Chapter VIII

Summary
And
Conclusions
Chapter-VIII

SUMMARY AND CONCLUSIONS

The study of agricultural land use and agricultural productivity seeks to identify, classify, describe and analyze the problems of agricultural landscape. It is also concerned with analysis of regional variation in cropping pattern, agricultural productivity and changes therein. In the present investigation, an attempt has been made to study the spatio-temporal variation and changes in agricultural land use and agricultural productivity in the Solapur district during the period of 1975 to 2000.

From the preceding analysis, the following summary and conclusions have been arrived at.

The large portion of the land surface of the Solapur district is like a plateau. The region is characterized by typical Deccan trap with small hills. There is no prominent hill range but little southwestern border part of the region and northeastern part of Barshi are covered by Mahadev and Balaghat range flank, which have height of above 600 meters and steep slope indicates that it is not suitable for agriculture. Except hilly area, in central part of Karmala, Madha and Mohol majority part of the district comes under plateau and plain region comprises river basins. According to relief features, the district has been divided in to three physiographic divisions viz. hills, foot hills and plains and plateau. The high proportion of plateau and plain area in the region indicates that most of part of region is favourable for agriculture. The relief features of region have affected the cropping pattern and agricultural operation. The intensity cropping and productivity is high in plain and plateau division. Except grazing, other agricultural operations are prohibited in
southwestern and northeastern border part of region due to steep slope, stony soil and ragged topography in hills flank of range area. Intensity of agricultural operation is high in plain and plateau areas.

There are six main rivers in Solapur district i.e. the Bhima, the Sina, the Nira, the Man, the Bhogawati and the Bori. Except Bhima, others are fordable in dry season indicates scarcity of rainfall. All these rivers have developed terraces, which are highly prized for soil fertility. These are the most important areas, where superior crops are cultivated and intensity of agricultural operations is high.

The climate of study region is semi arid, usually hot. The rainfall is uneven, uncertain and scanty. The region is a drought prone area. The annual co-efficient of variability of rainfall is more than 35 percent, which implies a great risk in crop cultivation indicates that there is great need of irrigation in all seasons. The whole region depends, for its rainfall, on southwest monsoon, which is concentrated in a brief period of about less than 47 days. Frequency of low rainfall and famine scarcity are the features of climate, which resulted into crop failure, and restricts the agricultural development. Agricultural operations are closely associated with the different seasons in the year. Intensity of agricultural operation, cropping pattern, intensity of cropping and productivity of crops is related to the variability of rainfall.

The soil in the Solapur district is mainly of volcanic origin and can be classified in to four main categories. The high proportion of deep (43 percent) and medium deep soil (21-27 percent) indicates that a majority part of soil in the region is highly favorable for agriculture. The concentration of agricultural operation is high in deep to very deep soil due to moisture retaining capacity and high proportion of clay, which give better yield of crops like sugarcane, jowar, wheat, gram, cotton and tur. The district as a whole has 23.52 percent area of shallow soil, which
has low organic content and low moisture retain. The region has 23.52 percent area of shallow soil, which has low organic content and low moisture retentively, so inferior crops are cultivated, however, providing irrigation facilities, fruit crops can be successively cultivated in such soil because it is rich in availability of potash. Medium and deep black soils are rich in phosphorous and potash content and has considerable potentials for other crops than fruit crops by its virtue of high moisture holding capacity. Percentage of nitrogen content in the soil is low all over the district; states that there is need to provide these content for better productivity.

Availability of surface water is high in the Bhima Basin. About below 49 percent water of yearly flow is used at present, it indicates there is high scope to use surface water of the Bhima, Sina, Man and Bori rivers. However, except Bhima basin co-efficient of variation in yearly flow is above 40 percent, which indicates uncertainty of availability of water in rest of river. Among all river basins, Bhima basin has high concentration of sugarcane and agricultural operation. Surface water is inadequate in the most of the part of the Solapur district. Therefore, groundwater is the source of irrigation through the wells. Depleting of water table is anxious problem in the study region mainly due to excess gross draft of ground water under drought prone condition indicates that there is great need to increase recharge by artificial ways, particularly in Barshi, Pandharapur, Mangalvedha and Mohol talukas. The above stated facts of physical determinants suggest that the physical determinants, except scantly rainfall and water resources, are favourable for agriculture development.

