PART I

PHYSICO-SOCIO-ECONOMIC SETTING
CHAPTER I

THE PHYSICAL SETTING
The physical environment - relief, drainage, climate, soil and sub-soil water influences the crop growing in many ways. They determine the type of crops, the timing of agricultural operations the extent of risk involved in agriculture and improvement of agriculture. The plant response thus is conditioned by the total environment. The human, social and economic factors clearly influence the choice of farming systems, yet they can operate only within the limits set by the physical environment. In this chapter, therefore, the location and factors of physical environment which appear relevant to the pattern of agricultural activities are presented.

A) LOCATION:

The district of Kolhapur lies between 15°45' and 17°11' north latitudes and 73°41' and 74°42' east longitudes and is located entirely in the Panchaganga and Krishna Basins. Only small tract of western fringes falls within the boundaries of westerly flowing river valleys. East west spread of the district is about 107 kms. and across north south it is about 154 kms. which give an area of 8258 sq. km. (2.68 % of State's area). It is bounded on the north by Sangli district, on the west by Ratnagiri district and on the south and...
east it has a common boundary with Karnataka State. For administrative purposes it is divided into 12 talukas (Fig. 1.1). The average area of a taluka works out to 688.16 sq. km. comprising 91 villages on an average (including towns).

The district has a long historical and cultural background. It is newly formed after the merger of Kolhapur state. From 1st November 1956 the Chandgad taluka of Belgaum district with an area of 964.5 sq. km. and a population of 80513 was merged with the Kolhapur district as a separate taluka of the district.

B) RELIEF AND DRAINAGE:

Relief:

Relief of the land influences landuse, particularly through the elevation, ruggedness and slope. Relief also influences farming by modifying the climate and by affecting the ease of cultivation (Singh, 1971). The relief and drainage pattern of the district is exhibited in Fig. 1.2.

The relief varies markedly from place to place and the broad land relief changes are seen in the west-east direction with local variations. These variations in land are due to the geological complexity of the region and varied geomorphological evolutions (Deshpande, 1971).
Therefore, the relief of the district can be best appre-
ciated against the background of its geology. It may be
noted in general that over a major portion of the district
the Deccan 'Trap' influences the landscape, only in the
south the rocks of the Dharwar and lower Kadalgi series
introduce a change in the topography.

The district on the whole is a part of the Deccan
table land with the Sahyadri scarp forming the most
prominent feature along its western administrative
boundary. The Sahyadri proper is a narrow crest zone
of the divide with a width of 15 to 25 kms (Dikshit,
1971). It is broken in several places by stream erosion
on both the flanks. The watershed which divides the
eastern drainages from the western is marked by hill top
features separated by low saddles. In height the crest-
line proper varies from above 900 m. to as low as 600 m.
avove sea level. In many places rapid erosion by the
Konkan streams has literally pushed back the crest line
features into the plateau. In this crestline, there are
many isolated basaltic table-lands such as Vishalgad in
the north, Gagangad in the middle and Bhudargad in the
south.

From this gently uneven and mature looking crest
line of the Sahyadris the Kolhapur portion of the plateau
is marked by several hill ranges which emerge from the
main range and develop an eastward or north-eastward trend (Fig. 1.2). Some of them extend upto 90 kms. while other terminate after a short stretch. All these ranges have flat tops and steep escarpments on flanks which carry several terraces or steps. Water action has carved out river valleys and their tributary valleys leaving the harder material as residual hill ranges. A laterite capping marks many of these plateau tops and altogether this step-like mature landscape has earned the Swedish name 'trape' topography (Gazetteer of Kolhapur district). A special feature of the ranges is the existence of many gaps and saddles which are traversed by well constructed roads. Of these ranges the northern most is the Vishalgad-Panhala range extending up to the lower level of Krishna basin. In the central portion of the district exists the hill range which separates the Kumbhi river from the Dhamani, the Pal Donger, the small hill range which separates the Tulsi from the Bhogavati. To south of the Bhogavati lies the south Dudhganga and north Dudhganga ranges. In south the hill ranges have the same trend the Kagal range and Bhudargad range proper. In the southern extremity of the district (Gadhinglaj and Chandgad talukas) the topography gets much varied, numerous minor hill ranges are separated by small valleys.
Relief Divisions

With the variations of relief in west-east direction the district can be divided into three relief divisions viz., (i) Hills and Ghats, (ii) Foot hills and (iii) Plains (Fig. 1.3.A).

