Chapter VIII

CONCLUSION, FINDINGS AND SUGGESTIONS

8.1 Conclusion
8.2 Findings
8.3 Suggestions
Chapter VIII

CONCLUSION, FINDINGS AND SUGGESTIONS

8.1 Conclusion

The entire research work on the agricultural transformation and development in Satara district has been presented in the foregoing analysis. The whole research work is organized into eight chapters.

Chapter I include the introductory aspects of the central theme of the study containing the introduction, background of study, statement of the problem, study area, aim and objectives of the study, review of literature, justification for the selection of study area, significance of research work, database and methodology, terms and terminology used in the research work, limitations to the study, outline of the research work. It is important to note that various sources of maps and other primary and secondary information and methods of collecting primary and secondary data are clearly mentioned in the chapter. Moreover, a brief review of works on agricultural geography by different scholars and geographers at international, national, regional and local level is also done here.

Chapter II deals with geographical background of the study area. It has been divided into two parts viz. physical background and socio-economic background. In physical background covers mainly location of the study area, physiography and drainage, climate, soil, natural vegetation. While, in socio-economic background has been analysed in terms of demographic dimensions, transportation network, occupational structure, size of land holdings etc. An analysis of the physiography and drainage has been made which shows that the district is able with a fairly large river basin covering its northern and the southern parts with abundant water resources favourable for cultivation of varieties of crops. The areas adjoining the surrounding plateaus have perceptible high gradient. The study area reveals that 29.06 per cent of the district is above 800 m, 58 per cent area of the district lies between 600 to 800 m, while the remaining part of the district is lies below 600 m from MSL.

The main rivers in the district flow towards the south-eastern direction. In Satara district, there are four main river basins viz. Nira, Krishna, Yerala and Man river basins. Nira river basin flowing from northern part of district flow towards the eastern direction, Krishna river basin is covered central part of the district and flow from northern to southern direction. Yerala river basin is captured with southern part of
district with flow towards southern direction and Man river basin is covered south-eastern area and flow from north-western to south-eastern direction.

Along with characteristics of topography and soil, rainfall is the also important factor influencing on the growth of crops. Due to the abnormal geographical location, the eastern part of the district suffers from a rain shadow effect. The present agricultural landscape is essentially the product of the monsoon, which is erratic and inadequate in nature. Thus, there is even crop failure at times due to non-availability of water in the proper cropping season.

The soil of the district shows that a major part of it has ranging from deep black soil to hilly shallow soil as well as laterite soil, where maximum yield can be expected with the application of fertilizer and water supply, as and when necessary. Continuous cultivating of the area has resulted in the depletion of soil fertility, and thus yield is guaranteed to come down, if no fertilizer or manure is added. The soil of the foothills offers a better scope for development of mango plantation and shallow soil of the plateau is suitable for the pomegranate plantation in south-eastern part of the district. It is also important of crop rotation for the maintenance of the soil fertility in sugarcane belt. Natural vegetation is the most important for the balancing the environmental condition in an area. Natural vegetation cover is directly and indirectly depends on the physiography, climatic condition and type of soil. Only 14.89 per cent area is covered by different type of natural vegetation during 1975-76, it has declined up to 11.46 per cent in 2010-11 in the study area.

The characteristics of demographic dimensions are the important aspects of the agricultural development. The district has a phenomenal growth of population during the period of investigation. The growth of population is rapidly increased in urban areas as compared to rural areas in the study area. This is due partly to the natural growth and partly to the result of immigration from the rural to urban areas which have created acute shortage of land. The density of population of the district is concerned, it may be mentioned that during a period of thirty years, the district has recorded 194 persons per sq. km. in 1981, which is increased to 287 persons per sq. km in 2011. It is further noticed that there is a little scope for horizontal expansion of agricultural land but higher the scope of vertical expansion of agriculture in the district. On the other hand, level of literacy is high which applied for innovation of agriculture. The level of urbanization is low and most of people are lives in rural areas.
Occupational structure is determines the level of economic development in a region. Working population is one of the important indicators of the agricultural development. The work participation rate for the total workers is defined as the percentage of total workers to total population. In a similar way it is defined for main and marginal workers. As per census of 1981, 33.56 per cent population of the district is recorded as as main workers, 7.88 per cent as marginal workers and the remaining 58.56 per cent population as non-workers. The corresponding figures compared to the census of 2011, there has been increased to 39.43 per cent in the work participation for the main workers, but the marginal workers has been declined from 7.88 per cent to 5.68 per cent in 2011.

Transportation network is one of the important aspects of agricultural development. It is used for the marketing of agricultural produce as well as much important to bringing agricultural inputs to the farms. It is most important for the growth and development of agricultural industries. It has been observed that the total length of road network 9707.24 km and the density road network is per hundred sq.km is 92.63 km. during the year of 2010-11. The highest length of road network is found in Phaltan tahsil with 1256.78 km., while lowest length of road network is found in Jaoli tahsil with 481.26 km. Average density of road network is 92.63 km. per hundred sq. km. in the study area. The highest road density found in Mahabaleshwar tahsil with 137.99 km. while lowest is found in Man tahsil with 70.71 km. per hundred sq. km. area.

The size of holdings is an important for the development of agriculture. It is a close relation to agricultural land use and cropping pattern. There are number of changes are observed in the size of land holding in different categories in the study area. It has been obtained that the largest number of land-holders increased from 212027 to 486827, possess less than 0.49 hectare of land; whereas the highest hectares of land, i.e. more than 20 hectares, is possessed declined from 649 in 1990-91 to 445 in 2010-11 land holders. The average size of holding is also declined from 1.34 hectare in 1975-76 to 0.74 hectare in 2010-11 in the study area.

