CHAPTER IV

SOILS

The character of the agriculture of a country is dependent to a large extent on the nature and properties of its soils and climate. It is the quality and the nature of the soil that predominantly determine the land use, the occupation of the inhabitants and the degree and amount of their prosperity. Unlike climate, soil differs considerably within short distances. Even within a village, soils differ from plot to plot. In many parts of the Panchmahals district, where the topography shows sharp irregularities in the slope of land, it is common to find bare rocks lying adjacent to depressions covered with deep black soil, while in between there may be hill slopes covered with infertile, stony brown or red soil.

Methodological Difficulties:

The methodological difficulties in studying the soils of this area or any other part of India are only too well-known. "The most competent pedologist would probably find it impossible to present a general view of the soil-pattern of India which should be at once accurate, comprehensive and reasonably detailed".1

The only sources of information for soil-study are the Settlement Reports and the Gazetteers for both the districts. Settlement Reports have been published at intervals whenever the previous settlement expired. In 1953, the Indian Council of Agricultural Research published the Final Report of the All India Soil Survey Scheme; this, however, gives only a very brief review of soils on a district-wise basis. Even if one tries to contact the agricultural officers or the farmers themselves, little substantial information is obtained. The village papers contain information on the soils of every plot of land prepared for purposes of revenue assessment, but this classification is based on the utility or fertility of the soils. Recently, the State Government have established a Soil Testing Laboratory at Junagadh for the purpose of determining the chemical composition of various soil samples.

Within the limits of Central Gujarat great varieties of soils are found: They may be broadly classified into five groups:

I. Deep black soil
II. Medium black soil
III. Sandy Loam
IV. Coarse sandy soil on hill slopes (brown or red in colour)
V. Coarse shallow soil from granite.

Figure 10\(^1\) shows the distribution of these soils in Central Gujarat.

1. The map is based on information available from settlement reports of the Districts of Baroda and Panchmahals, All India Soils Survey Scheme (1953), New Delhi, ICAR, (New Delhi, 1953).
SOURCES:
(1) SETTLEMENT REPORTS AND GAZETTEERS OF THE DISTRICTS OF PANCHMAHALS, REWA KANTHA AND BARODA STATE.
(2) BULLETIN No.73 ICAR. FINAL REPORT OF THE ALL INDIA SOIL SURVEY SCHEME 1958.
(3) FIELD WORK OF THE WRITER.
I. Deep Black Soil:

It is also referred to as Black Cotton Soil or Regur. Over a south western part of Baroda district and in the Central part of Devgadh Baria taluka of the Panchmahals district, the typical soil is the black 'cotton' soil. This soil, which covers large portions of the Bombay Decoan, the Malwa Plateau, greater portions of Gujarat, and Saurashtra varies greatly in colour, consistency and fertility, but possesses the constant character of being highly argillaceous (clayey) and somewhat calcareous. It has also a tendency to become very adhesive when wet, and to develop deep cracks when dry. Owing to its high clay content it becomes unworkable during heavy rains. Its moisture retaining capacity is so large, that it can produce a winter crop without irrigation after a normal rainy season. Therefore in the absence of irrigation facilities, agriculture is entirely dependent on rainfall and a failure of the monsoon rains involves the loss of both the kharif and rabi crops.

This soil contains a large quantity of calcium, magnesium carbonates and is fairly rich in iron, lime and alumina, but its nitrogen and phosphorous content is very low. The potash content is very variable but on the whole, it is sufficient to meet the crop requirements.

The black 'cotton' soil found in Baroda and Panchmahals districts produces cotton year after year. Very often jowar as second crop is also grown. It is the best soil in the area under investigation.

The suitability of black cotton soil for irrigation is a matter of controversy and it appears to differ according to the composition of different varieties of this soil.\(^1\) The highly sticky, deep black soil in parts of the Karjan, Padra, and Sinor are hardly, irrigated. It may be noted that most of the irrigated areas in the Dabhoi taluka have sandy soils or sandy loams. The capacity of the black soil to retain moisture is, however, made use of in the 'embankment' type of irrigation, described later.

II. Medium Black Soil:

According to the Soil Map of India,\(^2\) showing the district-wise distribution of soils, a major portion of Baroda district has medium black soil and the district of Panchmahals has gravelly soil. It is obvious that this is a very broad generalization and for details of soils, recourse must only be made to the local classification made for purposes of revenue assessment. This classification, which has been given local names, is based more on the productivity of different soils than on their chemical composition.

2. The Final Report of the All India Soil Survey Scheme, New Delhi, ICAR (New Delhi, 1953).
The local classification recognizes the following types of soils:

(a) Gorat  (b) Goradu and  (c) Basar

(a) Gorat:

Gorat soil is alluvial and thus differs chiefly in its content of sand and clay. It does not crack when dry. It contains 60-80 per cent of sand. It is low in organic matter and nitrogen. It contains 0.1 per cent phosphoric acid and about an equal amount of potash. It contains however 0.05-0.06 per cent of nitrogen.

