Chapter V

Agricultural Land-Use
CHAPTER-V
AGRICULTURAL LAND-USE

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Chapter-V

AGRICULTURAL LAND-USE

5.1 Introduction:

Agricultural land-use is a proportion of area used to grow different crops during the agricultural year. In other wards cropping patterns are the extent to which the arable land under different agricultural activities can be put to use. Cropping pattern is, however, a dynamic concept as it changes over space and time because of it is a combine effect of physical, social, economic and technological factors at the particular time.

The study of crop association provides an adequate understanding of land and integrative reality that demands distributional analysis (A. Mohammad, 1978). The study of the agricultural land use not only provides base for understanding the complex structure of agricultural landscape of the region, but also helps for better planning. In this chapter effort is made to study the cropping pattern and overall change in cropping pattern, correlation between different agricultural land-use categories, ranking of crops, crop combinations changes, crop concentration and pattern of diversification.

Cropping pattern of the study region is typical of an underdeveloped agricultural economy. Variety of crops are grown in the study region. The overall cropping pattern of the region is outlined and it is followed by a discussion of the individual crops calculating the percentage of strength for each taluka derives the relative strengths of the crops grown. There is spatial variation in cropping pattern upon rainfall and soil condition therefore detailed analysis of each tillage crop based on quinquennial average and respective changes there in as following.
5.2 Cropping Pattern

Most of the study region comes under drought prone area, where seasonal and uncertain rainfall is the main characteristics. Therefore, agricultural of the area depend on irrigation. Implementation of new technological inputs, machineries, High Yielding Varieties of seeds, commercial crops, chemical fertilizer and irrigation facilities supported to the agriculture and agricultural pattern. The cropping pattern of the study areas are very typical because, both dryland culture and irrigated culture are directly governed by other geographical factors and modified by the emergent, social and economic circumstances. Therefore, present section deals with cropping pattern and changes of crops in the Solapur district.

The crops of the region are classified into –

A. Food-crops
B. non-food-crops

A. Food Crops:

Food crops are very dominant in cropping pattern of study region. During the 1995-2000, the district as a whole has 88.16 percent of area under food crops. The map 5.1 A shows the regional variations of food crops ranging from 70 to 95 percent of the total cropped area. High proportion of area under food crop was in Sangola, Pandharpur, Mohol, Malshiras and Mangalvedha talukas, i.e. above 90 %. The moderate area under food crops found in North Solapur, Barshi, South Solapur, Madha and Karmala talukas i.e. from 80 to 90 %, whereas low was recorded in the Akkalkot talukas, i.e. 80 percent.

The change that has occurred in food crop distribution during the period of investigation is shown in the map 5.1 B. The district as a whole has been gradually decreasing the area under food crops about 1.44 percent.
However, taluka level analysis reveals considerable changes; it is decreased in the talukas of Madha, Mangalvedha, South Solapur, Akkalkot, Barshi and North Solapur, ranging between 0.15 to 4.09 percent. But remarkable decrease is found in Karmala taluka (5.96 percent,) due to increase the area under sugar cane cultivation due to Ujani irrigation project. There are some positive changes found in Malshiras, Sangola, Pandharpur and Mohol talukas, in Malshiras, Sangola talukas it increased >4 percent.

During 1995-2000, total food crops occupy 80.85 percent of total irrigated area of study region. The high proportion of irrigated area under total food crops was observed in Mangalvedha, Pandharpur, Sangola, Malshiras talukas, i.e. >85 percent, whereas low in North Solapur, Barshi, Akkalkot, Karmala and Madha talukas i.e.80%.

Irrigated area under total food crops has decreased by 5.60 percent the district during the period of investigation. However, taluka level analysis reveals both positive and negative changes. Negative change is recorded in the talukas of Akkalkot, Madha, North Solapur, Barshi, Akkalkot, South Solapur, Mohol and Karmala. Remarkable decrease in area under food crops is found in Madha talukas (41.16 percent) followed by Akkalkot, (25.48%) due to increase in irrigated area under oil seeds and sugarcane, whereas it is lowest in Mohol(2.06 percent). While area under food crops are increased in Sangola, Pandharpur, Malshiras and Mangalvedha talukas (04 to18%).

I Cereals:

In this category jowar, wheat, bajara, maize are important food grain crops. Jowar is the major cereal crop of the region. During 1995-2000, the district as a whole there was 70.73 percent area under cereals which was higher than the state’s average of 45.61. The great dominance of cereals is due to dryland culture and low development of irrigation.
The spatial distribution and changes in the area under total cereals is depicted in map 5.2 A and B. Area under cereals was high in Sangola, Mangalvedha, Mohol and North Solapur talukas, i.e. above 75 % of total cropped area, whereas it was low in Barshi, Karmala and Akkalkot talukas, because the tendency of farmers is to grow oil seeds as a cash crop, particularly in Akkalkot and Karmala talukas and pulses in Barshi taluka due to development of dal mills and oil mills in the region concern.

During the period of investigation, the district as a whole has a decreased 0.88 percent of cropped areas under cereals. But it is surprise to note that some talukas have increased the area under cereal Mangalvedha, South Solapur, Sangola, Mohol, Malshiras and North Solapur talukas. High increase i.e. over 10 percent area under cereals is found in Mangalvedha. Whereas low in Malshiras and North Solapur talukas i.e.<5 percent. The very high decrease in area under cereals is found in Karmala taluka about 15 percent followed by Pandharapur and Barshi about 9.21 % and 7.27 % respectively, whereas low in Madha taluka.

During the 1995-2000, the district as a whole has 42.90 percent irrigated area under cereals. Spatial distribution is very uneven, ranging from 30.5 to 61.11 percent. The high proportion of irrigated area under cereals was observed only in Sangola taluka, i.e. 61.11 percent. whereas it was low in Barshi, Akkalkot, South Solapur, Mangalvedha and Madha talukas i.e. below 40 percent.

Irrigated area under cereals has decreased by 18.21 percent the district during the period of investigation. But regional analysis reveals both positive and negative changes. Negative change is recorded in Madha, Mangalvedha, Karmala, Barshi, Mohol, South Solapur, Akkalkot and Pandharapur talukas, ranging between 16.31 to 44.15 percent. Maximum negative change is found in Madha taluka, i.e. 44.15 percent,
followed by Mangalvedha, whereas it is low in Pandharapur and Akkalkot talukas i.e. below 20 percent. (Appendix- 1) Slight positive change is found in North Solapur, Sangola and Malshiras talukas, ranging from 0.51 to 1.49 percent,

The spatio temporal distribution of each cereal crop:

Jowar:

Jowar ranks first in the cropping pattern of the study region. Being a drought resistance crop, it is grown as rain fed as well as irrigated crop. It requires 27°C to 32°C temperatures and 500 to 1000 mm rainfall. It is sown in both kharif and rabi seasons. However, in study region it mainly in rabi season. It is sown in September and harvested in March. The very low percentages of kharif jowar is seen in the study region. It is a staple food in the region in addition provides dry fodder. Due to its extra ordinary quality, jowar of this region is famous as “Barshi and Mangalvedha Jowar” all over India. It is also called “Barshi shalu”. Spatial pattern of jowar is a reflection of topography, climate and irrigation facility.

During the 1995-2000, out of total cropped area, the district as a whole has 60.46 percent area under jowar, which is higher than the state’s average of 15.25 percent. High-cultivated area under jowar is found in Mangalvedha, Sangola, North Solapur, South Solapur and Mohol, Madha talukas, i.e. above 65% of the cropped area, moderate is only in Barshi taluka, whereas it is low in Karmala, Pandharapur and Akkalkot, Malshiras talukas i.e. >55 percent. There is only Malshiras taluka having less 50% of cropped area under this crop due to high proportion of sugarcane. [Map No.5.3 A] During the period of investigation, the district as a whole has seen slight positive change i.e. 1.12 percent, however taluka level analysis reveals considerable change.
SOLAPUR DISTRICT

JOWAR CROPPING
1995-2000

INDEX
% of total cropped area
Above 65 High
55 to 65 Medium
Below 55 Low

Region
Average: 60.46

Map No. 5.3 A

SOLAPUR DISTRICT

VOLUME OF CHANGE IN JOWAR CROPPING
FROM 1975-80 TO 1995-2000

INDEX
Increase in %
Above 15 High
7 to 15 Medium
Below 7 Low
Decrease in %
Above 10 High
5 to 10 Medium
Below 5 Low

Region
Average: 1.12

Map No. 5.3 B

SOLAPUR DISTRICT

WHEAT CROPPING
1995-2000

INDEX
% of total cropped area
Above 6 High
3 to 6 Medium
Below 3 Low

Region
Average: 4.31

Map No. 5.4 A

SOLAPUR DISTRICT

VOLUME OF CHANGE IN WHEAT CROPPING
FROM 1975-80 TO 1995-2000

INDEX
Increase in %
Above 3 High
1 to 3 Medium
Below 1 Low
Decrease in %
Above 2 High
Below 2 Low

Region
Average: 1.12

Map No. 5.4 B
The map 5.3 B reveals that out of eleven talukas, seven have registered an increase. High increase in area under jowar is found in Mangalvedha and Sangola talukas, i.e. >15 percent, whereas it is low in Madha, North Solapur and Akkalkot talukas. This positive change is largely due to introduction of high yielding variety of jowar seeds, moreover Mangalvedha is known as “Jowar kothar” of Solapur District.

The cultivated area under jowar decreased in Karmala, Pandharpur, Barshi and Malshiras talukas. High rate of decrease is in Karmala and Pandharpur talukas, i.e. >10 percent. Actually, these talukas are also traditional jowar growing talukas, however, since the development of irrigation facilities at present the farmers of these talukas have turned to the cultivation of commercial crops.

