CHAPTER - VII

SUMMARY AND CONCLUSIONS

7.1 INTRODUCTION

In most developing countries, the socio-economic needs of rapidly increasing populations are the main driving force in the allocation of land resources to various kinds of uses, with food production as the primary land use. Heavy population pressure and the related increased competition from different types of land users have emphasized the need for more effective land-use planning and management. Rational and sustainable land use is an issue of great concern to governments and land users interested in preserving the land resources for the benefit of present and future populations. Policy-makers and land users face two basic challenges: the need to reverse trends of land degradation in already-cultivated areas by improving conditions and re-establishing their level of fertility; and prevention of the degradation of land resources in new development areas through appropriate and just allocation and use of these resources to maintain productivity and minimize soil erosion. In both cases an integrated approach to planning and management of land resources is a key factor in a solution which will ensure that land is allocated to uses providing the greatest sustainable benefits In this context, the present study has made an attempt to evolve agricultural potential units by characterizing and integrating rainfall, soil and groundwater into village level. The resulting units are the, which have a unique combination soil mapping units, rainfall probability and groundwater reliability regimes, which help in implementing managerial measures and prioritization of villages. The study has also pointed out that the integrated approach is powerful tool to be judiciously used even in village level.

Aiming at this, the thesis has in the previous six chapters, presented a well-designed report by emphasizing the integrated approach to evolve agricultural potential units with due consideration of the major physical parameters such as probability of conditional rainfall, land capability, and groundwater reliability with aid of GIS and Remote sensing. Finally, all the potential units are identified with the existing cropping pattern and suggested cropping pattern by the field observation and

by refereeing the report of *Tamil Nadu Agricultural University (TNAU).* The present chapter deals with the summary of the thesis, pesent the findings and conclusion derived from the study and indicates their implications for the future.

7.2 SUMMARY

Tiruchirappalli district one among 32 districts of Tamil Nadu State is the geographical centre of the State and it is situated on the southern bank of river the Cauvery which flows across With an area of 4403.83 sq. km it lies between 10^{o} 18' and 11^{o} 25' north latitudes and 78^{o} 08' and 79^{o} 0' east longitudes and is situated on the plains between the Shevaroy Hills to the north and the Palani Hills to the south and south-west. This district consists of 9 taluks, namely Lalgudi, Mannachanallur, Manapparai, Musiri, Srirangam, Thuraiyur, Thotiyam, Tiruverumbur and Tiruchirappalli. The district enjoys a tropical climate and it is hot and dry for at least eight months of the year. The hottest months are from March to July and becomes the climate moderate from August to October. The normal annual rainfall over the district varies from about 730 mm to about 900 mm. the Cauvery is the major, and the only perennial river in the district. Out of the total geographical area, net area cropped is 1, 85, 193 Hectares. out of which about 102799 Ha (55 %) are irrigated and about 82394 Ha (45 %) are rainfed.

The River Cauvery irrigates about 51, 000 Ha. in Tiruchirappalli, Lalgudi and Musiri Divisions. Multi various crops are grown in this District and Agriculture is the main occupation for most of the people in the District.

In the light of the above, the present study has been carried out to evolve agricultural potential units of Triruchirappalli District with the fulfillment of the following bjectives: 1. to analyse the spatio-temporal characteristics of rainfall, 2. to find out the groundwater level, fluctuation and recharge in association with rainfall, 3. to identify the probable areas with reliable rainfall and groundwater for cropping activities of the district and 4. to evolve suitable cropping pattern and cropping activities accordingly. These objectives are fulfilled with various spatial and non spatial data sources to study the physical, economic and social characteristics of the

study area, spatio-temporal distribution of climatic variables mainly rainfall, groundwater reliability and soil capability.

In order to evolve Agricultural potential units, parameter such as Land Capability, Irrigability, Productivity, Frequency of Wet weeks, Probability of Sowing Week and Groundwater Exploitation Condition have been superimposed altogether by using weighted overlay model available in Arc GIS. Agriculturally, about 14 % (625 sq.km) of area has been estimated as higher potential, 28 % (1237sq.km) of area into low, 31 % (1361 sq.km) of area is moderate and about 27 % (1180 sq.km) of area have been identified as poor in terms of agricultural potential. All these potential areas are suggested with suitable cropping pattern. The findings of the entire research are as given in the following paragraphs.