(i) Areas with altitude of 600 to 900 metres and above belong to the first division. The major portion of this category comes in the western part of the district from Malkapur in north to Samangad in south (Fig.1.3.A). This division consists of scraps of the Sahyadris and steep basaltic walls. Quite a large area of this division is under forest cover. The important forts like in this division.

(ii) The area having the height of 450 to 600 metres comes under this head. From the main Sahyadri several hill ranges run to the east and the foot hill zone of these ranges is included in this relief division. The average gradient in the foot hill zone varies from 5 metres per kilometre to 22 metres per kilometre (Director of Groundwater Survey and Development Agency, Government of Maharashtra). This area is covered by forest in the western part and scrub, grasslands towards the east.
(iii) The area having an altitude below 450 metres comes under this relief division. The major portion of the river valleys draining the land towards east comes under this head. The gradient of land in this region varies from 0.58 metres per kilometre to 3.2 metres per kilometre and within the lowlands the slopes are rarely steep. From the human point of view this division is the most important area of the district. It is well-cultivated and large sized nucleated villages are typical of this region.

On the basis of data supplied by Director of Ground-water Survey and Development Agency, Government of Maharashtra, the talukawise areal extent of these relief divisions in the region is analysed. Table 1.1 and Fig. 1.3.B, C and D reveal that level land in the district is relatively small i.e. only 20.88 percent of the total geographical area and is confined to Shirol, Hatkanangale, Karveer, Kagal and Gadhinglaj talukas. Foot hill zone comprises some 33.10 percent of the total geographical area and is mainly situated in Shahuwadi, Bhudargad, Gadhinglaj, Bawada, Chandgad, Kagal and Hatkanangale talukas and part of it is also of agricultural relevance. But the major part of the land area viz., 46.02 percent is rugged and of little use being not very suitable for cultivation (Fig. 1.3.B).
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Taluka</th>
<th>Hills</th>
<th>Ghats</th>
<th>Foot hills</th>
<th>Plains</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shahuwadi</td>
<td>58.39</td>
<td>40.47</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Panhala</td>
<td>68.32</td>
<td>18.41</td>
<td>13.27</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Karveer</td>
<td>32.06</td>
<td>22.36</td>
<td>45.58</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Hatkanangale</td>
<td>13.11</td>
<td>37.71</td>
<td>49.18</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Shirol</td>
<td>1.33</td>
<td>22.35</td>
<td>76.12</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bawada</td>
<td>65.63</td>
<td>34.37</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Radhanagari</td>
<td>72.43</td>
<td>24.00</td>
<td>3.57</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Kagal</td>
<td>18.58</td>
<td>32.24</td>
<td>49.18</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Bhudargad</td>
<td>49.70</td>
<td>45.72</td>
<td>4.58</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Ajra</td>
<td>66.54</td>
<td>28.38</td>
<td>5.08</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Gadchinglaj</td>
<td>31.46</td>
<td>44.76</td>
<td>23.78</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chandgad</td>
<td>45.63</td>
<td>39.86</td>
<td>14.51</td>
<td></td>
</tr>
</tbody>
</table>

**District average** 46.02 33.10 20.88

Source: Director of Groundwater Survey and Development Agency, Government of Maharashtra.
Thus, the foregoing discussion reveals that relatively unfavourable topography for agriculture exists in the western part of the district. The proportion of land which is steep or high is more in the west. Many hills with dense forest cover are too high for cultivation. In contrast to this, extensive areas of level to gently rolling land which are well suited to agriculture are found in the eastern part of the region.