Non-physical determinants are also responsible to some extent in influencing the cropping pattern and changes therein. During the last six decades, the growth rate of population of the Solapur district is low as
compare to the state. Agricultural density and caloric density is high in Pandharpur and Malshiras talukas mainly due to the perennial irrigation facilities. The high co-efficient of over population in Malshiras and Pandharpur talukas i.e. 1.55 and 1.34 respectively indicates high pressure of population on agricultural land. Expect North Solapur taluka, per capita net sown area is decreased in the all talukas. There is a considerable positive change in literacy all over the region; particularly it is high in the Malshiras taluka. This increasing pressure of population, decrease in net sown area and increases in literacy, has brought about change in cropping pattern and agricultural productivity.

As evidence shows that, the well is an important source of irrigation constituting 75.83 percent of total irrigated area and 24.17 percent by surface irrigation. Ujani irrigation project, which is a life of Solapur district plays a very important role in the development of agriculture. This project has changed the cropping pattern of the study region from traditional crop to cash crop largely. There are eight medium and 855 minor irrigation projects, the amount and distribution of monsoon rainfall affect the water storage capacity of these projects. Surface irrigated area is increased in all talukas. Irrigated area is high in northwestern part of study region due to Ujani dam and Nira canal. Remarkable increase in surface irrigated area in Karmala, Madha and Sangola has brought about a change in cropping pattern. It is seen that due to increase in surface irrigated area the district as a whole has 1.28 negative change in percentage of well irrigated area of total irrigated area. Except Madha and Sangola taluka, well-irrigated area is increased in all talukas. High well-irrigated area in Pandharpur and Malshiras talukas is due to definite recharge from canal irrigation. intensity of irrigation is very high in Pandharpur and Malshiras talukas due to high development of surface irrigation, which resulted into concentration of sugarcane
cultivation. There are 1779 percolation tanks in the study region. The large number of tanks is in Sangola taluka. Intensity of irrigation is high in Pandharpur and Malshiras talukas, whereas, it is low in Madha, Mangalvedha, North Solapur, Mohol and Akkalkot talukas. High development of drip irrigation in Sangola and Mohol taluka indicates an increase in area under fruits cultivation. During the period of investigation high variation in indices of gross irrigated area may be result of high variability of monsoon rainfall. With the availability of iron ploughs, wooden ploughs are decreased in mostly parts of region, but total ploughs are decreased in Pandharpur, Mohol, Mangalvedha and Sangola taluks with the availability of tractors. The oil engines are replaced by electric pumps to greater level. the density of bullock carts decreased in all talukas, Except Barshi and Akkalkot talukas with an increase in the number of tractors about eight times. However, spatial distribution of tractor is very uneven. The density of tractor is high in highly irrigated areas. It is to be observed that the per hectare use of chemical fertilizer has increased by ten times the district, while area under high yielding variety is increased about two times during the period of investigation. Majority farmers themselves are own cultivators in the mode of land tenure. The proportion of tenant cultivator is negligible. As far as the land holding is concerned, the Solapur district is an area of medium land size holding.

The average cultivated area per cultivator in the district is 1.76 hectares. It is high in southwestern part of the region, whereas it is low in central western part as a result of development of irrigation. Considerable decrease in average cultivated area per cultivator is observed in the study region. The share of cultivators is 34.2 percent of the total working population, which is high than the state’s 28.7 percent. The density of cultivator is high in Malshiras, Pandharpur and Sangola taluka due to the
development of irrigation facilities. The density of agricultural labour of the district is 48, which is less than that of state 60.75. The density of agricultural labour increased in all talukas, it is high in irrigated area. The density of livestock increased in each taluka of the study region, Goats are dominant in livestock, and cattle are next to goats. The proportion of goats and buffaloes are increased, while cattle and sheep are decreased in total livestock during the period of investigation. The density of livestock is high in irrigated area due to availability of green fodders. The density of draught force decreased in five talukas with availability of tractors. Average number of cows and buffaloes increased by 11.64 and 29.46 per 1000 population respectively, due to the growth in dairy industry. There are 30 regulated markets in the study region. The numbers of primary agricultural societies increased by twice. The number of agricultural societies is high in northern and northwestern of the part of region, which constitute most of the irrigated area. During the period of investigation, average length of a road per 100 sq km increased of each types of road except other roads. Price structures reveals that there is a tremendous variation in agricultural commodities, which affects the area under crops and reveals that the other food crops have gained more prices than cereals. Above facts reveals that development of non physical determinants is high in central western parts of region.

