CHAPTER–VIII
AGRICULTURAL PRODUCTIVITY REGIONS

6.1 General Introduction

Spatial patterns of agricultural productivity are interplay of multifarious environmental, technological and institutional factors. It has said, “productivity is the point where human skills and interests, technology and the social and business environment all coverage” (APO, 1998). Physical environment such as soil, climate, and relief import certain broad limits besides techno-economic factors within the region. Among others, irrigation water is the most limiting resources in Jiroft watershed. Despite much effort there has been little success in increasing irrigated lands and other fundamental services. The main reason is financial limitations. An increase only in drip or sprinkler irrigation to save water for new agricultural lands. On the other hand, inputs, such as, chemicals, fertilizers, and labour have not increased adjacently. Although the region suffers from the shortage of rainfall and water availability in recent years as a result of extensive droughts, yet, productivity of most crops has increased. It is especially so in case of potato, cucumber, orange, onion, tomato and watermelon in central and south parts study area. Despite production growth, waste lands are also extremely high amounting to approximately 15 percent of the total area. In some crops such as onions the rate is even higher. The waste land occurs during different stages of production, harvesting, transfer, marketing, storing and retailing. One way for in increasing the productivity is to decrease the rate of
wastage. Another issue is to investigate the externalities of production with respect to environment and losses due to sustainability of basic resources. Increasing the area under cultivation by traditional farming systems is not an efficient way to enhance agricultural production since more fertile lands have already been brought under cultivation in Jiroft plain. Thus increasing productivity of currently cultivated land is an alternative that entirely depends on application of improved farming inputs and techniques, implying increasing food production by technology and capital in study region.

In the previous chapter namely, "Crop Combination and Diversification" delineates crop regions with considering area under crops in Jiroft watershed. This chapter is fully devoted to focus on the production aspect in the study area. The understanding of existing levels of productivity is essential for better planning and management to bring up the backward areas. The population is rapidly increasing and this rapidly increasing population needs to feed properly. Thus, it is imperative to make comprehensive study of each crop and production. Here an attempt has been made to identify crop productivity regions and the factors involved in it. The term 'Productivity' is regarded as, "A ratio of the output to input in relation to land, labour, capital and overall resources employed in agriculture." Rao and Jasbir Singh (1981) considered "Productivity as the degree at which the economic, cultural, technical and organizational variables are able to exploit the biotic resources of the area for agricultural production". Bhatia (1967) defined agricultural efficiency as, "The
aggregate performance of various crops in regard to their output per acre”. Singh (1979) defined agricultural productivity as, “The quantity of returns from arable land”. He argued that quantity of produce denotes its intensity and spatial expansion.

The term agricultural productivity is both dynamic and relative concept. The study of agricultural productivity is essential for differentiating and delimiting the areas whose performance and accomplishments are diversified. The studies on agricultural productivity are helpful in involving a future oriented strategy for agricultural planning.

The concept of agricultural productivity is very complex. However, various scholars have introduced many different methods of its measurements. Kendall (1939) has suggested four methods to measure the productivity, such as, Productivity coefficient, Ranking co-efficient, Value co-efficient and Energy co-efficient or Starch Equivalent. Bhatia’s (1967) method deals with the yield and the magnitude of area under various crops. Yields per hectare only may not give a correct picture of the importance of a particular crop. It may have high yields but insignificant hectarage under that crop. But the weighted against its hectarage brings out the productivity in the true sense. Stamp (1956) has taken 10,00,000 calories per year as Standard Nutrition Unit (total calories required by a normal human being in a year). For determining the productivity levels Enyedi (1964) calculated an index of productivity. Shafi (1972 and 1974) also adopted this approach to determine the productivity indices with respect to twelve crops in India. In developing countries
where population is dense and fast growing, there is need to increase in the total calorie value of crops. Shafi (1983) used this method for his study of agricultural productivity of Uttar Pradesh. Crop productivity is a function of factors like physiography, soil type, rainfall, irrigation etc. The present study aims at computing of crop productivity for Jiroft Watershed having diversity in soil, local relief and irrigation and transport network. The Study watershed exhibits rolling plain with local undulations sloping at central and south, moderate hill range in west and high elevation mountain range passes in north and east parts. The physiography has direct influence on the soil types, climate condition and their spatial distribution of crops and productivity.

