CHAPTER-I

“AGRICULTURAL TECHNOLOGY AND ITS IMPACT ON AGRARIAN STRUCTURE AND AGRICULTURAL PRODUCTION IN SOLAPUR DISTRICT” - A GEOGRAPHICAL STUDY

1. INTRODUCTION

The new agricultural strategy adopted in the Mid-Sixty’s (1965), has helped in revolutionizing Indian agriculture. The new strategy is characterized by the adoption of HYV seeds, fertilizers, pesticides, irrigation, machinery, improved implements, soil conservation and institutional credit etc. The adoption of these components has resulted in increase in output. The success of the new strategy depends on factors like better factor endowment are the first to adopt modern inputs to reap the benefits. Therefore, the differential adoption of new strategy due to differential opportunities in terms of factors result in differential gains.

Technology refers to knowledge used in production to improve productivities. It has played a significant role in strengthening farmers hold on agricultural resources and enabling him to reap better harvest. Agricultural technology tends to decrease the unit cost of inputs without decreasing the output. It is become possible to bring large proportion of area under cultivation to get the optimum benefits from agricultural technology some sort of mechanization of farm operations per and post-harvest in necessary for the simple reason so that multiple cropping can be reaped.

There are many barriers impending the adoption of these technology including a lack of uniform and consistent regulatory frame –works and intellectual property protections, the inability of small holder farmers to access financing and capital to invest in technology that will improve their yields, as well as a general lack of understanding of the positive role that science and technology can play in agriculture and food.

Despite these challenges agricultural technology has played a central role in overcoming food security challenges in the past. The 20th century marked a time of significant public investments in scientific research that contributed to historical increased in food production. Coined the Green Revolution, Norman Borloug’s discoveries contributed to historical increases in food production during a time of widespread hunger and malnutrition.
Solapur District of Maharashtra State, ideals represent an important geographical unit, which witnessed the application of agricultural technology in agrarian structure and agricultural production. There are a number of factors influencing an agricultural development in a region like Solapur District. Very recently introduced technological factors of the region, include irrigation, agricultural implements and machinery, adoption of improved seeds, use of chemical fertilizers etc. Therefore, an attempt has been made to study the impact of agricultural technology on agrarian structure and crop production of the Solapur District.

2. THE CHOICE OF THE TOPIC AND REGION

Many considerations have influenced the choice of the present topic of study and the selection of the region. The district of Solapur is a peculiar region; passing through a transformation stage and emerged out recently as one of the progressive agricultural district in the Maharashtra State. From the last three decades the district has been characterized by adoption of new technology in agriculture transforming the agricultural landscape.

The impact made by Ujani Major Project of Bhima River in recent time is of vital importance, as it is reflected in agricultural sector. There is greater awareness among the farmers mainly in irrigated tracts, to modernize the agriculture to maximizing agricultural production. Though, it is necessary to investigate the impact of irrigation technology on agricultural production and agrarian structure of the Solapur District.

Solapur District comprising eleven tahsils which State has significant location on Maharashtra Plateau. For the present study North Solapur, Madha, Malshiras, Karmala, Akalkot, Pandharpur, Barshi, Sangola, South Solapur, Mangalwedhe and Mohol are considered. A major part of the district lies in the Bhima basin. According to topography of the district can be broadly divided into three zones viz.

I. Eastern Zone- This comprises of Barshi, North-Solapur, South-Solapur and Akalkot tahsils.

II. Central or Transitional Zone- Madha, Mohol, Mangalwedhe and eastern part of Pandharpur tehsils covered by this zone.

III. Western Zone- Karmala, Sangola, Malshiras and Western part of Pandharpur comes under this zone.
There are no prominent hill ranges in the district. The distinct as a whole farms a broad flat or waving basin occupied by the Bhima River, which flow in the middle in a south-easterly direction except in Barshi, Karmala, Mohol, Malshiras and Sangola. The district has few hills and even these are isolated. Hence, it is supports to high concentration of agriculture. As a result these characteristics make this region a distinct physical entity and homogenous unit for geographical investigation.