The general land-use pattern of study region reveals that physical and socio-economic factors have strong control on land-use. It is observed that in the district share of net sown area to the total geographical area is more than 70 percent indicates suitable topography, followed by fallow land. Whereas the share of area under forest is only 2.11 percent this indicates, that there is a great need of aorestation. The other uncultivated land, is concentrated in western part of the district; due to decrease in forest area. Other fallow land is high in southeastern and
northwestern part, whereas current fallow land is concentrated southwestern part of district mainly due to adverse condition of rainfall, lowering of ground water table. The higher net sown area in eastern part of region is a result of relatively high rainfall. Per capita net sown area is low in central western part of region is result of high development of irrigation in Pandharpur and Malshiras talukas.

The land-use pattern of the study region is not stable as there are many spatio-temporal oscillations. Negative change is observed in categories of area under forest, other uncultivable land and net sown area. Positive change in area, not available for cultivation is observed in those talukas, which have urban centers. All talukas have negative change except Sangola taluka, in other uncultivable land, indicates that most of the area under this category transferred to arable land. The fallow land increased in most part of the study region due to frequency of crop failure because of adverse and unreliable nature of rainfall, which compelled farmers to live the land fallow. The proportion of net sown area has decreased by 4.73 percent and left as fallow land during the period of investigation. Positive change in net sown area only Malshiras taluka i.e. about 11 percent which is the result of perennial and protective irrigation from Nira canal. The scarcity condition has hampered the intensification and utilization of net sown area. There is a 6.67 percent over all change in land use in the district. Significant overall change in general land-use is observed in western part of district. The matrix of co-efficient of correlation show, that there is high mutual transfer between the category of fallow land and net sown area. The negligible increase in cropping intensity in the Solapur district suggests that it is largely controlled by drought conditions. District as a whole has 24.09 percent of culturable area for extension of cultivation area in future, which is higher than the
average of state i.e. 21.09 percent, indicates that there is high scope for extension of cultivation area in future.

The entire cropping pattern seems to be controlled by agroclimatic conditions. However, the development of technological and socioeconomic conditions has changed the cropping pattern. The evidences suggest that there was a dominance of food grains in the cropping pattern. Among cereals jowar, wheat, and bajara are the main cereals of study region, whereas rice, maize and other cereals are not significant in the cropping pattern of the region. Jowar is the leading cereal crop in rabi season due to its drought resistance nature. It share is relatively high in south and central part. Wheat is second cereal of rabi season, which is mainly concentrated in the irrigated area. Bajara is mostly confined to the southwestern part, as a result of high variability of rainfall and shallow soil. Among the pulses, tur and Gram are the important pulses. The concentration of tur is observed in eastern part, due to relatively high rainfall and availability of local market. However, Gram is concentrated in north and the central part. Sugarcane and fruit and vegetable are important leading cash crops of the study region, which occupies 6 percent and 3 percent of total cropped area respectively, due to the development of technological factors. They occupy important place in the district economy. High concentration of sugarcane is in Malshiras, Pandharapur talukas as a result of higher development of irrigation facilities and along with the development of irrigation and an increase in the number of sugar factories. The concentration of fruit and vegetables is observed in central and western part, due to the development of drip irrigation and suitability of soil and climate. Groundnut and other oilseeds, particularly sunflower, are the two important nonfood crops occupying significant position in the cropping pattern. Concentration of groundnut is in northwestern part and southeastern parts, whereas other
oilseeds are concentrated in eastern part because of relatively high rainfall and lower development of irrigation.