During 1995-2000, the Share of jowar was 23.24 percent of total irrigated in the district. However, spatial distribution varies from taluka to taluka. The high proportion of irrigated area under jowar was observed in Sangola taluka i.e. 43.56 percent, where as it was low in Barshi, Akkalkot, South Solapur, and Mangalvedha, talukas, i.e. < 20 percent. [Table No. 5.1]

The district as a whole has 8.63 percent negative change in irrigated area under jowar, during the period of under review. However, taluka level analysis reveals both positive and negative changes. Negative change is recorded in the talukas of Karmala, Madha, Mohol, Barshi, Mangalvedha, South Solapur, Akkalkot Pandharpur and Malshiras, ranging between 0.78 and 24.56 percent. Maximum negative change is found in Karmala taluka, i.e. 24.56 percent, followed by Madha, due to the increase irrigated area under non food grains, whereas it is low in Akkalkot, Malshiras, Pandharpur and South Solapur talukas, i.e. below 10 percent. Positive change is found in talukas of Sangola and North Solapur, i.e.14.39 and 9.34 percent respectively.
Wheat:

Wheat ranks second among cereals in the cropping pattern, during 1995-2000. Wheat is a rabi crop and requires winter temperature between 10\(^0\) to 20\(^0\). It can also be grown in areas, where rainfall is less than 500 mm with the help of irrigation. In the study region, post monsoon rainfall is not sufficient for maximum production. The extent of irrigation provided to this crop determines its areal extent and yielding capacity. Wheat is generally sown in October and harvested in the month of February.

During 1995-2000, wheat occupies only 4.31 percent of the total cropped area of the region, which is higher than the state’s average of 3.93 percent. However, within the district proportion of wheat varies from 2 to over 10 percent of total cropped area. The map 5.4 A reveals that high concentration was observed in Malshiras and Pandharpur talukas, i.e. 6 percent, due to irrigation development, whereas it was low is in Madha, Sangola, Mangalvedha, and Akkalkot talukas i.e. <3 percent.

In the case of wheat cultivation, the district as a whole has no major change is observed during the period under observation. The positive change in area under wheat cultivation is found in Pandharpur Malshiras North Solapur and South solapur talukas. Highest increase is found only in Pandharpur taluka, about 4.39 percent, followed by Malshiras. The North Solapur and South solapur talukas show negligible positive change in area under wheat cultivation, whereas rest of talukas registered very low negative change in area under wheat cultivation.

The share of wheat in irrigated area was 12.44 percent of the total irrigated area during 1995-2000 in the district. Spatial distribution is very uneven, ranging from 5.39 to 25.41 percent. The high-irrigated area under
### Table No. 5.1: % of Irrigated area under different crops 1975-80 & 1995-2000

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Source: Compiled by Researcher
wheat was observed in South Solapur taluka i.e. 25.41 percent. It was Moderate in Mohol, Karmala, Malshiras, North Solapur, Pandharpur and Mangalvedha, ranging from 10 to 20 percent, whereas it is low in Rest of talukas. [Table No. 5.1 ]

During the period of investigation, irrigated area under wheat has decreased by 3.09 percent in the district. However, taluka level analysis shows both positive and negative changes. Negative change is recorded in the Madha, Pandharpur, Sangola, Mangalvedha, Akkalkot, and Barshi talukas, ranging between 3.33 & 17.95 percent. Remarkable negative change is found in Akkalkot taluka i.e. 17.95 percent followed by Mangalvedha, due to the increase of irrigated area under oilseed and sugarcane respectively. Positive change is found in rest of five talukas ranging form 0.85 to 3.33 percent.[ Table No. 5.1 ]

Bajara:

It is an inferior kharif food grains and rank third among cereals in the region. Bajara is the most drought resistant crop requires less amount of rainfall i.e. 500 mm sustains on shallow, black lighter soil or inferior land. Generally, it is sown in June-July and harvested in September.

During 1995-2000, there was 3.35 percent area under bajara in the district, which was less than the state’s average of 8.01 percent. The map 5.5 A exhibits that the regional distribution of area under bajara varies, the high proportion of bajara observed in Malshiras and Sangola talukas i.e. over 6 percent, due to rainfall and soil conditions. It was moderate in Mangalvedha and Karmala taluka ranging between 3 to 6 percent, whereas it is low in rest of talukas.(Map-5.5 A)

During the period of investigation area under bajara decreased by 1.9 percent in the Solapur district. The map 5.5 B reveals that, 8 talukas registered negative trend. High decrease in area under bajara is in Sangola and Mangalvedha talukas i.e. >9 percent, because of inferior land in
Sangola, which was traditionally under bajara, is converted into fruit cultivation, which is profitable than bajara and in Mangalvedha it is converted into jowar. Moderate decrease is in Akalkot taluka. The Madha, Pandharpur, Mohol, South Solapur and North Solapur talukas have seen insignificant negative change. However it has increased by 5.52 percent in Malshiras talukas, due to the region lies in irrigated land and introduction of high yielding variety. Negligible increase in area under bajara is observed in Barshi and Karmala talukas.

Maize:

Maize is a mostly irrigated crop in study region. It requires 750 mm rainfall and medium to high quality soil. It is an important crop as it provides food for human being as well as fodder (Both wet and dry) to milch animals. It is grown in both kharif and Rubi season.

There was only 2.11 percent area under maize in the region during 1995-2000. However, spatial distribution of area under maize is varies. High proportion of maize was observed in Malshiras Sangola and Pandherpur talukas i.e. over 4 percent of cropped area whereas, moderate in Mohol and Mangalvedha talukas ranging from 2 to 4 percent of cropped area, whereas it was negligible in rest of talukas. (Map No.5.6 A)

The area under maize crop has increased by 1 percent in the district during the period under review. Out of 11 talukas of the region, eight talukas registered positive change in area under maize, high increase is observed in Sangola and Pandharpur taluka i.e. >3 percent, due to development of dairy industry, maize is used as fodder for milch cow, whereas low increase is observed in Mohol, Akkalkot North Solapur and Barshi talukas i.e.<2 percent. Highest decrease is observed in Madha taluka i.e.1.13 percent, due to lower prices of maize in market. [Map No.5.6 B]
During the 1995-2000, the district as a whole has 4.29 percent irrigated area under maize. High share of maize in irrigated area was in Karmala, Malshiras, Pandharpur and Magalvedha i.e., >5 percent due to development of irrigation and dairy farming, maize utilized as a fodder crop. It was moderate in Mohol and Sangola talukas, whereas it was low in remaing talukas i.e. below 3 percent.

Irrigated area under maize has decreased by 2.93 percent in the district during the period of investigation. However, taluka level analysis reveals considerable decrease. Negative change is found in the South Solapur, Madha, North Solapur, Mangalvedha, Mohol, Pandharpur, Barshi, Sangola and Akkalkot talukas, ranging between 1.09 & 11.54 percent. Remarkable negative change is found in South Solapur talukas i.e. 11.54 percent followed by Madha, due to lower prices. Irrigated area under maize increased in Karmala and Malshiras talukas, i.e. 2.37 and 0.90 percent respectively. [Table No. 5.1]

Pulses:

The variety of pulses i.e. tur, gram, udid, mung, matki, hulaga etc are cultivated in the study region. Normally pulses are cultivated in kharip season. These pulses are very useful in many ways. They serve as excellent nutritious food for human being, other remaining materiel is useful as fodder, locally called ‘kand bhuskat’ and are useful in order to maintain soil fertility. The soil and moisture requirements vary pulse to pulse but generally, tur is grown on fertile soil and hulaga on shallow soil. Mostly pulses are rain fed and sown as an inter crop.

during 1995-200, pulses occupies 8.77 % of the total cropped area of study region, which is less than the state’s average of 16.93 percent. The map 5.7. A reveals that the regional variation in the share of pulses cropped area, ranging from 3.75 to 22.36 percent, which is largely influenced by agro-climatic and edaphic conditions. In general,
proportion of area under pulses increases from west to east. The highest proportion of area under pulses was in Barshi taluka i.e. 22.36 percent, because of local availability of market due to development of dal mills in Barshi. The medium proportion was in Akkalkot, Karmala and Madha talukas, ranging from 7% to 15% of total cropped area, whereas low in rest of talukas, due to development of sugarcane and fruit farming.

During the period of investigation, area under pulses decreased by 6.53 percent in the district. In general, the importance of pulse cultivation has come down during last two decades in the study region, slight positive change in the area under pulses is found only in Barshi taluka, Otherwise rest of talukas show considerable negative change, ranging from 2.33% 14.4 percent (Map 5.7 B). High negative change in area under pulses is in Mangalvedha, South Solapur and Mohol talukas i.e. above 10 percent, whereas it is low in Karmala, Sangola and Akkalkot talukas i.e.<5 percent. This negative change is largely due to the shift towards crops like jowar, sugarcane, fruits and vegetables.

**Tur:**

For human beings and livestock tur is an important pulse crop as a nutritive food. It also constitutes important chain in rotation system of crops from the viewpoint of soil management (pawar 1989). It is sown in June / July and harvested in December / January. It requires moderate amount of rainfall and black to brown soil. Generally, this crop is grown as a rain fed crop and rarely supplemented by irrigation.

During 1995-2000, district as a whole have 3.26 percent area under tur out of total cropped area, which is less than the state’s average of 4.68 percent. The map 5.8 A exhibits the spatial distribution in area under tur, which is very uneven, ranging from below 1 percent to over 13 percent of total cropped area. Very high proportion of area under tur was in Barshi talukas about 13.76 percent because of impact of local market of Barshi.
It was high in Akkalkot taluka i.e. 6.29 percent. Moderate proportion of area under tur was in North Solapur about 3.97 percent, whereas it was below of the district average in rest of talukas.

During the period under review, district as a whole has 1.98 percent negative change in area under tur cultivation. However, taluka level analysis reveals negative change in all talukas except Barshi taluka ranging 1 to 6.98 percent. Remarkable negative change is found in South Solapur i.e. 6.98 percent followed Akkalkot, whereas it is below 2 percent in Karmala, Madha, Malshiras, Pandharpur, Mohol, Sangola and Pandharpur talukas. It indicates the changing tendency of farmers to grow other commercial crops along with sugarcane.