**Drainage:**

The drainage pattern of Kolhapur district is well developed and geared to the base level of the Krishna which has mastered all the river course of the district (Gazetteer of Kolhapur District). From north to south the district is drained by Varna, Panchganga, Dudhganga, Vedaganga, Hiranyakeshi, Ghatprabha and Tambraparni rivers (Fig. 1.2). Varna has a long course with a slope of 424 metres in 80 kms. length, quite steep slope but has much restricted basin. Panchaganga, on the other hand, commands a large drainage area through its main tributaries, Kasari, Kumbhi, Tulshi and Bhogavati. Panchaganga has a slope of 217 metres in 130 kms. length and it is perennial. Dudhganga with its main tributaries, Vedganga and Hiranyakeshi have long courses but smaller and independent valleys. Dudhganga has a slope of 217 metres in 75 kms. length and Hiranyakeshi...
with a slope of 60 metres in 55 kms. length (Director of Groundwater Survey and Development Agency, Government of Maharashtra). Other important rivers flowing through the district are Ghatprabha, Tambraparni and westerly flowing rivers of Shuk and Jamda. There is also an interesting contrast in the direction of flow of these rivers. Varna flows from the north-west to south-east, Panchganga from due west to east, while the southern rivers flow from south-west to north-east (Fig. 1.2). This is most probably due to the geological structure underlying and Krishna river which controls the flow of these rivers. Krishna from its confluence with Varna form the eastern boundary of Kolhapur district. It has meandering course through a black soil plain and is joined by Panchaganga near Narsobawadi and by Dudhganga and Ghatprabha outside the district.

These rivers have developed the flood plains and terraces which are (locally known as Malai) highly prized for soil fertility. These are most important areas of the district and are well cultivated. Further, the physical setting of these river valleys facilitated for constructing Kolhapur type of weirs, locally known as bandhara which facilitate good irrigation.
C) CLIMATE:

Climatic conditions are of foremost importance in determining the distribution and performance of crops. For healthy growth and good yields, certain optimum conditions of rainfall, temperature, wind, sunshine, soil moisture etc., are essential. In India particularly rainfall is the dominating climatic control.

The climate of Kolhapur district is wet tropical. The western part of the district is always cooler than the eastern part. The nights are generally cool due to the influence of sea breezes which set in the afternoon (Gazetteer of Kolhapur District). Temperature is not a significant consideration in plant growth than rainfall. On the whole there is an adequate warmth and bright sunshine throughout the year to provide ripening conditions of crops. The mean daily maximum temperature in Kolhapur district is 30.9°C and the mean daily minimum is 19.0°C. The daily range of temperature is not so wide. The mean monthly maximum and minimum temperatures and relative humidity in the district for Kolhapur centre are shown in Table 1.2

The change from warm season to cold season is fundamental feature of the climate and the agricultural operations are closely associated with the different seasons of the year. There are three seasons in the district the duration and characteristics of each season are presented below.
Table 1.2

Maximum and Minimum monthly temperatures and relative humidity in Kolhapur district (Centre - Kolhapur)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Months</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Mean temp</th>
<th>Range of temp</th>
<th>Relative humidity%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>°C</td>
<td>°C</td>
<td>°C</td>
<td>°C</td>
<td>0830 1st hour 1730 1st hour</td>
</tr>
<tr>
<td>1.</td>
<td>January</td>
<td>33.4</td>
<td>10.8</td>
<td>22.1</td>
<td>22.6</td>
<td>61 27</td>
</tr>
<tr>
<td>2.</td>
<td>February</td>
<td>34.8</td>
<td>10.2</td>
<td>22.5</td>
<td>24.6</td>
<td>57 23</td>
</tr>
<tr>
<td>3.</td>
<td>March</td>
<td>38.9</td>
<td>15.9</td>
<td>27.4</td>
<td>23.0</td>
<td>57 26</td>
</tr>
<tr>
<td>4.</td>
<td>April</td>
<td>39.8</td>
<td>18.0</td>
<td>28.9</td>
<td>21.8</td>
<td>64 38</td>
</tr>
<tr>
<td>5.</td>
<td>May</td>
<td>39.4</td>
<td>18.6</td>
<td>29.0</td>
<td>20.8</td>
<td>72 50</td>
</tr>
<tr>
<td>6.</td>
<td>June</td>
<td>37.8</td>
<td>20.2</td>
<td>29.0</td>
<td>17.6</td>
<td>82 70</td>
</tr>
<tr>
<td>7.</td>
<td>July</td>
<td>29.6</td>
<td>21.0</td>
<td>25.3</td>
<td>8.6</td>
<td>89 83</td>
</tr>
<tr>
<td>8.</td>
<td>August</td>
<td>29.8</td>
<td>19.3</td>
<td>24.5</td>
<td>10.5</td>
<td>90 82</td>
</tr>
<tr>
<td>9.</td>
<td>September</td>
<td>34.2</td>
<td>18.4</td>
<td>26.3</td>
<td>15.8</td>
<td>87 73</td>
</tr>
<tr>
<td>10.</td>
<td>October</td>
<td>35.6</td>
<td>18.8</td>
<td>27.2</td>
<td>16.8</td>
<td>82 61</td>
</tr>
<tr>
<td>11.</td>
<td>November</td>
<td>32.8</td>
<td>13.9</td>
<td>28.3</td>
<td>18.9</td>
<td>65 37</td>
</tr>
<tr>
<td>12.</td>
<td>December</td>
<td>32.9</td>
<td>13.0</td>
<td>22.9</td>
<td>19.9</td>
<td>61 30</td>
</tr>
</tbody>
</table>

