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The Irrigability Rating — Amaravathy Project

by

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Synopsis: A numerical rating of the soils of the Amaravathy Project for irrigation suitability is presented. Soil texture, soil salinity, soil permeability, soil pH and exchangeable sodium percentage were considered and marks allotted according to their importance in irrigation. The marks scored by a profile satisfactorily expressed the actual field conditions thus proving the effectiveness of the rating methods.

Introduction: The object of irrigation soil survey is to estimate the suitability of the soils for irrigation. Various methods of rating lands for irrigation suitability have been proposed. Dewan (1953) proposed "Irrigable values" based on the standards set up by the Imperial Bureau of Soil Science taking into consideration only the depth and salt content of the soil profile. Since irrigation efficiency is dependent upon the soil characters such as depth, drainage, tilth, salinity etc., the land can be successfully rated for irrigation suitability, only if all these factors are collectively considered. Accordingly, Mehta *et al.* (1958) proposed a method of numerical rating of lands for irrigation, taking into consideration the soil characters stated above, and applied the method to rating of lands of Chambal commanded area in Rajasthan. They suggested that, if the rating values do not express the actual conditions satisfactorily, individual values of certain characters may be modified. With certain such modifications they rated the lands in Jawai Project area (Mehta *et al.* 1961). Following the principles enunciated by the workers and with slight modifications to suit the conditions prevailing in the area, a rating of lands in the Amaravathy Ayacut is presented and discussed in this paper.

General description of the Amaravathy Ayacut area: The Amaravathy ayacut area is about 22,000 acres distributed equally in the taluks of Udumalpet and Dharapuram in Coimbatore district of Madras State. The area has an undulating topography and an average annual rainfall of about 20″, the rains falling mostly in the north-east monsoon season. The parent material of the soil has been derived from the granites and the gneisses of the Archean age.

The drainage of the ayacut area is only moderate. Before the introduction of irrigation, *cholam* was the most important crop in the area followed by *ragi* and groundnut. At present paddy and sugarcane are the most important crops (Govinda Iyer *et al.* 1961).

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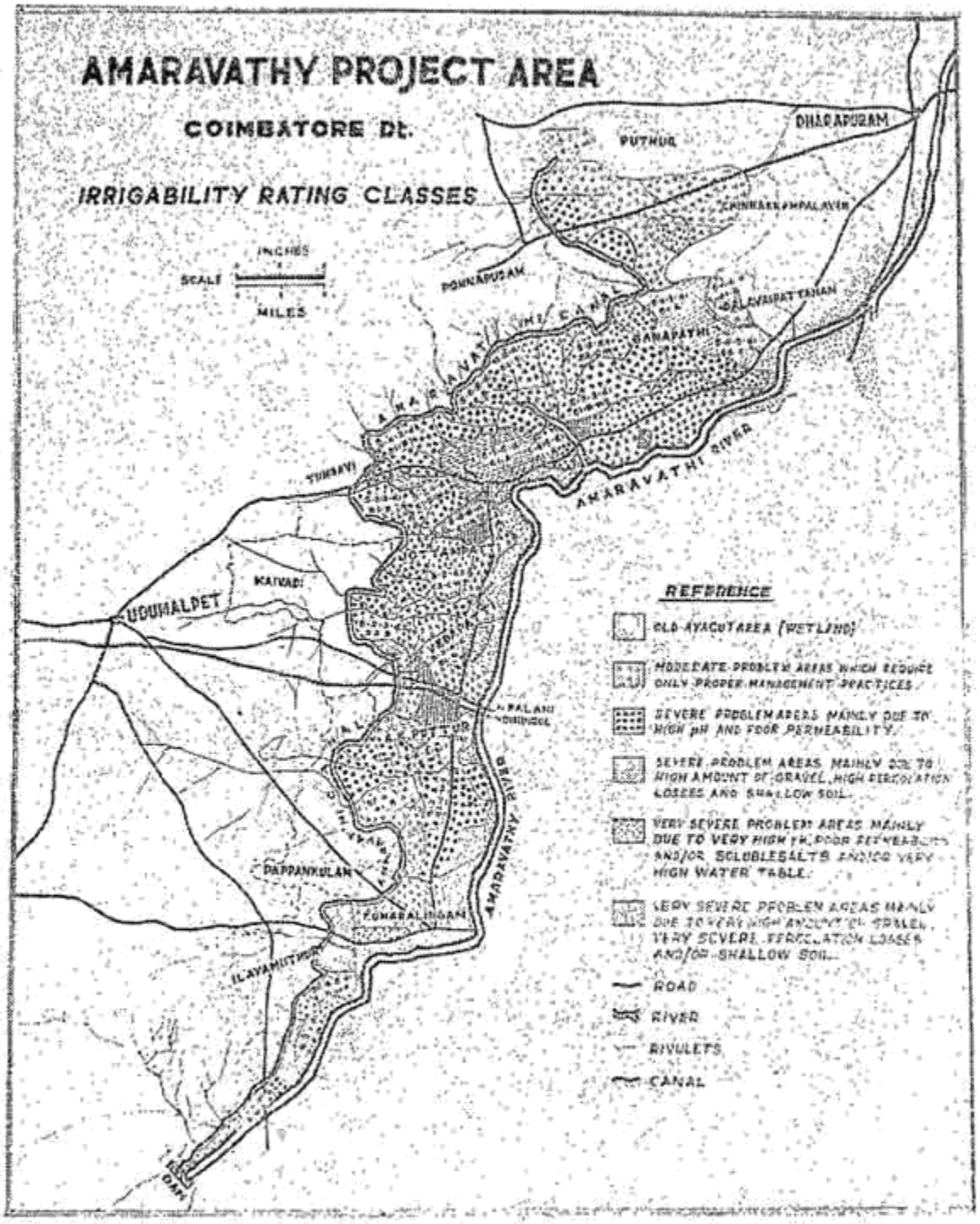