Chapter III discusses the land use pattern of the district and changes in different land use categories last thirty five years. It is observed that landuse/ landcover mapping has immense importance in development plan formulation, as land is the base upon which all kinds of developmental activities are carried on. It is concluded that the general land use pattern in study area for the period of investigation. It is clearly
observed that the forest cover of the district has declined from 14.08 per cent in 1975-76 to 11.46 per cent in 2010-11. The decreases in forest cover from 1,48,638 hectares area in 1975-76 to 1,21,324 hectares in 2010-11 was experienced during 35 years due to translation of forest land to settled area, particularly homestead area as well as agricultural land to mitigate the growing population pressure on land. Moreover, some forest areas are cleared for construction four line high way.

The land not available for cultivation includes land put to non-agricultural uses and barren and uncultivated land which was recorded 15.81 per cent in 1975-76 and declined to 12.04 per cent in 2010-11. Out of the total geographical area of the district, cultivable waste land covered 3.90 per cent of the area in 1975-76 which was reduced to 2.16 per cent in 2010-11. However, this is the only category of land which offers opportunity for expansion of agricultural land. It is observed that the fallow land increased from 7.05 per cent in 1975-76 to 9.55 per cent in 2010-11. It may be noted here that due to pressure of population in the district the fallow land has been gradually converted to agrarian land.

The net area sown in the district has a special significance because agrarian production and food supply largely depend on this type of land. The net area sown of the district has increased from 52.82 per cent in 1975-76 to 62.18 per cent in 2010-11. It is further observed that there have been spatio-temporal changes in area under different crops in Satara district. The increasing trend continued and become 17.76 per cent during the period of last 35 years from 1975-76 to 2010-11. It is an important that the net sown area though recorded significant increase in the district. There has been fluctuation in respect of area mainly because of climatic condition prevalent in the study area.

It has been concluded that the above discussion of the cropping pattern in the study area food grain crops are again dominant in the overall cropping pattern during period of investigation. The cultivation of different crops in the study area is mainly the influenced by physical and socio-economic factors. Different crops are grown in the study area. It has been observed that there are thirteen crops leaving aside the others category like vegetables, oilseeds, fibres, spices, fruits, etc. The cereals covered largest proportion of area among all other crops. It is observed in 1975-76 the cereals occupied 6,39,063 hectares claiming as high as 71.13 per cent of the GCA of the district, which is decreased to 5,97,399 hectares covering 63.76 per cent of land to GCA of the district in 2010-11. The proportional area under cereal is not recorded an increase because of
expansion of area under agriculture on the one hand and importance of some cash crops on the other such as sugarcane, fruits and vegetables. Out of the tahsils the highest area under cereals is recorded in Mahabaleshwar tahsil covering 81.42 per cent while lowest in Karad tahsil which recorded as 59.95 per cent to the GCA in 1975-76. After 35 years i.e. 2010-11, the highest proportion of cereals area is recorded in Khandala tahsil which is recorded as 73.50 per cent, while lowest in Mahabaleshwar tahsil which recorded as 44.13 per cent to the GCA of the district.

Jowar is the dominant crop in all tahsils of the district. Among the tahsils the highest proportion of area under jowar is recorded in Wai tahsil in 1975-76. Out of the GCA 54.74 per cent is covered by jowar in the Wai tahsil, followed by Phaltan tahsil is 51.44 per cent. It is lowest in Mahabaleshwar tahsil with recorded as 17.97 per cent to GCA of the tahsil. After 35 years i.e. in 2010-11, there are significant changes in respect of area under jowar cultivation. The highest proportion is claimed by Phaltan tahsil recorded as 45.48 per cent, while the lowest in Mahabaleshwar tahsil with 4.50 per cent due to the conversion of jowar area to commercial crops like sugarcane, oilseeds like ground-nut, fruits and vegetables etc.

Bajra is one of the crops among the cereals cultivated throughout the district. The proportion of bajra crop 19.37 per cent was recorded in the district during the period of 1975-76 and 14.39 per cent of land to GCA in 2010-11. The spatial distribution is varies from 49.85 per cent in Man tahsil, followed by Khatav and Khandala tahsils to 0.03 per cent in Patan tahsil of land to GCA in 1975-76. In 2010-11, the highest proportion of area under bajra is recorded in Khatav tahsil with 42.95 per cent of land, followed by Man and Khandala tahsils. While, lowest proportion of area under bajra is found in Satara district as 0.08 per cent of land to GCA and Mahabaleshwar and Jaoli tahsils having not cultivated of bajra. Wheat is an important food crops in the study area with cultivated throughout the district. The area under wheat cultivation is having 4.62 per cent to GCA in 1975-76, while in 2010-11 it is slightly increased to 5.6 per cent of land to GCA of the district. The highest proportion of wheat cultivated is recorded in the Satara tahsil with 21.34 per cent and lowest in Karad tahsil containing 1.09 per cent of land to GCA. In 2010-11, the highest proportionate of wheat cultivation is recorded in Phaltan tahsil only 8.08 per cent while lowest in Man tahsil with 3.63 per cent of land to GCA.

Pulses are also important food crops in Satara district. The pulses are like gram, tur, udid, mung, peas, matki and kulith etc. are cultivated in the district. The areas under
Chapter VIII

Conclusion, Findings and Suggestions

Pulses have been recording fluctuation during the 35 years period. In 1975-76 the area under pulses was 64,295 hectares which is recorded as 11.10 per cent of the GCA, while in 2010-11 the area under pulses is slightly increased to 69,484 hectares recorded as 11.13 per cent of the GCA. Among the tahsils of the district, highest proportion of the area under pulses is recorded in Koregaon tahsil in 1975-76. Out of the GCA 20.09 per cent is covered by pulses along in this tahsil which is followed by Khatav tahsil. While, the lowest proportion of area under pulses are recorded in Patan tahsil i.e. 4.49 per cent to GCA. In 2010-11, there are notable changes in respect of area under pulses cultivation. The highest area is recorded in Man tahsil which recorded as 19.04 per cent, while lowest in Mahabaleshwar tahsil recorded only 1.21 per cent of land to GCA in 2010-11.