**Gram:**

Gram is also an important pulse crop for human being and helpful to increase fertility by dropping its leaves after maturity. It is rabbi crop among pulses. It requires medium to high quality and well discharging soil as well as cool climate of winter season. It is sown in October-November and harvested in February-March and grown as rainfed as well as irrigated.

During 1995-2000, the district as a whole has 3.23 percent share of gram in total cropped area, which is less than the state’s average of 3.66 percent. The taluka level analysis reveals uneven distribution, ranging from over one percent to over 6 percent of cropped area (Map 5.9 A). The proportion of gram was high in Barshi taluka i.e. 6.44 percent. It was moderate in Karmala, Madha, Pandharpur and Akkalkot taluka, ranging from 3 to 5 percent of total cropped area, whereas low in Malshiras, Mohol, Sangola, Mangalvedha, South Solapur and North Solapur taluka, i.e. below 3 percent.

During the period of investigation, the district as a whole shows slight (0.44 %) positive change in area under gram. However, taluka level
analysis reveals both positive and negative. Positive change is recorded in Barshi, Akkalkot, Pandharpur, Sangola, Karmala, Madha and Malshiras talukas. The maximum change is in Barshi talukas i.e. 3.23 percent, whereas it is low in Sangola taluka. Negative change is found in Mangalvedha, Mohol, South Solapur and North Solapur talukas. The maximum negative change is found in Mangalvedha taluka i.e. 3.09 percent due to farmer’s preference for jowar, which is well suited in edaphic condition. [Map No.5.9 B]

During 1995-2000, there was 4.07 percent irrigated area under gram in the district as a whole. Spatial distribution is very uneven, highest irrigated area under gram was in Barshi taluka i.e. 16.71 percent followed by Akkalkot, due to development of favourable agro-climatic condition and Dal mills. It was moderate in Karmala, Madha, Sangola and Mangalvedha talukas, ranging from 3 to 5 percent, whereas it was below 3 percent in rest of talukas.

District as a whole have 1.43 percent increase in irrigated area under gram form 1975-80 to 95-2000. The positive change is found in the talukas of Akkalkot, Mangalvedha, Mohol, Sangola, Karmala, South Solapur, Madha, Pandharpur, and Barshi, ranging between 1.17 & 5.93 percent. The high rate of positive change is found in Akkalkot taluka, followed by Mangalvedha, whereas it is low in Pandharpur, Malshiras, North Solapur and South Solapur talukas i.e.<3 percent [Table No. 5.1]

Non foodgrains:

Sugarcane:

Sugarcane locally called ‘oos’ is the second leading crop in the study region and ranks first among cash crops. Sugarcane occupies an important place in the economy of the district. There is 1000 crore yearly turnover from sugarcane in the study region. (Sakal 17/03/06) There are 17 sugar factories in the study region. Sugarcane requires twelve month
to mature and is planted in the month of December-January. Besides, adsali cane cultivation is also practised in the study region.

Sugarcane is a water loving tropical crop and requires high temperature, maximum moisture. Solapur district has favourable climate except rainfall and soil for sugar cane cultivation. It is grown well in areas of black cotton (regur) soil which has high moisture retreating power and where perennial sources of irrigation are available, these factors collectively determine the intensity of sugarcane cropping, despite the competition from food grains and other cash crops.

During 1995-200, share of sugarcane is 5.67 percent in the total cropped area of study region, which is more than the state’s average of 2.64 percent. It ranks second among irrigated crops next to Jowar. The map 5.10 A reveals that the spatial distribution of area under sugarcane, which is very uneven, due to uneven distribution of irrigation facilities. Very high proportion of area under sugarcane was in Malshiras and Pandharpur talukas i.e. above 15 percent, where canal irrigation facilities are developed due to the Nira right bank canal and Ujani canal. High proportion of area under sugarcane was in Karmala taluka i.e. 9.44 percent, due to backwater of Ujani project. It was medium in Mohol, Mangalvedha, South Solapur, Mohol and Akkalkot talukas, whereas low in Madha, North solapur, Barshi and Sangola talukas.

The map 5.10 B exhibits the pattern of change in sugarcane cropping in the region. There is considerable increase (more than three times) in area under sugarcane is found during the period under investigation. The district as a whole has 4.04 percent positive change but taluka level change varies. Positive change is found in all talukas except North Solapur. Remarkable positive change is found in Pandharpur taluka i.e. 13.65 percent followed by Karmala and Malshiras talukas, due to perennial water source.
SOLAPUR DISTRICT
GRAM CROPPING
1995-2000

INDEX
% of total cropped area
Above 5  High
3 to 5  Medium
Below 3  Low

Region Average: 3.23

Map No. 5.9 A

SOLAPUR DISTRICT
VOLUME OF CHANGE IN GRAM CROPPING FROM 1975-80 TO 1995-2000

INDEX
Increase in %
Above 2  High
Below 2  Low
Decrease in %
Above 2  High
Below 2  Low

Region Average: 0.44

Map No. 5.9 B

SOLAPUR DISTRICT
SUGARCANE CROPPING
1995-2000

INDEX
% of total cropped area
Above 15  Very High
9 to 15  High
3 to 9  Medium
Below 3  Low

Region Average: 5.67

Map No. 5.10 A

SOLAPUR DISTRICT
VOLUME OF CHANGE IN SUGARCANE CROPPING FROM 1975-80 TO 1995-2000

INDEX
Increase in %
Above 10  Very High
5 to 10  High
3 to 5  Medium
Below 3  Low
Decrease in %
Below 1  Low

Region Average: 4.04

Map No. 5.10 B
Moderate positive change is in Mohol taluka about 3.08 percent, whereas it is below 3 percent in Madha, Mangalvedha, Sangola, South Solapur, Akkalkot and Barshi talukas.

During 1995-2000, there was 21.64 percent irrigated area under sugarcane in the district as a whole. Spatial distribution is very uneven, ranging from 7.13 to 36.47 percent. High proportion of irrigated area under sugarcane is found in Mangalvedha, Pandharpur Malshiras and South Solapur talukas, i.e. above 30 percent, due fertile soil in river basins and development of perennial irrigation. It was moderate in Mohol talukas i.e. 21.48 percent, whereas it was low in North Solapur, Barshi, Akkalkot, Sangola, Karmala and Madha talukas, i.e. below 20 percent.

Irrigated area under sugarcane has increased by 9.54 percent in the district during the period of investigation. However, regional analysis reveals considerable variation in changes. Positive change in irrigated area under sugarcane is found in all talukas except North Solapur ranging between 2.18 to 28.19 percent. The high rate of positive change is found in Manglvedha taluka, i.e. 28.19 percent, fallowed by Pandharpur, due to development of surface irrigation, whereas, it is low in Barshi, Madha, Akkalkot and Sangola talukas. There was a considerable positive change was found in the study region, because of the Bhima Ujani project which is known as the life Solapur district and increase in the number of sugar factories. [Table No. 5.1]

**Fruits and Vegetables:**

Dry climate, limited water resource scarcity of rainfall on one side and increasing wants on other side both, these compel farmers to cultivate fruits and vegetables. The variety of fruits and vegetables is grown in the study region such as pomegranate, ber, grape, mango, guava, lemon, chikku, banana, custard apple etc. The Sangola is famous for
pomegranate, Madha for ber, Barshi for mango and custard apple, North solapur for grape. Thomson seedless, Sonlika are the famous varieties of grape, which earn valuable foreign currency.

The area under vegetables is meager in the region. Leading talukas in respect of area under vegetable are Madha, Mohol, Pandharpur, Karmala and South Solapur talukas.

The share of fruits-vegetable is 2.63 percent in the total cropped area in the district, but spatial distribution varies from taluka to taluka ranging from 1.23 to 6.35 percent of total cropped area. The map 5.11 A shows that, high proportion is in Pandharpur taluka i.e. 6.35 percent. Moderate proportion of area under fruits-vegetables is in Sangola, Madha, Mohol, North Solapur, Karmala and Malshiras taluka ranging from 2 to 4 percent, whereas it is low in Mangalvedha, South Solapur, Akkalkot and Barshi taluka, that is below 2 percent.

The region has experienced considerable positive change in hectare under fruit vegetable from 7921.2 hectare (0.65 percent) to 29232.8 hectares (2.63 percent) during the period under review. All eleven talukas show positive change in area under fruit cultivation, ranging 0.48 to 5.81 percent. The map 5.11 B exhibits that high rate of positive change is found in Pandharpur taluka i.e. 5.81 percent. It is Moderate in Sangola, Mohol and Madha ranging from 2 to 4 percent, whereas it is low in rest of talukas. Almost all talukas show positive change in area under fruit and vegetable as the farmers have adopted fruit crops because of suitable climatic and edaphic conditions, apart from Government policy to give subsidy to fruit cultivation and drip irrigation.

During 1995-2000, share of fruits-vegetables in irrigated area is 9.70 percent of the total irrigated area in the district. Regional distribution varies, ranging from 5.09 to 18.95 percent. High proportion of irrigated area was in Sangola and Mohol talukas, i.e. above 15 percent
due to favourable soil and climate. It was moderate in Barshi, Pandharpur and Madha talukas, ranging between 10 & 15 percent, whereas it was low in Akkalkot, South Solapur, Mangalvedha, Malshiras and Karmala talukas. [Table No. 5.1]

During the period under review, the district as a whole has 2.37 percent positive change in irrigated area under fruits-vegetable. However, taluka level analysis reveals considerable changes. Positive change is found in Sangola, Mohol, Mangalvedha, Malshiras, Barshi and Karmala talukas, ranging between 0.15 & 9.71 percent. The high rate of positive change is found in Sangola, due to development of drip irrigation and favourable environment for pomegranate cultivation, whereas it is low in Karmala.

