CHAPTER – VII

SUMMARY AND CONCLUSION

The present study is concerned with the different aspects of agricultural technology and its impact on agrarian structure and production in Solapur district of Maharashtra State. According to the objectives of the study different methods and techniques are used to study the above mentioned theme. After studying the agricultural technology and its impact on agrarian structure and production, the important observations and findings of the preceding Chapters are presented below in summarized form.

7.1 SUMMARY

The findings giving the general geographical set-up of the study area are based on the secondary published data.

Physiography of an area is one of the primary determinants of agricultural technology directly and agrarian structure and production indirectly of the study region. The relief and structure influences the climate, soil types etc. and economy of the region, where the terrain has comprised diverse land forms and lithography. The three most significant aspects of terrain, namely altitude, slope and drainage pattern, exercise both a direct and indirect influence on agricultural land use. The effect of terrain operates, particularly through altitude, rugged relief and slope, which determines the area, unfit for irrigation technology and farm mechanization.

On the basis of physical set up, the region is divided into three major physiographic divisions, i.e. hilly region, plateau region and low land region.

There are no evidences of any structural disturbances such as folding and faulting. The hilly region in the western and south-western parts occupied by Mahadev ranges and Shukracharya ranges. In the north-eastern part of district extended Balaghat range. The average height of the plateau region is ranging from 450 to 600 meters. The low land region is occupied by the Bhima river and its tributaries. The plain area in the district covers about 20 percent of the geographical area of the district.
The Bhima forms the main river system of the study region. The river Bhima enters into Solapur district near Jinti village of Karmala tahsil. It joins the tributaries of Nira, Man and Sina within the district. The Bhima and the Sina are the most important rivers from the point of agriculture production.

Climate is one of the most significant physical determinants of agriculture, as it affects the availability of water for irrigation. The climate of the study region is characterized by a general dryness of the major part of the year. Climatically there are four seasons in the district, such as summer season, the south-west monsoon, the post-monsoon season, and the cold weather season. The month of May is generally, the hottest month of the year, while lowest in December. Sometimes, the temperature is recorded more than 40° C. More than 80 percent annual rain is concentrated in the month from June to September. Where maximum rainfall is about 655.3 mm at Akkalkot in the south-eastern border of the district, while the minimum amount of rainfall is registered 413.7 mm at Malshiras near the western border of the study region. Co-efficient rainfall variability ranges from 25.02% to 36.28% in the district. It is highest in Malshiras (36.28%) and lowest in S. Solapur (25.02%) tahsil. The highest intensity of rainfall is marked in Mangalweda (15.71 mm) and lowest intensity of rainfall is found in Akkalkot (11.10 mm) tahsil. The average rainfall intensity of district is recorded 13.25 mm.

The trap basaltic lava which are covered by thin mental of soil almost everywhere in the study region. The study of soils is essential in the analysis of irrigation technology, as irrigation agriculture depends on the control of moisture of soil. The soil information is necessary to judge the choice of crops, application of fertilizers, cultivation and irrigation scheduling. Three types of soils are observed in the district, i.e. black soils, Barad or Coarse Grey soils and tambadi or Reddish soils. Where black soils are grouped into two types such as medium black soil, and deep black soils. Both types of soils are noticed in central and eastern part of the district. While barad soils found near the ranges of hills in the southern part of Malshiras and Sangola tahsils.

The demographic factors are play vital role in the agricultural technology. The attitude of the people, mainly farmers are also important factor, which determines the adoption of innovation in agriculture. Highest population concentration is marked in N. Solapur tahsil (24.48%) and lowest in Mangalweda (4.76%) tahsil in 2011. In the year 2011, the sex ratio of Solapur district is marked 938 females per 1000 males. For
the year 2011, the rural density of population was 201 persons per sq.km., while it was 100 persons per sq.km. in 2001. The size of farm is a matter of great importance to success in agricultural and for accelerating agricultural production by applying modern farm technology. The rate of adoption of technological innovations is marked by influenced by the existing structure of land holding. Less than one hectare of land in un-irrigated area is registered 3.85% and 14.88% in irrigated area. About 83.12% of total holding are below 5 hectares in size, comprising more than 90% of irrigated area. Large size of class (10 and above hect.) constitute 4.58% of total holding.