Sugarcane is one of the important cash crops in Satara district. The area under sugarcane crops was 16,904 hectares in 1975-76 which is recorded as 2.92 per cent to GCA in 1975-76. While in 2010-11, the area under sugarcane has been significantly changes to 43,694 hectares which recorded as 7.00 per cent to GCA. Its highest proportion is recorded in the tahsils of Karad with 9.49 per cent, while lowest proportion in the Jaoli tahsil recorded 0.45 per cent and in Mahabaleshwar having sugarcane was not cultivated in 1975-76. In 2010-11, the highest proportionate is recorded in Karad tahsil with 20.51 per cent and lowest in Khandala tahsil with 1.45 per cent to GCA and not available in Mahabaleshwar tahsil. Oilseeds is one of the important category of crops it includes groundnut and sunflower is grown in the district. It occupied 67064 hectares covering 11.57 per cent to the GCA of the district in 1975-76, while it was slightly decreased 61,220 hectares claiming 10.19 per cent in 2010-11. Among the tahsils, highest proportion of the area under oilseeds is recorded in Patan tahsil which recorded as 30.15 per cent followed by Karad tahsil 21.36 per cent, while lowest in Mahabaleshwar tahsil with 0.66 per cent to GCA in 1975-86. In 2010-11, the highest area is claimed by Patan tahsil also which recorded 19.94 per cent followed by Satara tahsil recorded 19.78 per cent, while lowest in Man recorded as 0.89 per cent of the GCA.

Fruits and vegetable cultivation is one of the important in Satara district. The proportion of this crop was recorded as 1.12 per cent to GCA in 1975-76, it is large scale increased to 6.77 per cent of land to GCA in 2010-11. Its proportion was varies from 11.45 per cent in Mahabaleshwar tahsil to 0.48 per cent in Patan tahsil in 1975-76. In 2010-11, it has been rapidly increased to 54.38 per cent in Mahabaleshwar tahsil and
lowest in 3.39 per cent of land in Patan tahsil. Cotton and other fibres are also cultivated in Satara district. It covers 1.15 per cent to the GCA of the district in 1975-76 and 0.62 per cent in 2010-11. It is also growing more or less throughout the district except Mahabaleshwar tahsil. It is lies between 6.02 per cent in Phaltan tahsil and 0.01 per cent in Koregaon tahsil in 1975-76 and Khandala 1.77 per cent to 0.06 per cent of land to GCA in Satara tahsil. Condiments and spices are important cash-crops of the district. It is constitutes of only 1.02 per cent to GCA in Satara district. Condiments and spices are varies between 1.80 per cent in Koregaon tahsil and 0.10 per cent of land to GCA in Mahabaleshwar tahsil in 1975-76. In 2010-11, the highest proportion of area under this crop is recorded in Wai tahsil with 1.15 per cent while lowest in Khatav tahsil with 0.10 of land to GCA.

Chapter IV has been concluded that the above discussion of the regionalization of agriculture in Satara district during the period of 1975-76 and 2010-11 with using different methods. The analysis of crop-combination is presented by Weaver’s and Raffiullah’s method. As per year of 1975-76 datasets, the analysis of crop combination with applying the Weaver’s method have been observed ten crop combination in three tahsils viz. Wai, Phaltan and Khatav, while in 2010-11, six tehsils viz. Wai, Khandala, Man, Khatav and Koregaon are having recorded as high with ten crop combination. Seven crop combinations are found in Mahabaleshwar tahsil in 1975-76 and Satara tahsil in 2010-11. During the period of 2010-11, eight crop combinations are found in four tahsils viz. Mahabaleshwar, Jaoli, Patan and Karad tahsils. The analysis of crop combination based on Raffiullah’s method, it has been observed that the monoculture crop was found in six tahsils viz. Mahabaleshwar, Wai, Satara, Jaoli, Patan and Karad during the period of 1975-76, while Wai, Khandala, Man, Khandala, Koregaon, Satara, Jaoli, Patan and Karad tahsils are found in monoculture combination during the period of 2010-11. Two crop combinations are obtained in Khandala, Phaltan, Man and Khatav tahsils in 1975-76 and Mahabaleshwar tahsil in 2010-11, whereas three crop combinations are obtained in Phaltan tahsil during 2010-11.

The concentration of major crops is concerned with the summarize and measurement in crop concentration of eleven principal crops, i.e. jowar, bajra, rice, wheat, other cereals, pulses, sugarcane, fruits and vegetables, spices, oilseeds and fibres in different tahsils of Satara district. It is noted that jowar and bajra being the staple food of the area and due to homogeneity of soil and climatic condition. It is cultivated in almost all parts of the district except the Jaoli and Mahabaleshwar tahsils. However,
statistical analysis reveals that jowar concentration with location quotient value above 1.25 is found in eastern part of the district and concentration value below 0.50 is found in north-western part of the district. The highly concentration of rice with above 4.0 CI is found in Mahabaleshwar and Patan tahsils during 1975-76 while in 2010-11 in this do not found any tahsils in this category. The low level of concentration of rice with below 1.0 CI is found in central and eastern part of district during the both times of period. The highly concentration of wheat is recorded in northern and south-western part of the district while low level of concentration is observed in south-eastern part of the district. Bajra is one of the important food crops are cultivated in the district. It is highly concentration south-eastern part of district i.e. Man, Khatav and Koregaon tahsils while low level of bajra concentration is obtained in hilly and highly rainfall area such as in northern and north-western part of the district.