Materials and Methods: The field and laboratory data on the profile soil samples collected during the soil survey of the area were utilised for this investigation. The ayacut area was traversed on foot during the survey tours and the soil profiles dug according to topography, drainage conditions, etc., for each sub-water shed were examined for their morphological features and soil samples were analysed in the laboratory for texture, salinity status, soil pH and exchangeable bases adopting the standard methods described in

A. O. A. C. A measure of the permeability of the various horizons was obtained by determining the laboratory permeability on the soil samples using the permeameter designed by Puri (1933).

Following the principles enunciated by Mehta *et al.* (1961) with slight modifications to suit the local conditions prevailing in the area, marks were allotted for the different soil properties and to the different horizons as shown below. The nature of evaluation in each case is also shown in the last column.

Properties	Maximum marks	Surface soil	Subsoil	Substra-tum	Nature of evaluation
Texture	25	10	9	6	Addition
Total soluble salts	25	10	8	7	,,
Lab. permeability	20	...	13	7	,,
pH	21	7	7	7	,,
Exchangeable sodium%	9	3	3	3	,,

The effect of a particular soil texture on its irrigation behaviour will be considerably influenced by the quantity of gravel present in it. Therefore, as suggested by Mehta *et al.* (1961), a deduction in marks for the different layers from the marks allotted to the respective textural classes, has also been made. The distribution of marks for the different classes of the above soil characters has been fixed as given below:

Texture: Maximum marks 25.

S. No.	Textural class	Surface soil	Subsoil	Substratum
		(10)	(9)	(6)
1.	Clay	7	4	2
2.	Clay Loam	8	5	3
3.	Silty Clay Loam	10	9	5
4.	Loam	10	9	6
5.	Sandy Clay Loam	8	6	6
6.	Sandy Loam	6	6	5
7.	Sandy	3	2	1

Deduction for gravel

S. No.	Gravel %	Surface soil (10)	Subsoil (9)	Substratum (6)
1.	0 — 20	2	1	—
2.	20 — 30	5	3	2
3.	30 — 50	7	5	3
4.	More than 50	8	7	3

Laboratory permeability: Maximum marks 20.