7.3 FINDINGS

- Tiruchchirappalli district, one of the three districts carved out of the composite district of the same name, is located in the central part of Tamil Nadu between 10^{o} 18' and 11^{o} 25' north latitudes and 78^{o} 08' and 79^{o} 0' east longitudes. It has a total geographical area of 4403.83 sq.km, which is about 3.40 percent of the total geographical area of the state. The boundary is by Salem district in the north, Namakkal district in the north-west, Karur district in the west, Madurai and Pudukkottai districts in the south and Tanjavur and Perambalur districts in the east comprising 504 villages been subdivided into 8 taluks and 14 blocks.

- Tiruchirappalli city is located at the head of Cauvery delta and its altitude is low with 78.8 mts above the mean sea level. Tiruchirappalli is 150 kms away from Bay of Bengal. It forms a part of a vast plain of fertile alluvial soil with a gentle but gradual slope from the west.

- Tiruchirappalli districts consists of Archaean, cretaceous and Quatenary geological formations. to limited extent of Lalgudi taluk, formation of Upper Gondwana is observed. The Archaean consists of complex, igneous and metamorphic rocks such as Quartzite, Biotite and Horn blende, charnokite etc., Fault and folds are very common in the southern Manapparai taluk. They cris-

crossed the entire district, but with central part covered alluvium. The dominating lineaments are found in the NE-SW direction.

- The prominent geomorphic units of the study are: 1) Alluvial Plains, 2) Valley Fills, 3) Buried Pediments, 4) shallow Pediments, 5) Pediments and 6) Structural Hills. The alluvial plains are confined to the northern bank of the Cauvery River. Valley fill deposits are seen mainly in the northern part adjoining to the hillocks in Uppiliapuram and Thuraiyur taluks. Buried Pediments have been identified in almost all blocks in the district. Pediments are evenly distributed in the entire district. Structural hills are confined to the northern and southwestern borders of the district.

- The normal annual rainfall over the district varies from about 840 mm to about 900 mm. The coefficient of variation of the annual rainfall from the normal ranges from 24 per cent to 31 per cent.

- The Cauvery river is the most important river in the district and the tributaries of Cauvery, i.e. Coleroon river, Koraiyar river, Ariyar, Malattar channel, Uyyakondan channel also drain in this district.

- The major soil types encountered in the district are black cotton soils, red sandy to loamy soils and alluvial soils. A thin layer of red sandy soils overlies the western and southern parts of the district. Alluvial soils of considerable thickness occur in the central part, particularly in Tiruchchirappalli, Kulithalai, Musiri and Lalgudi taluks. Black cotton soils are observed in the northern part., whereas red loamy soils occur in the hilly regions.

- The total geographical area of Tiruchirappalli district is 4, 40, 383 hectares, of which net sown area occupied 1, 78, 076 hectares and this accounted for 40 per cent of the total area in the district. Area under not available for cultivation accounted for 21 per cent of the total land in the district, i.e. 93, 492 hectares. Nearly 26 per cent of the areas were classified under fallow lands and 6 per cent of the lands are under forest coverage. The remaining lands were classified under groves and orchards category.

- Paddy cultivation on an extensive scale is carried out carrthroughout the year. Cereals, Pulses and Oil Seeds are the major crops cultivated in the district and majority of the area is used for the production of cereals and pulses. Among the oil Seeds, coconut is the most important crop followed by groundnut.

- The district had a population of 1, 504, 485 as per 1991 census, which is about 2.70 percent of the population of the state. SC/ST categories account for 23.50 percent of the total population. Density of Tiruchirappalli district during 2011 is 602 people per sq. km. More than 87 per cent of the total population resides in rural areas. Average literacy rate of Tiruchirappalli in 2011 was 83.56 percent.

- Tiruchirappalli district is well connected with major cities in Tamil Nadu by rail and road network. By virtue of very central location, Tiruchirappalli city has become the meeting place of transportation lines (both road and rail) from north to south and east to west while travelling across the State.

- The monthly rainfall data for 32 years (1980–2011) have been collected for 13 stations which are located in and around Tiruchirappalli district. Accordingly, the annual rainfall of the district is 838 mm of which the northeast monsoon contributes 49% followed by southeast monsoon which receives 34 per cent, summer 14% and winter 3% of the total the annual rainfall respectively.

