Demands of Changes in Cropping Pattern: A Case Study of Akole Tahasil (M.S, India)

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Abstract: *A change in the agricultural land use implies a change in the proportion of area under different crops at two different times. As such the amount of area involved in change for Akole tahasil is calculated for individual crops and the crops of leading increases and decreased are marked. The intensity of land utilization is reflected in number of crops raised during the year. Among the various determinants of agriculture, it is assumed that irrigation positively affects the intensity of cropping. The study area has recorded in 20 years parts of the eastern side's significant increase in residential and agricultural area due to which gained more land from water bodies, barren and vacant lands. It is observed from the study area, there is a grater variation in the changes land use and cropping pattern, during the study period i.e. 1990-91 to 2010-11. About 80 % population depends directly upon land middle and eastern part of the Akole tahasil, state of Maharashtra, India, is mainly use of the agricultural land and converted into residential and other uses for the growth and development of the facilities. Farmers have adopt modern technology i.e. fruits and vegetables drip irrigation facility, variety seeds material, increasing use by composting biomass, improved planting technology and micro irrigation systems, crop loans, good network of transports and markets, agricultural advisory centers and also available facilities in the study area. Therefore, recently cropping pattern is change and day by day positive increased.*

Keywords: Cropping Pattern, Crops Season, Hilly Region, Irrigation Facilities, Demands of Markets.

Objectives:
1.   To study circle wise changes in cropping pattern.
2.   Comparison of 1990-91 to 2000-01 and 2000-01 to 2010-11 (20 years) changes cropping pattern.

1. Introduction

The whole part of the study area great trap region of the Deccan. The different landforms in a region constitute its physical setup or relief features. The watershed dividers the great spur of the Sahyadris which branches of at Harish Chandragarh and stretches completely across the part of study area from (Fig No. 2) west to east. In the hilly region, climate is slightly cool. The period from March to the first week of June is the hot season. The major crops cultivated in kharip season (June to October, November) Rice- Cereals-Bajra, Pulses- mug, math, Oilseeds- groundnut, Soya bean, kardai, jawas, sunflower, Cash crops - Cotton etc, rabbi season (October to March) Cereals - wheat, Jawar, Pulses-gram, Tur, sunflower etc and Mix Crops are (Kharip, Rabbi & Summer Seasons) e.g. Cereals- Maize, Cash crops - Sugarcane, All Fruits, Vegetables, Flowers and Fodder Crops etc. grown in the study area.

Soil is different types in different villages. Near the Pravara rivers wide tracts of deep rich Lands, Adhala Vally a good deal of fertile land bordering the river banks, Hilly areas to the western part of the study area red soils derived by residual weathering of the basalts' in a tropical humid climate, deeper on the slopes than on the levels is found. The drainage pattern is dendritic. Wilson reservoir (Bhandardara), Nilwande reservoir and Adhala reservoir are the major surface water bodies and a large number of Small tanks or reservoirs have been delineated most of which are minor irrigation projects or peculation tanks available.

1.1 Crop Season's

Two crop seasons Monsoon season (Kharip crop) and winter season (rabbi crops) are recognized in this region. The Kharip crops fall in two main groups those with short period and the long duration once with maturity periods of six to eight months. In the first group are all cereals, except Jawar, the maturity period of jawar varieties can be both short and long duration. The extend of rabbi crop is indicative of availability of soil moisture after harvest of Kharip or as in most parts of this region, the available irrigation resources, as many of these are grown under irrigation. Wheat to some extent is grown as unirrigated crop, but its major area is irrigated. Kharip in the main crop season where soils are texturally light and utilize rainwater effectively, whereas in the same region western part of scarcity zone (e.g. Solapur, Ahmednagar district in M.S) which have swelling shrinking type of montmorillonite clay makes it difficult to handle the land during rainy season. This restricts cultivation of crops during kharip in a proportion of 25 to 30 % leaving large proportion to rabbi cropping. The productivity of kharip as well as rabbi crops is very low. Niger, groundnut, safflower are the major oilseeds crops and gram, are the main pulses crops grown in the region. Mango, cash nut, jackfruit, karonda, jamun, guava, banana and grapes are the major horticultural crop grown in this region.