The district of Solapur belongs to drought-prone-region of Maharashtra. The district of Solapur also has different regions at the level of socio-economic development. It is due to their variations in the socio-economic development that might be minimized by implementations of use of technology and expertise use of man in various region of the district. To study the various in the use of technology at tehsil level of the district. In view of the preceding discussion the study pertaining to disparities in the use of technology has been considered to analyze. Such studies will go on to find the impact of technology on agrarian structure and agricultural production of the study region.

The work on the “Agricultural Technology and its Impact on Agrarian Structure and Agricultural Production in Solapur District” has not yet been attempted by any other geographer and such type of work can be useful. For preparing and implementing schemes regarding the mechanize to agriculture. Therefore, the researcher has selected this region and topic for the purpose of geographical investigation.

3. **OBJECTIVE OF THE RESEARCH**

Objective infact are the goals to achieve by researcher. In order to understand the nature of problem associated with region, it is at the very out-set necessary to formulate certain objectives. Without objectives a study cannot be fulfilled and completed. As a matter of fact, the main purpose of the research is to obtain the result by fulfilling the objectives. Once the objectives are clear, it may become easy to investigate and analyze the problem under study. The present study entitled “Agricultural Technology and its Impact on Agrarian Structure and Agricultural Production in Solapur District: A Geographical Study” has the following objectives to fulfil.

1. To study and analyze the spatio-temporal changes in technological components of agriculture and in what volume these changes have taken place.
2. To assess and evaluate the impact of agricultural technology on agricultural landuse and components.

3. To assess the positive impact of different technologies on agriculture in the region.

4. To know the impact of technology in agriculture sector.

5. To examine the development of agriculture farming in the using agriculture technology.

6. To observe the pattern of physical and cultural factors that have bearing on the introduction and spread of technology.

4. HYPOTHESIS

i. Agricultural technology is instrument in bring changes in cropping pattern and crop output.

ii. The region under study is economically backward and poor since it belongs to drought-prone-area of Maharashtra. The scarcity of water is the main reasons for low agricultural productivity, as compared to many other district of Maharashtra.

5. STUDY REGION

The region under study i.e. Solapur District lies to the southern part of Maharashtra State on the border of Maharashtra and Karnataka State. The district of Solapur lies between 17°05’N to 18°32’ N. latitudes and 74°42’ E. to 76°15’ E. longitudes. It is surrounded by Ahmednagar district to the north, Osmanabad district to the north-east, Karnataka state to south-east, Sangli district to the south-west, Satara district to the west and Pune district to the north-west. Solapur district has an area of 14878sq.km. and population 43,15,527 persons as per 2011 census. It ranks 4\textsuperscript{th} in term of area 7\textsuperscript{th} in terms of population amongst district in the Maharashtra State.

6. REVIEW OF LITERATURE

Before one start working on particular concept it origin and development should be considered. It would be more useful for comparing the views and ideas expressed in the researcher’s finding the light of work done earlier. Brief account is given as under.
1. Mohamad and Sekhri (2006): The study conducted by both author on agricultural modernization and ground water depletion in Ludhiana District, Punjab is worth mentioning in this context. The authors concluded that unless a balance between technology application and groundwater use is maintained, the sustainability of agriculture in the region would be jeopardized.

2. Shashikala and Padmaja (2005): Concluded that moisture adequacy becomes an important parameter in estimating the need for irrigation and exploring alternative crop combination to make agriculture more sustainable.

3. Bhattacharya (2007): Observed that the net influence on agriculture landuse manifests itself through variability of farming as the rural society in Midnapur in West Bengal is shaped by the interplay of local environmental hazard, landuse pattern and peoples initiatives.

4. Singh, B. (2004): He has study in Baraich, U.P. indicated at disturbance to food chain due to excessive use of chemical based insecticides pesticides and fertilizers. He advocated for safer practices in this regard.