- Based on the mean rainfall of the district, there are two rainfall zones have been classified. If the zone is receives ± 20% of the longterm (838) mean is to be considered normal zone where the rainfall is more than 670 mm) covers which the entire south in and around Ponnaiyar Dam and the extreme south covering Marungapuri and passes south east to northwest covering Nandhiyar Head and Thuraiyur. When the rainfall deficit goes more than 20% from nomal it is to be considered low rainfall (<670 mm) This is zone found over two major regions namely, western rainfall regime and eastern rainfall regime. Altogether normal rainfall zone covers 76% of the area and low rainfall zone covers 24% of the study area.

- Out of mean annual rainfall of the district winter contributes 3% (26 mm) covering the month of January and February. The rainfall during the summer (March, April and May) is about 117mm which is 14% of the mean annual rainfall.

- During southwest monsoon season, Tiruchirappalli district receives about 34% of rainfall. A high rainfall (above 347 mm) trough occurs in and around northern portion compiging Thuraiyur, Lalgudi, Manapparai and Marungapuri blocks From here the rainfall decreases radially in all the directions of the district. The normal rainfall varies between 231-347 mm is distributed over Thathaiyangarpet, Pullambadi, Musiri, Samayapuram, Upper Anaicut, Tiruchirappalli Airport, Tiruchirappalli Junction, Nandhiyar Head and Ponnaiyar Dam.

- Since, Tiruchirappalli is located in the mid and interior part of Tamil Nadu, the district receives low rainfall during northeast monsoon which is around 406 mm of rainfall that contributes 48% to the annual rainfall. The highest rainfall zone is seen in the northeastern part of the district. The normal rainfall zone (more than 325 mm) is distributed by covering Tiruchirappalli Airport, Lalgudi, Nandhiyar Head, Manaparai, Pullambadi and Marungapuri rain gauage stations. From here the rainfall decreases in all directions except in south and southwestern part of the district.

- The district average variability is 254% and this indicates the erratic nature of rainfall over the study area. In general, the variability is very high over the north east to southeast stretch covering Mannachanallur, Thuraiyur, Pullambadi, Manikandan, Manapparai and Vaiyampattai blocks. Beyond this zone the variability gradually declines towards the periphery of the district, where the variability lies between 157% and 250%

- During winter, the lowest variability (37%) observed over Thathaiyangarpet and Thuraiyur blocks and higher variability (52%) observed over the parts of Pullambadi and Ponnaiyarr Dam. During March, April and May are considered summer months and the variability during the summer lies around 81%

throughout the district. Minimum variability of summer season is 64 % and is observed over Nandhiyar Head, and the maximum variability (103 %) observed over Ponnaiyar dam.

- The district average variability is 120% during southwest monsoon. There is no much variation in variability of northeast monsoon season and the district average variability is 129%. It goes 148% over Ponnaiyar Dam and declines up to 106% over Tiruchirappalli airport.

- The district average Precipitation Ratio is 193% and it is higher over Tiruchirappalli Airport (310 %), Nandhiyar Head and Lalgudi (212%). The low Precipitation Ratio found over Ponnaiyar Dam (134%) and Tiruchy junction (148%). Precipitation Ratio during winter is erroneously higher and the district average shows the striking value of 840%. Precipitation Ratio summer is 546%. Though the Precipitation Ratio during is higher during summer the stability is relatively higher than the winter which shows the significance of rainfed cropping during summer months.

- During the month of June, July, August and September the district average Precipitation Ratio is estimated as 332% and it is spatially varied between 272% over Tiruchirappalli Junction and 436% over Marungapuri. Though the northeast monsoon Precipitation Ratio of the district exceeds 336%, majority of the region comes under the ratio of less than 300 mm and shows the influence of northeast monsoon rainfall over the district. However, it goes up to 562% over Tiruchirappalli Airport and it is well below 272% over Ponnaiyar Dam.

- The frequency occurrence of annual rainfall for 32 years for various stations has been analysed under five classes such as less than 260, 260 – 520, 520 – 780, 780 – 975, and above 975mm using 260 mm of interval. From the analysis it is clear that, 31% to 41% of the annual rainfall occurrence of the district ranges between 500 and 750 mm, whereas, another 25 to 38% of occurrence is subject to 750 to 950 mm annual rainfall.

