The Andhra Agric. J 58(4): 509-514, 2011

Mapping of Soil Salinity and p^H For Pathareddy Palem Pilot Area of Krishna Western Delta

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ABSTRACT

Soil salinization is a major form of land degradation in agricultural areas, where information on the extent and magnitude of soil salinity is needed for better planning and implementation of effective soil reclamation programs. Areas affected by salinization in Pathareddy Palem pilot area under Mutlur command area in Krishna Western Delta were studied using data obtained from Soil Science Division, APWAM, Bapatla. The main objectives of the study are to identify the areas affected with salinity in Pathareddy Palem in Mutlur command area, Krishna Western Delta and to draw soil salinity (1.6-61.3 dS m^{-1}, 0.94-43.2 dS m^{-1}) and p^H (6.7-8.4, 6.7-8.3) maps using Surfer 7.0 software for the years 2005 and 2006 respectively.

Key words : Electrical conductivity, Salinity, pH, Surfer.

Extensive areas of irrigated land have been and are increasingly becoming degraded by salinization and water logging resulting from over-irrigation and other forms of poor agricultural management (Ghassemi *et al.* 1995). Available data suggest that the present rate of such degradation has surpassed the present rate of expansion in irrigation (Seckler and David 1996). In some places, the very sustainability of irrigated agriculture is threatened by this degradation (Rhoades, 1997a; Rhoades, 1998). Ghabour and Daels (1993) concluded that detection of soil degradation by means of a conventional soil survey requires a great deal of time, but remote sensing data and techniques offer the possibility for mapping and monitoring these processes more quickly and economically. Soil salinization is a major form of land degradation in agricultural areas, where information on the extent and magnitude of soil salinity is needed for better planning and implementation of effective soil reclamation programs. Soil salinity varies over the irrigation cycle as the soil water content changes (Rhoades, 1978). To keep track of changes in salinity and anticipate further degradation, mapping and monitoring is essential for proper and timely decisions to be made to adjust the management practices or to undertake proper reclamation and rehabilitation measures. Halvorson and Rhoades, (1974) have been obtained numerous satisfactory field calibrations for many soils around the world and they have been found to be similar for soils of similar textures. Mapping and monitoring of salinity means first identifying the areas where salts concentrate and secondly, detecting the temporal and spatial changes in this occurrence. Carter *et al.* (1993) have developed mechanization of instrumentation for rapid mobilized in-situ measurement of EC, in field soils.

Ideally, it would be desirable to know the concentrations of the individual solutes in the soil water over the entire range of field water contents and to obtain this information immediately in the field. Practical methods are not available at present to permit such determinations, although determinations of total solute concentration (i.e., salinity) can be made in situ using electrical or electromagnetic signals from appropriate sensors. Such immediate determinations are so valuable for salinity diagnosis, inventorying, monitoring and irrigation management needs that, in many cases, they supplant the need for soil sampling and laboratory analyses. However, if knowledge of a particular solute(s) concentration is needed (such as when soil sodicity or the toxicity of a specific ion are to be assessed) then either a sample of soil, or of the soil water, is required to be analysed. Of course, the latter methods require much more time, expense and effort than the instrumental field methods. In this case, a combination of the various instrumental and laboratory methods should be used to minimize the need for sample collection and chemical analyses, especially when monitoring solute changes with time and characterizing the salinity conditions of extensive areas.