The productivity data, at village level is not available. To overcome this difficulty of yield data of each crop was collected during fieldwork both on yield and hectare for the six selected villages. These six villages are well spread over the Jiroft watershed (Fig.10.1). The soil types, rainfall, temperature, topography, water resources, irrigation facility, location of central market, transportation network, labour forces, population density, farming technology and cultivation technique, farmer knowledge and literacy are considered while interpreting the productivity. Orange, date, wheat, potato and tomato crops in were studied to compute productivity. The productivity index of these crops is shown in table-81. Among various methods of crop productivity, Enyedi’s and bhatia’s methods were chosen to compute crop productivity for Jiroft watershed. Finally compared these two methods. The spatial distribution of productivity for every crop was
computed, mapped. The data obtained for five leading crops were used
to delineate the crop productivity for study region and interpreted.

Productivity Region by Enyedi’s:
Enyedi’s has given following formula to computing crop productivity as:

\[
\text{Productivity Index} = \frac{Y}{Y_n} \times \frac{T}{T_n} \times 100
\]

Where:

\[Y = \text{Production of selected crop in a unit area.}\]
\[Y_n = \text{Total production of selected crop in entire region.}\]
\[T = \text{Area under selected crop in a unit area}\]
\[T_n = \text{Area under selected crop in entire region.}\]

<table>
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<tr>
<th>Sr. No</th>
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<th>Potato</th>
<th>Date</th>
<th>Wheat</th>
<th>Onion</th>
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</tbody>
</table>

Source: Computed by Researcher

The spatial distribution of orange productivity is displayed in Fig 8.1
least productivity is recorded in 11.6 per cent of total area at Esfanaghe
plateau in western part (<80) where soil is colluvial receiving low rainfall,
lack of irrigation and transportation facilities and low population density.
Whereas very large portion 34.3 per cent of total area in eastern, central,
and southern parts shows highest productivity (>100) due to deep fertile soils, availability of ground water, population density, good irrigation and transportation facilities and productive and surface water in Jiroft alluvial plain and valleys. Moderate productivity (80-100) of orange is identified in two isolated pockets on 57.1 per cent of total geographical area in north and southeastern parts. The general trend of productivity of orange shows decreasing towards west due to, change in soil irrigation and transport network, low population density, lack of water availability and markets.

Potato is vegetable cash crop of winter season. The spatial distribution of potato productivity is displayed in Fig 8.1B. The highest productivity is found in small portion on of 7.9 per cent of total area in central and southern parts (>105) due to developed Irrigation systems and good transportation network soil fertility and high labour forces mechanization and availability of agriculture implements. Also lowest productivity is found in 7.9 per cent of total area in eastern part (<75) due to rugged terrain with coarse shallow soil, lack of labour forces, undeveloped transportation network and small size of farms. Whereas moderate productivity (75-105) is identifies in very large portion of the study region covering area 84.2 per cent of total area from the north towards south and southeastern directions. Potato productivity indicates decreasing trend towards east. Date is a native cash crop of this region requires warm climate, less amount of water and coarse texture and sandy soil. It is one of the drought resistant crops in study region. The spatial distribution of date productivity is shown in Fig.8.2A.
Fig. 8.1 orange and wheat
The highest productivity of date is found on 33.3 per cent of total area in central, south and southeastern parts (>90). Whereas the lowest productivity is observed in north and northwest parts (<75) covering 35.3 per cent of total area. Moderate productivity of this crop is identified in transitional region in central, southwest and eastern parts on 31.4 per cent of total area. Date productivity shows decreasing trend from central, south and south-east parts to north and north-west due to cold weather, higher rainfall, and rugged topography. Hot weather in summer season, availability condition, sandy soil and high density of population and labour forces favours of high productivity of date in central and southern parts in study area.

