

Soils of the Madras Presidency

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The Madras Presidency occupies the greater part of the south of the peninsular India extending from the Vizagapatam District in the north, about 19°N , to Cape Comorin about 8°N and east to west about 88°E to 74°E . The portion from 19°N till about 16°N is a coastal strip extending inland for about 100 miles and therefrom the rest of the peninsula is continued in the Presidency with the exception of a large interior area of the Mysore State and a narrow coastal strip on the south west coast of the Travancore and Cochin States.

Geography The northern part is a coastal strip with a confused range of mountains inland called the Eastern Ghats, the parts to the south of this area are the broad deltas of the Godavari and Kistna, to the south of these deltas is again a coastal strip and hilly country to the west and then comes the Cauvery delta. The West Coast is a narrow coastal strip with mountains known as the Western Ghats often coming within a few miles of the sea. The interior of the presidency is a plateau ranging from a height of about 1500 feet above mean sea level and shelving gently eastwards towards the Bay of Bengal. The main river systems flow west to east, while a few short hill rivers fall into the Arabian sea on the West. The presidency is one of great contrasts in geography.

Climatology The presidency is one of contrasts in its climatology. All the area lies in the tropics, and most of the area enjoys the effect of the South West Monsoon and one part that of the retreating monsoon. As may be expected the West Coast which receives the southwesterly winds from the end of May onwards receives a very heavy rainfall. The northern parts of East Coast get a fairly heavy rainfall after the monsoon has established itself over the peninsula. Practically no rain falls over the south east coast during this period except under the influence of occasional depressions forming in the Bay of Bengal. The central elevated plateau being under the rain shadow of the western ghats, where the moist sea winds after shedding all their moisture do not give any appreciable precipitation. The retreating monsoon known as the north-east monsoon beginning about the end of September gives rains to most of the east coast and especially to the south east coast strip. The central plateau is once again a dry zone during this period and gets very little rainfall, except under the influence of depressions which might cross the coast and traverse this area. Climatologically the presidency can be roughly divided into four zones (i) the West Coast strip and adjacent mountain regions with a rainfall ranging from $75''$ — $150''$, mostly received during the south west monsoon (ii) the North East Coast which enjoys both the monsoons and has a rainfall of between $40''$ — $70''$, (iii) the South East Coast which has rains during the

retreating monsoon averaging 30"—50" (iv) the Central Plateau which is generally dry and arid with a rainfall of about 20"—25".

Climate has played its part in the types of soil in respect of weathering, but mean temperatures are uniformly high with little local variation. The hottest zone is the central plateau with a long dry summer and short cool winter resembling the continental type of climate. The coastal areas have moderate temperatures and a moist climate all through the year typical of tropical conditions.

Geology Most of the presidency lies on the very ancient peninsular mass of Archaean rocks. The general rock formation is mainly granites and gneisses but varying in composition from place to place. The characteristics of the central plateau are the ferro-magnesian lime-soda-felspar granites and gneisses of the central plateau with bosses of potash felspar granites and gneisses which occur at frequent intervals in this area.

In general the rock formation throughout the presidency is very uniform. On the East Coast we find the Khondolites and in the South we find the Charnokites. These two types of rocks are however closely associated with those of the central plateau. A notable exception is a fairly large area of Vindhyan age of the Kurnool-Cuddapah formation of sedimentary limestones and argillaceous rocks extending from south of the Kistna river over a considerable area in the Kurnool and Cuddapah districts of the Central plateau. Lateritic formations are of widespread local occurrence along the West and East coasts. The Dharwar formation is seen in the central plateau while local occurrences of sandstones are seen on the East Coast. The East Coast strip consists of recent alluvium and the great deltas of the Godavary, Kistna and Cauvery are alluvial in origin. The geological formations may be said to be fairly uniform though local variations have had much to do with soil heterogeneity in the presidency.

Soil Types :- The soil types met with are of the following main groups :

1. The red soils.
2. The black soils.
3. The coastal alluvium
4. Delta soils.
5. Lateritic soils.

Types 1, 3 and 5 are predominantly red, reddish or brown in colour while types 2 and 4 are dark coloured popularly described as black

In describing the soil types of the presidency within the compass of this note, it is difficult to avoid temptation of describing the main types as black and red, with numerous intermediate types based on colour differences. As will be seen in the sequel the differences between the black and red soils is real being based on their genetics if they lie in conformity on the underlying parent rock or if they are of alluvial origin depending on

the rock formation in the catchment of the river bringing them down and depositing them in the deltas.

Type 1 occurs over a large area of the presidency, and may be said to be the common type. It occurs in all sorts of situation ranging from hill slopes to deep valleys between hills in various parts of the presidency. Types 3 and 5 are also red or reddish brown though they form different soil types from the point of view of the soil chemist.