The Gorat soil extends over a considerable area in the eastern parts of the Dabhoi taluka. This soil when richer in clay is known as 'morrhun' (local name). If we proceed further, towards east, the Gorat soil becomes slightly sandy and is famous by its local name as 'maradi' well suited for pulse cultivation and when it is well grained it is also suitable for vegetable crops.

(b) Goradu:

Texturally the Goradu soil is a rich loam. It differs from Gorat mainly in containing loose grained particles. This soil has a light yellow colour. The physical properties of the soil are as follows:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay</td>
<td>35--50 per cent</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>1.0 per cent and above</td>
</tr>
<tr>
<td>pH</td>
<td>7.5 to 8.0</td>
</tr>
<tr>
<td>Total Exchange Capacity</td>
<td>40 to 50</td>
</tr>
<tr>
<td>Exchangeable Ca M.E. (per 100 grams of Soil)</td>
<td>30 to 40</td>
</tr>
</tbody>
</table>

This soil does not contain any pebble or gravel and is a friable soil which spreads well under the plough. It covers a fairly large area of the northwestern Panchmahals district and in the Hiran Valley of Baroda district. This soil also occurs in the Chorasi area.

**Gorada** is a very fertile soil and can respond very well to the addition of different types of fertilizers. It covers about 33 per cent of the total cultivated area (in the Baroda district) which speaks much of the agricultural condition. Tracts where these soils occur extensively have been intensively cultivated.

**(c) Besar:**

`Besar` soils are coarse and they have been formed by the inter-mixture of Gorat and medium black soil. It contains 6.0 to 10.0 per cent of clay and 70-80 per cent of sand. It also belongs to the category of loams. The colour of the soil is grey. This soil is available along the banks of the river Mahi and Narmada.

Although these different types of Medium Black Soils are recognized by the villagers, the three types are so intermixed that it is difficult to map them. The detailed mapping of each type can be taken up by some Government Organization as it involves team work.
III. Sandy Loam:

Sandy Loam is met with along the left bank of river Mahi. It is loose grained, light yellow in colour and rich in organic content. Towards the interior the colour of the soil changes to light grey and ultimately merges with the medium black soil on the southeast and the coarse shallow soil of granatic origin on the north-east.

This sandy loam covering a fairly extensive area of the Baroda Savli, western Halol and Kalol talukas is well suited for the cultivation of crops like cotton, tobacco, rice, jowar etc.

IV. Coarse Sandy Soil on hill slopes: (Brown or red in colour)

This soil covers the north-eastern hilly tract comprising eastern Santrampur taluka, southern and northern Dohad taluka, major portion of Limkheda taluka, and the northern part of Chhota Udepur taluka. Chemically this soil is inferior and so it is comparatively less fertile. It is very poor in nitrogen as well as in phosphate. Here the percentage of water is very low, about 0.1044. The red brown sandy soil is rich in iron and aluminium and is generally red in colour. In this brown sandy soil maize groundnuts, pulses, and other leguminous crops are grown for increasing the fertility of the soil.
V. "Coarse Shallow Soil From Granite:

It is chiefly a residual soil formed by the decomposition of underlying granites and gneisses. This soil differs from the soils of other parts of the area, in the sense, that the soils of other parts of Central Gujarat are transported soils of alluvial origin. The granitic soil is as a rule light-colored, shallow and infertile. It is found in southern Lunawada, south-western Shahera, Central Godhra, Eastern Kalol and Central part of Devgadh Baria talukas of the Panchmahals district.

If proper care is taken, this soil is suitable for paddy, maize, groundnut, bajri, banti and other crops.

SOILS AND CROPS

The relationship between soils and crops is so obvious that it merits special consideration here. It will, however, be worthwhile to give specific examples to illustrate the significance of soils. It must be remembered that in such a small area as Central Gujarat, the regional variation in crop cultivation and techniques are primarily if not entirely, due to the variation in soils. At one extreme, we have the very fertile sticky black soils of the Kanham area, lying in the southwest of the Baroda district, suitable for cashcrop like
cotton but hardly suited to paddy. At the other end, we have the stony, infertile red brown sandy soils; in many parts of the northeastern talukas of the Panchmahals district, the typical crops are maize, gram, groundnuts and other poor millets.

Again, the sandy loam soil found in the major portion of the Baroda district and some portion of Panchmahals district is suitable for all sorts of crops. Similarly Goradu and Gorat soils found in Dabholi southern part of the Waghdia taluka, Central part of the Lunawada taluka are aptly suited for various food crops and cash crops.

Villages typical of the various soil-areas and their dominant crops are given below.