Irrigated area under fruits-vegetables has increased in the entire study region as it is cash crops. The research scholar observed in his filed visit that farmers got more profit in fruit cultivation rather than cereal crops. One of the reasons is increasing literacy rate. Literate persons look at agriculture from the commercial point of view. Commercial farming helps to increase the standard of living.

B) NON-FOOD CROPS:

In the previous analysis the food crops are considered. This category of agricultural land-use consist the oil seeds, fibre, drugs-narcotics, miscellaneous non-food crops. Among the non-food crops fibre crops, drugs and narcotics, miscellaneous non-food crops occupy very negligible area, hence they are not analysed separately.

During 1995-200, the share of nonfood crops is 11.84 percent in the total cropped area of district, which is less than the state’s average of 29.10 percent. But Spatial distribution of area under non-food crops reveals considerable variation, ranging from 4.72 percent to 23.23 percent. High proportion of area under nonfood crops is observed in
Akkalkot, Karmala and Madha talukas i.e. over 16 percent due to area under oil seeds is high, whereas it is low in Malshiras, Pandharpur, Mohol, Sangola, Mangalvedha talukas. (Map 5.12 A)

During the period of investigation, the district as a whole has seen 1.44 percent positive change in area under nonfood crops. However, taluka level change varies and both positive and negative. Positive change is found in the talukas of Karmala, Madha, Akkalkot, Barshi, North Solapur, Mangalvedha and South Solapur, ranging from 0.15 to 5.95 percent. (Map 5.12 B) The highest positive change is found in Karmala taluka i.e. 5.95 percent, followed by Madha, because of increase in area under oil seeds. Positive change is negligible in the talukas of Mangalvedha and South Solapur. The negative change in area under nonfood crops is recorded in talukas of Malshiras, Sangola, Pandharpur and Mohol. The high rate of negative change is found in Malshiras and Sangola talukas about 4 percent because they loosed area under fibre and oil seeds.

During 1995-2000, the share of non-food crops was 19.15 percent in total irrigated area in the district. Spatial distribution is uneven, ranging from 6.60 to 45.57 percent. High proportion of irrigated area under total nonfood crops was in Akkalkot and Madha talukas, i.e. above 25 percent. Whereas it was low in Mangalvedha, Pandharpur, Sangola, and Malshiras talukas i.e <15 percent.

Irrigated area under nonfood crops has increased by 5.60 percent in the district during the period of investigation. Taluka level analysis reveals that the positive change in Madha, Akkalkot, Barshi, North Solapur, South Solapur, Karmala and Mohol talukas. The range of positive change is between 2.06 to 41.16 percent. The high rate of positive change is found in Madha and Akkalkot talukas, due to the increase of irrigated area under groundnut and sunflower.
It is low in North Solapur, South Solapur, Mohol and Karmala talukas, i.e. below 15 percent. Negative change is recorded in the talukas of Sangola, Pandharpur, Malshiras and Mangalvedha, ranging from 4.85 to 17.34 percent. Maximum negative change is found in Sangola taluka due to decrease in oil seeds and fibre. [Table No. 5.1]

**Oil Seeds:**

The oilseeds are very important in different ways as they are used both for edible and industrial purposes. It is to be seen that, the edible oil seeds occupy most of the cultivated area. Some oil seeds are grown in kharif season e.g. sesame, some are in both e.g. sunflower and groundnut. groundnut, safflower and sunflower are important oil seeds in the study region, as cash crops. The other oil seeds such as sesame, castor, linseed etc are meager in the study region.

Oil seeds together occupy 117909.9 hectare (10.59%) of the total cropped area of the region, during the period of 1995-200, which is less than the state’s average of 12.02 percent. The regional variation in the share of oil seeds is noticeable, ranging from below 3 percent to over 22 percent. The Maximum oilseed growing talukas are Akkalkot, Karmala and Madha, having more than 17 percent area under oil seeds. Moderate proportion was in Mangalvedha, South Solapur, Barshi and North Solapur talukas, whereas it was low in Malshiras, Pandharpur, Mohol and Sangola talukas.[Map No. 5.13 A]

The area under oil seeds has increased by 5.19 percent during the period of investigation. taluka analysis shows considerable changes, both positive and negative. (Map 5.13 B) Positive change is found in the talukas of Akkalkot, North Solapur, Karmala, Madha, South Solapur, Barshi and Mangalvedha i.e. from 0.83 to 9.95 percent.
The high rate of positive change is found in Akkalkot taluka i.e. 9.95 percent followed by North Solapur, due to local availability of market due to oil mills and lower area under cash crop like sugarcane, farmers in this talukas cultivate oil seeds to fulfill their economic needs. Whereas insignificant positive change is observed in Mangalvedha taluka. Negative change is found in the talukas of Sangola, Pandharapur, Malshiras and Mohol, due to development of sugarcane and fruit farming, area under oilseed is transferred into sugarcane and fruits cultivation.

**Safflower:**

Safflower requires dry and temperate climate and medium to high quality soil, with ph value of 7.5 to 8. Safflower is cultivated as an intercrop in jowar or separately in rabi season. It is mostly rainfed crop.

During 1995-2000, the share of safflower was 2.39 percent in the total cropped area of district, which is higher than the state’s average of 2.23 percent. The map 5.14 A exhibits that the spatial distribution is uneven, ranging from below 1 to over 10 percent. Very high proportion of area under safflower was found in Karmala taluka i.e. 10.54 percent, followed by Madha and Mangalvedha about 4.49 percent. whereas it is below district average in remaing talukas.

During the period under review, district as a whole has 2.15 percent negative change in area under safflower. All talukas show negative trend in area under safflower except Karmala, because of safflower replaced by sunflower, which is easy to harvest and have high productivity. (Map 5.14 B.)
Groundnut:

Groundnut is also an important oilseed in the Solapur district. It requires hot and dry climate, well drained shallow to medium deep soil with light red and brownish loamy with pH value of 6.5 to 7.5, but suffer in very cool and drought condition. It is grown in both kharif and rabbi in summer season. It is rain fed as well as irrigated crop in the study region.

During 1995-2000, groundnut occupies 2.89 percent of total cropped area of study region, which is less than the state’s average of 20.2 percent. Regional variation is ranging from below 1 to over 6 percent. The map 5.15 A reveals that high proportion of area under groundnut was in Madha and Akalkot talukas, >6 percent, followed by Karmala about 4.54 percent. It was moderate in Pandharpur and South Solapur talukas, where as it is below district’s average in Malshiras, Mohol, Sangola, Mangalvedha, Barshi and North Solapur talukas.

The area under groundnut has increased slightly i.e 0.37 percent during the period under review. Positive change is recorded in talukas of Madha, Akalkot, Karmala and Mohol. Remarkable positive change is found in Madha taluka due to favourable soil supported by development of irrigation, whereas it is insignificant in Mohol. Negative change is observed in the talukas of Sangola, South Solapur, Barshi, North Solapur, Mangalvedha, Malshiras and Pandharpur, i.e. <2 percent. (Map 5.15 B)

During 1995-2000, groundnut occupies 8.03 percent of total irrigated area of the region. The table 4.1 indicates that the spatial distribution is very uneven. High proportion of irrigated area under groundnut was in Madha taluka, i.e. 19.73 percent. It was low in North Solapur, Akalkot, South Solapur, Mangalvedha, Pandharpur, Sangola, and Malshiras talukas.

Irrigated area under groundnut has increased by 4.11 percent the district during the period of investigation. The positive change is noticed
in Madha, Karmala, Akkalkot, Barshi, North Solapur, South Solapur, Mangalvedha, Mohol and Malshiras talukas ranging between 0.65 to 17.23 percent. The high rate of positive change is found in Madha and Karmala, due to the development of irrigation, whereas it is low in Malshiras and Mangalvedha. Negative change is found in Pandharpur and Sangola talukas i.e. 4.62 and 5.77 percent respectively, because of farmers preference for fruits and sugarcane cultivation so as obtain more profit.

**Other Oil Seeds:**

This category consist sesame, linseed, sunflower etc. oil seeds. Among the other oilseed, it requires well-drained medium to deep soil and cultivated through out the year.

District as a whole have 5.31 percent area under other oil seed during 1995-2000, which is higher than the state’s average of 2.01 percent. Regional variation is high, ranging from <2 to >13 percent. High proportion was in Akkalkot and South Solapur, North Solapur talukas i.e. >8 percent. It was moderate in Madha and Barshi talukas, where as it was low in rest of talukas <4 percent.

During the period of investigation district as a whole has increased 4.38 percent area under other oil seeds. All talukas show positive change in area under other oil seeds, due to the area under sunflower is increasing because of it’s productivity is high, it is a small duration crop than safflower, groundnut and easy to harvest. It is cultivated through out the year due to this, farmers of study region inclined to grow the High Yielding Variety of sunflower. High increase was in Akkalkot and North Solapur talukas, i.e. >8 percent, because assure rainfall than other talukas. Low increase in area under other oilseed is observed in Karmala, Malshiras, Pandharpur, Mohol, and Sangola, Mangalvedha talukas i.e. <4 percent. [Table No. 5.1]
5.3 Overall Change in Cropping Pattern

The change in agricultural land use means the change in proportion of cultivated area under different crops at to different times. In order to measure the quantitative change Weavers Index (1954) is used. Index of change in agricultural land-use = \( A / B \) ‘A’ is the sum of difference of percentage of crops of increase and ‘B’ is the sum of difference of percentage of crops of decrease for the period under review, the percentage of land, which is actually involved in transfer of area from one crop to other. Higher the index, higher is the changes in land-use pattern and lower the index more is the stability.