The study region has development of irrigation, yielding crop varieties, the improved methods of crop fertilization, use of pesticides, improved iron plough, tractors, electric pumps, etc. Among these inputs, irrigation is the single most important factor contributing towards raising output.

The irrigation is the main axis around which the whole agricultural activities revolve. The Solapur district has different sources of irrigation. Well irrigation has significant position in the overall irrigation from well 70.24, 67.54, 80.14, 72.00 and 68.27 percent area was irrigated from 1971-72 to 2013-14. Canal is one of the source of irrigation, which ranges between 14.80% in the year 1991-92 to 20.99% during the year 2013-14. The predominance of lift irrigation is confined in north-western and central part of the district. It contributes about 9.27% of net irrigated area of the district. Area under lift irrigation is increases 5.81% during the period of investigation. The high concentration of lift irrigation is observed along the Bhima and Sina rivers. The tank irrigation in the district is just occupied 0.38% of the net irrigated area of the district. Other sources of irrigation, which contributed 0.48% in 1971-72 as against 1.09% during the year 2013-14 and marked 0.61% increase during the period under study.

The study region has different method of irrigation. The surface irrigation method is generally practiced in the Solapur district. Comparatively this method is less economic. The surface and overhead methods, i.e. drip and sprinkler irrigation methods are modern techniques in the field of irrigation. The area under drip irrigation is various in tahsil to tahsil. Where area under this irrigation method is recorded 280.62% increase during the period under consideration. The highest percent of growth in area under drip irrigation is registered in Karmala and lowest in N. Solapur tahsil. The district comes under the rain-shadow region, eastern part of western ghat. Drought and scarcity condition are very common. In view of this, use of
drip irrigation becomes essential. Therefore, drip irrigation is become popular among the farmers’ day by day.

The farmers in the study area use the different types of agricultural implements for the agricultural operation. The nature and intensity of agriculture mainly in irrigated area, has been determined by important implements. The density of each agricultural implements per 1000 hectares is worked out. The density of wooden plough (below 100) is found in Madha and Barshi, while high density (Above 200/10000 hct. cultivated area) is marked in Akkalkot, S. Solapur, Mohol, Karmala, and Pandharpur tahsils. Density of iron plough varies from 195/10000 hct. in Karmala to 425/10000 in Barshi tahsil in 1993-94. While in 2013-14, high density of iron ploughs is marked in Barshi in 2013-14.

Fig. 3.10 A & B reveals the distribution of seed-cum fertilizer drills in the Solapur district. High concentration (Above 10/10000 hect.) of seed-cum fertilizer drills are found in Karmala and Malshiras tahsils. The density is as high as 25 in Malshiras and low as 6 in Barshi in 2013-14. All eleven tahsils are marked overall increase of seed-cum fertilizer drills during the year 2013-14.

Fig. 3.11A reveals that the high density of threshers (Above 25 threshers/10000 hect. of cropped area) is confined in Karmala, Barshi and S. Solapur tahsils, medium density (15-25/10000 hect. of cropped area) is registered in Sangola, Mangalweda, Pandharpur, and Malshiras and Mohol tahsils. Low density (Below 15) is experienced in Madha, N. Solapur in 1993-94. During 2013-14, there is marked considerable change in the density of threshers/10000 hect. cropped area. The district with higher number of threshers/10000 hect. of cropped area is mostly in eastern part, medium density (20-30) is noticed in Sangola, Mohol, Pandharpur, Mangalweda and Akkalkot tahsils in 2013-14.

The average density of plant protectors in the district is marked 25 and 37/10000 hect. of cropped area in 1993-94 and 2013-14 respectively. In 1993-94, there are seven tahsils, namely Madha, N. Solapur, Pandharpur, Malshiras, Sangola, S. Solapur and Akkalkot having higher density of plant protectors than mean (25), medium and low density (15-30 and below 15) is observed in Mohol, Madha, S. Solapur and Mangalweda, Barshi, Karmala tahsils respectively in 1993-94.