Type 2 is a characteristic soil occupying for the most part, the central plateau of the peninsula over areas of over 3,000 square miles in extent with scattered occurrences elsewhere in less conspicuous areas. Type 4, the delta soils, occur mainly on the deltas of the two great rivers, the Godavary and Kistna and the other less important delta of the Cauvery.

Type 5 the laterite soils occur mainly on the West Coast of the peninsula and in frequent but scattered occurrences all along the East Coast and again on the hills in the south at high elevations.

No attempt has been made to map out the relative distribution of these main types of soils owing to the magnitude of the task and the lack of bearing of such a survey, on the economics of crop production. In general, the red and alluvial soils are the most productive, lying as they do in zones well favoured, by climatic conditions while the black soil type is usually met with in semi-arid regions of the central plateau and in scattered occurrences in almost equally dry areas in South Madras and Coimbatore district in the central districts. The black soil has therefore become associated with the unfortunate label of "Black Cotton Soil" not because it is particularly suitable for the cotton crop but more because it is cropped to dry crops including cotton owing to the seasonal conditions of the region in which it occurs.

The laterite type 5 occurs on the West Coast and in parts of the East Coast and supports cultivation of a sort not because of its fertility but because of the favourable climatic conditions in the regions where it occurs. For example the West Coast districts would be arid deserts but for the copious and unfailling rainfall they receive year after year.

Physical and Chemical Characteristics of the Main Soil Types The table below gives a summary of the main physical and Chemical characteristics of the five soil types of the Presidency as classified above.

The red soils are usually loams or sandy loams with a fair content of manurial constituents. The pH. is between 5 and 6. The salt status is low. The black soils are heavy clays with very good water holding capacity and low porosity. As regards their manurial constituents they are low in N and humus, but fair in P_2O_5 and K_2O . The pH. ranges between 8.5 and 9.5. The coastal alluvia are variable, ranging from sands to sandy loams or loams. Their fertility status is generally good. Their pH. ranges between 6 and 7. The delta soils are again variable being mostly clays or silt loams

Type No.	Colour	Physical properties			Chemical properties						
		Texture	Water holding capacity	Porosity	Content of nutrients*	pH.	SiO_2 R_2O_3 ratio	Silt status			
					N	P_2O_5	K_2O	Humus			
I. Red soil	Red to reddish brown	Loams or sand loams. Variable	Fair	Good	+	+	+	+	5.0 6.0	1-2	Low
II. Black soils	Black or in dark colour	Usually heavy clay soils	Very good	Poor	-	+	+	-	8.5 9.5	3-3.5	Usually high increasing with depth
III. Coastal alluvium	Brown or reddish brown	Variable from sandy to sand loam or loams	Fair	Good	±	+	+	±	6.0 7.0	1-2.5	Low
IV. Delta soils	Variable mostly dark like II	Mostly clay or silt loams, rarely sand loams	Very good	Fair	+	+	+	+	7.0 8.5	1-3	Usually low except in low lying depreciations
V. Laterite soils	Red or reddish brown	Sand loams or loams	Poor	Very good	-	+	±	±	4.0 6.0	1-1.5	Very low

* Fully supplied with plant nutrients.

- lacking in the particular plant food element.

± some portions well supplied; some not.

>8.0 tends to become alkaline.

<7.0 neutral or acidic.

rarely sandy loams. Their water holding capacity is very good and manurial constituents high. The pH. ranges between 7 to 8.5. The laterites are sandy loams or loams with poor water holding capacity. They are poor in their manurial constituents with a pH. between 4 and 6.

From the descriptions of the soils given above, and the tabular statement it will be seen that the soils of the Madras Presidency are very heterogenous. The previous paragraphs have given some details of the occurrence of these types of soils. There has been no accurate mapping of soil zones to differentiate black soils and red soils nor the differentiation between the coastal alluvia and the adjacent laterite soils. The central plateau contains a very peculiar mosaic of black and red soils lying side by side while in the great deltas black, red and sandy soils are found in a distribution which is vertical but not horizontal. To find an explanation for the horizontal distribution of the red and black soils side by side is difficult but the differences in vertical distribution can be explained perhaps by the fact that the great river Godavari brings down silts from various catchments at various seasons. The explanation for soils varying from black to red in their horizontal distribution may be found in their mineralogical composition which depends on the parent material from which they have been derived. This explanation seems to hold good for the very variable soils of the central plateau.

A study of the mineralogical composition of the clay fractions of the black and red soils showed that the black soil particles contained predominant amounts of the ferromagnesian minerals and an entire absence of mica and potash felspar while the red soil particles were poor in ferro-magnesian minerals and a preponderance of the mica group. The rocks underlying these soils were also similar in mineralogical composition. The conclusions arrived at were that the black and red soils of the central plateau are derived from different types of parent material.

Fertility Status and the Manurial Problem With the heterogeneous soils of the presidency, no well defined programme of manuring can be suggested. In general the main deficit is in the humus status of most soils, secondly a deficit of nitrogen and thirdly a deficit of phosphoric acid in the more intensively cropped areas.