1.2   Cropping Systems

The farmers decision on choice of crops and cropping systems is governed by several interrelated factors i.e. soil and climate, needs of households, socio economic issues,

market infrastructure, post harvest storage, availability of labour, technological developments etc. Cropping activities go on all round the year in India provided water is available for crops in Northern India there are two distinct seasons. Firstly, Rainy (kharip) season, period July to October and secondly, winter (Rabbi) season, period October to March. March to June zaid crops growing some area. In some part of the country there are no such distinct seasons, but there they have their own classification of season's e.g. mixed cropping, rotational cropping, mono cropping, double cropping, multiple cropping etc.

1.3 Sowing Period

Assessment has been made of the sowing and harvesting periods of major crops. These are rice, bajra, ground nut, cotton, maize, which are Kharip crops and wheat which is a rabbi crop. The conditions for sowing are not reached uniformly at the same time everywhere and the period extends for nearly a month and more for each crop. Sowing generally begins in the second week of the June and is more or less completed by the first week of July for the crops of ground nut and bajra. Smaller proportions of fields are shown thereafter sowing of maize crop, which is concentrated only in one zone. Generally commences about the same time as ground nut and bajra, but gets completed by the first week of July, relatively small percentage of fields remain to be sowing is completed little earlier than bajra. The sowing of cotton appears to be more staggered than case for groundnut, bajra or maize, through peak sowing period of cotton is about the same as these crops. The sowing of wheat is concentrated in the first week of November, with a peak in mid November, which is the recommended sowing time for irrigated wheat. In some parts, sowing of irrigated wheat is later than this period.

1.4 Harvesting Period

Out of the Kharip crops, the harvesting period of rice and maize is more sharply defined than other Kharip crops, it begins usually in the first week of month August and most of it is completed by the second week of September. The bajra crop and soyabeen crop are generally begins to be harvested about the same time as rice and maize crop, though the harvest period is more staggered comparing the weeks when largest proportioning of fields are harvested, it is seen that bajra is harvested little later than maize. The peak of harvesting of groundnut is somewhat later than that of bajra and most of it is concentrated between the second weeks of November to the second week of month December. Cotton is a Kharip crop with long maturity period, extending anything from 6-9 months. There are large numbers of pickling of cotton. The first pickling begins by about October and continues as late as in March. Such wide variation is because of varietal differences and due to the climate of soil. The second pickling usually begins about a month later and ends later by a similar period. The harvest period of wheat, like it's sowing time is in the month of March and little of the harvest in April and May.

2. Study Area

The study area Akole is a Tahasil place in Ahmednagar district, state of Maharashtra in India. Well surrounded with the mountains of Sahyadri, extends between $19^0 15^, 14^{,,}$ and $19^0 44^, 59^{,,}$ North Latitude and $73^0 37^, 00^{,,}$ to $74^0 07^, 24^{,,}$ East Longitudes, covering an area of 1, 50,508 hector. The Highest Peak of Kalsubai (5427 feet or 1646 mt's) in the Sahyadris with a mean annual rainfall of about 508.9 mm. lies in the study area.
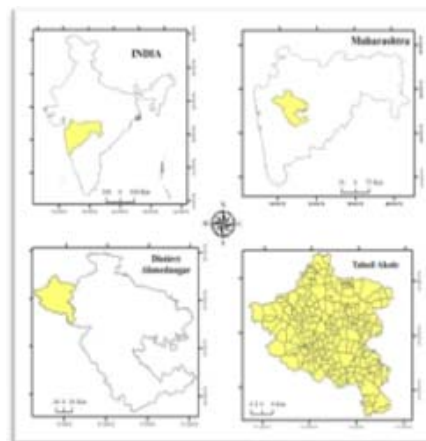