During 2013-14, out of the eleven tahsils, Malshiras, Pandharpur, and Sangola tahsils have changed their level, of which Pandharpur and Malshiras indicated
downward shift and Sangola tahsil marked upward shift, from medium to high during the period of investigation.

Fig. 3.13A depicts the spatial distribution of electric pump-sets in study area in 1993-94. The high density than mean (480/10000 hect. of cropped area) are observed in Madha, Barshi, Mohol, Pandharpur, Malshiras, Sangola, Mangalweda tahsils in the 1993-94. While Fig. 3.13B show the temporal changes in electric pumps in the district. The high (above 800 electric pumps/10000 hect. of cropped area) changes in electric pumps sets are noticed in the Pandharpur, Madha and Mohol during 2013-14. While medium change (500-800 electric pumps/10000 hect.) is observed in Barshi, Malshiras, Sangola and Mangalweda tahsils during the same year.

Density of tractors/10000 hect. of cropped area varies from 45 in Madha to 160 in Pandharpur and 100 in Barshi to 260 in Malshiras in 1993-94 and 2013-14 respectively. High density (140/10000 hect.) of tractors is recorded in Malshiras, Pandharpur tahsils in 1993-94. Whereas, the high density of tractors/10000 hect. of cropped area is marked in Malshiras, Pandharpur and Sangola tahsils during 2013-14. Medium density (150-200) of tractors is noticed in the Madha, Mohol and Mangalweda tahsils. The low density of tractors/10000 hect. of cropped area is experienced in Barshi, N. Solapur, Karmala, S. Solapur and Akkalkot tahsils during 2013-14.

Table 3.7 depicts that highest use of high yield varieties of seeds is marked by wheat (1592 Quintals), followed by other oil seeds (1340 Quintals), total pulses (490), Jowar (475 Quintals), Rice (190), Sunflower (102 Quintals), and Cotton (30) during the year 1993-94. The use of high yield varieties of seeds is increased by 3.42 time in 2003-04 and by 1.99 times in 2013-14. Rice has marked 52.63 percent decrease in its distribution in the district from 1993-94 and 2013-14.

Table 3.9 shows that the consumption of fertilizers in the study region has increased tremendously from 27867 M.T. in 1993-94 to 362237 M.T. in the year 2013-14. The consumption of nitrogenous fertilizers is marked upward trends in the period investigation. The highest consumption of nitrogenous fertilizers are marked 180512 M.T. during the period of 1994-2000 and lowest during the year 2006-14. The consumption of potassic fertilizer increased 10.34 times during the study period. But in the year 2006-14, the consumption of same fertilizers is marked 12695 M.T. decrease in district. The highest fertilizer consumption kg/hect. is registered in
Pandharpur tahsil (222.58 kg/hect.), lowest in Akkalkot (63.29 kg/hect.) in the year 2013-14.

Table 4.1 reveals that out of the total geographical area, about 13.03% of its total area is non-arable in the year 1993-94 as against 9.71% in 2013-14. The proportion of arable land is 86.97% in the year 1993-94 and it increases upto 90.29% during the year 2013-14. Some changes in the general land use have been observed during the period under investigation. The area under forest has decreased by 0.21%, where recently agricultural technology particularly irrigation technology are made available. The negative changes is observed in other uncultivated land by 3.83% and fallow land by 2.21%, while positive change in area not available for cultivation by 0.72% during the period under consideration. The proportion of net sown area was 70.97% in 1993-94 and it has increased by 5.53%. The basic benefit of agricultural technology is that it will increase the land under cultivation.

Table 4.2 shows that the highest non-agricultural land use is noticed in Mohol tahsil (13.13%) and lowest in Akkalkot (0.71%) tahsil in the year 2013-14. Above district average (7.46%) non-agricultural land use is found in N. Solapur, Mohol, Pandharpur, Sangola tahsils. While below district average non-agricultural land is noticed in Karmala, Madha, Barshi, Malshiras, Mangalweda, S. Solapur and Akkalkot tahsils.