Table 1. Soil pH and EC_e values of Pathareddy palem on May 2005

S.No	p^H	EC_e	S.No	p^H	EC_e	S.No	p^H	EC_e	S.No	p^H	EC_e
1	8.0	7.4	16	7.7	43.4	31	7.6	38.4	46	8.3	8.1
2	8.0	18.3	17	7.7	8.4	32	8.1	7.3	47	7.8	3.9
3	7.3	56.1	18	7.4	10.7	33	7.3	23.5	48	8.0	8.0
4	8.0	34.7	19	7.3	15.7	34	7.7	26.1	49	7.1	8.3
5	8.1	5.2	20	7.8	26.4	35	8.1	10.9	50	7.8	36.3
6	8.1	7.0	21	8.1	2.7	36	8.1	15.7	51	7.9	44.7
7	8.2	6.9	22	6.7	34.2	37	7.9	7.0	52	7.7	15.6
8	7.8	30.8	23	7.4	2.1	38	8.1	4.6	53	7.0	63.4
9	7.6	47.9	24	7.9	12.3	39	7.8	9.0	54	7.7	35.1
10	7.2	30.5	25	7.2	61.0	40	6.9	24.9	55	7.7	31.7
11	7.8	32.7	26	7.2	22.2	41	7.7	6.2	56	7.4	31.3
12	7.4	10.6	27	8.1	10.0	42	7.5	9.1	57	8.2	5.1
13	8.0	6.6	28	7.5	7.9	43	7.7	28.5	58	8.0	12.0
14	8.4	1.6	29	6.7	21.2	44	7.6	33.6	59	7.5	8.4
15	7.5	62.1	30	6.9	38.2	45	8.1	23.3	60	7.3	35.4

Table 2. Soil pH and EC_e values of Pathareddy palem on May 2006.

S.No	p^H	EC_e	S.No	p^H	EC_e	S.No	p^H	EC_e	S.No	p^H	EC_e
1	7.2	14.0	16	7.7	24.0	31	8.2	1.9	46	7.9	8.1
2	6.7	3.9	17	7.8	10.8	32	8.1	1.4	47	7.7	4.0
3	7.3	8.5	18	7.9	4.2	33	7.8	2.9	48	7.6	23.5
4	8.2	8.9	19	7.9	21.8	34	7.7	10.2	49	7.3	26.5
5	8.0	18.4	20	6.9	22.5	35	7.2	9.6	50	7.7	17.6
6	8.1	4.2	21	7.8	34.5	36	7.9	21.5	51	8.3	3.9
7	8.2	5.9	22	8.2	1.6	37	7.4	9.2	52	8.1	11.5
8	7.1	4.7	23	8.0	21.3	38	7.2	10.1	53	7.2	28.3
9	7.8	12.8	24	8.1	3.7	39	7.4	26.1	54	8.2	1.1
10	7.0	10.3	25	7.6	31.8	40	7.7	1.6	55	7.3	3.1
11	7.7	7.6	26	7.6	13.2	41	7.5	2.1	56	7.3	13.2
12	8.3	1.1	27	7.7	12.7	42	7.6	5.2	57	8.1	4.2
13	8.1	0.9	28	7.7	2.4	43	8.2	1.4	58	8.0	15.8
14	7.8	14.5	29	7.6	3.7	44	7.6	11.8	59	8.3	5.2
15	7.8	29.8	30	7.5	5.1	45	7.1	3.7	60	7.3	43.2

The data available with A.P.Water Management Project, Bapatla Center on Krishna Western Delta, were used for the present study. The center is the nodal center of Acharya N G Ranga Agricultural University for water management research activities on increase of the water use efficiency and productivity with in the irrigation commands in agricultural sector in Andhra Pradesh.

Based on the available review, the present investigation was planed with the following objectives.

I. To identify the areas affected salinity in Pathareddy Palem in Mutlur command area.

II.To draw soil salinity and p^H maps for Pathareddy Palem in Mutlur command using Surfer 7.0.

MATERIAL AND METHODS

Study area

Out of the two pilot areas of the Project, the soil of Mutlur was found to be saline in nature. The data on soil pH and soil salinity for Pathareddy Palem pilot area of Mutlur, available with A. P. Water Management Project were utilized for salinity and pH mapping.