YEAR 39.8 10.2 25.0 29.6 - -

Source: Socio-economic Review and District Statistical Abstract of Kolhapur District.
1) **Hot Season**:

There is a rapid rise in temperature in March, April and May, the hottest months of the year with an mean maximum temperature of 38.9°C, 39.8°C and 39.4°C respectively (Table 1.2). Daily maximum temperature exceeding 37.7°C is fairly frequent in April. The mean daily maximum temperature varies from 18.8°C to 22.2°C.

The diurnal variation of temperature is high and the mean value ranges from 17.0°C in March to 12.6°C in May.

The mean relative humidity in this period (March to May) in 65 percent in the morning and 35 to 40 percent in the evening. Low values of humidity of the order of 15 to 20 percent occur in these months in the afternoon. The prevailing wind direction is mainly westerly, though in the afternoon of March and April easterly winds occur. There is also a season of thunderstorm in April and May and the rainfall is accompanied by thunderstorms.

11) **Rainy Season**:

The normal period of the onset of the south-west monsoon in the district is the first week of June and there is rainfall all over the district in the months of
July and August. The monthly maximum temperatures for July and August are 29.6° C and 29.8° C. Towards the end of September temperature again begins to rise (Table 1.2). The moisture content of the atmosphere in this season is very high and the air is nearly saturated on several days. The mean relative humidity from June to September is 87 % in the morning and 77 % in the evening. The direction of winds during this period is mainly westerly. There is a complete changeover in October when the winds are mainly from north-east to east. In this season the annual rainfall varies widely from 700 mm. in the north-east to 5000 mm. in the west. A fuller account of rainfall is given in the later section.

iii) Cold Season:

The day temperature remains higher than that of in the monsoon. The mean minimum temperature is the lowest and it ranges from 14.4° C to 16.1° C. December and January are the coldest months of the year with minimum temperatures of 13.0° C and 10.8° C. The lowest temperature on individual days may go down to 7.2° C. The range of temperature is rather large. The mean daily range of temperature in December and January is 15.6° C. The mean relative humidity for the season is 63 percent in the morning and 33 percent in the evening.
RAINFALL:

Of all the weather elements rainfall is the dominant single weather parameter and climatic hazard that affects plant growth and crop production because of its insecurity, variability and for major parts its meagreness (Singh, 1974). Such nature of rainfall demands a thorough analysis. In this study the annual average distribution, annual variation from normal, intensity of rainfall and annual average rainfall variability are discussed.

Average Annual Rainfall:

The region gets rain from the south-west as well as north-east monsoon. Fig. 1.4 shows the distribution of average annual rainfall in the region. The average annual rainfall in the region varies widely from 500 mm. in Kurundwad and Shirol area in the north east to over 6000 mm. in Bawada area in the west. The isohyets particularly run from north to south and about 3/4th part of the district receives more than 1000 mm. rain annually (Fig. 1.4). The rainfall is very heavy and assured in Shahuwadi, Bawada, Radhanagar, Bhudargad, Ajra and Chandgad talukas in west. Here, farming without irrigation is possible in rainy season. It diminishes gradually towards east and touches the lowest
level of 500 mm. which is not adequate. So irrigation is necessary particularly in Shirol and Hatkanangale talukas. While in the transitional zone comprising Panhala (part), Karveer (part), Kagal (part) and Gadhinglaj taluka, rainfall is moderate and fairly regular.