As regard to pulses Khata, Man, Koregaon tahsils are recorded as very high concentration, while Mahabaleshwar, Patan and Jaoli tahsils are recorded as very low concentration during the period of investigation. In case of sugarcane, highly concentration with above 1.0 CI is registered in Karad and Phaltan tahsils during the year of 1975-76, while in the year 2010-11, highly concentration is recorded as Phaltan, Karad and Koregaon tahsils. The very low level of sugarcane concentration with below 0.25 CI is recorded in Mahabaleshwar, Man, Jaoli and Khandala tahsils in 1975-76, after that 35 years very low concentration is found in Mahabaleshwar and Khandala tahsils. The very high concentration of spices with above 2.0 CI are found Karad tahsil in 1975-76 and Wai tahsil in 2010-11, while very low concentration with below 0.50 CI is recorded in Mahabaleshwar, Phaltan and Khandala tahsils in 1975-76 and Khatav tahsil in 2010-11. In the case of oilseeds highest concentration with above 2.0 CI is found in Patan tahsil in 1975-76, while Patan and Satara tahsils in 2010-11. Very low level of oilseeds concentration is recorded in Mahabaleshwar, Khandala, Man, Khatav and Phaltan tahsils during the period of 1975-76 and Mahabaleshwar, Man, Phaltan, Khatav and Koregaon tahsils in the year of 2010-11. On the other hand, in the case of fibre crop the highest concentration is recorded in Phaltan and Khandala tahsils in 1975-76 and Khandala, Phaltan, Khatav and Man tahsils in 2010-11, while lowest concentration with below 0.25 CI is found in Mahabaleshwar, Satara, Jaoli, Patan, Koregaon and Wai tahsils in 1975-76 and Mahabaleshwar, Satara and Koregaon tahsils in 2010-11. In the case of fruits and vegetables the highest concentration is found in Mahabaleshwar and Karad tahsil in 1975-76 and during the period of 2010-11 is found
only in Mahabaleshwar tahsil with above 1.25 CI, while lowest concentration of fruits and vegetables with below 0.75 CI are recorded in Patan, Karad, Jaoli and Khatav tahsils in the year 1975-76 and Patan and Karad tahsils in 2010-11.

The crop diversification is concerned almost tahsils are recorded as diversified cropping pattern. In subsistence economy farmers use to cultivate a large number of crops depending on their need for consumption and physical and non-physical environmental condition of growing crops in an area. The spatial variation of crop diversification has been analysed by Bhatia’s and Jasbir Singh’s method of crop diversification. The study of crop diversification based of Bhatia’s method, in study area reveals that in the year 1975-76 three tahsils, viz. Mahabaleshwar, Koregaon and Patan tahsils are recorded as high degree of diversification, while very low level of diversification is found in Phaltan, Man and Khatav tahsils. The high level of diversification is found in Jaoli tahsil and medium level of diversification in Wai tahsil. The remaining three tahsils, viz. Karad, Satara and Khandala show low degree of diversification. As compared the data of 1975-76 with that of 2010-11, it is observed that very high degree of crop diversification found in Karad, Patan, Satara, Wai and Mahabaleshwar tahsils, while very low level of crop diversification is recorded in Khandala. Koregaon and Phaltan tahsils.

The analysis of crop diversification using the Jasbir Singh’s method of crop diversification, it is observed that very high crop diversification obtained in Karad and Phaltan tahsils during the year of 197-76, while in 2010-11 the highest crop diversification is found in Patan, Karad, Jaoli and Wai tahsils. Very low degree of crop diversification is found in Man, Khatav and Khandala tahsils in the year of 1975-76 and only Man tahsil in 2010-11. High degree of crop diversification is obtained in Mahabaleshwar and Jaoli tahsils during the 1975-76 and Mahabaleshwar, Khandala, Phaltan and Satara tahsils during the 2010-11. The moderate level of crop diversification is observed in Wai tahsil in 1975-76, while Koregaon and Khatav tahsils in 2010-11. Low degree of crop diversification is found in Koregaon, Satara and Patan tahsils in 1975-76, while 2010-11, low level of crop diversification is not found in any tahsils of the district.

Chapter V deals with the agricultural production, productivity and levels of agricultural productivity in the study area. It has been observed that the gross production increased of rice, wheat, jowar, bajra, other cereals, pulses, sugarcane, fruits and vegetables and oilseeds, while declined the production of spices and fibres during
the period of investigation. The highest mean production is obtained with the sugarcane followed by jowar, oilseeds and bajra while lowest in other cereals, fibres and species. Highest standard deviation of production is observed with the crops of sugarcane followed by jowar, while lowest in spices, other cereals and fibres. The highest production co-efficient of variability is recorded in fibres followed by other cereals, while lower the variability is obtained in wheat, oilseeds, jowar and rice production. The highest CAGR of production is observed with fruits and vegetables followed by sugarcane, rice and other cereals while lowest in wheat followed by oilseeds, jowar, and rice. The spatio-temporal changes of the major crop production has been analysed in the study area during the period of study. The positive changes rice production has been recorded in Mahabaleshwar, Wai, Khandala, Satara, Jaoli, Patan and Khandala tahsils, while negative changes are found in Phaltan, Man, Khatav and Koregaon tahsils. A highest change of wheat production is obtained in Patan tahsil, while lowest in Satara tahsil. Negative changes in jowar production are recorded in Mahabaleshwar and Phaltan tahsils. On the other hand, bajra production has been increased in Patan and Karad tahsils. Production of pulses are increased in Wai, Khandala, Phaltan, Koregaon, Satara, Jaoli, Patan and Karad tahsils, while declined in Mahabaleshwar and Man tahsils. Sugarcane is one of the major cash crops cultivated in the district. The production of sugarcane has been increased throughout the district except Mahabaleshwar tahsil. Fruits and vegetables production is increased all tahsils in the district, while the production of fibres declined throughout the district. The production of spices are increased in Mahabaleshwar, Wai, Khandala, Phaltan, Man, Jaoli and Patan tahsils while decreased in Karad, Satara, Koregaon and Khatav tahsils. The highest changes of oilseeds production is recorded in Khandala tahsil followed by Patan, Jaoli and Satara tahsils, while lowest production recorded in Phaltan, Man and Koregaon tahsils during the period of investigation.