In general the red, the coastal alluvial soils and the delta soils are intensively cropped owing to favourable seasonal conditions and extensive irrigation facilities. The laterite area is also heavily cropped owing to the very high rainfall while the black soil areas of the interior are lightly cropped with a crop rotation hardly reaching 50% of the area.

The manurial requirements of the heavily cropped areas are usually heavy doses of cattle manure and of compost wherever available and green manure ploughed in for the paddy crop. This improves the humus status of the soil. In addition, application of ammonium sulphate was recommended till supplies have become practically non-existent under the present

conditions. The use of oil cakes from groundnut, castor and gingelly are now taking the place of ammonium sulphate as suppliers of nitrogen in the heavily cropped areas. For the supply of P_2O_5 , super-phosphate was in wide use but here again war conditions have cut off supplies and the better forms of super are not available and hence recourse has to be made to steamed bone meal which is available in plenty locally, Madras being a producing centre. There is no indication of deficit of potash in any part of the province.

The manurial requirements of the presidency may be stated in brief as follows:—

- (i) Humus supply all over the area.
- (ii) Nitrogen supply all over the area
- (iii) Phosphoric acid supply in intensively cultivated areas
- (iv) No marked need for Potash almost any where

The manurial requirements of the dry areas comprising the black soils have not been studied as yet but preliminary indications are that (i) Humus status and Nitrogen are both low and pointing to a need for the application of cattle manure and compost wherever possible and incorporation of green leaf under dry conditions.

In addition the dry black soils have a very low microbiological population which has to be increased by improving the humus and nitrogen status.

The phosphoric acid status is satisfactory and the potash status generally good.

Reaction to Irrigation and Alkalinity The red, delta, coastal alluvial and the laterite soils are under extensive irrigation and except in isolated areas, have given no trouble as regards alkalinity. With their high porosity and permeability water drains away quickly and in spite of a high water table in certain areas in the Deltas where it reaches a height of 5—6 feet, no serious trouble has arisen. The problem of the black soils is different. The soils being heavy clays of great depths underlaid by a layer of gravelly sub-soil and with a profile of increasing amounts of salts downwards, fears were entertained as to their suitability for irrigation under the proposed Tungabhadra Project in the central plateau. Work done at the Agricultural Research Station, Siruguppa, has shown that these fears are entirely groundless and the salts move down the profile in all types of irrigation ranging from light to very heavy. Hence the starting of the project has been recommended to the Government.

The amelioration of the alkaline areas in localized patches in the Cauvery river area, was undertaken successfully by the addition of sulphur at 1 ton per acre and gypsum at 10 tons per acre in one block dose followed by a drainage scheme and flushing out of the products of reaction, besides the growing of green manure and ploughing it in at the rate of 10,000 lbs. per acre. The problem was taken up five years ago and

successfully concluded by the growing of a paddy crop giving upto 3,000 lbs. of grain per acre in two years' time.

Soil Erosion Soil erosion in this province is not such a serious menace as in the U. S. A. except perhaps on the hills where promiscuous clearing of forest and cultivation of hill slopes has caused some trouble. In the black soil area of the central plateau sheet erosion causes some damage by the reason that the land is naturally undulating and favours the carrying off of the surface soil during heavy and sudden downpours of rain. It must not be forgotten that after all erosion is a natural phenomenon and has both its disadvantages and advantages. The disadvantages are the loss of surface soil to the local farmer and the advantages are the building up of the great deltas out of the washed down material. Sheet erosion in the central plateau is however being combated by the advocacy of the putting up of small "bunds" at frequent intervals down the contour, when the valuable fine fractions of soils are not carried away but deposited in the region of the bunds and thus preventing loss of soil and what is more a better conservation of the available moisture. In the hills, the Nilgiri Hills mainly, the cultivation of hill sides of more than a certain slope is being prohibited and also recommendations made to potato growers mainly to cultivate in ridges and furrows along the contour and not against it.

A Novel Method of Improving the Germination of *Prosopis juliflora* Seeds

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Prosopis juliflora, commonly known as mesquite or algaroba, is a tree recently introduced into this country. Its pods have a thick and spongy pericarp containing syrupy matter which is said to be of high nutritive value and is relished by all kinds of stock in America (Kunhi Kennan, 1928). On the karoo in South Africa sheep and goats are fed with the pods. Sometimes the pods are collected and ground to serve as cattle food. The tree is said to produce timber suitable for furniture and the flowers form a good honey-bee pasturage.

The Madras Agricultural Department has advocated the use of this plant for a live fence. It is suitable for this purpose as the seedlings make fairly quick and thick growth and are provided with sharp thorns. The plants are deep rooted and come up well with scanty rainfall. A considerable percentage of the seeds of *Prosopis juliflora*, however, are 'hard' or impervious to water under conditions favourable for germination. The following are the results of a few trials made at the Millet Breeding Station, Coimbatore, to find out an easy method of inducing germination in these hard seeds.