Index of change computed reveals four different areas of changes is exhibited in Map No. 5.16 A.,B,C

Outstanding Area of Change:

Outstanding area of change with greater dynamism (over 25 percent) is observed in Pandharpur, Sangola and Mangalvedha talukas. Because of in Pandharpur taluka, proportion of irrigated area has increased by more than three times during the period of investigation, which is mainly brought under sugarcane, fruit and vegetable. The main crop of decrease cultivated area is jowar followed by other pulses. In Mangalvedha, taluka proportion of irrigated area has increased nearly twice and main crops of cultivated area increased are jowar and sugarcane, while main crops of decrease area are pulses and bajara. In Sangola taluka irrigated area is increased from 14235.8 hectares to 20579.4 hectares, drip-irrigated area is increased highly, which is mainly brought under jowar, fruit-vegetable. The main crops of decreased cultivated area are bajara and maize.

High Area of Change:

The area of high change i.e. between 19 to 25 percent is found in Malshiras, Mohol, Karmala and South Solapur taluka. In Malshiras
taluka, irrigated area has increased by one and half times during the period under review. The main crops of increased cultivated area are sugarcane and bajara, while decreased are cotton and safflower. In Mohol, taluka proportion of irrigated area has increased by more than one and half times. The main crops of increased cultivated area are jowar and sugarcane while decreased are pulses and safflower. In Karmala taluka proportion of irrigated land has increased by more than 3 times, the main crops of increased cultivated area are sugarcane and safflower, while decreased are jower and pulses. In South Solapur, taluka proportion of irrigated land has increased by more than two times. The main crops of increased cultivated area are oil-seeds and sugarcane while decreased are tur and other pulses.

**Moderate Areas of Change:**

The proportion between 13 percent to 19 percent change is recorded in Madha North Solapur and Akkalkot talukas. Proportion of irrigated area of Madha taluka has increased from 20337.4 to 24796.8 hectares. The main crops of cultivated area increased are jowar, fruits-vegetable, groundnut and other oil seeds, whereas crops of decreased cultivated area are other pulses, safflower and maize. In North Solapur taluka, proportion of irrigated area is increased by more than one and half times during the period of investigation. The crops of increased cultivated area are jowar, other oil seeds and fruits-vegetable, whereas crops of decreased cultivated area are tur, safflower and other pulses. In Akkalkot taluka, irrigated area is increased by more than two times during the period of investigation. The crops main of increased cultivated area are other oil seeds, sugarcane and groundnut, whereas crops of decreased cultivated area are tur and Safflower.
Areas of Low Change:

The proportion below 13 percent change is found in Barshi taluka, where irrigated area of Barshi taluka is increased more than three times. The crops of increased cultivated area are gram, fruits-vegetable, and other oil seeds. This taluka have brought increased irrigated area under these crops at the cost of jowar, other pulses and groundnut.

Overall Changes in Irrigated Cropping Pattern.

During the period of under review, irrigated cropping pattern is changed to a greater extent, due to expansion of irrigation, mechanization, introduction of fruits and vegetable because the policy of Government. The district as a whole has 23.85 percent change in irrigated cropping pattern. However, taluka level changes vary, ranging from 16.89 to 47.15 percent. The map 5.17 A reveals that, very high rate of change is observed in Madha taluka i.e. 47.15 percent, followed by Akkalkot and Mangalvedha, i.e. 44.67 percent and 42.88 percent respectively. The high change is recorded in the taluks of Karmala, Mohol, Sangola and South Solapur, ranging between 30 to 40 percent. Moderate change is found in Pandharpur, Barshi and North Solapur talukas, ranging from 20 to 30 percent. Low change is found in Malshiras taluka i.e. 16.89 percent, where irrigation facilities are provided since long back.

Sugarcane has come up as main increased irrigated area crop, in the taluks of Karmala, Malshiras, Pandharpur, Mohol, Mangalvedha, south Solapur, which collectively covers 64.91 percent area of region due to expansion of irrigation facility, because of Ujani irrigation project. (Map 5.17 B) Groundnut is leading irrigated area crop in Madha and Barshi talukas, whereas in Akkalkot and North Solapur sunflower is increased cultivated irrigated area crops due to expansion of seasonal irrigation area. Fruits and vegetable are second increased cultivated irrigated area crop in five talukas out of eleven talukas.
Regarding the crops of leading in decreased irrigated area, jowar is an important crop, which lost irrigated highly in Karmala, Madha, Mohol and Barshi talukas, this area is replaced by sugarcane and groundnut. Cottan has lost irrigated area in Malshiras, whereas wheat in Mangalvedha and Akkalkot talukas. (Map 5.17 C) Other nonfood crops have lost high-irrigated area in Sangola and Pandharpur, which is replaced by sugarcane, fruit and vegetable, and jowar. Maize has lost highest irrigated area in South Solapur, which is replaced by sugarcane and groundnut.

5.4 Correlation Between Different Agricultural Land-Use Categories:
Correlation between different crop categories gives idea about mutual transfer of area between crops, so that attempt is made here to study the correlation between different crops. The total area under various crops has been divided in to five categories Viz. area under cereals, pulses, sugarcane, fruits vegetable and fibre, naturally a change in one followed by a change in another or all the remaining categories. The co-efficient of correlation of each of the category with rest of the categories have been calculated, to determine the association of the different categories, the values of coefficients are given in the table No. 5.2.

Table 5.2 A :
Matrix of co-efficient of correlation between different categories of Agricultural land-use of Solapur District:

<table>
<thead>
<tr>
<th>Solapur District</th>
<th>Category</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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</thead>
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<td></td>
<td>A</td>
<td>-</td>
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<tr>
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<td>B</td>
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<td>-0.83</td>
<td>0.67</td>
<td>-0.48</td>
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<tr>
<td></td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.92</td>
<td>-0.90</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.94</td>
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<tr>
<td></td>
<td>E</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.67</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>-</td>
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</tr>
</tbody>
</table>

Note-Where A=Cereals, B=Pulses, C=Sugarcane, D=Fruit-vegetable, E=Fibre, F=Oilseeds
<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<td>1. North Solapur</td>
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<td>11. Madha</td>
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<td>-0.03</td>
<td>0.25</td>
<td></td>
<td>0.34</td>
</tr>
</tbody>
</table>

Source: Compiled by Researcher
High negative correlation between different categories:

1. Cereals with other crops

During the period of investigation, considering the district as a whole, cereals have high negative correlation with oil seeds. Taluka level analysis reveals that, (table 5.2)

I cereals have high negative correlation with fruit-vegetable only in Barshi taluka, which is amounted by -0.80 co-efficient of correlation.

II High negative correlation between cereals and fibre is found only in Pandharapur taluka, which is amounted by -0.70 co-efficient of correlation.

2. Pulses with Sugarcane, fruit vegetable fibre and oilseeds:

Considering the district as a whole, pulses have high negative correlation with sugarcane, fruits-vegetable and oil seeds, during the period of investigation. However, taluka level analysis varies, which is as following.

I. During the period of under review, high negative correlation between pulses and sugarcane is found in of Mohol, Pandharapur, Malshiras and Karmala talukas, which is amounted by -0.65,-0.84,-0.79 and -0.76 co-efficient of correlation respectively.

II. Pulses have high negative correlation with fruit-vegetable in the talukas of North Solapur, Akkalkot, South Solapur, Mohol, Mangalvedha, Pandharapur, Sangola, Malshiras and Karmala ranging between -0.66 to -0.95 co-efficient of correlation.

III. Pulses have high negative correlation with oilseeds in talukas of North Solapur and Karmala, that is -0.73 and -0.68 co-efficient of correlation.
3. **Sugarcane with fruits-vegetable, fibre and oilseeds:**
   During the period of investigation, considering the district as a whole, sugarcane has high negative correlation with, fibre, however at taluka level it differs as per category and taluka.
   I. The table 5.2 reveals that sugarcane has high negative correlation with oilseeds only in Pandharpur taluka, which is amounted by -0.75 co-efficient of correlation
   II. High negative correlation between sugarcane and fibre is found in the Malshiras taluka, which is amounted by -0.83 co-efficient of correlation

4. **Fruit-vegetable with fibre and oilseeds:**
   During the period of investigation, considering the district as a whole, fruits-vegetable have high negative correlation with, fibre.
   I. During the period of under review, high negative correlation between fruit-vegetable and oilseeds is found only in Sangola taluka, which is amounted by -0.86 co-efficient of correlation
   II. Fruits and vegetable have high negative correlation with fibre in Barshi, South Solapur, Mohol, Mangalvedha, Malshiras and Karmala talukas. which is amounted by -0.67 to -0.93 co-efficient of correlation

5. **Fibre and oilseeds:**
   The table 5.2 indicates that considering the district as whole has high negative correlation between fibre and oilseeds. But, taluka level analysis reveals that the rate of negative correlation varies as per taluka. The high negative correlation between fibre and oilseeds is found only in South Solapur taluka, which is amounted by -0.65 co-efficient of correlation
Above analysis reveals that district as a whole have high mutual transfer between cereals and oil-seeds, between pulses and sugarcane, between pulses and fruit-vegetables, between fruit-vegetables and fiber. However taluka level analysis indicates:

1. High mutual transfer between pulses and fruit-vegetables in Akkalkot, South Solapur, Mohol, Mangalvedha, Pandharpur, Malshiras, Karmala talukas.

2. Between fruit-vegetables and fibre crops in Barshi, Mohol, Mangalvedha, Malshiras, Karmala talukas.

3. Between pulses and sugarcane is observed in Akkalkot, Pandharpur, Malshiras and Karmala talukas.

4. Between pulses and oil-seeds in North Solapur and Karmala talukas.

5. Between sugarcane and fruit-vegetables in Barshi and Sangola.

6. Between sugarcane and oil-seeds in Pandharpur taluka.

7. Between fruit-vegetables and oil-seeds in Sangola taluka.

8. Between sugarcane and fibre in Sangola taluka.

9. Between pulses and fibre.

Above stated facts indicated that there is highest mutual transfer in area under cultivation is found between pulses and fruit-vegetables, followed by fruit-vegetable and fibre, between pulses and sugarcane.