The highest mean yield is found with the crops of fruits and vegetables, while lowest with species and sugarcane. The highest CAGR of yield is recorded with the crops of sugarcane, bajra, jowar and oilseeds while lowest with the crops of wheat, other cereals and fruits and vegetables. The trends of agricultural productivity have been analysed with the year of 1975-76 and 2010-11 in the study area. The highest change of rice productivity is recorded in Koregaon tahsil, while lowest in Jaoli tahsil. The wheat productivity has been increased all tahsils in the district except Mahabaleshwar tahsil during this period. The productivity of jowar and bajra has been
increased all over the district but there are more spatial variations. In case of pulses the productivity has been increased from 469.6 kg to 581.40 kg per hectare during the period study in study area. The highest changes of pulses productivity is obtained in Phaltan tahsil while lowest in Mahabaleshwar tahsil. The negative changes are observed in Patan, Jaoli, Mahabaleshwar, Man and Khatav tahsils. Sugarcane productivity has been increased all tahsils except Mahabaleshwar and Khatav tahsils in the district. It has been observed that all tahsils of the district recorded as positive changes in fruits and vegetables productivity. The highest changes are recorded in Mahabaleshwar tahsil, while lowest in Karad tahsils followed by Wai tahsil. The change of spices production is observed in positive change, on the other hand fibres also negative changes are observed in all over in the study area. The productivity of oilseeds has been observed positive changes except Mahabaleshwar tahsil during the period of study.

The levels of agricultural productivity have been measured by using Kendall’s ranking co-efficient method and Sapre and Deshpande’s Agricultural efficiency method. As per Kendall’s method, it is observed that the highest agricultural productivity is found in Karad tahsil followed by Phaltan tahsil during the both times of period. Sugarcane is the leading crop in this tahsil. Next to sugarcane, wheat and groundnut are the important crops. The high agricultural productivity is found in Khandala, Koregaon and Satara tahsils in 1975-76 and Wai, Khandala and Satara tahsils in 2010-11. The leading crops in this tahsils are jowar, pulses, oilseeds, bajra and sugarcane. The moderate agricultural productivity is obtained in Wai tahsil in 1975-76 and Koregaon in 2010-11. The low agricultural productivity is recorded in Man and Patan tahsils in 1975-76 and during 2010-11, found in Man, Khatav and Patan tahsils, because it has been facing drought problem. While, areas of very low agricultural productivity are obtained in Mahabaleshwar, Jaoli and Khatav tahsils during the 1975-76 and Mahabaleshwar and Jaoli tahsils in 2010-11. Mainly due to the fact that the part of these tahsils are situated in hilly area, undulating topography and extreme climatic condition. The analysis of agricultural productivity based on the Sapre and Deshpande’s method, it has been observed that the highest agricultural productivity obtained in Phaltan tahsil in 1975-76 and Karad tahsil during the 2010-11. Very high agricultural productivity is recorded in Phaltan and Karad tahsils during 1975-67 and Karad tahsil in 2010-11, while very low productivity is recorded in Khatav, Jaoli and Patan tahsils during the both times of period. High agricultural productivity is obtained in Wai tahsil during 1975-76 and Phaltan and Satara tahsils in the year of 2010-11. The moderate
level of agricultural productivity is found in Khandala, Man, Koregaon and Satara tahsils in 1975-76, same tahsils are obtained during the period of 2010-11 except Satara tahsil, while low degree of agricultural productivity is obtained in Mahabaleshwar tahsil in 1975-76 and Mahabaleshwar and Man tahsils during the period of 2010-11.

Chapter VI deals with the agricultural land use and development in 87 sample villages of Satara district. It is concluded that the jowar, bajra, sugarcane, groundnut and rice are dominant crops cultivated in Satara district. Other than this maize, fruits, vegetables and pulses etc. are cultivated in different villages of the Satara district. It has been observed that the areas of plateau region with fertile soil, highly irrigated having sugarcane, wheat and oilseeds are mostly cultivated. The Sahyadri and Mahadev hilly ranges having fruits, pulses and oilseeds are cultivated.

The crop combination of the sample villages has been analysed. There are three crop combination to ten crop combination are obtained in sample villages by the Weaver’s method. Out of 14 villages are often ten crop combinations, while maximum i.e. 23 villages are obtained six crop combination. Minimum three crop combinations are recorded in four villages’ viz. Vahite, Mol, Rajpuri and Kumthe. According to Raffiullah’s method, the crop combination is obtained ranging from monoculture to three crop combination. Maximum 81 villages are having monoculture crop combination, two villages i.e. Taradgaon and Shindewadi (Pl) are found two crop combination and four villages viz. Ving, Rajpuri, Kumthe and Devali are recorded three crop combination in the total sample villages of Satara district.

According to Bhatia’s method, the highly diversified regions are obtained in sample villages. The diversification index is obtained ranging from 12.69 DI (Landewadi) to 33.33 DI (Taradgaon). It has been observed that the very high diversification is found in 26 villages and high diversification found in 40 villages in the sample villages. Near about same diversification condition is obtained by the Jabir Singh’s method, there are also highly crop diversified regions i.e. 19 villages are obtained in very high and 35 villages obtained in high diversification in sample villages in Satara district. There are number of factors responsible for the crop diversification such as topography, climatic condition i.e. rainfall, irrigation, type of soil etc.

The analysed the agricultural modernization in sample villages of Satara district using with some variables and calculated the composite index of level of modernization. It is derived ranging from 56.57 (Keloli) to 186.05 (Kodoli). It has been observed that the irrigation is dominant determinates influenced on the agricultural
inputs. Agricultural mechanization is depends upon the agricultural inputs. It has been observed that the very high mechanization is recorded in 10 villages, while very low found in 21 villages. High mechanization is observed in 19 villages, medium in 16 villages and 31 villages are obtained in low mechanization. The agricultural productivity has been analysed using the Kendall’s method and Sapre and Deshpande’s method. There are more variations of the agricultural productivity in Sample villages. According to Kendall’s method, the productivity values are found between the 6.05 (Shindewadi) to 76.55 (Davari.). The productivity values are obtained ranging from 79.98 (Pathavade) to 156.34 (Julewadi).