5. N.Swapna (2012): In his article entitled “Role of bio-technology in the development of agriculture sector in India” published in inter-science Management review. He concluded that Bio-technologies not a single technology. It can be broadly defined as “Using Organism or their products for commercial purpose”. Modern bio-technology has offered opportunities to produce more nutritious and better testing foods, higher crop yields and plants that are naturally protected from disease and insects. Modern bio-technology allows for the transfer of only one or few desirable genes, thereby permitting scientists to develop crops with scientific beneficial traits and reduce undesirable traits. Benefits can also be seen in the environment, where insect-protected bio-tech crops reduce the need for chemical pesticide use. This article studies the performance of bio-technology in the development of agriculture sector in various forms.

6. Tripathy, R.N. and Small, B.(1969): In their study examined the economics of High Yielding Varieties and traditional varieties of paddy. They found out that an average 42-64 days were required for cultivation of HYVs and 57-80 days for the traditional varieties.

7. Dhondyal S.P.(1968): He studied the impact of bio-chemical technology on farm output and farm earning. In this study, it was observed that the level of production and
net income per hectar pushed by high yielding varieties in conjunction with increased complementary inputs of water and fertilizer in the sample area, Kalayanpur Block.

8. Sharma, S.K. (1984): He states that the soul of green revolution is the miracle seed known as high yielding variety, which has spatio-temporal varieties in its diffusion. Among a host of factors, environmental factors especially climate plays a decisive role in adoption of HYVs in Madhya Pradesh as is related in this study. The author offers giving general trend and spatial pattern of adoption of HYVs of wheat, rice, jowar, maize and bajra in the state analysis its use in Sagar District and Bhopal, Vidisha Plateau on the basis of 100 and 143 selected samples respectively. The study examines the relationship between climate and HYVs of rice, which shows that on the whole the climatic condition is not very conducive for its adoption, leaving the exceptions part. Hence, the farmers prefer the improved indigenous varieties. Wheat has shown a contrary result and it does not face the environment problem. Generally, it is grown with irrigation, which is available. It helps not only in adoption of HYVs of wheat but also use of chemical fertilizers and plant protection chemicals.

9. Noor Mohammad (1975): In this paper has made an attempt to ascertain the impact of socio-demographic factors on diffusion of agricultural innovations in Suryapur Plain of north-eastern U.P. The author has selected four major groups of innovations viz. chemical fertilizers, improved varieties of seeds, improved agricultural implements and plant protection measures and has assessed the impact of seven socio-demographic variables i.e. education, training age, caste, value-orientation, occupation and size of family on adoption of above innovations. The farmers constitute the ultimate unit of study and total of 129 articulate farmers are selected from 45 sample villages lying in different homogenous strata of the region. The study is based on primary data collected by the author in 1974-75 at three levels i.e. block, village and farmers. The data are processed and each respondent is assessed to different parameters as well as adoption rate according to scoring schemes evolved by the author for qualifying the variables. The study reveals that socio-demographic factors play a very significant role in the diffusion of agricultural innovations.

10. Jain, C.K. (1985): He has described and explained the trend and pattern of adoption of modern farm technology, such as irrigation, its sources, area irrigated and its spatial pattern, high yield varieties of seed, plant protection measures and farm implements. Author has worked out composite index of levels of adoption by giving rational weightage to each innovation and have grouped the districts into six levels of adoption.
He observed that innovation farm technology in M.P. is depressingly low degree of adoption of modern farm technology. The traditional technology is yet more acceptable to the cultivation with marginal and small holdings and limited economic means which make them more tradition-oriented and properly stricken. Big sizes of holdings, commercialization of crops and urban influences have facilitated the modernization of farming in this area. He concluded that the extension agency should be geared up to spread adoption of improved farm technology.

11. Chatterjee, B.(2006): He has analyzed the impact of modern technology on food grain production in West Bengal. In this work he concluded that, the increase in food grain production occurred due to increase in modern technology such as fertilizer, pesticides, HYVs and irrigation.

12. Ranade, C.G.(1980): He examined that the effect of cropping pattern, fertilizer and irrigation on agricultural output per hectare across 54 agro-climatic regions covering 16 major states during the pre-Green Revolution period from 1960 to 1965 and then for the past-Green Revolution period.