The changes in cropping pattern have occurred in response to many forces. The district as a whole has experienced 14.55 percent change in cropland use. The area under cultivation of the leading crops like Sugarcane, jowar has increased, whereas under pulses, bajara and gram has decreased considerably. It is to be observed that the general trend in cropping pattern is from food grains to cash crops with increase of technological factors. The major shift is in total pulses, which shows considerable loss. The cultivated area also declined under safflower and fibre crops, however fruits-vegetable have gained significant increase due to development of technological factors, infrastructural facilities. Regional disparities are observed in change of the pattern of agricultural land use. Outstanding change in cropping pattern has occurred in 25 percent area of the district where provision of irrigation and drip irrigation are increased. However, the changes are low in rainfed areas. The changes in agricultural land use are in areas along the riverbank and canal areas, which have fertile soil. The change is also observed in the areas of shallow soils where drip irrigation is facilitated, and it stimulated the farmer to cultivate fruit crops. Thus, the change in agricultural land use pattern is mainly due to many innovative in agricultural technology.

Considering irrigated cropping pattern, jowar is the dominant crop, followed by wheat. Sugarcane is a leading in perennial irrigated cash crop, occupying about 14.85 percent of total irrigated area followed by fruits-vegetables (13.52). Groundnut and sunflower are leading irrigated oilseeds other oil seeds are insignificant. During the period of under review, there is 23.95 percent overall change in irrigated cropping pattern in the study region. Maximum change is found in Madha, Akkalkot and Mangalvedha talukas, which above 40 percent of total irrigated area.
High change is in Mohol, Sangola and South Solapur talukas and it is 30 to 40 percent. The moderate change is in central and northeastern part of the region. Sugarcane came as a leading crop in increase-irrigated area in six talukas as a result of Ujani irrigation project and growth of sugar factories; other are groundnut and sunflower each in two talukas. Jowar, wheat, sunflower and maize are leading crop of decrease in irrigated area due to with availability of perennial irrigation farmer choose commercial crop like sugarcane and fruits. The evidences state that in the general trend of agricultural land use, there is over all decrease in area under food grains and increase in sugarcane, fruits cropped area.

The process of agricultural change in the Solapur district has its roots in construction of the Ujani irrigation project and Nira right bank canal. Besides this many government programmes introduced in five yeas plan such as minor irrigation scheme, ‘Panlot Vikas’ (1983) etc provided an essential fillip to promote the agricultural change in the region. Increase in the number of sugar factories during the last two decades resulted much of the irrigated area, which was previously under cereals and pulses crops, in bringing under sugarcane. Establishment of agricultural research centers of M.F. Krushi Vidyapeet at Solapur, Mohol, Pandharpur and Jeur also played an crucial role in promote innovations and advise the farmers of the study region. Another important feature is that the well response of farmers of study region to ‘Phal Udyam Vikas Yojana’ (1990-91) and innovation in water supply particularly drip irrigation, which have brought most of arable land under fruit cultivation. However, in this agricultural land use change, irrigation along with other innovations has played very significant role. The credit society provided the opportunity to the farmers to purchase tractors and to install pipelines and electric pumps for water supply. This development of irrigation compels farmers to adopt the other innovations, such as use of fertilizer,
High Yielding Variety of seeds, pesticides, new implements and innovation of provision of water. In addition, “Solapur Zilha Phal Utpadk Sangh” i.e. pomegranate, clustered apple, ber, grape is played important role to obtain national and international market. These innovations were largely responsible in breaking the old structure of farming in the region.

Cereals have high negative correlation with oilseed, followed by fruits-vegetables and sugarcane. Pulses have very high negative correlation with sugarcane and fruit-vegetables. Fruit-vegetable has very high negative correlation with fibre, while sugarcane has high positive correlation with fruit and vegetable.

The analysis of correlation between different landuse category states that during the period of investigation there is highest mutual transfer between area under pulses and fruits-vegetable followed by fruits-vegetable and fibre, between pulses and sugarcane it means that most of the land which is under pulses and fibre is brought under sugarcane and fruits-vegetable.

four combination based on Doi’s method and three crop combination regions based on Rafiullah’s method have emerged in the present study. High diversification of crops is observed in the western and southeastern part of the study region based on Bhatias method.

