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the atmosphere have been ascertained to vary from 26 tons to 36 tons of water per acre of soil.

It is obvious that well pulverised and cultivated soils attract much more dew than those which are compact and close. If under irrigation there are facilities for the rapid removal of surplus water by surface and percolation drainage, the soil would soon be fit for working and being brought into a condition to absorb the dew, thus indirectly contributing to the economic use of irrigation water.

Drainage, therefore, is a good protective measure and a doubtful curative agent for the evils that necessarily arise from irrigation. The provision of a sound drainage system should be done with due regard to the depth, composition and distribution of the deposits of soil and subsoil. Much has yet to be done by soil scientists and drainage engineers before land drainage in this country can be put on a scientific basis, affording data by which the various classes of soils can be drained with the maximum efficiency and minimum expenditure. In this then, as in other departments of Agricultural Science, we see that though much has been done, more yet remains to be done. We have as yet taken a few onward steps and the direction of further advance—dictated at once by policy and business exigencies—should be by painstaking research coupled with sound reasoning based on mature experience and judgment.

SOIL SURVEY OF THE LOWER BHAVANI PROJECT AREA

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The object of this paper is to give in a succinct form the work of an Agricultural Chemist and the necessity for consulting him in launching any new irrigation project. With this purpose a descriptive account is given of the work done by the Chemistry Section here in connection with the Lower Bhavani Project.

This project aims at constructing a dam across the river Bhavani at a place 9 miles west of Satyamangalam and taking a channel from there across the country in a south-easterly direction to join the river Cauvery somewhere near Kodumudi. The strip of land which thus lies between this channel on one side and the rivers Bhavani and the Cauvery on the other is about 60 to 70 miles long and of an average breadth of 4 to 5 miles. The total area which will thus get to be under irrigation when the channel becomes a *fait accompli* will be about 200,000 acres, the main crops being millets, nadam cotton and occasionally groundnut. There is no doubt that when the area comes under irrigation we will be greatly adding to the prosperity of the whole tract by enabling ryots to go in for more paying crops which for want of water they are unable to raise now.

The Tract. The whole area is an extremely undulating one with numerous elevations and depressions and cut up at intervals by small water courses. The soil with very few exceptions is lateritic throughout, red in colour, sometimes loamy, but often sandy or gravelly and largely admixed with fragments of quartz which may often be seen thickly covering large areas presenting a characteristic feature. The soil is generally shallow varying in depth from 9 to 27 inches, 17 inches being the average of the rainfed area. In gardens under well irrigation which are often situated in hollows the soil is deeper and finer in texture. In no case, however, was it found to extend below 4 feet. The parent rock which is usually struck before the depth is reached is gneiss, sometimes massive and granitic in character, especially at lower depths and at other times stratified in layers which may be horizontal or inclined or compressed in folds. Before the parent rock is struck however, a layer of friable weathered rock is struck of varying depth just below the surface soil. Sometimes a compact layer of fragmenting quartz also occurs just underneath the surface soil and above the decomposing rock. The soil profile therefore, characteristic of the tract, could be described in the following terms:

0—17 inches.	Red loam, often sandy or gravelly.
17—30 inches.	Layer of broken quartz and crystalline felspar.
30—36 inches.	Red silty loam.
36—45 inches.	Weathered friable rock.
Below 45 inches.	Hard parent rock.

The shallow nature of the soil connotes a limited amount of weathering accounted for partly by the contour and general slope of the land favouring a large run off and partly by the limited rainfall and the quartzose nature of the parent rock. Erosion by carrying away some of the surface soil would further account for the limited depth of the soil.

Soil Survey: For purposes of survey soil samples were taken from spots roughly about 3 miles distant from each other and for the most part from areas devoted to the raising of dry or rainfed crops. Samples were taken at 9 inches depth down to 27 inches. Samples were drawn at intervals adjoining garden areas under well irrigation to see what changes, if any, the soil had undergone as the result of irrigation and cultivation. Altogether about 200 samples were thus drawn. The work done in the laboratory on these samples comprised the following:

1. Mechanical analysis into the usual fractions, viz., fine gravel, coarse sand, fine sand, silt, fine silt and clay.

2. Determination of certain factors relating to the water relationship to the samples, viz., maximum water holding capacity, pore space, volume expansion and apparent and real specific gravity.