The level of agricultural development is an important aspect of agricultural activity. There are more variations in the agricultural development from one village to another. It has been observed that the highly agricultural development is obtained the areas of fertile soil, highly irrigated area, plateau and river basin. While low level of development is obtained in the villages of Man, Khatav, Jaoli and Mahabaleshwar tahsils. Because of these villages are situated in hilly areas of the Jaoli, Patan and Mahabaleshwar tahsils and drought prone and low irrigated villages of the Man and Khatav tahsils.

Chapter VII discusses the inter-relationship among the different variables and pattern of agricultural development in the district. Among the physical factors, the most important are droughts which cause severe distress to the farmers at the time of both kharif and rabi crop cultivation. Irrigational facilities are not only localized so far, but also inadequate, especially during the long and continuous rainless season.

Among the socio-economic factors like percentage of total workers to total population, percentage of agricultural workers to total workers, literate population, percentage of NSA, cropping intensity, irrigation intensity, percentage of area under food crops, use of fertilizers, use of HYVs of seeds, use of machineries etc. are plays an important role in the present pattern of agricultural transformation and development.

The correlation coefficient establishes relationship between chosen variables. The strongly positive correlation is obtained between percentage of total workers and agricultural workers (0.83 and 0.90 during 1975-76 and 2010-11 respectively), percentage of area under non-food crops and number of tractors (0.81 in 2010-11), percentage of area under sugarcane and consumption of chemical fertilizers (0.88 and 0.80 during 1975-76 and 2010-11 respectively), agricultural productivity and consumption of fertilizers (0.84 in 2010-11), percentage of area under sugarcane and
number of tractors (0.83 in 2010-11), consumption of fertilizers and number of tractors (0.83 in 2010-11). Very low level of positive correlation is lies between the percentage of total workers and cropping intensity (0.08 and 0.14 during 1975-76 and 2010-11 respectively), literate population and percentage of surface irrigation (0.16 and -0.10 during 1975-76 and 2010-11 respectively), percentage of agricultural workers and percentage of area under food crops (0.03 and 0.20 during 1975-76 and 2010-11 respectively), percentage of area under surface irrigation and percentage of area under food crops (0.07). This fact explains that areal extents of above crops are increasing with increasing area under net sown area and therefore the variables show positive correlation.

The strongly negative correlation is lies between percentage of area under food crops and number of tractors (-0.81 in 2010-11), percentage of area under food crops and use of HYVs of seeds (-0.78 in 1975-76), percentage of NSA and use of HYVs of seeds (-0.72 in 2010-11). According to 1975-76 datasets, very low level of negative correlation is obtained between the variables of percentage of total workers to percentage of area under food crops (-0.14) percentage of total workers and percentage of area under sugarcane (-0.16), percentage of agricultural workers and irrigation intensity (-0.03), agricultural workers and agricultural productivity (-0.01), literate population and area under food crops (-0.01), literate population and area under non-food crops (-0.09), NSA and cropping intensity (-0.01), NSA and irrigation intensity (-0.01), cropping intensity and area under surface irrigation (-0.01), cropping intensity and area under sugarcane (-0.20), irrigation intensity and area under non-food crops (-0.13), area under food crops and agricultural productivity (-0.13), area under non-food crops and crop diversification (-0.08). As per year of 2010-11, the very low correlation is recorded with the variables of agricultural workers and cropping intensity (-0.05), agricultural workers and area under non-food crops (-0.20), literate population and crop diversification (-0.08), cropping intensity with agricultural productivity (-0.19) and use of HYVs of seeds (-0.11), irrigation intensity with area under food crops (-0.07), area under sugarcane (-0.05) and crop diversification (-0.09), area under non-food crops and use of HYVs of seeds (-0.05), area under sugarcane and use of HYVs of seeds (-0.06) and use of HYVs of seeds with consumption of fertilizers (-0.04). These variables are not experiencing a proportional increase in the district and therefore show negative correlation.
Chapter VIII

The spatial pattern of level of agricultural development of Satara district is concerned it is analysed for the period of two time i.e. 1975-76 and 2010-11 by using composite Z-Score where fifteen attributes has been analysed. It has been observed that Phaltan, Karad and Wai tahsils are recorded as high level of agricultural development during the period of 1975-76, while low level of agricultural development have been observed in Mahabaleshwar, Man, Khatav, Koregaon and Patan tahsils and moderate level of development is recorded in Khandala, Satara and Jaoli tahsils during 1975-76. On the other hand, in 2010-11 high degree of agricultural development is obtained in Karad and Phaltan tahsils. Moderate level of agricultural development is recorded in five tahsils viz. Wai, Khandala, Koregaon, Satara and Jaoli tahsils, while low level of development found in Mahabaleshwar, Man, Khatav and Patan tahsils during the period of 2010-11.

8.2 Findings

The major findings of the present study are:

1. Inadequate and uneven distribution rainfall is one the important problem in the study area. Which are western areas of the district rainfall received more than 6000 mm with declined eastward up to 500 mm.

2. Though net sown area in the district recorded an increase from 5,58,756 hectares (52.80 per cent) to 6,58,009 hectares (62.18 per cent) of the total area during 1975-76 to 2010-11 as recording an increase of 17.76 per cent, the population growth is much more recording about two and half times more (47.34 per cent) than the increase of net area sown. This reveals that the high growth rate of population exerts excessive pressure on agricultural land. Thus, more areas are converted to agricultural land in order to mitigate the demand of the growing population and agricultural landuse has been also changing. Introduction of cash crops, plantation crops and other commercial crops also another important change in the agricultural landscape.

