Analysis of Groundwater for Irrigation Management in Maheswaram Watershed

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Abstract ---- The suitability of ground water for irrigation is contingent or the effects of the mineral constituents of the water on both the plant and soil. Soils may harm plant growth by physically by limiting the uptake of water through modification of osmotic process, or chemically metabolic reactions such as those caused by toxic constituents. The ground water sample of Maheshwaram water shed was considered for the chemical analysis to determine its suitability for irrigation. The parameters considered for analysis were depth of ground water. Hydrogen ion concentration, specific conductivity, total dissolved solids, total hardness, sodium absorption ratio percentage of sodium and the sample are collected for a period of eleven years(1985-1995). The mean depth and mean of chemical constituents were calculated. A program in C was developed to find the correlation coefficient of chemical components with respect to the depth. Only two parameters total hardness and sodium absorption ratio showed positive correlation with the depth while the other components show negative correlation. Based on mean sodium absorption ratio(SAR=0.91) the ground water comes under the category of low sodium water and the water is suitable for all types of crops and all types of soils. The average percentage of sodium was found to be 16.57%. The ground water was categorized as class 1 type of water.

I. INTRODUCTION

A good irrigation water which performs the functions, to name a few

1. It acts as a solvent for the nutrients
2. The irrigation water supplies moisture essential for the life of bacteria beneficial to plant growth.
3. Irrigation water with controlled supplies washes out or dilutes salts in the soil.

Irrigation water may be said to be unsatisfactory for its internal views if it contains chemicals, toxic to plants or the persons using it as food, chemicals which react with soil to produce unsatisfactory moisture conditions and bacteria injurious to persons and animals eating plants irrigated with water. Irrigation water which contains various types of salts and high concentration than that is required for a good plant growth may defeat its very purpose. The salt content of irrigation water is usually expressed by one of the following ways-

1. Parts per million ppm or mg/litre
2. Milli equivalents/litre
3. Electrical conductivity expressed as micro mhos/cm

Presence of salts Na, Ca, Mg, K, in irrigation water may be injurious to plant growth. Excessive quantity of these salts reduce the osmotic activity of the plants thus preventing the absorption of nutrients from the soil. In addition they may have indirect chemical effects on the metabolism of the plant and may reduce permeability of soils.

II. CLASSIFICATION OF IRRIGATION WATER

Based on SAR irrigation water is classified into four types

1.   Low sodium water s1 SAR(0-10)
2. Medium sodium water s2 SAR(10-18)
3. High sodium water SAR(18-26)
4. Very high sodium water SAR>26. Where

Average SAR of ground water occurring in Maheshwaram is found to be .91 while the percentage of sodium is found to be 16.6. Based on SAR the water is suitable for all types of soils .

Because of low percentage of sodium even after prolonged use of such water the soil does not become sticky and plastic when wet and does not form clots and crusts upon drying .

Correlation coefficient was calculated between the depth of ground water and other parameters namely PH, Specific conductivity TDS, TH, SAR, percentage of Na, and they are -0.54, -0.17, 0.48 , 0.12 and -0.42 respectively. A program was developed in c to find the correlation coefficient .

From the values of (r) coefficient correlation parameters SAR and TH depend on depth of ground water while PH, Specific Conductivity, TDS and %Na do not depend on depth of ground water or quantity of ground water.

III. STUDY REGION

Maheswaram Watershed in Rangareddy district of Andhra Pradesh is spread over an area of 302.5 Sq.Km., .Its weathered zone chiefly consists red soils formed by the disintegration of granite. This zones thickness varies from 6.00 to 17.70 metres. The topography of Maheswaram mandalam is rolling as the slope is variant. Based on the agro-climatic conditions the Andhra Pradesh state is divided into seven zones. Maheswaram Mandalam being in a semi arid region (rainfall 750-900) has an average annual rainfall of 770mm. Absolutely pure water cannot be expected for irrigation. The acceptable limits to the impurities so that the yield of the crop is not hampered.