- A rainfall of more than 2.5 mm on any particular day is called rainy day. A day receiving more than 5 mm is called a crop rainy day. The rainy day analysis of the district has been made with reference to the normal year (2007), wet year (2005) and dry year (2002) based on the district normal rainfall. Accordingly, the rainy days during normal year is 32, whereas it is 44 days and 22 days during wet and dry year respectively. The rainy days of normal year varies between 36-46 days.

- The rainfall deviation from the long-term mean annual is determined for the study area in order to understand the normal years, excess period and deficit years. Accordingly, ± 20% deviation from the mean comes under normal rainfall period. The Percentage of deviation more than 20% is considered excess and -20% is under deficit years. Out of 32 years, 6 years which is about 15% of the total years under the study shows, that the excess rainfall and equally around 15 % of the years under deficit rainfall.

- Conditional rainfall can be conceived as a particular amount of rainfall anticipated in a particular place over specified period normally a week. A week with 7.5 mm or more rainfall is treated as a wet week and a week with less than 7.5 mm as a dry week, if consecutive weeks record 7.5 mm or more, it is considered as a wet spell. With the established monsoon, from the 35^{th} week (last week of the August), the probability of wet week exceeds 50 % and exceeds even 75 % during the month of October. If considering the frequency of wet week occurrences above 50 % of probability, it varies between 10 to 12 over the major portion of district and it becomes higher (above 12) over Tottiyam, Thattaiyangrpet, Manapparai and Vaiyampatti.

- If three week total rainfall exceeding 25 mm could be considered for sowing, hence, a sowing week is considered as a sowing week only if it had a weekly rain of 7.5 and the initial three weeks total exceeded 25 mm. Accordingly, by considering the entire district, sowing window comprising the weeks of 39, 40 and 41 (4^{th} week of September and 1^{st} and 2^{nd} week of October) has the average probability of 40 % which is not only the highest but also the earliest sowing

window and no where the probability of showing week exceeds 64 percentage except over Lalgudi during the sowing window comprising 44, 45 and 46th weeks. Hence, it is presumed that the rainfed and dry cropping activity of the district always relay with supplementary irrigation mainly groundwater.

- During post monsoon, groundwater level is higher over the parts of Andanallur, Manikandan and Uppliyapuram blocks where, the water level lies within 3 meter from the surface, where as water level lies above 9 meter from the surface over Thottiyam, Thattaiyangarpet and Thuraiyur blocks. The normal water level range of the district exists between 5 to 7 meters observed over central and eastern blocks of the district. During Premonsoon season, water level goes above 12 meter and nowhere water level exists above 4 meter in the district. The normal water table of the district ranges between 7 and 10 meter. Pattern of water level over the district exhibits the influence of structural control rather than climatic control.

- During normal year (2008), major part of the district comes under the water level between 5 and 14 meter. Where as, premonsoon water level during wet year (2006) is higher, lies within 2 meter from the surface and it goes up to 4 meter in the major parts of the district and it fluctuates between 4 and 8 meter during postmonsoon period. The annual average water level of the entire district varies between 2 and 8 meter.

- In the dry years during premonsoon period, major part of the district observed with low water level and lies between 5 to 14 meter and during post monsoon season the water level of the major part of the district goes from f6 to 22 meters.

- The water level difference between post and Premonsoon period implies the influence of both rainfall and draft. Entire northern and southern blocks of the district are observed with the fluctuation range between 3 to 4 meter and goes even very high fluctuation of above 5 where may be caused by higher extraction of groundwater over these area.

- The difference of the rainfall in % from the annual mean (840 mm) is used to access the influence of rainfall over groundwater occurrence over the district. A random association exists between mean groundwater level and normal year rainfall. Where ever the excess rainfall occurrences have observed the groundwater level either goes high or low. During wet year, a close association exists between rainfall and groundwater level with reference to the areas with 25% deficit rainfall fallows, a declined groundwater level by 25% and so on. It indicates that the deficit ratio between rainfall and groundwater during dry year is typically 1:2 that is 10% of deficit rainfall has been leading in to 20% of declined groundwater level and so on.

- The status of groundwater exploitation shows that out of 14 blocks, 4 blocks are categorized as over exploited and 1 block as Critical and rest is Safe. Based on the high level of ground water development in the above mentioned overexploited blocks, further groundwater development is not envisaged in these blocks and in Musiri, where the groundwater development has Critical stage, the block could be considered vulnerable to water level depletion.