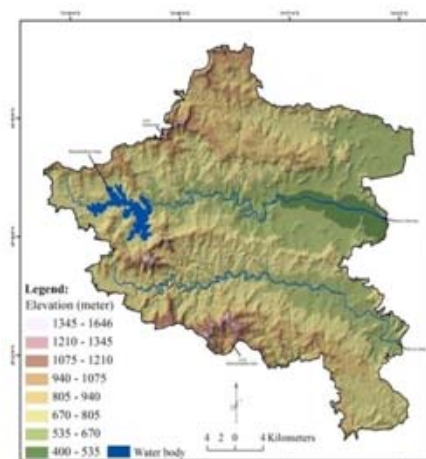**Figure 1:** Map of the Study area

Figure 2: DEM Map, Akole Tahasil

Area under forest in 41,698 hectors and agriculture land 98,712 hectors. Total Villages 191 and 4 (Four) Revenue Circles namely Rajur, Akole, Samsherpur and Kotul. Total population is 2, 91,950 Census 2011 (No. of Male 1, 47,880 and No. of Female 1, 44,070), literacy 1, 92,461 persons and one of which 1, 39,730 (ST) Tribal people in this area. The climate of the tahasil is hot and dry. It is characterized by a hot summer and general dryness except during the south – west monsoon season in India.

3. Data and Methodology

Cropping pattern of study area was prepared with the help of Arc GIS 10.1, Arc View 3.32 and RS analysis Ilwis 3.3 software packages various thematic maps related to study area was prepared by using Survey of India Toposheet of 1: 50000 scale as the raster maps.

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3.1 Cropping pattern

The broad picture of present study with the help of Secondary Sources and following procedure used for period of 1990-91 to 2010-11 (20 years).

3.1.1 Crop combination (Weaver's, 1954)

$$\text{Variance} = \frac{\Sigma d^2}{n} \qquad \text{Standard Deviation} = \sqrt{\frac{\Sigma d^2}{n}}$$

Where,
'd'-The difference between actual crop % in a given unit and the % in the theoretical distribution, 'n' -the numbers of crops in a given combination.

3.1.2 Crop Concentration (Jasbir Sing 1976)
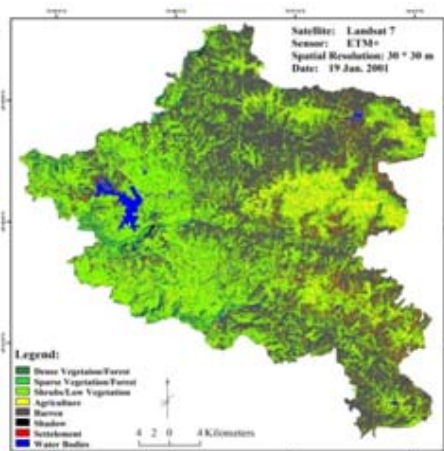
$$Ci = \frac{Pae}{Par} \times 100$$

Where,
'C' - Crop Concentration, 'Ci' - Crop Concentration index, 'Pae' - % of the Crop 'a' to the total harvested area in an enumeration unit, 'Par'- % of the Crop 'a' to the total harvested area in the entire Region.
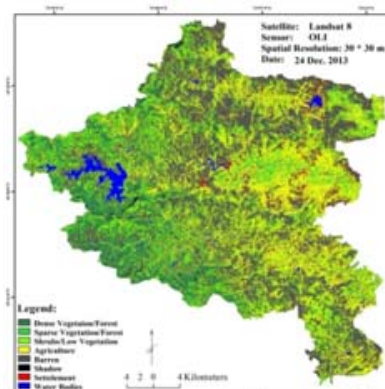
4. Results and Discussion

In the 2000-01 agricultural area, agriculture labour and settlement area is very less. Because of agricultural facilities, demands of markets, sources of tourist and facilities, modern techniques in agriculture are undeveloped and tribal people are totally depended on primary activities (Fig. no.3-I), but forest area is maximum available in the study area. Next decades 2010-11, agricultural facilities, sources of irrigation, modern techniques, demands of markets and other facilities are available in the present area. Then agricultural area, agricultural labour and settlement is directly increase and forest area and vegetation is day by day decreased 2010-11 (Fig. no.3-II).

