-1 micro-watershed. **Fig. 18.** Land suitability map for bengalgram in Kalgi South-1 micro-watershed.

Land suitability of agricultural crops

The suitability assessment for agricultural crops in Kalgi South-1 village showed that about 563 ha (90.65%) area is highly suitable, an area of about 47 ha (7.59%) of micro-watershed found moderately suit-

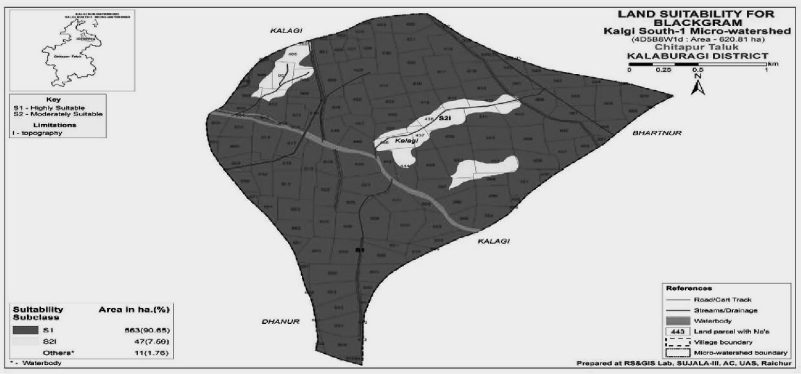

Fig.19 Land suitability map for blackgram in Kalgi South-1 micro-watershed

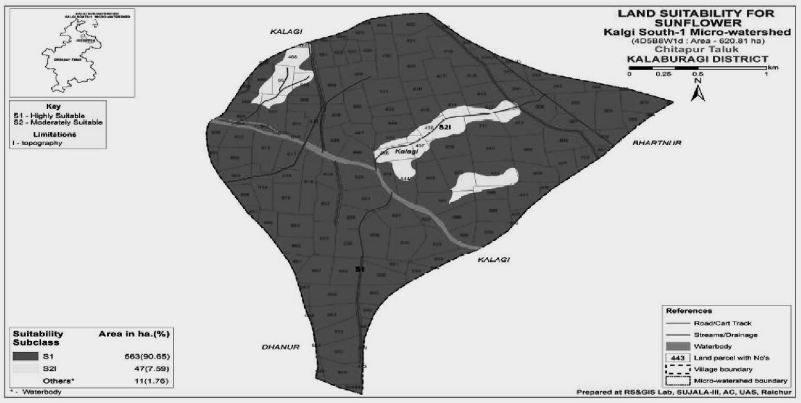

Fig.20 Land suitability map for sunflower in Kalgi South-1 micro-watershed

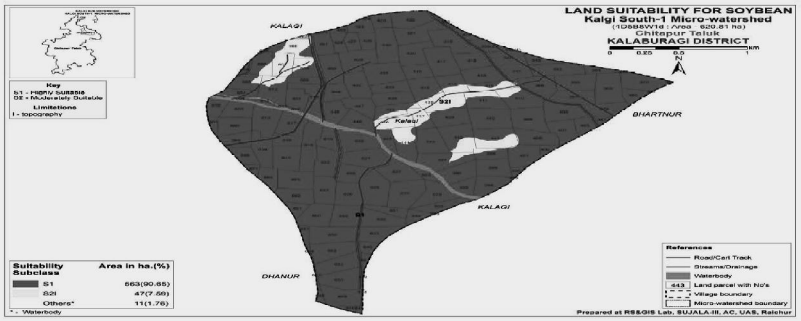

Fig. 21 Land suitability map for soyabean in Kalgi South-1 micro-watershed

Fig. 19. Land suitability map for blackgram in Kalgi South-1 micro-watershed. **Fig. 20.** Land suitability map for sunflower in Kalgi South-1 micro-watershed. **Fig. 21.** Land suitability map for soyabean in Kalgi South-1 micro-watershed.

able with limitations of texture for sorghum, maize, redgram, bengalgram, blackgram, sunflower, soyabean, cotton and sugarcane production. Similar findings were also reported by Maheshkumar et al. (2017) (Figs. 15—23).

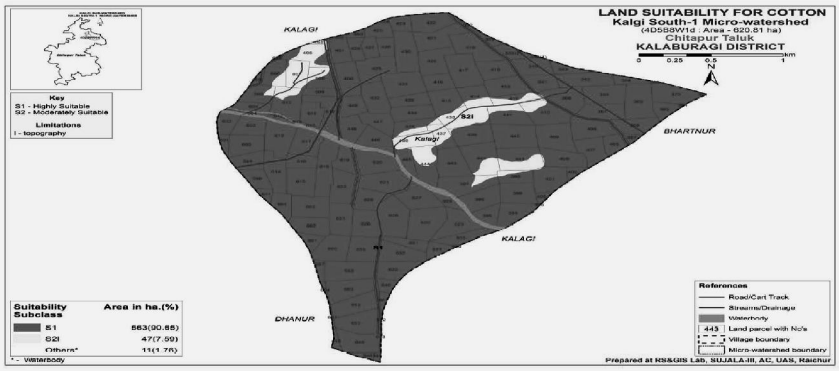

Fig.22 Land suitability map for cotton in Kalgi South-1 micro-watershed

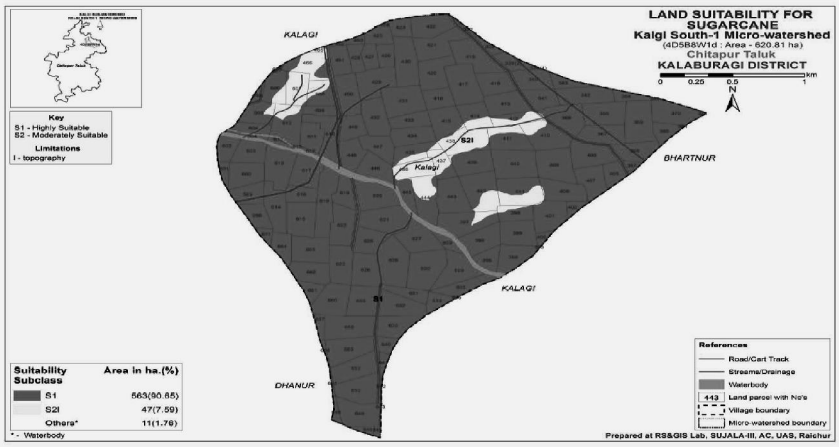

Fig.23 Land suitability map for sugarcane in Kalgi South-1 micro-watershed

Fig. 22. Land suitability map for cotton in Kalgi South-1 micro-watershed. **Fig. 23.** Land suitability map for sugarcane in Kalgi South-1 micro-watershed.

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