Wheat is major food crop of winter season in Jiroft watershed. The spatial distribution of pattern of wheat productivity is displayed in Fig.8.2 B. The highest productivity of wheat is observed in 7.7 per cent of total area in Esfandaghe plateau (<120). Whereas lowest productivity of wheat is appeared in eastern parts which covers 3.9 per cent of total area due to rugged terrain, small size of farms and lack of irrigation, arable lands and transportation facility. Moderate productivity of this crop (80-120) is observed in very large portion with covering an area 88.4 per cent of total area entire the study region. The productivity of wheat is increasing towards west due to physiography, soil and moderate temperature and rainfall conditions.
Fig. 8.2 onion and potato
Onion is a winter cash crop in Jirot watershed. The spatial distribution of onion productivity is shown in Fig 8.3B. It shows highest productivity (>100) in central south and southwestern parts on 28.6 per cent of total area in study area. The fine alluvial fertile soil with developed irrigation systems, good transportation and market facility favour the onion cultivation here. Eastern part has experienced lowest productivity (<90) due to rugged terrain and steep slopes, shallow and sub-deep and infertile soil and lack of transportation facility on 8.1 per cent of total area. Moderate productivity (90 to 100) is identified in large parts in north, north-west and south-east parts in Jiroft watershed.

6.3 Region by Bhatia’s method Agricultural Productivity

According to Bhatia’s (1967) hectares yields express all physical and human factors connected with the production of crops and the sharing of cropland among the various crops reflecting various factors involved in land utilization. At the same time the contribution of each crop to agricultural productivity would be relative to its percentage of the crop land also. Bhatia’s assumed that the hectare yield expresses the physical and human factors involved in the productivity. The agriculture efficiency is the aggregate performance of different crops in regard to output per hectare. The hectare-yiled of any crop corresponding average hectare yields for entire region to obtain productivity index. According to this technique, yields of the five leading crops for six sample villages are calculated as a percentage to the study region yield of the respective crops. This may be expressed as:
\[ I_ya = \frac{Y_c}{Y_r} \times 100 \]

Where \( I_ya \) is the yield index of crop “a”

\( Y_c \) = Is the hectare yield of crop “a” in component areal unit

\( Y_r \) = Is the average yield of crop “a” in the entire study region

**Table-8.2. productivity Region By Bahatia’s Method**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Village</th>
<th>Crops and productivity index</th>
<th>Orange</th>
<th>Potato</th>
<th>Date</th>
<th>Wheat</th>
<th>Onion</th>
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</tr>
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</table>

Source: Computed by Researcher

The spatial distribution of orange productivity is shown in Fig.8.4A. This map shows sixteen rural districts have highest productivity value (>100) covering 51.2 per cent of total geographical area. These districts are located in central, south, southeast, east and southeast parts in Jiroft watershed. High value of orange productivity is the result of various factors, namely, moderate climate, high population density, irrigation and transportation facility, fertile soil and uneven surface. Whereas the region with least productivity (<90) is identified at Esfanaghe district lying western part where on colluvial soil having low rainfall, lack of irrigation and transportation facilities and low population density.
Fig. 8.4 orange and wheat
Moderate productivity (90-100) of orange is found in north part consisting four districts, namely, Sarduiyeh, Gevar, Saghdar and north part of Halil due to cold climate, more rainfall, rugged topography, thin soil, low population density, lack of developed irrigation and transportation facility. This region covers 23 per cent of total area. The general trend of productivity of orange shows decreasing towards west due to change in soil, irrigation and transport network facilities, low population density, lack of water availability and market facility.