IV. METHOD OF CALCULATING CORRELATION COEFFICIENT

The correlation coefficient is a quantitative measure of the dependence between the variables. I5 estimate is obtained from

$r = 1/n \ E$

where (xi, yi) is the ith observation of x and y, x and sx are the mean and standard deviation of x respectively and Y and y are the mean and standard deviation of Y respectively. Equation 1 reveals that the correlation coefficient becomes positive or negative depending upon whether the numerator is +ve or −ve. When the correlation coefficient is equal to +1 all the points of the Scatter diagram with fall on a definite straight line with +ve slope. When the correlation coefficient is equal to -1 all the points lie on a straight line with −ve slope. It is to be noted that the correlation coefficient as defined in equation 1 is a measure of linear.

V. ANALYSIS OF GROUND WATER

The ground water in Maheshwaram water shed was considered for the analysis and consequently determine its applicability for irrigation.

Postmanson depths of groundwater level were taken as the reference parameters with which the constituents of ground water were correlated.

A program in C to compute the correlation coefficient was developed,

The correlation coefficient for Hydrogen ion concentration PH, Specific Conductivity, Total dissolved solids, total hardness, Na absorption ratio,

% of sodium were computed with reference to depth and were shown in the following table

GROUND WATER CONSTITUENTS OF MAHESHWARAM

	DEPTH	PH	SP. CON			
				TDS	TH	SAR	NA
r-	-	-0.54	-0.17	-0.17	0.48	0.12	-0.42
mean-	7.0045	7.73	1212	775	472	0.91	8.6
STD.DEV	2.445	0.365	353	226	122	0.51	1.96

CLASSIFICATION OF IRRIGATION WATER BASED ON SAR

S.No	Type of water	Suitability
1.	Low Sodium water S1	Suitable for all types of crops
	SAR 0-10	and all types of soils
2.	Medium Sodium water S2	Suitable for coarse texture of
	SAR 10-18	organic soils with good permeability
3.	High Sodium water S3	Harmful for almost all types of crops
	SAR 18-26	and soils
4.	Very high Sodium water S4	Unsuitable for Irrigation
	SAR >26	

VI. RESULTS AND ANALYSIS

The ground water of Maheswaram watershed was subjected for chemical analysis to find its suitability for irrigation. The ground water depths for ten successive years were analysed and its suitability for irrigation was determined. The chief chemical constituents namely specific conductivity, TDS, TH, SAR, and percentage of NA were analysed for their dependence on the depth of ground water. The mean and correlation coefficients of the indicated parameters were calculated. The average depth was found to be 7.045mts. The parameter PH is not dependent on the depth of ground water as its correlation coefficient was -0.54. Similarly specific conductance, total dissolved solids and percentage of sodium were independent of the depth of ground water as the correlation coefficients were respectively -0.17, -0.17 and -0.42.

The parameters that showed dependence on the depth of ground water were total hardness and sodium absorption ration. These two show a positive correlation coefficient of 0.48 and 0.12 respectively with the depth of ground water.

VII. CONCLUSIONS

The ground water of Maheswaram watershed was analysed for its suitability to irrigation. The ground water confirms with the standards of USDA as per SAR and percentage of Na content. Hydrogen ion concentration specific conductance, TDS, total hardness, do not depend on the depth of ground water. Only total hardness and SAR are independent of depth of ground water. Based on SAR and percentage of sodium the ground water of

maheswaram is categorized as class 1 irrigation water and can be used for longer periods of irrigation.