13. Vaidyanathan and Others (1994): Have studied to assess irrigation impact on productivity of land at national level and state level. They used the multiple regression technique to assess the irrigation impact. The estimates of the value of production per hectare of irrigated and un-irrigated areas were based on official data on landuse, irrigation crop patterns and yield productivity was measured in terms of market value of output per unit area. The basic source of data for this study was estimates of the area and production of principal crops in India published annually by the Directorate of Economics and Statistics, Ministry of Agriculture Government of India.

The study concluded that the productivity of irrigated area shows a significant rising trend in a majority of states covered (eight out of thirteen) while only four showed a significant trend in rain fed area. The differential between irrigated and rain fed yield have been rising in all the states and thus, in a large majority of states, but not all irrigated yields was more stable than un-irrigated yields.

14. Shah, S.L. and Agrawal, R.C.(1970): Both authors indicated that distribution of agricultural inputs have widened due to the impact of the new technology which are likely to increase. Further with the advancement of the new technology with the introduction of new technology the income levels of progressive farmers have considerably increased but there is a significant difference in the income level of
progressive and less progressive farmers in the different size groups of holdings in Budawn District of U.P.

15. **Malik and Padhi(1995):** They have attempted to study irrigation impact on agricultural development through different irrigation systems in Orissa. This study intended to undertake a comparative analysis of the impact of different systems of irrigation on cropping pattern, cropping intensity, productivity, income and employment. Further in this analysis different systems of irrigation were compared with the control areas multi-stage stratified random sampling technique was used for this study. The first stage constituted the selection of different irrigation projects, selection of the districts formed the second stage of the survey. The villages were taken as the primary units and households as the ultimate units. The yield performance in different system of irrigation underwater found to be higher compared to the yields in different system under different source of irrigation.

The literature on agricultural technology is very few as compared to studies done on landuse, cropping pattern, agricultural productivity etc. since last decade. Geographers have been taking interest in studying agricultural technology.

7. **DATA-BASE AND METHODOLOGY**

The work is based on a primary and secondary sources of data. The data collected and use for the period 1993-94 and 2013-14. The primary data is the raw data collected through different sources for which special questionnaires were designed through intensive field work comprising schedule, interviews and discussions with the farmers.

Tahsil is considered as areal unit of the present research work. Wherever, the data is not available at tehsil level mainly yield per hectare consumption of fertilizers, operation-wise, and season-wise use of tractors and crop-wise use of high Yielding Varieties seeds, where researcher has generated the same through sampling technique.

The broad picture of present agricultural implements, land-utilization etc. of the district is prepared with the help of secondary data obtained from Official Statistics from Socio-Economic Review, District Statistical Abstract, District Census Handbooks, Season and Crops Reports published by the Agriculture Department, Irrigation Department, Gazetteers and some un-published records. The information is also obtained from the Bureau of Economics and Statistics, the Zilha Parishad etc. It is
considered necessary to supplement secondary information by in-depth, micro-studies at village level. For this purpose six villages from each agro-climatic zone has chosen.

A micro-level study includes plot to plot survey at the land covering information of relevant aspects of such as source of irrigation, utilization of modern agricultural implements, High Yielding Varieties of seeds consumption of fertilizers etc.

The collected data was presented and represented by statistical and cartographic techniques. The study has been addressed for five objectives. The cover these objectives following methodologies has been adopted. First objective is concerned with the study of spatio-temporal changes in agricultural technology. For the temporal changes the two points of period i.e. 1993-94 and 2013-14. The following components of technologies are considered here as agricultural technologies which are irrigation, High Yield Varieties seeds, chemical fertilizers and mechanization. Whereas, changes in irrigation technologies measured in terms of area under well irrigation, area under canal irrigation, area under drip irrigation etc. The intensity of various irrigation methods are calculated by following methods…..

\[
\text{Intensity of Irrigation} = \frac{\text{Net Area Irrigated}}{\text{Net Area Sown}} \times 100
\]