5.5 **Intensity of Cropping**

The problem about shrink of proportion of net area sown is due to low productivity and risk of crop failure, which are taxing the rural population of the study region. So that it is fruitful to find out the intensity of cropping.
The intensity of cropping means more than one crops raised on a same field during the same year. The higher the index of the intensity of cropping higher is the land-use efficiency and vice-versa (Sing jasbir 1974). The percentage of gross sown area to net sown area gives a measure of index to intensity of cropping. The index of intensity of cropping is obtained by using following formula.

\[
\text{Index intensity of cropping} = \frac{\text{Gross cropped area}}{\text{Net area sown}} \times 100
\]

In the study region, most of the crops are grown during kharif and rabbi seasons due to particular climatic conditions and traditional methods of cropping in the area of well irrigation. Most common practice adopted by the farmers is that in kharif crops of short duration like the one bajara, maize, mug, sunflower etc. are again sown by rabbi jawar and safflower in same year. In the irrigation areas farmer’s use to practice, three crops in a year. Intensity of cropping is controlled largely by the drought conditions and soil fertility in the study region.

For the spatial analysis of intensity of cropping, the strength of percentage the region is divided in to three categories viz-low intensity, medium intensity and high intensity. [Table No.5.2]

1 Areas of low intensity of cropping: (<106 percent)

During 1995-200, there is 106.99 cropping intensity in the district as a whole. Low intensity index is found in Akkalkot South Solapur, Mohol, Mangalvedha, Pandharpur and Madha talukas. The cause of low cropping intensity index is varies from taluka to taluka, lowering of groundwater table scarcity of rainfall and poverty of farmers are common reasons. However it is low in Madha, Mohol, Mangalvedha and
Pandherpur talukas due to most of irrigated area is used for the cash crop like sugarcane, which is an annual crops as they are benefited by Ujani irrigation project.

Table No.5.3.

**Index of Intensity of Cropping.**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Taluka/District</th>
<th>Index Of Intensity Of Cropping</th>
<th>Volume of change in %</th>
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</thead>
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<td>106.01 106.86</td>
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<td>Mohol</td>
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<td>Mangalvedha</td>
<td>106.59 105.87</td>
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<tr>
<td>9</td>
<td>Malshiras</td>
<td>113.03 108.94</td>
<td>-4.09</td>
</tr>
<tr>
<td>10</td>
<td>Karmala</td>
<td>106.79 117.63</td>
<td>10.84</td>
</tr>
<tr>
<td>11</td>
<td>Madha</td>
<td>105.82 102.16</td>
<td>-3.66</td>
</tr>
<tr>
<td>12</td>
<td>District</td>
<td>106.73 106.99</td>
<td>0.26</td>
</tr>
</tbody>
</table>

*Source: Compiled by Researcher.*

**II Area of medium intensity of cropping (106 to 110 percent)**

During 1995-2000, medium cropping intensity is recorded in North Solapur, Barshi, Sangola, and Malshiras talukas. In Malshiras and Sangola taluka due to irrigated area is used for annual cash crops respectively, sugarcane and fruit cultivation the intensity is medium. In North Solapur and Barshi taluka, the farmer’s are cultivated kharif and rabi crops widely.

**III Area of high intensity of cropping (<110 percent)**

During 1995-2000, high intensity of cropping is found only in Karmala taluka, due to perennial and protective irrigation facility of Ujani backwater, the farmers in area adjoining area backwater cultivated rabi and kharif crops widely.
Changes in intensity of cropping:

The table 5.3 indicates that during the period of investigation the intensity of cropping increased only 0.26 percent in the district as a whole. The taluka level analysis of the intensity of cropping indicates that the intensity of cropping is increased in North Solapur, Mohol, Sangola and Karmala talukas i.e.10.84%. The highest increase is found Karmala talukas due to adjoining area of Ujani project benefited by lift irrigation. Sangola ranks second (2.19 percent) which benefited by Nira canal as well as minor irrigation project. Insignificant increase in intensity of cropping is recorded in North Solapur and Mohol talukas.

Intensity of cropping is decreased in Malshiras, Madha, Pandharpur, Mangalvedha, South Solapur, Akalkot, and Barshi talukas. High decrease is found in Malshiras taluka about 4.09 percent, followed by Madha (3.66 percent) due to in crease in use of irrigated area for annual cash crop e.g. sugarcane.

5.6 Agricultural Region:

Region is one of the basic concepts of geography. A widely accepted definition of region is “an area that is different from other areas, according to the specified criteria”. Among the different types of region, agricultural region is very import at to the point of agricultural geographer. Any segment of the earth’s surface possessing a distinctive from of agricultural is an agricultural region. The agricultural region is a device for selecting and investigating regional grouping of the complex agricultural phenomena. According to Buchana (1959) agricultural region must be defined in terms of agricultural elements, that is by crop, livestock or enterprises data, so that attempt is made here to define agricultural region of Solapur district based on crops and livestock.
1. **Crop Combination Regions and Changes:**

The study of crop combination regions constitutes an important aspect of agricultural geography. It is fruitful in many ways such as to understand the cropping pattern, crop concentration, and agricultural operations in a given area. The crop combinations give an idea about the agricultural typology and agricultural income of a region. Such regions provides areal significance and strength of individual crops, to advocate suitable device for planning improvements in the under developed regions. Besides this, they are helpful in the introduction of innovations in agriculture. In simple manner crop combination analysis is really core of agricultural geographic investigation.

In the present study, an effort is made to delineate the crop combinations for the years 1975-80 and in 1995-2000, by applying the minimum deviation method advocated by Weaver (1954), Doi’s method (1959) and Maximum positive deviation method by Rafiullah (1956).

I **Agricultural Regions Based on Crop-combination :**

After calculation of crop combination by minimum deviation method (Weavers) it is observed that all the crops in the series occupying as much as one and above one percent of the total cropped areas and resultant combination become over generalized. In other words, this method is not suitable to delineate a precise crop combination of Solapur district, so that attempt is made to delineate crop combination region by Rufiullah’s method and Doi’s method. These two methods simplifies the crop association by dropping the inclusion of insignificant crops in the combination for example Rafiulh's method gives two crop combination and Doi’s method gives three crop combination in Karmala talukas, instead of ten crop combination to this taluka based on weavers method for 1995-2000.
Rafiullah’s Method:

According to Hussain (1972), Rafiullah’s maximum positive deviation method gives such combinations that are representative of the primary crops further crop combinations are in conformity with the soil and rainfall distribution. Therefore, maximum positive deviation method has an advantage over Weaver’s method. The Rafiullah’s formula may be expressed as following.

\[ d = \frac{\sum D^2 p - D^2 n}{N^2} \]

Where,
\[ d \] = deviation
\[ D_p = +ve \text{ difference from the median value of theoretical curve value of combination} \]
\[ D_n = -ve \text{ difference from the median value of theoretical curve value of combination} \]
\[ N = \text{No. of crops in the combination} \]

The resultant of crop combination region by Rufiuulla’s method is as following.

Monoculture:

During 1995-2000, the talukas having monoculture crop combination are Mohol and Mangalvedha (Map 5.18 B) and monoculture crop is jowar. Because these talukas lies in Bhina sina basin with regur soil, this crop is suitable for climatic setting and introduction of High Yielding Variety; the farmers devote most of their arable land to this crop. Mangalvedha is known as ‘Godauns’ of jowar of Solapur District.
SOLAPUR DISTRICT
CROP COMBINATION REGIONS BY
MAXIMUM DEVIATION METHOD (RAFIULLAH)
1975-80

INDEX
- 2 Crops
  i) J+Sa  ii) J+B
  iii) J+T  iv) J+oP
- 3 Crops
  J + Su + B

Map No. 5.18 A

SOLAPUR DISTRICT
CROP COMBINATION REGIONS BY
MAXIMUM DEVIATION METHOD (RAFIULLAH)
1995-2000

INDEX
- Monoculture Crops
  J
- 2 Crops
  i) J+Sa  ii) J+Gn
  iii) J+S  iv) J+B
  v) J+oO  vi) J+T
- 3 Crops
  i) J+Su+B

Map No. 5.18 B

J = Jowar, Su = Safflower, Gm = Groundnut, S = Sugarcane, B = Bajara, oO = Other Oil Seeds, T = Tur, Op = Other pulses, W = Wheat
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N Solapur</td>
<td>J+T</td>
<td>J+oO</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Barshi</td>
<td>J+T</td>
<td>J+T</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Akkalkot</td>
<td>J+T</td>
<td>J+oO</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>S. Solapur</td>
<td>J+T</td>
<td>J+Oo</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Mohol</td>
<td>J+oP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Mangalvedha</td>
<td>J</td>
<td>J+B</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Pandharpur</td>
<td>J+oP</td>
<td>J+S</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Sangola</td>
<td>J+B</td>
<td>J+B</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Malshiras</td>
<td>J+S+</td>
<td>J+S+B</td>
<td>-</td>
<td>W</td>
</tr>
<tr>
<td>10</td>
<td>Karmala</td>
<td>J+Sa</td>
<td>J+Sa</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Madha</td>
<td>J+Sa</td>
<td>J+G</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Distrect</td>
<td>J+oP</td>
<td>J+Sa</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Source**: Compiled by Researcher

**Note**: J- Jowar, T- Tur, B- Bajara, W- Wheat, S-Sugarcane, S- Safflower, oP- Other Pulses, oO- Other Oilseeds.

**Two Crops Combination**

This combination includes the maximum number of talukas. However, most of talukas have different crops association in the combination. In Akkalkot, South Solapur and North Solapur talukas, constituent crops of combination are jowar and other oil seeds. Other oil seeds particularly sunflower entered as second crop in these talukas because of High Yielding Variety of sunflower, it is short period crop with high productivity. In Karmala jowar and safflower association is recorded, In Madh jowar and groundnut entered in crop combination. Barshi taluka shows crops of jowar and tur in combination, while Pandharpur constituent jowar and sugarcane association. Sangola shows jowar and bajara association. Except Sangola and Pandharpur, other all talukas shows oil seeds and pulses are second ranking crops, due to these are cash crop, very well fit in agro climatic setting and soil fertility.
Three Crops Combination

Three-crops combination is observed in Malshiras talukas. In Malshiras taluka jowar, sugarcane and bajara are the crops in combination. Because of regur soil in Nira basin, perennial water provision from Nira right bank canal and Ujani canal, sugarcane emerged as second crop in combination.