Apart from the annual average rainfall distribution, there are also annual variations from normal. Fig. 1.5 shows the annual variation of rainfall from normal for selected stations namely, Shahuwadi, Bawada, Karveer, Shirol, Gadhinglaj and Chandgad in the district. The total annual rainfall at the stations varies from year to year and this deviation of annual rainfall from the normal during the period under investigation can show the uncertainty and ill-distribution of rainfall.

Seasonal Distribution of Rainfall:

The seasonal distribution of rainfall is shown in Fig. 1.6. Throughout the district rain falls from May to November, however the main rainy season is from June to September and a very large percentage (75 to 90%) of annual rainfall over the region is received during this south west monsoon season (Fig. 1.6.A). July is the month of maximum rainfall throughout the district. By the end of September the south west monsoon loses its strength
Rainfall variation in Kolhapur District

Shahawad

Bawada

Chadcdad

Karvher

Gadinglaj

Shipol
and gives way to the north east monsoon. During December and February the rainfall over the whole district is nearly uniform being 1 to 2 percent of the annual rainfall (Fig. 1.6.C). On the other hand in hot season 5 to 10 percent rise in rainfall is shown in the region (Fig. 1.6.D).

Thus, the usefulness of the rainfall for agriculture is greatly limited by this normal concentration into a few months. The rainfall may be quite sufficient to meet the annual water need for successful crop production if it is well distributed and is received at the time when required most. This characteristic of concentration of the rainfall in certain period reduces its usefulness.

Intensity of Rainfall:

Besides, the annual and seasonal variation, the amount that falls in any given short time (rainy day) is normally much significant. As it influences the intensity of soil erosion by rain and the usefulness of rain for agriculture. The expression intensity is used in this investigation in the sense of rainfall per rainy day in 24 hours period (Singh, 1974). The intensity of rainfall is shown in Fig. 1.7.B.

The intensity of annual rainfall varies from above 20 mm. to below 5 mm. It is over 20 mm. in Bawada, Radha-
Rainy Season (JUNE - SEPTEMBER)

Post Monsoon Season (OCTOBER & NOVEMBER)

% of mean annual rainfall

Cold Season (DECEMBER - FEBRUARY)

Hot Season (MARCH - MAY)

% of mean annual rainfall

Fig. 1-6
nagari and Chandgad and 15 mm. to 20 mm. in Bhudargad and Ajra talukas. In the eastern part it is from 10 mm. to 15 mm. and below 10 mm. per rainy day. Thus, the intensity of rainfall is maximum in the west and decreases towards the east.

Rainfall Variability:

The rainfall reliability is measured by the coefficient of variability. The annual coefficient of variability thus, indicates the regularity or irregularity of rainfall. The higher the coefficient of variability, the lower is the assurance of rainfall. Fig. 1.7.C records the average annual rainfall variability in the region. It is over 26 percent in the eastern part of the region and so is the low reliability of rainfall (not assured). On the other hand rainfall reliability is greater in western part, where the coefficient of variability is under 18 percent (assured). Areas of medium degree of reliability of rainfall are with 18 to 26 percent of coefficient of variability (generally assured). In general the degree of reliability of rainfall is more in western part than in the eastern part of the region (Fig. 1.7.C).

Generally three seasons are recognised in the region. The region gets the rain from south west monsoon and it is
Average Annual Rainfall

Variability

No of Rainy Days
Intensity of Rainfall

A

B

C

Average Annual Rainfall

Variability

Rainfall Zona

Percentage Of Variability

Dependence

Above - > 26
Not assured
Generally assured
Assured

18 - - 26
Below - - 18
largely concentrated in four months from June to September, leaving rest of the year dry. There are also annual variations of rainfall from normal. The overall distribution of rainfall shows marked spatial differences from west to east. The variability of rainfall is relatively high in eastern part than in western part of the region.

D) SOILS:

Since the soil is the essential material on which agriculture is based, any comprehensive survey of the geography of agriculture should include a fairly thorough treatment of soils (Symons, 1967). Spatial distribution of soil types and fertility are presented in this section. A little data on the soils of Maharashtra are available. So the present discussion of soils is largely based on the District Gazetteer, the District Census Handbook and Underground Water Survey Agency, Report only.