4.1 Land use and Land Cover Pattern

I) 2000-01

II) 2010-11

Figure 3: Satellite Image of Study Area

4.2 Classification of cropping pattern (1990-91 to 2010-11)

Table 1: Classification of Crop in Percentage Source: Dept. of Agriculture, Akole Tahasil

Sr. No.	Name of Crops	1990-91	2000-01	2010-11
1	Rice	94.85	93.23	99.69
2	Bajra	66.85	70.65	57.52
3	Wheat	32.07	33.63	30.56
4	Jawar & Maize	16.35	14.85	18.49
5	Pulses	19.12	19.93	21.02
6	Soya been	20.53	22.44	22.61
7	Other Oilseeds	13.47	11.43	12.13
8	Cotton	14.9	14.43	16.88
9	Sugarcane	8.11	8.24	7.59
10	Fruit	7.74	7.79	6.86
11	Vegetable	68.87	62.82	62.37
12	Flower	29.31	32.12	36.58
13	Fodder	7.6	8.17	7.45

(Note: j&m- Other Cereals (Jawar & Maize), s.b - Soyabeen, oth.od- Other Oilseeds, s.c- Sugarcane, f.c- Fruit Crops, v.c – vegetable crops, fl.c- Flower Crops, fd.c- Fodder Crops). In 1990-91 agricultural cropped area more than 60 % i.e. rice, vegetable and bajra crop, 60 to 20 % i.e. wheat, fl.c and s.b crop, less than 20 % cultivated crop is pulses, j&m, cotton, oth.od, sc, fc and fd.c. Next decades 2000-01 and 2010-11 agricultural cropped area is same growing crops in the decades 1990-91 bajra, f.c, v.c and fd.c. 2010-11 bajra, wheat, v.c and fl.c are changed value (Table no. 1). 1990-91 to 2010-11 various crops area and growing crop is changed because of demands of markets and adopt the new techniques.

4.3 Changing Cropping Pattern (1990-91 to 2010-11)

Table 2: Crop in Percentage Source: Dept. of Agriculture, Akole Tahasil.

Name of Crops	1)AKOLE CIRCLE		2)KOTUL CIRCLE		3)RAJUR CIRCLE		4)SAMSHERPUR CIRCLE		TOTAL AKOLE TAHSIL	
	Changing Crop Values in percentage									
	1991 to 2001	2001 to 2011	1991 to 2001	2001to 2011	1991to 2001	2001to 2011	1991to 2001	2001to 2011	1991 to 2001	2001 to 2011
Rice	-0.27	-0.78	+0.64	-1.00	-0.91	-1.48	-1.08	+9.72	-1.62	+6.46
Bajra	+1.83	+1.18	+1.35	-2.42	+1.00	-7.38	-0.38	-4.51	+3.8	-13.13
Wheat	+0.78	-0.84	+0.62	-2.64	+0.04	+0.31	+0.12	+0.1	+1.56	-3.07
J & M	-1.97	+3.28	-0.09	+0.75	NA	+1.41	-0.13	-1.8	-1.5	+3.64
Pulses	+0.13	-0.55	+1.08	+0.85	-0.5	+0.77	+0.1	+0.02	+0.81	+1.09
S.b	-0.2	-1.8	+1.89	+1.88	+0.05	+0.05	+0.17	+0.04	+1.91	+0.17
Oth.Od	-0.37	+0.4	-0.95	+0.26	-0.21	+0.23	-0.51	-0.19	-2.04	+0.7
Cotton	+0.06	+0.1	+0.03	+0.9	-0.09	+1.37	-0.47	+0.08	-0.47	+2.45
S.c	+0.13	-0.65	NA	NA	NA	NA	NA	NA	+0.13	-0.65
F.C	+0.12	-0.21	+0.29	-0.1	+0.31	-0.1	-0.67	-0.52	+0.05	-0.93
V.C	+0.09	-1.5	-5.24	+0.63	-0.31	+2.21	-0.59	-1.79	-6.05	-0.45
Fl.C	-0.24	+1.79	+0.36	+0.85	-0.03	+2.56	+2.72	-0.74	+2.81	+4.46
Fd.C	-0.09	-0.42	0.00	+0.05	-0.06	+0.06	+0.72	-0.41	+0.57	-0.72