The changes in crop combination are occurred during the period of investigation. Out of eleven talukas six talukas reveal changes in the crops combination region based on Rafiullah’s method, while six talukas show change in crop combination region by Doi’s method respectively during the period under review. Mangalvedha, Mohol, North Solapur and Songola talukas have high degree of jowar concentration. High concentration of wheat is in Malshiras and Pandharpur talukas, due to high development of irrigation.
Sugarcane concentration is high in the area of black cotton soil and perennial irrigation facilities. Very high concentration of groundnut is observed in Akkalkot taluka, while it is high in Karmala and Madha talukas. Moderate to high concentration shift of fruit and vegetable combine found in Pandharpur taluka, whereas it is low to moderate in Sangola taluka due to suitable climate, soil and development of technological factors. Above fact indicates that changes in agricultural land use is closely related to changes in non-physical determinants.

Agricultural productivity is the reflection of combined effect of human efforts with non-physical and physical determinants. Per hectare yield of jowar in Solapur district is higher than the Maharastra state indicates that agro climatic condition of district is suitable for jowar cultivation. Per hectare yield of jowar in creased in all taluka except Malshiras, but highest increase in Pandharpur is resulted considerable increase in irrigation facilities and use of HYV. Positive change in yield of wheat and gram is found in all talukas. Decline in yield of tur in mostly talukas is mainly due to scanty rainfall. Yield of groundnut is gone up in Karmala and Madha talukas is as result of availability of Ujani water. It is to be stated that low increase or decline in yield of tur, groundnut and bajara as they are rainfed crops. Decrease in Sugarcane yield in Malshiras is mainly due to over-irrigation, high doses of chemical fertilizer and low crop rotation. High sugarcane yield in Pandharpur and Mohol taluka is as result of perennial irrigation and adoption of innovation. High yield of bajara in Malshiras and Sangola is mainly due to soil and climate.

Production of jowar is increased in all talukas except Karmala and Malshiras. Decline in jowar production in Malshiras and Karmala is mainly due to most of the irrigated land went under commercial crops. Production of wheat and gram is increased in all talukas. Considerable increase of gram production in Barshi taluka is mainly due to suitable
agro climate and availability of local market. Remarkable decrease of bajara production in Sangola taluka was due to considerable loss in area under bajara because increase in area under fruits-crops. Tur production was decreased in most part of region due to it is mostly rainfed crop. Remarkable increase of groundnut production in Madha is as resulted availability of backwater, whereas remarkable decrease in Barshi is resulted crop failure due to poor irrigation, indicates impact of irrigation. Considerable positive change in Sugarcane production in Pandharpur, Malshiras, Karmala, Mohol and South Solapur is as resulted of development of perennial irrigation and growth of sugar industries, whereas considerable decrease in Sangola resulted that it loosed area under sugarcane due to fruit cultivation.

The analysis of coefficient of variation reveals that high fluctuation in yield of jowar in Sangola and Mangalvedha talukas is a resulted scanty rainfall, whereas more stability in yield of jowar in Pandharpur, Madha, Malshiras, Barshi, South Solapur indicates that these talukas are more consistence in jowar production than others. The variability of wheat production is high as compare to yield in all talukas indicates fluctuation in provision of irrigation. The coefficient of variation analysis reveals high fluctuation in yield and production of bajara and tur in all talukas may be stated that these are rainfed crops. Low variability in yield of groundnut is observed in irrigated talukas. The very high variability in groundnut production in all talukas indicates that groundnut production is unsure in study region. More stability of sugarcane yield than other crops is due to it is irrigated crop, however high fluctuation in sugarcane production than the yield indicates uncertainty in irrigation facilities.