Positive changes in area under potential land use is marked in Madha, N. Solapur, Pandharpur, Mangalweda, S. Solapur and Akkalkot tahsils between 1993-94 to 2013-14. While negative changes are experienced in Karmala, Barshi, Mohol, Malshiras and Sangola tahsils during the same period.

During the year 1993-94, the highest area in agriculture land is registered in Akkalkot (98.42%) tahsil and lowest in Sangola (81.19%) tahsils. On the contrary this, in the year 2013-14, whereas the highest area under agriculture land is found again in Akkalkot (95.65%) and lowest in Sangola (77.36%) tahsils. Whereas Karmala, Madha, Barshi, N. Solapur, Mohol, Pandharpur, Malshiras, Mangalweda and S. Solapur tahsils are registered 87.45%, 90.93%, 89%, 89.06%, 85.19%, 85.70%, 87.25%, 88.60% and 92.89% area under agriculture in 2013-14. The induction of modern technology in the district has brought a change in general land use.

The gross cropped area has been increased by 9.23% (103053 hect.). It may be attributed to the fact that the agricultural technology has played significant role in the horizontal as well as vertical expansion of crop land in the district. The overall
cropping pattern of the district was dominated by food grains during 1993-94. After the gap of twenty years, i.e. 2013-14, few changes in cropping pattern is noticed in the study area. The percentage share of cereal crop was 75.64% (1993-94) and 67.24% (2013-14) of the total gross cropped area. Jowar is the main cereal crop of the district, which cover about 66.30% during 1993-94, as against 56.25% during 2013-14. Wheat covered about 4.33% and 4.58% of the total cropped area respectively in 1993-94 and 2013-14. Bajara occupied 2.25% and 3.30% during 1993-94 and 2013-14 respectively.

The percentage area shares of pulses taken together, increased consistently from 5.11% (1993-94) to 7.86% (2013-14), the increase being the sharpest in the case of all selected pulses.

Fig. 4.2 shows that the change in cropping pattern in the study region during the period under study. The positive change was found for the crop i.e. Wheat (0.25%), Bajara (1.05%), Maize (0.47%), Gram (1.21%), Tur (0.43%), Sugarcane (1.5%), Fruit and Vegetables (1.44%), Cotton (0.37%), Sunflower (1.36%). The negative change was noticed for the crops i.e. rice, Jowar, other cereals and other crops and change was 0.11%, 10.05%, 0.01%, 0.04%. All over, it may be concluded that the changes in cropping pattern shows that changing the farmers’ attitude and impact of agricultural technology are responsible.

Table 4.4 shows that both positive and negative changes in the share of HYVs of rice, Jowar, Wheat, etc. crops in total gross cropped area is marked in the district. The positive change in HYVs of rice crop is marked in Mohol, S. Solapur, Pandharpur tahsils whereas negative change is registered in Akkalkot, Mangalweda, Barshi, Sangola, Malshiras and N. Solapur tahsils between 1993-94 and 2013-14. While positive change in HYVs of Jowar crop is recorded in Karmala, Akkalkot, S. Solapur, N. Solapur, Mohol, Mangalweda and Barshi tahsils. The negative change in area under HYVs of wheat is recorded in Akkalkot, S. Solapur, and Barshi tahsils, while positive change is observed in N. Solapur, Karmala, Mangalweda, Mohol, Sangola, Pandharpur, Malshiras and Madha tahsils.

Out of the total cropped area below 5% share of HYVs of sugarcane in gross cropped area is marked in Akkalkot, Barshi, Madha, whereas 5 to 8% share is marked in S. Solapur, N. Solapur, Mohol, Karmala and Mangalweda tahsils. Above 8% share of HYVs of sugarcane is took place in Sangola, Malshiras and Pandharpur tahsils in 2013-14.
During 1993-94, areas of high diversification were found in Barshi, Malshiras, N. Solapur and South Solapur, moderate diversification was marked in Karmala, Sangola, Pandharpur tahsils. Low diversification was marked in Mangalweda, Akkalkot, Mohol and Madha tahsils. During 2013-14, moderate to low crop diversification was marked in Karmala, high to low in Barshi, low to moderate in Madha, Mohol and Mangalweda tahsils.