The comparison between map 5.18 A & B and table 5.2 reveals the change in crop combination regions based on maximum deviation method. Two talukas, i.e. Mohol and Mangalvedha recorded the changes in crop association pattern, two to one change observed in these talukas. There is no change in number of crops in the association pattern in remaining eight talukas, during the period of under review.

Doi’s Method:
The Weaver’s technique was subsequently modified by Doi (1959). Doi’s technique used to considered to be the earliest for combination analysis prior to the application of computer programming facilities. The Doi’s formula may be expressed as-

\[(\sum d^2)\]

The combination having the lowest \((\sum d^2)\) will be the crop combination. In Doi’s technique, it is not required to calculate \((\sum d^2)\) for each combination is actually established by on sheet table (appendix-2) which represents critical values for various elements at different ranks against cumulative % of elements at higher ranks. (Majid Husain-2002)

Monoculture:

During 1995-2000 As per Doi’s method (1959) monoculture is practiced in six talukas of study region i.e. Madha, Mohol, Sangola, Mangalvedha, South Solapur and North Solapur. Jowar is monoculture crop in these talukas due to agro climatic and soil condition. (Map No.5.19B)
SOLAPUR DISTRICT
CROP COMBINATION REGIONS
BY DOI’S METHOD 1975-80

INDEX

- Monoculture: Jowar
- 2 Crops:
  i) J+B
  ii) J+Op
  iii) J+T
- 3 Crops:
  J+B+Op
- 4 Crops:
  J+Su+W+Op

Map No. 5.19 A

SOLAPUR DISTRICT
CROP COMBINATION REGIONS
BY DOI’S METHOD
1995-2000

INDEX

- Monoculture Crops: J
- 2 Crops:
  i) J+T
  ii) J+S
  iii) J+oO
- 3 Crops:
  i) J+Sa+S
- 4 Crops:
  i) J+S+B+W

Map No. 5.19 B

J=Jowar, Sa=Saflower, Gm=Groundnut, S=Sugarcane, B=Bajara, oO=Other Oil Seeds, T=Tur, Op=Other pulses, W=Wheat
Table No.5.5
Crop combination region by Doi's method

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Taluka</th>
<th>Monoculture</th>
<th>Two</th>
<th>Three</th>
<th>Four</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N Solapur</td>
<td>J</td>
<td>J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Barshi</td>
<td>-</td>
<td>J+T</td>
<td>J+T</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Akkalkot</td>
<td>-</td>
<td>J+T</td>
<td>J+oO</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S. Solapur</td>
<td>-</td>
<td>J</td>
<td>J+T</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mohol</td>
<td>-</td>
<td>J</td>
<td>J+oP</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mangalvedha</td>
<td>J</td>
<td></td>
<td>J+B+oP</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pandharpur</td>
<td>J</td>
<td></td>
<td>J+S</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sangola</td>
<td>J</td>
<td>J+B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Malshiras</td>
<td>-</td>
<td></td>
<td>J+S+W+oP</td>
<td>J+S+B+W</td>
</tr>
<tr>
<td>10</td>
<td>Karmala</td>
<td>J</td>
<td></td>
<td>J+Sa+S</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Madha</td>
<td>J</td>
<td>J</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Compiled by Researcher

Note: J- Jowar, T- Tur, B- Bajara, W- Wheat, S-Sugarcane, Sa-Safflower, oP- Other Pulses, oO- Other Oilseeds.

Two Crop Combination:

Two-crop combination is recorded in three talukas and these are Pandharpur, Akkalkot and Barshi taluka. In Akkalkot taluka, jowar and other oilseed crops entered in crop combination, whereas in Barshi taluka jowar and tur association is registered, in Pandharpur jowar and sugarcane association is recorded. The irrigation facilities are poor in Akkalkot and Barshi talukas. While in Pandharpur due development of irrigation sugarcane and jowar association recorded.

Three Crops Combination:

Three crop combination is recorded only in Karmala taluka. The crops entered are jowar, safflower and sugarcane due to provision of irrigation, in western part of taluka farmers devote their land to sugarcane there fore sugarcane entered in combination.
Four Crops Combination:

During 1995-2000, Malshiras talukas having four-crops combination. In Malshiras taluka jowar, sugarcane, bajara and wheat constitute the combination due to high development of irrigation.

The comparison between map 5.19A & B reveals the change in crop combination region based on Doi's method. Six talukas shows the change in crop combination i.e. Karmala, Pandharpur, Mohol, Sangola, Mangalvedha and South Solapur. One crop to three crops change is recorded in Karmala taluka; one crop to two crops recorded in Pandharpur, three crops to one crop change is recorded in Mangalvedha taluka. While two crops to one crop is recorded in Mohol, Sangola and South Solapur talukas. Remaing talukas have no change in number of crops in the crop association pattern during the period of investigation.

II Agriculture Regions based on Livestock Combination

A study of the livestock combination is important to assess the local significance and association of livestock. It shows that different livestock are raised in combination in combination in various enumeration units. It is investigated by using the method of least deviation from the theoretical standard introduced by Wevear 1954, the percentage of each livestock category in talukas is calculated. The theoretical curve for the standard measurement was employed as follows. For the determination of the Minimum Deviation the Standard Deviation Method is used.

\[ S.D. = \frac{\sum d^2}{n} \]

Where d is the difference between the actual livestock category percentage in a given taluka and the appropriate percentage in the theoretical cure and n is the number of livestock category in a given
combination. The combination with least (smallest) value of S.D. will be combination to be selected.

One Mono livestock = 100 % of the No of livestock in on category.
Two Livestock combination = 50 % in each of two livestock in on category.
Three Livestock combination = 33.3 % in each of three livestock category.
Four Livestock combination = 25 % in each of four livestock category.

However, in this combination young stock of cattle, buffaloes and poultry are not involved, as they are not of any use for agriculture. So that cattle, buffaloes, sheep and goats are considered and their combination is shown in map 5.20 A&B, it shows that these livestock combination are resultant of physical and socio-economic environments and changes in technological development of the region.

By using the Weaver’s method five categories of livestock combination is observed in 1978 and 6 categories of livestock combination is observed in 1997. These are represented on the map 5.20 A&B

1. During 1978, goats and cattle combination is confined to five talukas i.e. Karmala, Barshi, Madha, South Solapur & Akkalkot.
2. Goat, cattle, buffaloes combination is found in North Solapur taluka.
3. Goat cattle and sheep combination is occurred in central part of study region i.e. Mohol and Pandharpur Talukas.
4. Goat, sheep and cattle combination is observed in Mangalvedha talukas.
5. Sheep, goat and cattle combination is found in western part of study region i.e. Sangola and Malshiras talukas.
SOLAPUR DISTRICT
LIVE STOCK COMBINATION REGIONS
(WEVEAR'S METHOD)
1975-80

INDEX
Combination

G+C
G+C+B
G+C+S
G+S+C
S+G+C

Map No. 5.20 A

SOLAPUR DISTRICT
LIVE STOCK COMBINATION REGIONS
(WEVEAR'S METHOD)
1995-2000

INDEX
Combination

G+C
G+S
G+C+B
G+S+C
G+C+B+S
G+C+S+B

Map No. 5.20 B

G= Goat, C= Cow, S= Sheep, B= Buffalo
Considerable changes have occurred in the livestock combination during 1997, as shown in map 5.26 B out of eleven talukas seven talukas are involved in the change in livestock combination. The combination is changed from goat and cattle to goats, cattle, sheep and buffaloes in Madha taluka. In Mohol taluka, combination is changed from goat, cattle and sheep to goat, cattle, sheep and buffaloes. It is changed from goat and cattle to goat, cattle and buffaloes in South Solapur and Akkalkot talukas, in Pandharpur from goat, cattle and sheep to goats, cattle, buffaloes and sheep. The combination changed from sheep, goats and cattle to goats and sheep in Malshiras and Sangola talukas, during the period of investigation.

2 Crop Concentration:

Crop concentration is the variations in the density of any crop in an area at a given point of time. Delineation of crop concentration region helps in ascertaining the areas where a particular crop grows well even with the help of minimum inputs. This has too much importance for agricultural development and planning.

The concentration of crop and livestock concentration can be quantified with the help of location quotient or by coefficient of localization. Location quotient technique is enable the geographers and planners to understand the areas of specialization of different crops grown in region at a given point of time. This technique was primarily devised to study industrial location. Florence (1948) compared the share of an enterprise with that of the entire nation with the help of a location quotient method. Chishom (1962) made an attempt to measure the relative regional concentration with the help of coefficient of localization.

Here attempt is made to determine the regional concentration of crops by using Bhatia’s (1965) method for the calculation of location quotient. The formula used for concentration crop is as under.
Index for the determination of crop concentration = \[ \frac{\text{Area of X crop in the component areal unit}}{\text{Area of all crops in the component areal unit}} + \frac{\text{Area of X crop in the entire region}}{\text{Area of all crops in the entire region}} \]

By applying the above technique, the pattern of crop concentration for different crops under consideration is worked out. The index value of crop concentration is calculated for the period 1975-1980 and 1995-2000.

1. Jowar:

During 1995-2000, the map 5.21 B reveals that high degree of concentration of jowar is recorded in Mangalvedha, Mohol, North Solapur and Sangola talukas, while moderate concentration is found in Madha, South Solapur and Barshi taluka. Low concentration is recorded in rest of talukas due to development of irrigation facility farmer prefer to devote their land for cash crop.