Trend analysis reveals that district as a whole shows positive trend in per hectare yield and production of all selected crops except tur. Highest positive trend per hectare yield of jowar is found in Pandharpur
taluka. Incase of jowar production eight talukas shows positive trend, whereas three shows little negative trend indicates that jowar is well suited in Solapur district. In case of wheat almost all talukas shows positive trend in per hectare yield and production, indicates development of technological factors in the region. The highest positive trend in per hectare yield and production of bajara in Sangola and Malshiras taluka respectively indicates these talukas are more suitable than other talukas. As far as trend in case of yield of tur concern, mostly talukas shows negative trend. Considering trends in yield and production of gram all most all talukas shows positive trend indicates that gram is well suited than other pulses in the region. The high positive trend in yield and production of groundnut is observed in Karmala taluka. Trend analysis of sugarcane production reveals that almost all talukas reveals positive trend except Sangola.

As per Bhatia’s method high productivity is in central and north western part of the district, consist Pandharpur and Karmala talukas contributes 21.1 percent of net sown area of district due to high due high development of irrigation along with technological factors. Whereas it is low in South eastern part comprises North Solapur, Akkalkot, Sangola and Mangalvedha talukas covers 30.57 percent of net sown area. During the period under review six talukas shows change in level of a productivity low to high productivity change in Pandharpur and Karmala taluka mainly due to Ujani irrigation project. As per Shafi’s method level of agricultural productivity is high in Pandharpur, Mohol, Madha, Sangola and North Solapur talukas, contributes 54.9 percent of the total net sown area, whereas it is low in rest of talukas which covers 45.1 percent of total net show area of study region during 1995-2000. During the period under observation six talukas shows change in level of agricultural productivity by Shafi’s method.
Composite index of agricultural productivity reveals that productivity is high only in Pandharpur and Mohol taluka covers only about 17 percent of geographical area, mainly due to high growth of irrigation facilities, whereas it is low in Barshi, Akkalkot and North Solapur talukas, which collectively covers 24.78 percent of geographical area due to poor irrigation facilities. During the period of investigation, as per gradation of composite index, the change in level agricultural productivity is recorded in six talukas. Low to high level productivity change is in Pandharpur taluka and low to moderate level productivity change in Karmal taluka indicates great impact of nonphysical factors particularly irrigation.

The above stated facts suggest that agricultural productivity is closely associated with irrigation and its associated factors in the region.

Topography and soil is of all villages is favorable for farming, except little part villager Kanher and Gormale. Rainfall is relatively high in village, Kawathe and Bagehalli, whereas Kanher falls in high scarcity zone. It is to be observed that all physical factors are suitable for crop cultivation except rainfall. Meager of annual rainfall in all villages underlines great need of irrigation. Physical factors of the villages have influenced the cropping pattern and productivity.

The density of population and farm worker is high in irrigated villages. The village shiral (T) and Kharsoli have source of irrigation form Ujani project, whereas Kanher and Sangewadi has Nira canal. Ghargaon and Galandwadi are totally depending on groundwater for irrigation. High growth of irrigation wells is observed in surface irrigated due to definite recharge by canal indicates uncertain and scanty rainfall. Significant share of wells in the total irrigated area is observed in of Ghargaon, Galandwadi, Bagehalli, Sangewadi, Dhawalas, Kanher and Gormale village, whereas considerable share of surface irrigation is in
village Shiral (T) and Kharsoli. The high positive change in surface irrigation and intensity of irrigation is observed in Shiral (T) and Kharsoli village, whereas it is low in Kawathe, Ghargaon, Galandwadi, Bagehalli, Gormale and Sangewadi, as they are deprived of major irrigation project. Traditional methods of irrigation found particularly furrows and corrugation are in use almost in all villages, however little development of drip method is observed in some selected villages.

The expansion of irrigation has induced the use of mechanical and bio-chemical inputs, however its distribution is very uneven. The remarkable increase tractors and electric pumps is observed in highly irrigated village i.e. Shiral (T), Kharsoli and Kanher village. Still there is no single tractor in Kawathe, Bagehalli, and Galandwadi and Ghargaon village Traditional implements, like iron, ploughs bullock carts etc. are still used. However, wooden ploughs, which replaced by iron ploughs. HYV seeds of jowar, bajara, wheat, sugarcane, tur, gram, maize are adopted in all villages but it use is high in irrigated area. Consumption of chemical fertilizer was low in all villages during 1980, but it has gone up with development of irrigation facilities. The milch animals are increased in all villages, but with availability green fodder and dairies, however their increase is high in irrigated village. Considerable decrease in bullocks is observed in irrigated villages with availability of tractors.