- The sustainability of a rainfed and dry cropping area needs the precise assessment about the land performance. Each soil type occurring in each soil mapping unit is characterized in terms of its land characteristics and qualities, which relate to the edaphic requirements of plants or to land-use requirements for management or conservation. The 87 soils units falling in the study area have been taken into consideration for assessing land capability since each unit has unique taxonomical and land properties. All this 87 soil units come under 3 taxonomical soil group and are Alfisols (44% of the area), Inceptisols (41%) and 13% of the area covered by Vertisols.

- Soils identified in Tiruhirappalli District were grouped into seven land capability classes (II to VIII) based on the Soil characteristics such as soil texture, depth, gravelliness, pH, calcareousness, Land features: such as slope, erosion and drainage and rainfall. There are 16 land capability sub classes of have been identified in the district. The land capability class II_s, III_{es} and II_{es} are

dominantly observed over the study area. Out of which 40% of land are categorized as good cultivable land (class II $_{s/es}$). The land capability class III_{es} and III_{es}-IV_{es} have been observed as a intervening patches. Out of which 26% of the land comes under moderately good (class III_{es} and III_{es}-IV_{es}). The remaining 34% of the land are fairly good for cultivation.

- The soil irrigability classes are nothing but grouping of similar soil type of series, which have their similar soil limitations for sustained use under irrigation. 3s is the major irrigability class of the region covering 30% of area of the district distributed over entire southern half of the district another 12% area of the district covered with Sub-class 3 d attributed by heavy soil texture, low permeability and sodicity are the major limitations for sustained agriculture.

- In the study area there are 5 classes of soil productivity observed namely very poor (8-19%), poor (8-34%), moderate (8-64%), good (20-43%) and excellent (35-64%). Very poor productivity class which is 8-19% shares almost 40% of the area covering mainly Manapparai, Mannachanallur, Marungapuri and Thuraiyur blocks. Around 22% of the area is covered by excellent productivity classes distributed over Marungapuri, Thottiyam, Musiri, Thathaiyangarpettai and Vaiyampatti blocks. Another 20% of the area covered by good productivity classes distributed over Pullambadi, Manachanallur and Lalgudi blocks.

- Land use assessment of the study area is done with the aid of both statistical data from village papers and the satellite imagery. Accordingly, forest occupies only 4% of the study area of and 20% of the study area and is covered by non - agricultural landuse. Current fallow and other fallow occupies 30 % of the area and this implies the pressure of agricultural activities. Marungapuri, Manapparai, Mannachanallur and Vaiyampatti are dominantly found with other fallow lands followed by Thathaiyangarpettai, Musiri, Pullambadi, Manikanadam and Thiruverumpur blocks. On the district whole about 39% of the area comes under net cultivable land.

- Agricultural potential areas are the Land resources mapping units, defined in terms of rainfall reliability, groundwater availability and soil characteristics and

having a specific range of potentials and constraints emphasizing agricultural status. Weighted overlay is a technique which is available in GIS for applying a common scale of values to diverse and dissimilar input to create an integrated analysis. In this method, first the each theme is scaled or ranked either high to low or good to poor etc., and then each input raster is weighted, or assigned a per cent influence based on its importance to the model.

- Accordingly, Land Capability, Irrigability, Productivity, Frequency of Wet weeks, Probability of Sowing Week and Groundwater Exploitation Condition are have been superimposed and the minimum score of 0.8 and the maximum of 4 have been arrived. The score was finally classified as into agricultural potential units such as high (0.8 - 0.15), moderate (0.15 – 0.2), low (0.2 - 0.25) and poor (0.25 – 4).

- About 14% (625 sq.km) of area has been estimated as higher potential, 28% (1237sq.km) of area as low, 31 % (1361 sq.km) of area is moderate and about 27% (1180 sq.km) of area have been identified as poor in terms of agricultural potential.

- Anadanallur (81%) and Manikandan (66%) are the blocks shared with larger proportion of land with higher agricultural potential. Thathaiyangarpettai, block consists larger proportion of poor agricultural area which comes around 72% total area of the block followed by Uppliyapuram and Marungapuri blocks where the proportion of poor agricultural potential area is about 40%.