The map 5.21A & B reveal that during the period under review high to low and high to moderate concentration shift is observed in Karmala and Barshi taluka respectively. Moderate to high concentration shift is recorded in Mohol, Sangola and Mangalvedha talukas. There is no change rest of talukas about Jowar concentration.

2. Wheat:

During 1995-2000, high concentration of wheat is in Malshiras and Pandharpur talukas due to fertile soil of Nira and Bhima basin and development of irrigation. whereas low concentration is found in Karmala, Madha, Sangola, Mangalvedha, Akkalkot and North Solapur talukas. (Map 5.22 A & B)
Low to high concentration shift of wheat is observed in Pandharpur taluka. While a change from moderate to low concentration shift is found in Karmala, Madha, Mangalvedha and Akkalkot talukas. There is no change in wheat concentration in remaining talukas during the period of 1975-2000.

3. Sugarcane:

Very high concentration of sugarcane is found in Pandharpur and Malshiras talukas, due to development of perennial irrigation facilities and back cotton soil in Bhima and Nira Basin. It is high in Karmala, whereas moderate in Mohol and South Solapur talukas. It is low in rest of talukas due to poor irrigation development. (Map 5.23 A & B)

During the period of investigation high to very high concentration shift is observed in Pandharpur taluka, where as low to high concentration shift is in Karmala talukas. This shift is due to major irrigation project. Low to moderate concentration shift is found in Mohol taluka. Moderate to low concentration shift of sugarcane is in North Solapur taluka.

4. Bajara:

High concentration of bajara is found in Malshiras and Sangola talukas, due to the favorable climatic and soil condition. Moderate concentration is in Mangalvedha and Karmala taluka whereas low concentration is in remaining seven talukas. (Map 5.24 A & B)

During the period of investigation moderate to high concentration and low to moderate concentration shift is found in Malshiras and Karmala taluka respectively.

Mangalvedha shows, the shift from high to moderate, where as it is from moderate to low in Akkalkot and Barshi taluka. There is no change in bajara concentration rest of talukas.
5. Maize:

During 1995-2000, the high concentration of maize is found in Malshiras, Pandharpur, and Sangola taluka. Moderate concentration is recorded in Mohol and Mangalvedha taluka, while low concentration is in rest of talukas. (Map 5.25 A & B)

Moderate to high concentration shift is found only in Sangola talukas during the period of under review. Low to moderate concentration shift is observed in Mangalvedha taluka. High to moderate concentration shift of maize is recorded in Mohol, where as it is moderate to low in North Solapur and Madha talukas. There is no change in maize concentration in the rest of talukas.

6. Tur:

Very high concentration of tur is found in Barshi taluka, due to development of pulses market, while it is high in Akkalkot taluka. Moderate concentration of tur is recorded is recorded in South Solapur and North Solapur taluka. whereas it is low in remaining taluka due to low rainfall condition. (Map 5.26A & B)

During the period under review high to moderate tur concentration shift is found in North Solapur and South Solapur talukas. Moderate to low concentration shift is in Madha and Mohol talukas, in the rest of talukas there is no change in tur concentration.

7. Groundnut:

Very high concentration of groundnut is found in Akkalkot taluka and it is high in Karmala and Madha talukas because Akkalkot taluka falls in relatively high rainfall and Karmala and Madha benefited by backwater of Ujani project. Moderate concentration of groundnut is in Pandharpur and South Solapur talukas, while low concentration is in rest of talukas during 1995-2000. (Map 5.27 A & B)
Moderate to high concentration shift is observed in Madha taluka, While Moderate to low shift is recorded in Malshiras, Sangola, Barshi, North Solapur talukas. There is no change in concentration of groundnut, in remaing six talukas from 75-80 to 95-2000.

8. Fruits and vegetable:

During 1995-2000, High concentration of fruits and vegetable combine is observed only in Pandharpur taluka. Moderate concentration is recorded in Sangola, Mohol, Madha and Malshiras talukas, where as low concentration of fruits and vegetable is in rest of talukas.

Moderate to high concentration shift of fruits and vegetable is found in Pandharpur taluka, while it is low to moderate in Sangola taluka, Because of suitable climate and soil for fruit cultivation. High to moderate concentration shift is in Mohol taluka; where as moderate to low concentration shift is in South Solapur and Akkalkot talukas. There is no change in fruit and vegetable concentration in the rest of talukas, during the period of investigation. [Map No.5.28 A & B]

3. Crop Diversification:

Crop diversification is a concept, which is opposite to crop specialization. Diversification in cropping pattern means raising different crops in arable land (More K.S.1981). The keener the competition of crops higher is magnitude of diversification. The pattern of diversification is closely influenced by the soil characteristics, soil moisture; amount of rainfall received, the availability of irrigation facilities, the accessibility of the arable land and the technology deployed by the cultivators. Among these physical factors are more important.

The study of the spatial pattern of crop diversification is very important to under stand the adoption of judicious crop rotation for the maintenance of soil fecundity. The fecundity of soil is associated with a mixed farming system rather than crop specialization (Jasbir Singh and
The study of diversification is important, which helps the future planning and development of agriculture. In view of the importance of these attributes of diversification, an attempt is made to investigate the spatial pattern of crop diversification. The Bhatia’s (1965) formula used for crop diversification, which is as following.

\[
\text{Index of crop Diversification} = \frac{\% \text{ of sown area under X crop}}{\text{Number of X crop}}
\]

Where, X crops are these crops that individually occupy one percent or more of the total cultivated area in a taluka as a unit.

Table No.5.6

Solapur District : Crops in Diversification (1975-80 To 1995-2000)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>sum of A.</td>
<td>Number of crops</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U.x crop</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Karmala</td>
<td>96.14</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Madha</td>
<td>95.61</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Malshiras</td>
<td>98.23</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>Pandharpur</td>
<td>94.27</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Mohol</td>
<td>96.29</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>Sangola</td>
<td>95.66</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>Mangalvedha</td>
<td>93.99</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>S.Solapur</td>
<td>93.72</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>Akkalkot</td>
<td>93.33</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Barshi</td>
<td>95.53</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>N.Solapur</td>
<td>97.65</td>
<td>13</td>
</tr>
</tbody>
</table>

Source- Compiled by Researcher.

The indices of crop diversification are calculated for period of 1975-80 and 1995-2000 (Table 4.4) and shown in map 5.29 A & B respectively. For the preparation of map of the spatial pattern of crop diversification the indices are grouped in to three categories viz (i) Area of high diversification(<9) (ii)Area of moderate diversification (9 to 10.5) (iii) Areas of low diversification (>10.5).
During the period of 1995-2000, high diversification of crop is found in the central and Southeastern part of the region consists Malshiras, Mohol, South Solapur and Akkalkot talukas. Diversification is moderate in Karmala, Madha and Mangalvedha, whereas it is low in Pandharpur; Sangola, Barshi and North Solapur talukas.

Changes of diversification can be obtained from the comparison of two maps 5.29A & B, in Akkalkot taluka changes is from moderate to high diversification. In Karmala and Mangalvedha changes is from low to moderate diversification. In North Solapur changes is from high to low and in Pandharpur it is moderate low diversification due to development of irrigation and technological factors. In remaining six talukas, there is no change in diversification from 1975-80 to 1995-2000.

**Summary:**

The foregoing analysis clearly indicates that there is dominance of food grains (cereals & pulses), which occupy 79.5 percent of gross cropped area. Jowar, wheat, bajara are dominant cereals in cropping pattern, while rice, maize and other cereals are insignificant in the cropping pattern of the region. Among the pulses, tur and gram are the important pulses, whereas moong, black gram (udid), horse gram (hulga) etc. are ancillary in the cropping pattern of the region.

Sugarcane and fruits-vegetables is important leading cash crop of study region occupies about 6 percent and 3 percent total cropped area respectively, due to development of irrigation facilities, sugarcane occupies important place in district economy. Groundnut and other oil seeds particularly sunflower are the two important non-food crops occupying significant position in the cropping pattern of the district.
Condiments and spices, cotton, other fibre, drugs and narcotics misc. nonfood crops occupy very small share of the cultivated land.

The District as a whole has experienced 14.55 percent change in crop land-use during the period of investigation. Maximum change (over 25 %) is found in Southwestern part, whereas moderate change in eastern and southeastern part of the district. Jowar, sugarcane and other oil seeds are the main crops of increased cultivated area, while crops of decreased cultivated area are other pulses, bajara and gram.

Taken in to consideration irrigated cropping pattern, jowar is dominant irrigated crop, followed by wheat, whereas other cereals are ancillary. Sugarcane is leading perennial irrigated cash crop occupying about 14.85 percent of total irrigated area, followed by fruits-vegetable (13.52 percent). Groundnut and sunflower are leading irrigated oil seeds other oil seeds have ancillary place.

The District as a whole has 23.95 percent overall change in irrigated cropping pattern during the period of investigation. Maximum change is found in Madha, Akkalkot and Mangalvedha taluka over 40 percent of total irrigated area. High change is in Mohol, Sangola and South Solapur talukas ranging between 30 to 40 percent, while moderate change is in central and northeastern part of the region. Sugarcane came as a leading increase irrigated area crop in six talukas, groundnut and sunflower each in two talukas. Jowar, wheat, safflower and maize are main decrease-irrigated area crops. General trend of agricultural land use is that over all decrease in area under food grain and increase area under cash crops.

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.

Intensity of cropping in Pandharpur taluka is mainly due to most of irrigated land used for cash crops. Whereas it is high in Karmala due to backwater of Ujani project farmers in adjoining area cultivated rabbi and kharif crops widely.

Four crops combination based on Doi's method and three crop combination regions based on Rafiullah method have emerged in the present study. High diversification of crops is allusive in western and southeastern part of the study region based on Bhatias method.
Reference:
5. Debashis Das (1992) : Caste structures and utilisation of water resources for irrigation; New dimentions in agricultural geography Volume 3 editer Noor Mohamal P.292.