The soils are mainly derived from trap, except in the forest covered mountainous area in the west where they are of lateritic origin. On the basis of the different physical characteristics three broad soil zones can be distinguished: (i) The western part (with heavy rainfall) is mountainous and woody and is covered with lateritic and reddish brown soils, (ii) the central part with coarse
shallow and medium black soils and (iii) the dry eastern part with precarious rainfall is covered with black soils of varying depth. Table 1.3 shows the chemical and physical characteristics of these broad soil zones and Fig. 1.8 attempts to show the spatial distribution of various soil types in the region under study.

1) Laterite Soils:

Laterites are red to brownish in colour by the presence of iron, and are mostly eroded and shallow with good drainage. These soils are acidic with low phosphoric content. Laterite soils are derived from the weathering of several types of rocks. These soils show considerable leaching and washing of plant nutrients due to chemical weathering under monsoon conditions.

They occur mainly in the western hilly tracts of heavy rainfall on the hill tops and in the ridges which are not covered by forest. The overall share of these soils is 10.62 percent of the total soil cover, with large concentration in Bawada (82.97 %) and Radhanagari (32.18 %) (Figs. 1.8 and 1.9.A). Hill millets are taken from them. In the valleys where paddy happens to be the main crop they are fairly deep.
Table 1.3
Composition of Soils in Kolhapur District

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Laterite</th>
<th>Brown</th>
<th>Medium and deep black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>Tambad</td>
<td>Halki kali</td>
<td>Madyam or Bhari kali</td>
</tr>
<tr>
<td>Colour</td>
<td>Red to brownish red</td>
<td>Reddish brown</td>
<td>Gray to deep black</td>
</tr>
<tr>
<td>Depth</td>
<td>7 cms</td>
<td>7.12 cms</td>
<td>12-20 cms</td>
</tr>
<tr>
<td>Drainage</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Topography</td>
<td>Undulating</td>
<td>Undulating</td>
<td>More or less flat</td>
</tr>
<tr>
<td>Sand (percent)</td>
<td>35-40</td>
<td>45-50</td>
<td>10-15</td>
</tr>
<tr>
<td>Silt (percent)</td>
<td>25-30</td>
<td>20-25</td>
<td>30-40</td>
</tr>
<tr>
<td>Clay (percent)</td>
<td>25-35</td>
<td>20-25</td>
<td>35-50</td>
</tr>
<tr>
<td>Lime (CaCO₃) (percent)</td>
<td>Nil</td>
<td>1-3</td>
<td>1-5</td>
</tr>
<tr>
<td>pH</td>
<td>4.50-6.50</td>
<td>6.50-7.50</td>
<td>7.50-8.50</td>
</tr>
<tr>
<td>Nitrogen (percent)</td>
<td>0.08-0.10</td>
<td>0.05-0.08</td>
<td>0.06-0.08</td>
</tr>
<tr>
<td>Phosphoric acid (Mg percent) (P₂O₅ available)</td>
<td>0.00-5.00</td>
<td>10.00-15.00</td>
<td>15.00-20.00</td>
</tr>
<tr>
<td>Potash (Mg percent) (K₂O available)</td>
<td>15.00-20.00</td>
<td>20.00-25.00</td>
<td>20.00-25.00</td>
</tr>
</tbody>
</table>

Source: Gazetteer of Kolhapur District.
KOLHAPUR DISTRICT
SOILS

Laterite soils
Reddish brown soils
Coarse shallow soils
Medium black soils
Deep black soils

Fig. 1.8
ii) Reddish Brown Soils:

They are mainly derived from trap and are dark brown in colour with reddish tinge. They are rich and fertile with excellent granular structure, almost neutral in reaction and well supplied with calcium. These soils respond well to the application of fertilizers. As this tract receives a guaranteed rainfall of 1000 mm. to 1250 mm. On the whole, their fertility is low to medium. These soils have mainly a sandy and loamy texture (Table 1.3) and their productive capacity is low.

This category of soils embrace 32.81 percent of the total soil cover and patches of these soils are in the north west portion of the region, particularly on the hill slopes. These soils dominate mainly in Shahuwadi (100 %), Panhala (59.30 %) and Radhanagari (42.83 %). Elsewhere its proportion is low (Figs. 1.8 and 1.9.B).