3. As more increase of net sown area is not possible by scarifying area under different categories of landuse, like area under forest, area not available of cultivation etc., and the only way to increase area under agriculture is to reuse the crop land using innovative measure. But intensity of cropping is very low even less than 120 per cent indicating a weak situation. This is due to lack of irrigational facilities in most of the tahsils of the district.
4. In hilly ranges of land heavy rains, removal of natural vegetation can be disastrous. It leads to wide-spread soil-erosion. In the plateau area and river basin areas the land has been under cultivated number of years and it is not taken care of, it loses its fertility reducing its yield. Large tracts of fertile land suffer from soil erosion by water.

5. Size of operational holdings and fragmentation of landholding are the major factors influencing agricultural transformation and development. Majority of the holdings are below the size of 0.99 hectares as recording 56.46 per cent and 0.50 to 0.99 hectares. Therefore, there are recorded as 21.55 per cent agricultural modernization is not possible.

6. Major area of agricultural land situated on the bank of the Krishna and Nira have been eroded by the river. In some of the tahsils viz. Patan, Karad and Satara there has been change in the type of agriculture for which these areas recorded a negative change in the intensity of cropping. Due to high frequency of sugarcane cultivation, the intensity of cropping is lower and farmers have not cultivated other crops. The intensity of cropping has been increased all tahsils except the Patan and Satara tahsils during the period of investigation. The intensity of cropping is low almost all tahsils except Khandala, Wai and Jaoli tahsils during the period of 2010-11.

7. There has been strong positive correlation between total workers and agricultural workers is \( r = +0.90 \). It is clear that with the increase of percentage of total workers the percentage of agricultural workers also increases because of most of the people are engaged in agricultural sector.

8. Special incentive should be given to the farmers in the study area for modern agricultural inputs especially towards the use of tractors, use of HYVs of seeds, consumption of fertilizers and other modern implements. In this regard the concerned Agricultural Department can play an effective role.

9. There are obtained that the no availability of canal or surface water throughout the district.

10. It has been observed that uneven, uncertain and irregular rainfall in study area.

11. In view of the growing unemployment problem, a section of educated unemployed youths have also started as advanced scientific farming with using advanced agricultural techniques in sugarcane cultivation, pomegranate, banana
and mango plantation and new commercial crop like vegetables and other fruits on commercial basis in order to get more profit from small area of land.

12. Introduction of vegetable gardening on commercial basis in vicinity of Krishna and Nira river and irrigated areas of the district by farmers of immigrant origin, have contributed significantly for status of economic development of the district.

13. It has been observed that the HYVs of seeds of jowar is not cultivated throughout the study area, but other crops having high market value, especially vegetables are cultivated in areas of the district.

14. The low-lying areas are devoted to sugarcane by the farmers, which they are cultivated in irrigated areas.

15. The high agricultural productivity has been found in southern part of the district along the Krishna river especially in Karad tahsil and northern part of the district along with Nira river, particularly in Phaltan tahsil. The medium agricultural productivity areas are found in Khandala and Jaoli tahsils. The other tahsils like Koregaon, Patan and Satara fall under medium agricultural productivity which are facing the problem of rain water deficiency. The low agricultural productivity has been experienced in the Mahabaleshwar tahsil. The Mahabaleshwar is hilly and undulating area, heavy rainfall so facing soil erosion problem. The very low agricultural productivity areas are found in Man and Khatav tahsil. Because these tahsils have drought affected area so shows a very low agricultural productivity.

16. The number of farmers has been using old and inefficient methods and techniques of farming. Only in the few, farmers have started adopting improved implements like iron ploughs, sugarcane crushers, pumping sets, fodder cutters, tractors, power tiller, etc.

17. Soil fertility has been declined due the continuous cultivated same crop in the same land such as in Karad and Phaltan tahsils having continuously sugarcane cultivated, over use of water as a result salinization and water logging occurred.

18. It has been observed that the farmers consider agriculture as a source of life rather than a business proposition. Therefore development remains at a low level.

19. The analysis on innovative techniques in agriculture that the farmers prefer to use irrigation for multiple cropping and majority of them use fertilizer for higher
production of crops, especially sugarcane, fruits and vegetables cultivation which is prepared on commercial basis.

20. It has been observed that Karad and Phaltan tahsils of Satara district has some advantages because of its favourable situation like topography, soil and climatic condition for growing different commercial and horticultural crops, especially sugarcane, banana plantation and vegetables.

21. Declining the fertility of soils in the tahsils of Karad, Phaltan, Jaoli, Patan and Mahabaleshwar due to the over use of water, fertilizers and hilly areas soil erosion due to the high rainfall received in short period.

22. It has been observed that the poor management of soil and technological gaps in practices of some crops e.g. only traditional crops like bajra, jowar and pulses are cultivated in Man and Khatav tahsils.

23. The level of agricultural development is observed to the composite $Z$- Score indicates that the positive values are found in the tahsils of Karad, Phaltan, Satara, Wai, Koregaon, Man and Khandala. On the other hand, the negative values are found in Mahabaleshwar, Jaoli, Patan, and Khatav tahsils. Out of the positive values with the highest composite $Z$-Score value, Phaltan tahsil in 1975-76 and Karad tahsil in 2010-11, i.e. 0.76 and 0.51 respectively. On the other hand, highest negative value is recorded in Mahabaleshwar tahsil in 1975-76 and Man tahsil in 2010-11, i.e. -0.53 and -0.32 respectively.

24. The increasing pressure of population on land is an important demographic factor responsible for low development of agriculture. Hence, agricultural sector has become overloaded and this has adversely affected the agricultural development.