S. No.	Class	Percolation rate, cc/hr.	Subsoil (13)	Substratum (7)
1.	Very slow	0 — 50	7	3
2.	Slow	50 — 100	10	6
3.	Moderate	100 — 150	13	7
4.	Moderately rapid	150 — 200	13	7
5.	Rapid	200 — 250	10	5
6.	Very rapid	>250	7	5

Soluble salts: Maximum marks 25

S. No.	Soluble salts %	Surface soil (10)	Subsoil (8)	Substratum (7)
1.	<0·2	10	8	7
2.	0·2 — 0·3	8	6	4
3.	0·3 — 0·4	5	5	5
4.	0·4 — 0·5	4	4	4
5.	More than 0·5	2	3	3

pH: Maximum marks 21

S. No.	pH	Surface soil (7)	Subsoil (7)	Substratun (7)
1.	6·5 — 8·5	7	7	7
2.	8·5 — 9·0 or 6·0 — 6·5	6	5	5
3.	More than 9·0 or below 6·0	2·25	2·25	2·25

Exchangeable Sodium : Maximum marks — 9.

S. No.	Exchangeable sodium %	Surface soil (3)	Subsoil (3)	Substratum (3)
1.	Less than 15 m.e.	3	3	3
2.	Above 15 m.e.	2·5	2·5	2·5

After awarding marks for each of the soil properties as described above, the total marks for each profile was calculated separately by totalling up of the marks. Since the occurrence of a high water table is an unfavourable external factor of considerable importance in irrigation agriculture, the deduction of 25% of the total marks obtained by the profile is made in the final evaluation of such a profile.

Results : The field and laboratory data obtained in respect of 75 soil profiles were evaluated as detailed above and according to the marks scored by the individual profile, the profiles were grouped into three classes.

I. Those scoring more than 70 marks.
II. Those scoring marks from 55 to 70.
III. Those with marks less than 55.

Scoring of representative profile in each class is given in table 1 for illustration.

In the Amaravathy Project Ayacut area which is about 22,000 acres, 6,550 acres of land fall under Class I, 10,770 acres under Class II and 4,660 acres under Class III. The distribution of different classes of land is shown in the map.

The rating classes established have the problems as indicated below.

Class	Range of Marks	Nature of problem
I	>70	Little or only moderate problem requiring proper cultural and irrigational management practices.
II	55—70	Severe problems due to heavy percolation losses or alkalinity requiring soil and water conservation measures.
III	<55	Very severe problems due to very heavy percolation losses, or high amount of gravel, shallow depth, high alkalinity and/or high water-table, requiring special management practices.

TABLE 1.