The study of the land utilization conducted in the selected villages of Solapur district reveals that the existing pattern of land-use and productivity are related to soil, climate, and nonphysical determinants. Regarding general land use pattern of the villages, it may be stated that area under forest is nil in all selected villages, except Kharsoli and Bagehalli, indicates great need of afforestation. During the period observation, area not available for cultivation is increased only Shiral (T) due to most of the area gone under backwater. High proportion of other
uncultivable and in Kharsoli village indicates that there is scope to brought land under cultivation. Increase in fallow land is observed in most of the villages due to scanty rainfall and inadequate development of surface irrigation, however trend of decrease other fallow land in Kanher and Shiral (T) as a result of development of irrigation. Over 78 percent of the geographical area is observed under cultivation in all selected villages except Shiral (T) and Kharsoli, Remarkable positive change in net area sown area is observed in Kharsoli and kanher villages as a result of introduction and development of irrigation. Positive trend in gross cropped area and areas sown more than once is observed in surface irrigated villages, and high rainfall villages.

Very high overall change in general land-use is observed in village Shiral (T) may be explained in substantial loss in net sown area, which went under backwater. Semi dynamic changes in overall change in general land use is observed in Kharsoli Kanher, Sangewadi and Gormale villages.

There is a considerable hold of soil, climate, irrigation land holding, fertilizers, literacy farm workers, prices of commodity etc. on the cropping pattern and productivity of selected villages. The spatial distribution of crops indicates that commercial crops, are grown on large scale in the surface irrigated villages. Over 80 percent cultivated areas under food crops are observed in all selected village, indicates the dominance of food crop. Jowar is major food grains in all villages except shiral (T) Kharsoli, where dominance of sugarcane is as result of perennial irrigation facility. Considerable positive change in nonfood grain i.e. sugarcane and fruits-vegetables is observed in perennial irrigated villages i.e. Shiral (T) Kharsoli, Kanher and Sangewadi, while positive change in food grains is observed in seasonal irrigated area, indicates hold of irrigation on cropping pattern. Jowar is staple crop
occupies over 55 to 80 percent of cropped area in all village except Kharsoli Shiral (T) and Kanher, indicates hold of soil and rainfall, however with expansion of technological factors negative trend is area under jowar is observed in mostly village. Positive change in area under maize is as result of growth of milch animals.

It is to be stated that negative trend in area under pulses in all villages indicates frequency of crop failure, uncertain rainfall and farmers disregard about post control. over 45 percent of cropped area under nonfood grains particularly sugarcane observed in perennial irrigated villages, and ranks first in the cropping in Shiral (T) and Kharsoli. Trend of positive change in area under fruit–vegetable in all selected villages is resulted as a suitable climate and technological development; considerable positive change in sangewadi village is due to development of drip-irrigation.

Non-food crops are not significant compare to food crops in cropping, however, share of non-food crop is high in such villages where irrigation facilities are poor. The negative trend of nonfood grains in mostly villages indicates that farmers are turn toward cash crop like sugarcane and fruit vegetable with development of irrigation, other inputs and growth in literacy.

The changes in land use are highly related to nature and expansion of irrigation facilities and other technological factors. The cropping pattern has changed in all villages, with varying proportion but the intensity or rate of change in general decreases from perennial surface facility to seasonal well irrigation facility. Overall high change is observed in Shiral (T) and Kharsoli village i.e. 56 percent is as result of high growth of perennial irrigation, a crops of leading in area under cultivation is sugarcane. Overall change is low in well irrigated and rainfed villages. Jowar, wheat, sugarcane and fruit-vegetables are the
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important irrigated crops in selected villages however, sugarcane is dominant in surface irrigated villages. Among irrigated cropping jowar has not lost first rank in selected villages, expect Shiral, Kharsoli and Sangewadi.