25. It has been observed that the sustainable agricultural development in the study area is not yet achieved. But, there is still vast scope for sustainable agricultural development in the study area by using inputs like bio-fertilizer, use of micro irrigation system and applying proper scientific crop rotation methods. There are also enough scope for multiple cropping with 200 per cent cropping intensity that is cultivation of two or three crops in the same plot of land is not done especially due to lack of irrigation facilities and lack of investment. There is immense scope for production of cash earning with market demand crops like grape, ginger, pomegranate, turmeric, flowers. Moreover, enough scope for development of horticulture, floriculture and livestock farming etc. in small
operational holdings of Satara district. But motivation towards such type of farming and proper training is not imparted to the farmers. Moreover, irrigation potential is also high in the study area as the district has many constructing the nala building, Kolhapur type bandaras in hilly and plateau areas, diverting the river water outside the drought prone areas, etc. Thus, the Satara district has tremendous scope for sustainable agricultural development using proper agricultural practices.

8.3 Suggestions

The analysis of made in the work provide not only the existing transformation and development status of agriculture in Satara district of Maharashtra. It is also attractions out certain post-observational ideas that need the attention of both the future planners and researchers. These ideas are bounded below in the form of observations or suggestions for consideration.

The following suggestions are recommended for improving the existing land use system that may positively help in a balanced agricultural development of the district.

1. Firstly, any kind of agricultural development programme in the district needs strategies for agricultural planning. Therefore, proper crop calendar should be prepared considering the edaphic, and physiographic and climatic conditions at micro level in the district.

2. The Satara district has been witnessing a rapid growth of population resulting in a tremendous pressure on agricultural land resource. Therefore, the scope for horizontal expansion of agriculture is limited; the only way to feed the growing millions is by increasing production through increase in intensity of cropping, using modern techniques.

3. Significant proportion of fallow land available in Jaoli, Khandala, Khatav and Man tahsils maintains the scope for future utilization in agriculture through implementation of innovative practices and suitable crop choice like fruit farming system.

4. The government should give up top the priority to develop the irrigation facilities in central and south-eastern part of district in its plan and policies in order to invigorate Indian agricultural technology.

5. The peasants of this area should be guided and trained for the use of micro irrigation systems such as drip, sprinkler etc. Which is save water increased
production, helpful for maintain the quality of soil and decrease the problem of salinization and water logging.

6. Cropping pattern should be changed according to the needs of society, to suit the capability of land and highly returns of them.

7. The low water required improved varieties and well developed packages should be used for the different type crops.

8. There is enormous scope for mixed or multiple cropping in the study area. So, farmers should be trained up for choice of multiple cropping with higher income and employment generations.

9. Better scope for production of cash crops as well as market demand crops like grapes, pomegranate, mango, turmeric, potato, flowers including orchids on commercial basis should be provided.

10. Proper training should be communicated to the farmers to increase cultivation of profitable crops. Because of there are vast opportunities for the profitable diversification of existing cropping pattern and farming system.

11. The lack of proper scientific crop rotation is found in the study area. Therefore, training should be communicated to the farmer for proper use of scientific crop rotation to improve the fertility of soil and for high production.

12. To provide the critical technological knowledge about the specific areas of the crop production viz. seed treatment, balance fertilization and insect pest and disease management.

13. Overuse of chemical fertilizers is responsible for the degradation of soil in the study area. Hence, the use of organic manure and manage the fertilizer programme is one of the essential requirement of study area.

14. The training of adequate soil and health management practices and proper and efficient water management should be taken for sustainable agricultural development in the region with advanced agricultural inputs.

15. Special attention is to be given to increase the cropping intensity in almost all the tahsils of the district. There are very urgent needs of cultivating sufficient rabi crops by using irrigation, fertilizers, machineries etc. mainly in bajra fields during winter period, when they remain uncultivated. This can help not only in increasing the intensity of cropping but also can upgrade the general economic status of the farmers.
16. The provision of irrigation facilities and other modern inputs, so that educated youths may be easily attracted towards agriculture.

17. The control over of the distributors and the private in the agricultural marketing system should be replaced by a well-organized state controlled marketing system. Besides, the individual and fragmented small farming system should be organized into cooperative farming system, so that agricultural innovation and modernization programmes can be easily adopted.

18. Market hubs and cargo hubs should be constructed at Karad, Satara towns which are connected by roads and railways.

19. Storage facilities should be provided for the storage of fruits and vegetables.

20. To provide the technological knowledge for the sustaining natural resources like soil, water etc. with increased efficiency.

21. To provide the agricultural education, research and training and motivation of the farmers by efficient extension work are very much essential in the cases of all groups of farmers. Sufficient helpline should be provided by the government and regular field visit should be made by the department officially, so that they can guide the farmers in the application of the different agricultural programmers.

22. The vegetable cultivation of the area needs a special commercial thrust. The farmers of immigrant origin mainly cultivate vegetables on commercial basis where transport facilities are lacking for earning cash from sale of the crops in the market. Proper infrastructural and transport facilities should be developed.

23. Agriculture is the main source of economy in study area; therefore, there importance should be given to develop agriculture more and more to mitigate the demand of people. On the basis of the findings the basic observation is that the overall agricultural development as well as agricultural modernization is a need for lowering physiological density under existing land use and cropping pattern. Here, it may be noted that either the net sown area is to be increased for lowering the physiological density or a substantial proportion of workforce is to be motivated to other non-agricultural occupation, thereby lowering the agricultural dependency and keeping the physiological density unaltered.

Thus, the present study is considered as a representation of the existing agricultural growth and development scenario of Satara district of Maharashtra. It is, however, expected that this work will encourage the researchers working in the field of
agricultural geography to undertake more studies intensively. It is worth mentioning in this connection that spatial analysis alone may not be enough for balanced planning for development of a very complicated sector like agriculture, unless it is properly supported by structural analysis of the related factors along with micro physiographic analysis. Therefore, in-depth studies considering physical and human factors are of ultimate necessity for steady agricultural development in Satara district.