Measurement of soil EC and pH

Soil salinity (electrical conductivity of soils) varies depending on the amount of moisture held by soil particles. Sands have a low conductivity, silts have a medium conductivity, and clays have a high conductivity. Consequently, EC_e correlates strongly to soil particle size and texture. Soil salinity (EC_e) is a measurement that correlates with soil properties that affect crop productivity, including soil texture, cation exchange capacity (CEC), drainage conditions, organic matter level, salinity, and subsoil characteristics. Soil EC_e and p^H maps often used to explain yield variation, interpretation of on-farm tests, salinity diagonisis, and planning drainage remediation. Electrical conductivity (EC) is the ability of a material to transmit (conduct) an electrical current and is commonly expressed in units of milli Siemens per meter (mS m^{-1}). Soil EC measure ments may also be reported in units of deci Siemens per meter (dS m^{-1}), which is equal to the reading in mS m^{-1} divided by 100.

The soil pH indicates the hydrogen or hydroxyl ion activity of the soil-water system and there by indicates whether the soil is acidic, neutral or alkaline in reaction. Soil EC and pH were measured using EC Meter and pH meters respectively.

Soil salinity and pH data

The data of pH and EC_e already available with the project of soil samples at different locations were collected for Pathareddy Palem pilot area under Mutlur command area from Soil Science division, APWAM Project for Pathareddy Palem in Mutlur command for representing salinity mapping and are presented in Table 1 and Table 2.

Mapping of soil pH and salinity

Secondary data of pH and EC_e values were collected for Pathareddy Palem pilot area at different soil sampling locations from Soil Science division, APWAM Project. Which were a heads measured using the apparatus available at Soil Science division, APWAMP. Using Surfer 7.0 Version, the obtained pH values were assigned to Z value, where as X and Y values are the locus of the grid points where sample was collected. Creating a Grid file using XYZ data file and a contour map was drawn using surfer options, which represents equal pH contours or spatial variations of pH within the pilot area.

In the similar way, electrical conductivity values were assigned to Z value, and contour maps with EC_e values were drawn for the same grid points which represent equal salinity contours or spatial variation of salinity within the pilot area. The standard Kriging interpolation technique option was chosen for contours.

RESULTS AND DISCUSSIONS

Assessment of salinity and pH in Mutlur Command

Salt-affected soils owe their distinctive character to the fact that they contain excessive. The term 'saline' is used in connection with soils for which the conductivity of the saturation extract is more than 4 dS m^{-1} at 25^0 C. The trend showed that p^H values for all the samples were less than 8.5 i.e. in the range of 6.7-8.4. The EC_e values ranged from 1.6 - 61.3 dS m^{-1} in Pathareddy Palem during May, 2005. During May, 2006, pH values ranged from 6.7 - 8.3. The EC_e values ranged from 0.94 - 43.2 dS m^{-1}. This reduction of salinity can be attributed due to the construction of open subsurface drainage systems in the pilot area because there has no much variation in the ground water table, rainfall pattern and cropping pattern in the study area for these consecutive years.

Using Surfer 7.0 soil maps were drawn for both pH and EC_e values and were represented in Fig.1, 2, 3 and 4 during May, 2005 and May, 2006

Fig.1 Soil pH mapping of Pathareddy Palem under Mutlur drainage pilot area on May 2005 by using Surfer