- Normalized Difference Vegetation Index (NDVI) provides information about the vigour of the vegetation which in turn is influenced by edaphic, and climatic factors can be used to assess the integrity of evolved agricultural potential areas. The higher NDVI value (above 0.6) of the study area is associated with the hilly area, where the agricultural potential is poor and the plains where the potential is high. The very low NDVI value of 0.2 – 0.4 is manly associated with both poor and low agricultural potential areas.

7.4 CONCLUSION

- Precise, integrated and scientific methods of evolving agricultural potential units for Tiruchirappalli District have been attempted and achieved using geospatial technique.

- Delineating boundary of the relative agricultural potential areas over the surface of the earth is judicially attained through integrating climatic, hydrologic and edaphic factors.

- In the district whole, normal mean annual rainfall (above 670 mm) zone covers 76% of the area and low rainfall (below 670 mm) zone covers 24% of the study area. 31% to 41% of the annual rainfall occurrence of the district ranges between 500 and 750 mm, whereas, another 25 to 38% of occurrence is subject to 750 to 950mm annual rainfall.

- Variability is very high over the north east to southeast stretch covering Mannachanallur, Thuraiyur, Pullambadi, Manikandan, Manaparai and Vaiyampatti blocks. Beyond this zone the variability gradually declines towards the periphery of the district. The abnormality rainfall during northeast monsoon is quite low comparing with Premonsoon season.

- In normal year the rainy days are higher (above 45) over the blocks of Uppliyapuram, Thuraiyur, Thathaiyangarpet, Thottiyam, Musiri, Manachanallur and Pullambadi. The rainy days are goes below 40 over the rest of the areas. The comparison of rainy days during normal, wet and dry year shows that the rainy days is always higher over the blocks of Tottiyam, Musiri, Anandanallur, Manikandan, Vaiyampatti, Mannachanallur, Thathaiangarpet and part of Pullambadi.

- Probability analysis of sowing weeks shows that no where the probability of showing week exceeds 64 percentage except over Lalgudi during the sowing window comprising 44, 45 and 46th weeks. sowing window comprising the weeks of 39, 40 and 41 (4th week of September and 1st and 2nd week of October)

has the average probability of 40 % which is not only the highest but also the earliest sowing window. Hence, it is presumed that the rainfed and dry cropping activity of the district always relay with supplementary irrigation mainly groundwater.

- The annual rainfall of individual years plays vital role in the determining groundwater level during the current and subsequent years, however the spatial pattern of water level over the district exhibits higher structural control rather than climatic control.

- The land capability class II_s, III_{es} and II_{es} are dominantly observed over the study area. out of which only 40% of land are categorized as good cultivable land (class $II_{s/es}$), another 26% percent of the land is comes under moderately good (class III_{es} and III_{es}-IV_{es}). The remaining 34% of the land fairly good for cultivation.

- In terms of Land Capability, Irrigability, Productivity, Frequency of Wet weeks, Probability of Sowing Week and Groundwater Exploitation Condition, about 14 % (625 sq.km) of area has been estimated as higher potential, 28 % (1237sq.km) of area into low, 31 % (1361 sq.km) of area is moderate and about 27 % (1180 sq.km) of area has been identified as poor.

- The higher agricultural potential areas are mainly attributed by land capability, probability of wet weeks and groundwater availability, and Inter or mixed cropping and high yielding varieties can be introduced. Area of cash crops like oil seeds, cotton, chilies, Mango can be expanded.

- For moderate agricultural potential areas Maize, Fodder pulses, sesame, soybean, gingelly, groundnut, sunflower, sorghum, pearl millet and jatropha are the alternate crops advised for the villages with Red, laterite, black and alluvial soils with irrigation facility. Whereas for the rainfed lands Groundnut with redgram, Green chilli, cluster bean and bhendi, Sorghum, millets with pulses, gingelly and cucurbits can be planted.

- In low agricultural potential areas water is an important limiting factor to crop growth in addition to soil capability. Floodwater harvesting makes dry valleys and flood plains more productive. Maize, Fodder and pulses, Sesame, soybean, gingelly, groundnut, sunflower, sorghum and pearl millet and jatropha are recommended for these areas

- Poor Agricultural Potential Areas required efficient system of soil and crop management in which maximum amount of moisture is conserved. Cluster bean, lab lab, bhendi, watermelon, cluster bean, cucumber, *Periwinkle,* senna, Jatropha, Fodder, sorghum, minor millets, fodder and coriander are the crops recommended for these villages.