The data pertaining to the number of tractors, oil engines, electric pump-sets in each tehsil is collected and index values for each machine in each tehsil is obtained with the help of following formula (Jasbir Singh’s Method, 1984)

\[
I_a = \frac{Z_a}{R_a} \times 100
\]

Where,

\(I_a\) = Index of ‘a’ machine
\(Z_a\) = The number of ‘a’ machine per 100 hectares of cultivated land in tehsil
\(R_a\) = The number of ‘a’ machine per 100 hectares of cultivated area in the district

To highlight agrarian structure, Weaver’s Technique is applied for delimiting the crop combination zones in the district.
The crop combination zones are obtained by the following techniques of Weaver’s which is presented as follows…

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

Where,

\[d = \text{The difference between the crop percentage in a given areal unit and the percentage in the theoretical percentage.}\]
\[n = \text{The number of crops in a given combination.}\]

To assess the impact of agricultural technology on crops production and productivity and areal strength of crops several techniques are used in agricultural geography. In the present study crop yield and crop concentration indices ranking coefficient techniques is used. This technique is introduced by Jasbir Singh (1976). The procedure of this technique is as follows….

\[
\text{I } y_i = \frac{y_{ae}}{y_{ar}} \times 100
\]

Where,

\[y_i = \text{is the crop yield}\]
\[y_{ae} = \text{is the average yield per hectare of crop ‘a’ in the component enumeration unit, and}\]
\[y_{ar} = \text{is the average yield of the crop ‘a’ in the entire region}\]

\[
\text{II } C_i = \frac{P_{ae}}{P_{ar}} \times 100
\]

Where,

\[C_i = \text{is the Crop Concentration Index}\]
\[P_{ae} = \text{is the percentage strength of crop ‘a’ in the total harvested area in the Component enumeration unit}\]
\[P_{ar} = \text{is the percentage strength of crop ‘a’ in the total harvested area in the entire Region.}\]
The crop yield and concentration indices, thus, derived for all the component enumeration units and crops are ranked separately. Yield and concentration ranks for individual crop are added and there after divided by two, thus, giving the crop yield and concentration indices ranking co-efficient

$$\text{Crop Yield and Concentration Indices ranking co-efficient for crop 'a' } = \frac{\text{Crop Yield Index ranking of crop 'a'} + \text{Crop Concentration Index ranking of crop 'a'}}{2}$$

The result thus, derived will give us an idea of the level of agricultural productivity, the lower ranking co-efficient, the higher the level of agricultural productivity and vice-versa.

8. ORGANIZATION OF THE STUDY

The entire study is organized into seven chapters. The first chapter deals with introduction, objectives, hypothesis, selection of the topic and region, review of literature, data base and methodology, organization of study and references.

The second chapter concern with physical and demographic components, in which comprises location, relief, drainage, climate, soils, population growth, density, literacy and sex-ratio.

The type of the agricultural technologies are the subject matter of third chapter and deals irrigation technology, farms implement technology, seed technology, fertilizer technology.

Fourth chapter highlights the impact agricultural technologies on general and agricultural landuse.

The impact of agricultural technology on crop production and productivity is discussed in fifth chapter.

Sixth chapter is divided into two parts in first involves some of the emerging features and they are pursued through case study at micro-level. While in second part is concerned with the level of agricultural technology and performance.

Seventh chapter concerned with brief summary and conclusion, which has been presented with meaningful and viable recommendation for future planning.
9. CONCLUSION

Agricultural technology is the application of knowledge involving the use of combination of biological and chemical inputs, particularly irrigation, high yielding seeds, chemical fertilizers, mechanization and plant protection measures. The Solapur district is one of the agriculturally progressive district in western Maharashtra. The district has different modes of irrigation. However, surface methods of irrigation are practiced over 98% area to total irrigated area. The study growth of tractorization shows the growth in the number of tractor has been accelerated from 4280 in 1993-94 to 5298 in 2013-14. The impact of seed technology on agricultural productivity reveals the fact that high yielding varieties of different crops have led to increase in yields per unit area. The regional variations are observed in consumption of fertilizer per unit area.
10. REFERENCES