Study area include 4 circles i.e. Akole, Kotul, Rajur and Samsherpur circles cultivated crop area values and 13th crop groups shows that table no. 2. 1990-91 to 2000-01 Akole circle increase crops bajra, wheat, pulses, cotton, s.c, f.c and v.c, Kotul circles i.e. rice, bajra, wheat, pulses, s.b, cotton, f.c and fl.c, Rajur circle i.e. bajra, wheat, s.b & f.c and Samsherpur circle i.e. wheat, pulses, s.b, fl.c and fd.c. Decrease crops values in Akole circle i.e. rice, j&m, s.b, oth.od, fl.c, fd.c, Kotul circle i.e. j&m, oth.od, v.c and fd.c, Rajur circle i.e. rice, pulses, oth.od, cotton, v.c, fl.c, fd.c and Samsherpur circle i.e. rice, bajra, j&m, oth.od, cotton, f.c and v.c. 2000-01 to 2010-11 Akole circle increase crops bajra, j&m, oth.od, cotton and fl.c, Kotul circle i.e. j&m, pulses, s.b, oth.od, cotton, v.c, fl.c and fd.c, Rajur circle i.e. wheat, j&m, pulses, s.b, oth.od, cotton, v.c, fl.c and fd.c and Samsherpur circle i.e. rice, wheat. Decrease crops values in Akole circles rice, wheat, pulses, s.b, s.c, f.c and v.c, Kotul circle i.e.rice, bajra, wheat and f.c, Rajur circle i.e. rice, bajra, and f.c and Samsherpur circle i.e. bajra, pulses, oth.od, f.c, v.c, fl.c and fd.c. In the present study area 1990-91 to 2000-01 changed crops values increases in the bajra, wheat, pulses, s.b, s.c, f.c and fd.c and 2000-01 to 2010-11 i.e. rice, j&m, pulses, s.b, oth.od, cotton & fl.c. The study area 20 years, including 4 circles changing cropping pattern is mostly effective irrigation facilities and modern techniques. Except hilly region and forest area food and cash crop successfully developed. Circle wise changed showed fig. no. 7 and 8. Present study area total 191 villages studied and used crop combination (Weaver 1954) and crop concentration (Jusbir Singh 1976) methods fig. no. 4 and 5.
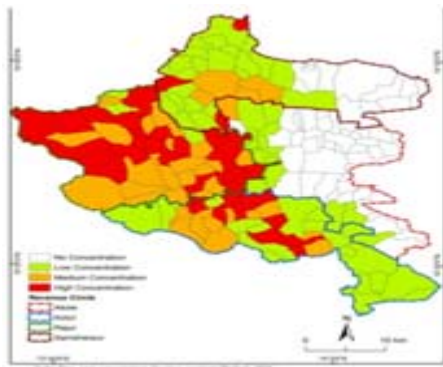