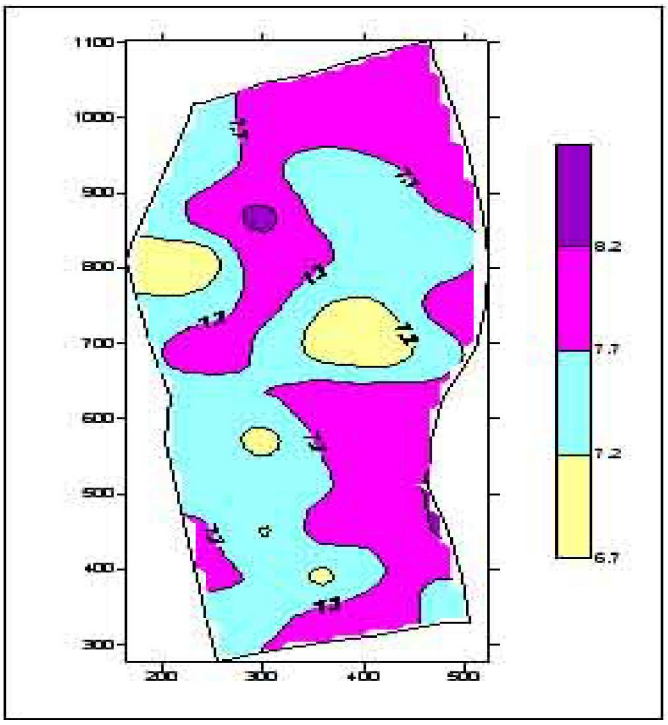


Fig.2 Soil EC_e mapping of Pathareddy Palem under Mutlur drainage pilot area on May 2005 by using Surfer.

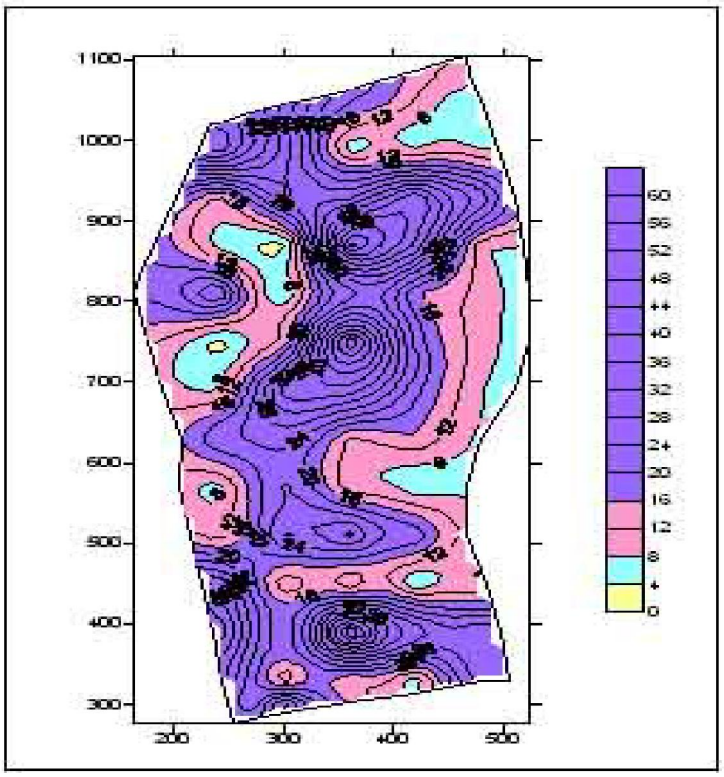


Fig.3 Soil pH mapping of Pathareddy Palem under Mutlur drainage pilot area on May 2006 by using Surfer