Considering change trend in agricultural land use pulses, cereals and oilseeds are losses their area under cultivation, whereas cash crops are gain area under their cultivation with the development of non-physical determinants.

Agricultural productivity is influenced by number of factors including physical demographical technological variable. Agricultural productivity is increased in all villages with the development of non-physical determinants. Increase in jowar productivity is varies in different villages. Per hectare yield of jowar increased in all selected villages, considerable increase above 1600 kg in Shiral (T) indicates great influence assure irrigation facility and of HYV, fertilizer. Per hectare yield of wheat is high in Kawathe, Kharsoli, Kanher and Shiral (T) may be resulted use of and development of irrigation. Per hectare yield of bajara, tur etc are relatively low and increase in productivity is also relatively low, mainly due to most of area under those crop are deprived of irrigation. Remarkable positive change in per hectare yield of groundnut in Shiral (T), where as decrease in Sangewadi, underlines the great importance of irrigation. Per hectare yield of sugarcane is also increased in all selected villages, however remarkable increase is found in those villages where irrigation facility is perennial. The per hectare yield of sugarcane is low in Ghargaon, Dhawalas, Bagehalli indicates poor and uncertainty in irrigation.

Problem of drought, decline of ground water table, lack of irrigation, low productivity, uncertain and low market prices, ignorance
Suggestions:

In the context of the findings stated above, following suggestions for better agricultural land use and productivity have been made.

1. It is to be suggested that to solve the anxious problem, that is decline of ground water, public awareness to recharge ground water in different artificial way is essential.

2. Percentage of nitrogen content in the soil is low in all over the study region so that there is a need of crop rotation to cultivate such crops, which will help to increase such content for better productivity.

3. The district has very negligible area under forest so that afforesting should be done by public and private sector, which is better for increasing ground water level and soil conservation which in turn, will be useful for better productivity.

4. To restrict the increase of fallow land, irrigation is the best answer. There is a greater need of expansion and improvement in the existing facilities of irrigation.

5. There is only 5.25 percent drip irrigated area to net irrigated area in the district, it means that about 95 percent area is irrigated by flood method, which has some drawbacks and cannot be tolerated in drought prone area like Solapur district. Therefore, effort should be made to remove these drawbacks and popularize the innovative micro level irrigation methods i.e. drip, sprinkler, zirapi etc.
6. The district has favourable climate and about 25 percent shallow land with rich in potash content, which is useful for quality production of fruits so efforts should be made to alter the cropping pattern from inferior crop to crops like fruits and vegetables.

7. Physical environment of the region is favourable for goat and sheep rearing, therefore efforts should be made to increase goat rearing particularly in southwestern and northeastern parts of Sangola, Malshiras and Barshi taluka.

8. Area under fodder crop should be increased for milch cattle for dairy industry, which supplements farmer’s economic condition.

9. According to estimate made in chapter II, only 40 percent of yearly flow of rivers is being utilized at present. Thus, there is a large scope to bring additional land under irrigation.

10. Literate people adopt innovation quickly in agriculture than the illiterate so effort should be made for public awareness that majority literate people to turn to farming activity which also helpful to reduce unemployment.

11. Fruits prices decreased to greater extent in season so that effort should be made to establish fruit processing industry.

12. Frequency of low rainfall and famine scarcity, resulted in crop failure therefore, efforts should be made for expansion in the irrigation facilities.

13. The irrigation facilities should be equally distributed according to the needs of area non-irrigated land should be made irrigated in order to diffuse the benefits of irrigation for better productivity.
14. To save the pulses processing industries efforts should be made to make public aware of pests control by biotic control.

15. Sugar cane yield has decreased in predominant areas so efforts should be made for public awareness about crop rotation and water management to maintain soil fertility.

16. To increase the agricultural productivity, it is essential to instill following facts in the farmers mind by extension work, agricultural exhibition, farmers meetings etc. because most of the farmers are still ignorant about following facts:

I. Choice of the crop and its High Yielding Variety seeds developed by Agricultural Universities and Seed Corporation as per report of soil testing and water testing.

II. The use of fertilizers by testing soil nutrients with organic mater.

III. Proper practices of water management

IV. The use of integrated pest management practices.