Locality	Profile Horizon	Texture					Permeability		Soil Reaction		Soluble salts		Exchangeable Nos.		Total Marks	Marks reduced for high water table	Class
		Soil type	Marks	Gravel %	Marks Reduced	Total Marks	Percolation cc/hr	Marks	pH	Marks	%	Marks	%	Marks			
PUTHUR	Surface soil	Sandy loam	6	4·5	−2	4	...	...	8·5	7	0·15	10	18·93	2·5			
	Subsoil	,,	6	4·2	−1	5	66	7	8·5	7	0·15	8	18·93	2·5			
	Substratum	Clay	2	1·4	−0	2	26	6	8·9	5	0·06	7	22·57	2·5			
						11		13		19		25		7·5	75·5		I
KUMARA LINGAM	Surface soil	Sandy	3	7·8	−2	1	...	...	6·7	7	0·13	10	2·55	3			
	Subsoil	Sandy loam	6	48·4	−5	1	158	13	6·5	7	0·21	6	0·73	3			
	Substratum	Sandy loam	5	21·6	−2	3	198	7	7·0	7	0·16	7	5·22	3			
						5		20		21		23		9	78		I
DHALA-VAIPAT-TANAM	Surface soil	Sandy	3	4·7	−2	1	...	...	8·3	7	0·24	8	17·05	2·5			
	Subsoil	Sandy loam	6	29·4	−3	3	251	7	8·1	7	0·25	6	15·23	2·5			
	Substratum	Sandy	1	32·1	−3	−2	202	5	8·3	7	0·26	4	17·05	2·5			
						2		12		21		18		7·5	60·5		II
VENKITA-PURAM	Surface soil	Sandy	3	2·8	−2	1	...	...	9·9	2·25	0·16	10	31·67	2·5			
	Subsoil	Sandy	2	6·2	−1	1	55	10	10·0	2·25	0·18	8	32·65	2·5			
	Substratum	Sandy	1	2·5	−0	1	32	3	10·0	2·25	0·20	7	32·65	2·5			
						3		13		6·75		25		7·5	55·5		II
PERIYA-PUTHUR	Surface soil	Sandy	3	1·1	−2	1	...	...	9·8	2·25	0·24	8	30·80	2·5			
	Subsoil	Sandy	2	3·7	−1	1	69	10	9·5	2·25	0·26	6	28·10	2·5			
	Substratum	Sandy	1	26·2	−2	−1	24	3	9·6	2·25	2·28	4	29·01	2·5			
						1		13		6·75		18		7·5	46·25	11.56	III
JOTHAM PATTI	Surface soil	Sandy	3	25·9	−5	−2	...	...	8·5	7	0·26	8	18·93	2·5			
	Subsoil	Sandy	2	53·8	−7	−5	>500	7	8·4	7	0·30	6	17·96	2·5			
	Substratum	Sandy	1	43·5	−3	−2	436	5	8·5	7	0·22	4	18·93	2·5			
						−9		12		21		18		7·5	49·5	12·40	III

Discussion and Conclusion: Rating of lands for irrigation suitability provides an indication as to the cropping pattern to be adopted depending upon the irrigation possibilities of the soils and the water requirement of the crops. According to the rating presented above, class I occupying mostly the elevated areas will give average to good response to irrigation for wetland crops under common management practices. The irrigation project was designed to have only dry crops in these soils, but due to the wetness that prevails in these soils during the irrigation season, they are unsuitable for dry crops requiring light irrigation. Paddy and sugarcane cultivated at present in these soils appear to come up well. Well managed holdings have recorded up to 3,000 lb. of paddy and 40 tons of sugarcane per acre respectively. These clearly indicate the importance of a pre-irrigation soil survey which would have enabled to evolve before-hand, a suitable cropping pattern for the project area.

Class II and Class III lands suffer from one or more of the following causes to a degree varying from severe to very severe. The causes are: Percolation loss, high amount of gravel, shallow depth, high alkalinity and/or high water table. These lands mostly occupy valley bottoms and flood plains of drainage rivulets. Excessive seepage from the main canal and distributories together with the heavy irrigation practised in Class I lands, has resulted in high water table and water stagnation in the lands, falling in Class III. Improvement of the existing drainage system followed by efficient soil management including the reclamation of alkali affected soils is necessary for profitable exploitation of these areas. Here again paddy or sugarcane alone can be cultivated with maximum return.

It thus follows that the main problems in the Amaravathy ayacut area are excessive percolation losses in the tops and slopes of the undulations, and high alkalinity with or without high water-table in the low-lying valleys.

Some of the more important urgent steps suggested to solve the problems are: (1) Lining the main canal with cement concrete atleast in portions where there is too much seepage; (2) Development of efficient soil management practices to increase the moisture retentivity of class I lands; (3) Planning proper field lay-outs, cropping systems, drainage patterns and water requirements, (intensity and frequency of irrigation) in order to avoid wastage of water and water-logging; (4) Improvement of the general natural drainage system in the valleys to lower the water-table, and (5) Reclamation of the alkali affected areas.

Summary: A numerical rating of the soils of the Amaravathy Project for their irrigation suitability was carried out. Soil texture, soil salinity, soil pH, exchangeable-sodium percentage and laboratory permeability were

used for the rating. Marks were allotted for these properties in the different soil horizons, and totalled for each profile. Three classes were established with ranges in marks greater than 70, 55 to 70 and less than 55 to represent the three rating classes: no problem, severe problem and very severe problem. The values expressed the actual field conditions satisfactorily.

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