MANAGEMENT MAP OF FORESTRY WORKS
IN
MAHESHWARAM WATERSHED PROJECT
SCALE : 1:50000

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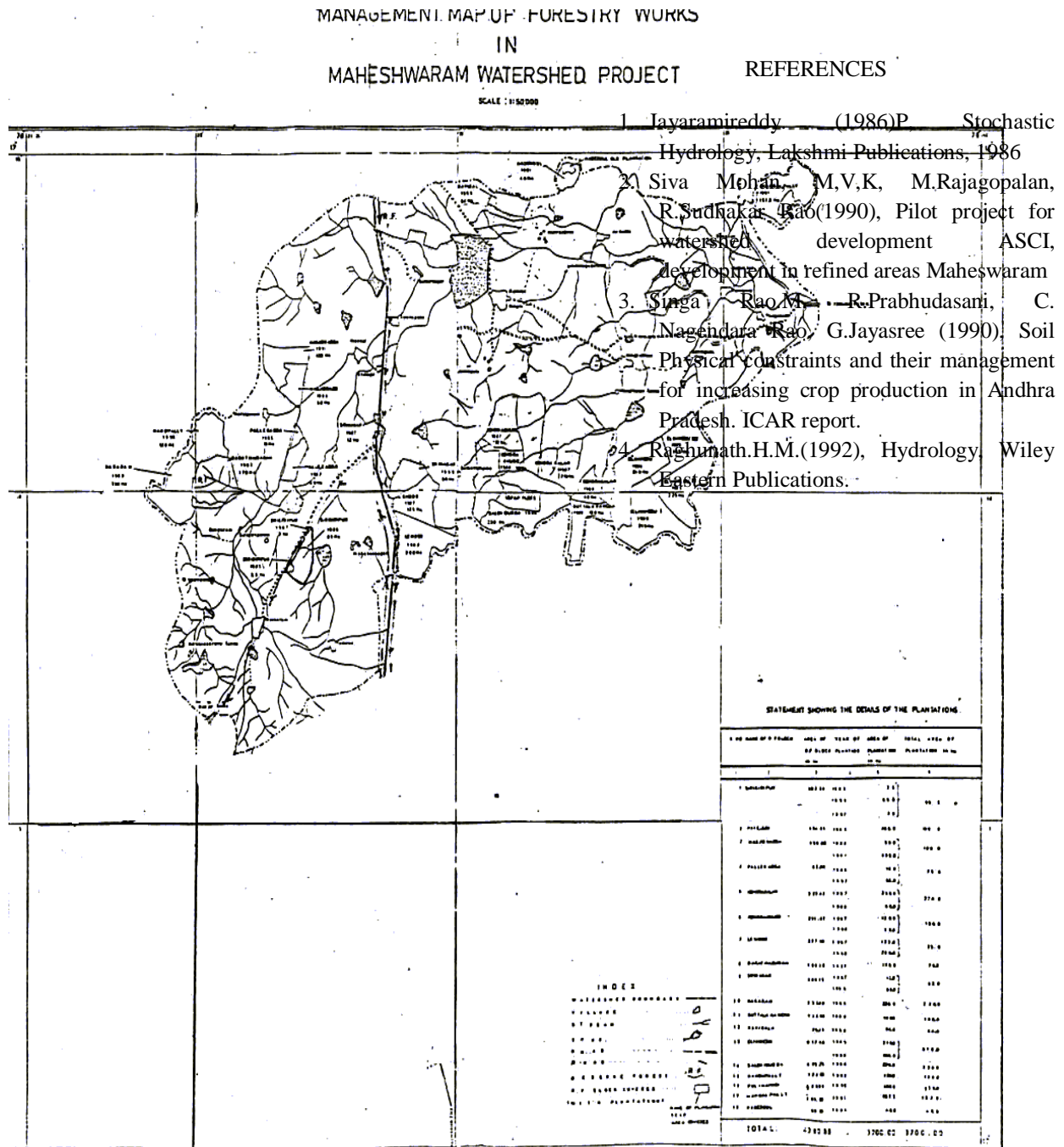4. Raghunath.H.M.(1992), Hydrology, Wiley Eastern Publications.

FIGURE 1. Maheswaram watershed