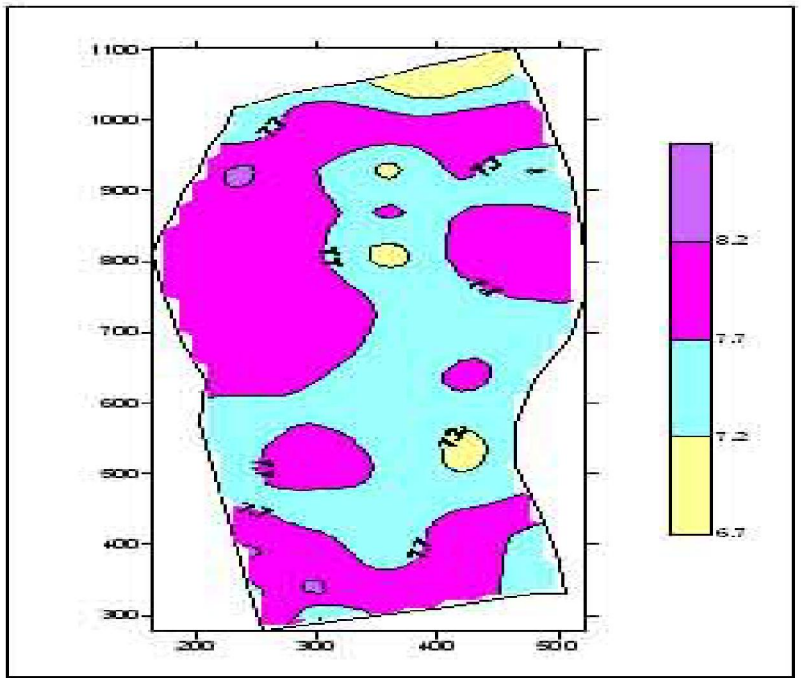
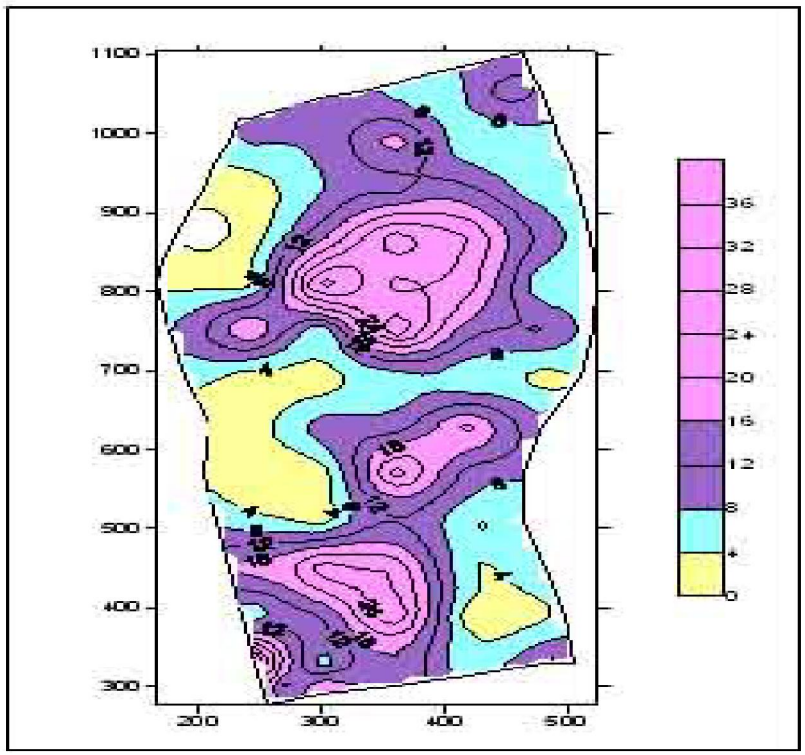


Fig.4. Soil EC_e mapping of Pathareddy Palem under Mutlur drainage pilot area on May 2006 by using Surfer



respectively for Pathareddy Palem in Mutlur command area. From the equal salinity (Iso-salinity) maps prepared for Pathareddy Palem pilot area, it was observed that the more per cent of area lies under the salinity range of 16-61.3 dS/m for entire pilot area in the year 2005. Similarly, the range reduced to 0.94-43.2 dS m^{-1} in the year 2006 which may be due to the installation of open subsurface drainage system. There was no much change in the pH range in the pilot area for both the years.

CONCLUSIONS

This type of study would be helpful for the scientists to recommend the application of fertilizers in the soil, based on the soil salinity and pH. The Drainage system to be adopted for the area can also be planned to reduce the cost of installation of the system. From the equal salinity maps prepared for Pathireddy Palem pilot area, it can be concluded that more area lies under the salinity range of 16-61.3 dS/m for entire pilot area in the year 2005. Similarly, the range reduced to 0.94-43.2 dS/m in the year 2006, which may be due to the installation of open subsurface drainage system. There was no much change in the pH range in the pilot area for both the years. These soil EC maps can be used to define management zones reflecting obvious trends in soil properties. Each zone can be sampled and treated independently.

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(Received on 23.05.2011 and revised on 14.06.2011)