These soils at higher elevations are usually unsuitable for cultivation, whereas in lowland areas jowar and groundnut are grown on these soils in kharif season. Sugarcane and vegetables are taken wherever irrigation facilities are available.
Laterite Soils  
Reddish Brown Soils  
Coarse Shallow Soils

Region average = 25.60
Region average = 32.81
Region average = 25.60

Fig. 1-9
iii) Coarse Shallow Soils:

These are residual soils and are derived from trap. They are somewhat sandy and usually found on hill slopes. These soils cover 25.60 percent of the total area and are located in Hatkanangale (63.28 %) and Ajra (71.24 %). In Panhala, Karveer, Bhudargad and Gadchinglaj, their proportion range from 20 to 60 percent. While in Kagal, Chandgad and Radhanagari its proportion is below 20 percent (Figs. 1.8 and 1.9.C).

These soils are moderately productive. Generally, groundnut, wheat and jowar are raised on these soils, especially when well manured.

iv) Medium Black Soils:

They are derived from trap and vary in depth considerably from place to place, depending upon the topographical situation. They are thin and relatively less fertile than the deep black soils. Their texture varies from loam to clay loam.

They embrace 19.68 percent of the total soil cover and are found in the eastern part extending from Shirol to Chandgad taluka - Shirol (40.91 %), Kagal (63.76 %), Gadchinglaj (39.92 %) and Chandgad (36.87 %) (Figs. 1.8 and 1.10.A).
These soils are good for kharif and rabi crops. Jowar and groundnut are crops which respond well to the application of nitrogen to these soils. As drainage is good, the soils are amenable to irrigation and consequently paddy, sugarcane and vegetables can be successfully taken in them. Rice and sugarcane are also grown on these soils, where developed water supply is assured.

v) Deep Black Soils:

The deeper soils are black in colour and claggy. These soils have high clay content. Lime nodules occur in plenty and pH value is between 7.5 and 8.5 (Table 1.3). They are fairly rich in phosphorus contents. They are confined to level topography and share about 11.30 percent of the total soil cover with major concentration in Shirol taluka (Fig. 1.10.B). They are also found in parts of Hatkanangale, Kagal and Gadhinglaj talukas. There are ribbons of deep black soils along the major river valleys of the region i.e. Varna, Panchaganga, Dudhaganga, Vedganga and Hiranyakeshi (Fig. 1.8).

These soils are intensively cultivated and particularly are suitable for growing jowar, wheat and sugarcane.
FERTILITY STATUS (NPK) OF SOILS:

Adequate supply of nutrients is one of the several factors which influences crop yields. In other words, the utilization of soils for the cultivation of crops or plants in general depends on the amount of plant food materials present in the soil. The nutrients which are required by the plants in fairly large amounts are nitrogen, phosphoric acid and potash. Hence, the nutrition of plants centres round the supply of these three fertility constituents, besides other micronutrients in our soils.

The present discussion of these three nutrients in the soils of the region is based on the map provided by Konkan Agricultural University and Broad Soil Zones of Maharashtra, Research Bulletin 21. The soils in Kolhapur district except those of lateritic origin are poor in their nitrogen content and hence they respond to application of nitrogen carriers. So far as Phosphorus is concerned, most of our soils are fair in their contents of available phosphates but those of the lateritic zone are very poor and have always responded to the application of phosphates. In the non-lateritic soils the response to phosphate application is very low. As regards potash, it would be safe to say that our soils in State in general are fairly well supplied with this nutrient (Sahasrabudhe et al., 1969). However, sandy soils on steeply sloping terrain and
Fertility (NPK) Status of Soils

Deep Black Soils
Region average = 19.68
% of total soil covers

Medium Black Soils
% of total soil covers

A
B
C
leached soils of high rainfall area are expected to be low in this constituent. Fig. 1.10.C. shows the amount and distribution of these three nutrients of soils in the region under study.

Thus, the soils of the region fall into three main categories: (i) laterite, (ii) brown and (iii) medium and deep black. Laterite and brown comprise the western part of the region and black soils predominate in the eastern part. Generally, soils of the region are deficient in nitrogen and have low to medium reserves of phosphorus and potassium. The soils of river valleys are fertile and have considerable potentials for crop growing. Soil erosion is the general soil problem of the region.