In the year 1993-94, two crops combination zones are noticed in Madha, N. Solapur tahsils, where during 2013-14 same crop combination are observed only in Barshi tahsil. Three and four crop combination are recorded in Malshiras, Sangola, Akkalkot tahsils in 1993-94. While same crop combination zone is registered in Madha and Malshiras, Sangola tahsils respectively (2013-14).

Table 5.1 reveals that Solapur district has Maharashtra’s lowest yield in rice, wheat, bajara, etc. crop. The average yield of rice was 900 kg/hect. in 1993-94, decreasing up to 350 kg/hect. during 2011-14 and marked 61.11% decrease during the study period. The average yield of wheat increased from 1350 kg in 1993-96 to 1590 kg/hect in 2011-14. The percentage yield of jowar is ranked second amongst selected cereal crops.

The per hectare yield of tur and gram are increased from 492 kg and 680 kg/hect. and 556 kg to 685 kg/hect. during 1993-96 and 2011-14 respectively. The average per hect. yield of sunflower was 975 kg/hect in 1993-96, which in increased up to 1260 kg/hect. in 2011-14, which has marked an increase of 29.23% during the period of investigation. The yield of sugarcane is 8005 M.T./hect. during 1993-94 and increased up to 86 M.T./hect. in 2011-14.

Table 5.2 shows that the total production of rice in 1993-94 was 700 M.T., which has decreased by 200 M.T. in 2013-14. Where the production of rice was recorded 71.42% decrease since last twenty years. The production of wheat has marked 1.32 times increase from 1993-94 and 2013-14. The production of Jowar was 427900 M.T. in the year 2013-14. The production of jowar has marked 40.43% increase during the study period. The total production of Bajara was 3010 M.T. during the year 2013-14. The production of Maize has registered 3.00 times increase during the last twenty years.

The production of gram has marked 1.12 times increase, from 17400 M.T. to 19600 M.T. in 2013-14. The total production of Tur was 9670 M.T. during 2013-14.
The production of sugarcane was 26,35,200 M.T. in the year 1993-94 and 1,74,68,690 M.T. in 2013-14.

The very high productivity of Jowar was noticed in Mangalweda tahsil in 1993-94, whereas in 2013-14, same productivity of Jowar was marked in Madha and Mangalweda tahsils. Very low productivity of wheat was registered in Akkalkot in 1993-94 while very low wheat productivity was marked in Barshi and Mangalweda tahsils in 2013-14. High productivity of gram productivity was marked in N. Solapur and Mangalweda tahsils in 1993-94. Whereas, high productivity of gram was found in Mangalweda tahsil in 2013-14. Moderate productivity of sugarcane was confined in Sangola, Karmala, Mohol, N. Solapur and S. Solapur tahsils.

For the micro-level study of agricultural technology and its impact on agrarian structure, where 240 farmers are selected from the study region. While selecting sample farmers’ due weightage is given to large, medium and small size cultivators. The use of modern technologies and inputs are depending on the size of holding of farmers. It is noticed that about 83.33% farm house holds belonging to size class small and medium together constitutes 40.66% of the total cultivated area. On contrary, 16.67% of farm house holds of size class large control 59.34% of the total cultivated area.

Table 6.6 reveals that among medium size land holders 58.13%, 8.33% and 33.34% sample farmers are used surface, drip and sprinkler irrigation method respectively during 2013-14 small size land holders, where 82.14%, farmers used surface irrigation method and 7.14% and 10.72% are adopted drip and sprinkler irrigation method. In case of large size farmers, where 17.50%, 32.50% and 50% used surface, drip and sprinkler irrigation method respectively.