3. Determination of moisture in the air dried sample and loss on ignition.

The actual details of the methods employed will not be given here, but an attempt will be made to illustrate how the several figures obtained could be used with advantage in getting an idea of the water requirements of soils of this type.

The mechanical analysis shows that the majority of the samples contains over 85 per cent of coarse fractions, i. e., gravel, sand and fine sand. Of the remaining 15 per cent of fine fractions the average clay is only 4·5 per cent which is a very poor content of clay and indicates an extremely poor capacity for absorbing and retaining moisture. By far the most important of the determinations made was that of the estimation of the maximum moisture holding capacity. The average was only 26 per cent with but 8 samples having above 30 and one going down as low as 14. Under the field conditions this figure which was obtained under ideal laboratory conditions would be still lower with the result that the soil has an extremely poor retentive capacity. Pore space and specific gravity estimations showed again, the extremely porous nature of the soil and the futility of a copious irrigation on soils of this type. The estimated figures for specific gravity and moisture holding capacity enable us to calculate the water required for saturation and irrigation, if we assume that the quantity would be that which is required to saturate the soil to a depth of 9 inches. If a heavier irrigation is to be given we may assume a 12 inch depth. Figures thus calculated are found to be 2·78 inches for a 9 inch saturation and 3·71 inches for a 12 inch saturation. While this is actually so in theory, there may be some loss of water as part of the irrigated water will percolate down to the lower layers with which the top layer is in contact.

The amount of water required for irrigation would also depend upon other factors than those considered above, viz., the actual depth of the soil, nature of the crop, etc. which is best found by trial in each case.

The project contemplates the division of the entire area into first and second crop blocks, water being available for irrigation purposes, only alternatively for each block at a time. Such being the case the extremely porous nature of the soil of the project area, would in the absence of suitable measures to prevent it result in a considerable loss of water from the irrigation channels through seepage. The water thus lost might find its way into wells and serve to raise the water levels inside the wells. Again on soils of this type a frequent light irrigation is likely to be more advantageous than a heavy irrigation with long intervals. Because both by rapid drainage and by the poor retentive capacity of the soil a heavy irrigation will only result in loss of water, without benefitting the crop.

Our attention has been confined in this paper mainly to the soil and its water requirements and to show how an examination in the laboratory has helped us to decide on the quantity and frequency of irrigation. A lot more work will have to be done on the chemical analysis of the soil before any pronouncement can be made as regards suitable crops to be grown and the amount of plant food that is available in the soil. Generally speaking, however, with the work done so far, it is possible to just indicate in a very rough manner what kind of future cropping might make the tract more prosperous. Wet crops like paddy, betel and even sugarcane and plantain seem to be out of the question. The present dry crops of the tract might very profitably be replaced by irrigated varieties of the same. Yet another possible direction of future cropping might lie in the raising of orchards like pomegranate, oranges and limes which will get the necessary amount of water from the new channel and get their drainage problems automatically solved by the texture of the soil.

CERTAIN ASPECTS OF THE IRRIGATION POLICY OF THE MADRAS GOVERNMENT.

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Contribution for repairs to Irrigation Works from Ryotwari Land-holders. The Government's obligation to repair and maintain Irrigation Works serving ryotwari lands has been unquestioned till recently. But under G. O. 773 dated 2—5—33 and an order of the Board of Revenue passed in pursuance of the same (published in answer to question No. 711 in the local Legislative Council on 27—2 -1934), this well accepted feature of Ryotwari administration has been substantially modified.

The genesis of the order is somewhat strange. An officer of the Madras Government was asked to enquire and report on the question of retrenchment of Land Revenue Establishment. He discovered in the course of his investigations, that the state in this country "has perhaps too generously assumed" the obligation to repair Irrigation Works and suggested that the ryots under Minor Irrigation Works in charge of the Revenue Department may be required to bear their share of this obligation in the shape of payment of contributions. The Government accepted the officer's suggestions without any discussion and asked the Board of Revenue to implement the same by suitable instructions to District Collectors. The Board welcomed the new source of income and extended the principle to all classes of Irrigation Works, major and minor. It issued a blank cheque to the District Collectors to decide the proportion of the costs of repairs to be recovered from the ayacutdars. The ryot's share may be any fraction less than the whole. Four illustrative cases calling for contribution