E) WATER RESOURCES:

The rainfall is concentrated in south-west monsoon period and the rest of the year is dry, also variability factor further reduces the effectiveness of rainfall. Hence it is necessary to explore other sources of water which could be made economically available for effective and assured supply of irrigation in the region. These sources might be either underground water or surface water.
I) Underground Water:

In the region under study little work is done regarding underground water. As such taluka level data about different aspects of ground water are not available. But recently some work is being done by Groundwater Survey and Development Agency, Government of Maharashtra, and it has given watershedwise statistics regarding annual recharge, withdrawal and potentials in different talukas of District. It is therefore, decided to make a total of all watershed statistics, abstracted from Groundwater Survey Agency Report 1972-73, for obtaining total value for each taluka and the same is represented cartographically. An assessment of groundwater is made in the light of recharge, withdrawal and potentials in the region.

Groundwater Recharge:

The addition of water to the zone of saturation in aquifer is called groundwater recharge (Singh, 1979). The chief source of recharge in the study area as in other parts of Maharashtra State is rainfall. Seepage from rivers, dams, irrigation channels and irrigated fields and the subsoil inflow from surrounding areas are secondary sources. To assess recharge from these sources is not possible here due to lack of suitable data. So the total annual recharge
is considered here. Fig. 1.11.A shows the spatial pattern of annual groundwater recharge in the region under study. The highest recharge (above 900 lakh C.M.) is noted in talukas of Karveer and Hatkanangale followed by Shirol, Shahuwadi, Bhudargad, Ajra and Chandgad. In the remaining talukas recharge is from 300 to 600 and under 300 lakh C.M.

Groundwater Withdrawal:

The subsoil water which leaves the area is called discharge. Evapotranspiration, withdrawals by wells and subsoil outflow to rivers are the main sources of discharge (Singh, 1979). To assess discharge from all these sources is not possible here due to lack of data. However an attempt is made to assess the withdrawal by wells in the region on the data collected from Groundwater Survey Agency. Fig.1.11.B shows the spatial pattern of groundwater withdrawal from wells in the region. It has been observed that the highest groundwater i.e. above 400 lakh C.M. is pumped out by irrigation wells in Hatkanangale and Shirol talukas followed by Gadhinglaj (204 lakh C.M.), Panhala (169 lakh C.M.) and Karveer (123 lakh C.M.). The lower withdrawal of groundwater is noted in talukas of Shahuwadi, Bawada, Bhudargad, Ajra and Chandgad.
Irrigation Wells Feasible:

The Groundwater Survey and Development Agency, Government of Maharashtra has surveyed the individual watersheds by calculating recharge, withdrawal and balance of groundwater in terms of feasible number of wells. It has given the total annual recharge to the groundwater over the entire district 677.22 M.C.M. and the present exploitation from the existing irrigation dug wells 166.02 M.C.M. So there remains a balance of 511.20 M.C.M. of groundwater for future development. This balance of groundwater is expressed in terms of feasible number of wells in each taluka in the region (Fig. 1.11.C). The talukas of Karveer, Bhudargad and Shahuwadi have very high potentials (over 2500 wells per taluka), while 1,500 to 2,500 wells are feasible in Hatkanangale, Bawada, Gadhinglaj and Chandgad. In the remaining talukas the feasibility of 700 to 1500 and below 700 wells per taluka is observed.

Scope for Groundwater Development:

It may be pointed out that there is a ample scope for future development of groundwater for irrigation purposes in the district and in this regard the district may be divided into two divisions to its underground water supply, viz., (i) the hilly and rugged country forming the western ghats
and the narrow broken crested ridges stretching eastwards in the central portion - the area unfavourable for development and (ii) the plains towards east and the river banks - the area favourable for development (Fig. 1.11.D).

II) Surface Water:

The region has an advantageous position as regards the availability of surface water. It is drained by six rivers and these rivers have a seasonal flow from mid-November to mid-February and some become completely dry from March to May. But increase is observed from June to September. A detailed analysis of discharge (annual flow) of water from these rivers is not possible here due to lack of data. But a detailed analysis of the use of surface water by taking taluka as a unit is made in Chapter II.

The variability, unreliability and unsufficiency of rainfall makes it necessary to explore the feasibility of the use of underground and surface water for assured supply of irrigation. In the region the total recharge exceeds the total withdrawal and hence there is a balance of groundwater and this balance can be used for irrigation. In addition to this a substantial amount of surface water is available and this can be easily exploited and used for irrigation. There is thus an ample scope for future development of ground and surface water for irrigation purposes in the area under study.
REFERENCES