<table>
<thead>
<tr>
<th>Village</th>
<th>Location</th>
<th>Soil type</th>
<th>Percent of Net Sown Area</th>
<th>Double Crop Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danoli</td>
<td>Padra taluka (south-west of the meter gauge Railway.)</td>
<td>Deep Black soil</td>
<td>4.5</td>
<td>86.3 2.7(a) 2.3</td>
</tr>
<tr>
<td>Sithol</td>
<td>Jabugam taluka (4 kms. south-west of Jetpur)</td>
<td>Medium Black</td>
<td>23.6</td>
<td>7.0(a) 26.9 13.5(a) 9.2</td>
</tr>
</tbody>
</table>

1. Figures obtained from the concerned Village Talathis (Village Accountants).
<table>
<thead>
<tr>
<th>Village</th>
<th>Location</th>
<th>Soil Type</th>
<th>Percent of Net Sown Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Paddy</td>
</tr>
<tr>
<td>Ajod</td>
<td>Northern Baroda taluka (about 4 kms. north of Dasharath)</td>
<td>Sandy Loam</td>
<td>15.7</td>
</tr>
<tr>
<td>Varod</td>
<td>Jhalod taluka (3 kms. north-west of Limdi) on hill slopes (Brown or red in colour)</td>
<td>Coarse</td>
<td>18.9</td>
</tr>
<tr>
<td>Dayal</td>
<td>Godhra taluka (2 kms. south of Godhra)</td>
<td>Coarse shallow soil from Granite</td>
<td>8.6</td>
</tr>
</tbody>
</table>

It must, of course, be pointed out here that soil variation is not just the factor responsible for crop contrasts in every case. Slope, availability of irrigation, marketing facilities, Government aid and the type of people who till the land, are factors that will also have to be considered in trying to account for the distribution of crops. These other factors are dealt with in the appropriate chapters.
SOIL EROSION

There are two aspects of soil which have caused serious agricultural problems in many places of the area under study. One is the fertility of the soil which has to be maintained by the use of manures and fertilizers. This is considered in a later chapter.

The second problem is that of soil erosion. While the Baroda tracts are relatively free from this, soil erosion is almost a menace in the hilly tracts of the Panchmahals district. Considerable erosion is being done by the various tributaries of the Mahi river and soil conservation practices are an immediate necessity.

Much of the erosion is due, however, to the indiscriminate removal of tree growth from steeply sloping land for purposes of cultivation and the failure to take even the most elementary precautions to protect the surface soil from being washed away by heavy showers during the monsoon. Such widespread erosion has now produced bleak, treeless tracts in the northern and eastern portions of the Panchmahals district. Here the surface soil was already very thin and bare rocks unfit for supporting even poor types of vegetation are now exposed in many places. In travelling from Jhalod to Dohad and from Dohad to Devgadh Baria, one notices frequently undulating ground, often with steep slopes, largely un-utilized, with bare rocks exposed. Such areas hardly support paddy and cotton.
While reckless destruction of the original vegetation cover has removed much of the top layer of soil in Devgadh Baria taluka and northeastern and southeastern parts of Chhota Udepur taluka, the soil has been preserved in two areas viz., (i) In Sukhasar of the Santrampur taluka and at Sajeli in Jhalod taluka of Panchmahals district, where the construction of bunds around the fields has helped to retain the water and thus project the soil-particles. Patels in the southwestern part of Baroda taluka and Kolis of the Panchmahals area are the better type of agriculturists than the Bhils of the brown red sandy soil tracts (ii) Within the Reserve Forests, where indiscriminate cutting is prohibited, the vegetation cover has provided an effective check against the denudation of soil.

Small seasonal tributaries of the Mahi and Karad in the Panchmahals and the river Narmada with its tributaries including Orsang in Baroda district have cut deep ravines. In such places, because of erosion, paddy cultivation is replaced by other crops.

Checking Soil Erosion:

The menace of soil erosion cannot be checked altogether but it can be minimised to a great extent. Some of the methods usually advocated are as follows:

(i) Contour ploughing which should be done in sloping fields so that water may not run off directly.

(ii) Afforestation should be carried on as far as possible since it helps check soil erosion.
(iii) Proper attention should be paid in the construction of roads.

(iv) Cart-ways and pathways should not be indiscriminately made along the slope since they always result in dangerous erosion and land-cutting.

(v) Cattle grazing should be so regulated that the grass cover is not injured by reckless-grazing.

Contour methods are being adopted in certain places in the area under investigation but lack of trained staff and the cost involved are the chief handicaps. Bunding is the ready solution and in many an instance the author has noticed this method being adopted to check rapid run-off. If bunds could be properly laid by levelling methods, erosion will be effectively checked and the area under small millets can be given to other important food and cash crops. Double-cropping will also become possible. This is actually being done as part of development programmes in the taluka of Dohad, Limkheda and Jhalod of the Panchmahals district.