Potato is vegetable cash crop of winter season. The spatial distribution of potato productivity is displayed in Fig 8.4B. The highest productivity (>90) is found in south-central part covering 4 per cent of total geographical area and 10 per cent of total net sown area in study region due to well Irrigation and transportation network, high ground water potentiality with artesian wells are available, soil fertility and mechanization in agriculture in this region. Whereas lowest productivity is appeared in eastern part (<60) due to rugged terrain with coarse shallow soils lack of labour forces, transportation facility and small size of farms covering an area of 79263 hectares to the total area. Potato productivity indicates decreasing trend towards east due to changes in soil fertility, topography, climate conditions, population density, irrigation and transportation facilities. Moderate productivity (60-90) of potato is seen in 95.2 per cent of total geographical area in throughout Jiroft watershed.
Fig. 8.5 date and wheat
Fig. 8.6 Onion
Date is a native cash crop of the region requires warm climate, less amount of water and coarse textured sandy soil. It is one of the drought resistant crops in study region. The spatial distribution of date productivity is displayed in Fig.8.5A. The highest productivity (>100) of date is found in central, south and southeastern parts covering an area of 38.3 per cent of total geographical area. The main reasons of high productivity of date in this region are high temperature, low rainfall and sandy soils which favours the cultivation of date. Whereas the lowest productivity is observed in north and northwest parts (<80) due to low temperature, higher rainfall and humidity, rugged topography and steep slopes than Jiroft plain. This region covers 19.2 per cent of total area. Moderate productivity (80-100) is found in 57.5 per cent of total area in west, north-central and western parts in study area which experiencing moderate climatic conditions. Date productivity shows decreasing trend from, south-central south-east parts to the north part due to cold weather, higher rainfall and rugged topographical conditions. Whereas hot weather in summer season, sandy soil, high density of population and labour forces favours the high productivity of date in central southern parts of study area.

Wheat is major food crop of winter season in Jiroft watershed. The spatial distributional pattern of wheat productivity is displayed in Fig.8.5B. The highest productivity of wheat is observed in Esfandaghe district (<120) accounting 22.5 per cent of total area. Moderate temperature and rainfall are suitable for the cultivation of wheat which leads the high
productivity in this region. Whereas lowest productivity (<90) of wheat is observed in eastern part consisting eleven districts on 32.7 per cent to total area in east and southeast parts due to rugged terrain, small size of farms and undeveloped irrigation and transportation facility. Moderate productivity (90-100) of wheat is found in 44.8 per cent of total geographical area in most parts of the region in central parts running north south direction along the HalilRud river and its tributaries. Moderate productivity observed in this region to due to high rainfall in north and availability of surface water in central and south parts of this region. The productivity of wheat is increasing in east to west direction due to changes in the physiographical characteristics, soil, temperature and rainfall conditions.

Onion is one of the winter cash crops in Jiroft watershed. The spatial distribution of onion productivity is shown in Fig 8.6. It shows highest productivity (>100) in south-central part among ten rural districts covering 26.5 per cent area to the total area. The fine alluvial fertile soil developed irrigation systems and good transportation and market facility favouring onion cultivation in this area. Lowest productivity (<85) of onion is identified in eastern parts on 6 per cent of total area due to rugged terrain with coarse shallow soils, lack of labour forces, undeveloped transportation network and small size of farms. Moderate productivity (85 to 90) is identified in major parts in north, north-west and south-east parts in Jiroft watershed. This region covers 67.5 per cent of total area. As the result, variation in productivity is well marked within highland and lowland
region depending upon characteristics of relief, slope, micro-climate, drainage, water availability and irrigation facility, soil the level of diffusion of agricultural innovations, transportation facility and population density. In short, productivity of orange, date, onion, potato and wheat by two methods shows regional variation in agricultural productivity in Jiroft watershed.

6.4 Resume

The agricultural productivity of an area is influenced by a number of physico-socio-economic, institutional and organization factors. In recent years, agriculture sector has better potential for future development in study region. The variation in productivity is well marked within the various regions and also from one region to another region depending upon characteristics of relief, slope, climate, drainage and irrigation and transportation facilities, utilization of fertilizers and pesticides and soil fertility. The productivity also varies within the region. Although the region suffers from the shortage of rainfall and water availability as a result of extensive droughts, yet, productivity of most crops has increased in central and south-central parts. It is especially in case of potato, cucumber, orange, onion, tomato and watermelon in central and south parts study area due to increaseing drip or sprinkler irrigation. Whereas agricultural productivity in north, west and east parts is relatively low. as a result of rugged topography, steep slopes, thin soil, low capability of land, scarcity of arable land, limitation of water resources low population density, insufficient labour, traditional agricultural activity, lack or
undeveloped transportation facilities, poor irrigation facility, lack of market, limitation resources, traditional structures face small and fragmented plots, small-scale plots delimiting application of farm machinery, mechanization development. According to both Enyedi’s and Bhatia’s methods, crop productivity has shown decreasing trend towards north, west and east parts for these crops in study.