II) 2000-01
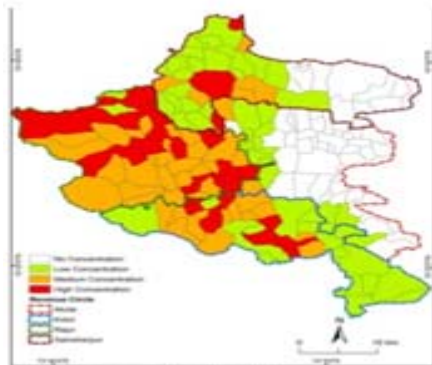

III) 2010-11
Figure 4: Crop Combination Values

Collected data and mentioned Annual Crop Combination as shown Fig no. 4. 1990-91(Fig no. I), 2000-01(Fig no. II) and 2010-11(Fig no. III) with highlights in the important changes. The increase and decrease value of during 1990-91 and 2010-11 period. It is observed is more significant in the rice crops leading to all circles and decreased crops in the fodder crops in 1990-91 to 2010-11 and fruit crops in the 2000-01. These changes are well associated with the intensity of irrigation followed by modern inputs and coupled with improved farming techniques.
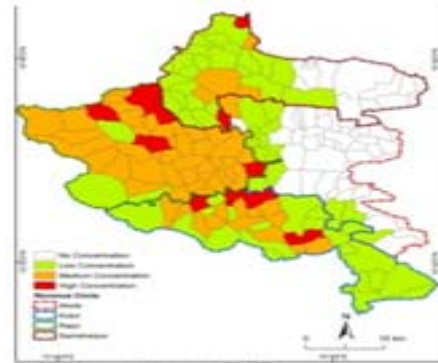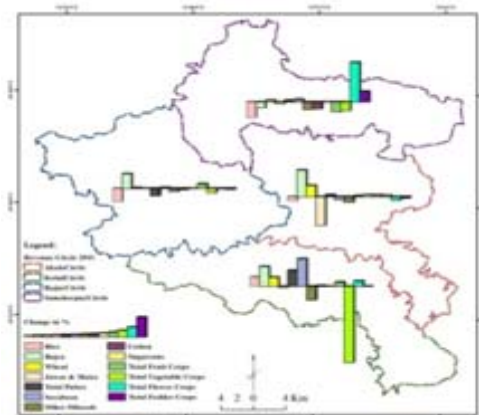

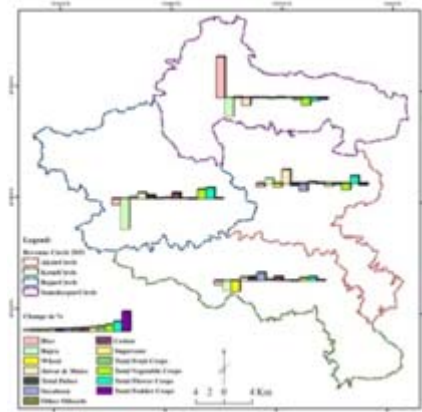I) 1990-91

I) 1990-91

II) 2000-01

III) 2010-11

Figure 5: Crop Concentration Values

I) 1990-91to 2000-01

II) (2000-01 to 2010-11)

Figure 6: Changing Cropping Pattern#

The period under investigation has phenomenal growth in the study area under bajra, flower, soyabeen, wheat, pulses, sugarcane, fruits and fodder crops from 1990-91 to 2000-01 (Table no.2 and Fig.no.6-I) and rice, flower, other cereals, cotton, pulses, soybean and other oilseeds from 2000-01 to 2010-2011 (Table no.2 and Fig.no.6-II). The significant increase of the cultivated area is available irrigation, demands of markets and modern techniques adopt of the study area. The areas under 1990-91 to 2000-01 period of 10 years decrease values rice, jawar and maize, other oilseeds, cotton and vegetables crops next decades bajra, wheat, s.cane, vegetable crops and fodder crops values is decreased.

5. Conclusions

It was observed the study area adoption of new technology is increasingly found in the irrigated areas. Intensive agricultural systems more accepted all over the study area. The major portion of the land is under cultivation is positive changed. Significant change is noted that in cropping pattern. The shift from rice, cereals, pulses, groundnut and sugarcane coincides with the irrigation developments in all villages. Although the entire cropping pattern seems to be governed by agro-climatic conditions, irrigation has played a prominent role by changing the nature and extent of cropping pattern. Rice and fodder cultivation prevail in western heavy rainfall zone. The southern, middle and eastern part, facilitated by assured irrigation and fertile soils are suitable for growing several crops.

It is made possible due to the increase in lift and canal sources of irrigation and also the special efforts made by co-operative, particulars sugar factories, farming equipments, labour and another facilities i.e. fertilizers, seeds, insecticides, electricity and credit also available for recent decades. The decrease in area under rice, other cereals, other oilseeds, cotton and vegetable crops from 1990-91 to 2000-01 and bajra, other cereals, sugarcane, fruit, vegetables and fodder crops from 2000-01 to 2010-11. In case of overall change, the shift from food grains to sugarcane is noteworthy in areas facilities by perennial sources of irrigation. While shift from cash crop to cereals, flower and rice it observed in the areas having only seasonal sources of irrigation.

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6. Future Scope for Research

To understand significance sound evolution and future planning for agriculture is consider for the study. The present study is very useful for social organization, N.G.O, Educational and Governmental Institutes, policies and Agro-based small scale Industries in the future.

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