Table 6.7 shows that out of 140 small size land holders, about 52.14% farmers are used wooden plough, and 22.14% iron plough in 2014-15. While proportion of electric pumps, sprinkler and other implements are used 15.11%, 1.42%, and 8.57% respectively. Where 6.66% and 12.5% medium and large size farmers are used drip irrigation respectively. 10% and 7.5% sprinkler sets are used by both size of farmers respectively.

It is noticed that high use of chemical fertilizers is marked 31.57% in the sugarcane, followed by 26% wheat, 14.28% fruit and vegetables, 7.51% jowar, 6.26% for sunflower compost fertilizer used 21.91%, 19.17%, 13.69% 10.95%, 16.73%,
6.84%, 4.10%, and 6.84 of Jowar, Wheat, Sugarcane, Cotton, Fruit and vegetables, Sunflower, Groundnut, and Chilies respectively.

Table 6.10 shows that HYVs of Jowar is the first ranking crop in all size of land holding farmers, wheat covered 16.66%, 33.33% and 23.93% area in small, medium and large holding farmers. HYVs of sugarcane is covered 3.80%, 4.18% and 12.35% all size of land holders respectively.

Table 6.11 depicts that having the same environmental, production of traditional jowar is 1980 kg/hect., whereas C8H-18 HYV of jowar obtained 3240 kg/hect., with 1160 kg absolute increase per unit of area. In case of traditional wheat is registered 2250 kg/hect., while HYV of wheat is marked 3290 kg/hect., with 1040 kg increase. In case of sunflower, the production of HYV of sunflower is increased 47.43% than the traditional variety of sunflower.

RECOMMENDATIONS

In the context of the findings stated above, some recommend for better use agricultural technology and agricultural production have been made as under-

Solapur District is located in a drought-prone area. There may be prolonged breaks of rain lasting over the greater part of July or August. The beginning of the rains may be delayed considerably over the large part of the region. It is unevenly distributed over the region. Though water scarcity is a serious problem in crop cultivation. It is recommended that the farmers should use the mulching techniques to minimize evaporation. Drip irrigation system is most useful in getting good yield during the water scarcity period. Today well and bore-well irrigation are the more common sources of irrigation in the district. Therefore, to strengthen these sources, the water-shade development programmes need to be implemented on a large scale in this district.

The problem of daily shortage of electricity is very serious. Therefore, it is recommended that to overcome this difficulty the use of fuel engines, solar plant, etc. may be made as an alternative to the electricity.

In the drought-prone region, drought resistant varieties of cereal, pulses, oil seeds, etc. crops may be cultivated.

Mechanization bring about technical advancement in agricultural operations. Increasing use of machines and tools would make the farmers conscious of improved
technology. Though Government should arrange the training programmes regarding
new trends and techniques, such as drip and sprinkler irrigation, use of HYV and
fertilizers, plant diseases and protection, etc.

Price of HYV of seeds are not affordable to the small and marginal farmers. Therefore, Government should provide high yielding variety seeds to the poor farmers on concession. Government should make it clear to get the original improved seeds to all the farmers on proper time.

Land is the significant productive asset in rural areas and small and marginal farmers are very poor. To improve their economic condition poverty alleviation programmes should be implemented in the district.

It is very necessary to provide agricultural technology to the study region, which may suit to existing physio-socio-economic setup.

Ground water is one of the source of irrigation in the district, therefore, ground water potentiality should be scientifically assessed and map.

The cropping pattern in the irrigated area has to be altered and crop like fruits, vegetables, etc. should be increased to get more yield.

The efforts are to be taken to popularize the use of mechanical and bio-chemical inputs among the farmers in the district.

The farmers of the district do not know the efficient and balanced use of agricultural inputs. In fact, the farmer know the success of farming based on modern technology would be depend upon. But unfortunately the farmer of the study region is not fully applying adequate manure and fertilizers to their field. The farmers should be made aware about the proper use of water and fertilizers.

Moreover, agricultural technology should be considered not only as security measure but also as a productivity measure.