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Ancillary Prospects of the Denatured Soil From Waterlogged Areas of Indira Gandhi Canal Scheme in Hanumangarh District of Rajasthan State, India

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The authors performed the physical and chemical analysis and explored the useful prospects of the denatured waterlogged/saline soil. The use of scrapped soil as fillers for active components of the fertilizers was also performed.

Key Words: Indira Gandhi canal, Waterlogged soil, Reference soil, Scrapped soil.

INTRODUCTION

Major parts of salts are eliminated by scrapping the surface soil which contains highly concentrated form of the salts present in the subsoil. This scrapped salty crust may be used as a source of fertilizers, where lands have low salinity and deficiency of nutrients. This salty crust in a definite ratio may be used and waterlogged soil samples were analyzed for their ingredients. It is likely that quite a few chemicals of economic and industrial use may be isolated. The authors have primarily concentrated as first approach to use scrapped soil as fillers for active components of the fertilizers[1].

EXPERIMENTAL

The present study consolidates the analysis of physical characteristics (pH, electrical conductivity or EC) and chemical characteristics (OC, N, P, K, Ca^{2+}, Mg^{2+}, Zn^{2+}, Fe^{2+}, Cu^{2+}, Mn^{2+}) of normal and waterlogged soil and were evaluated as per standard procedures[2,3] and the effect of different doses of denatured soil from Indira Gandhi canal scheme waterlogged areas applied to normal/fertilized soil on fertility, plant growth and crop yield. For this purpose, four observation sets (pot culture model)[4] comprising of different concentrations of denatured waterlogged soil with respect to a prime agricultural crop (wheat) under similar environmental conditions have been given in Table-1.

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TABLE-1
POT CULTURE MODEL

Pot No.	Composition of soil
1	100 % normal soil + recommended doses of fertilizer (DAP + Urea) (Reference pot)
2	50 % of the recommended doses of fertilizer (DAP + Urea) + equal amount of denatured waterlogged soil in the normal soil.
3	100 % denatured waterlogged soil equivalent to recommended doses of fertilizer
4	50 % normal soil + 50 % denatured soil from waterlogged areas with recommended doses of the fertilizer (DAP + Urea)

RESULTS AND DISCUSSION

The pH values of scrapped crust soil are found much higher than that of the optimum values (Table-2), which is probably due to the formation of basic oxides and hydroxides on prolonged and polluting waterlogging. Accordingly, electrical conductivity (EC) values are also higher as EC depends largely on the concentration of soluble ionic compounds. Since reference soil was taken from the remotely located fertile area which was free from waterlogging effect, hence EC values is found to be minimum. The values of organic carbon (OC) contents in scrapped salty crust waterlogged soil are more than that in the reference soil; this may be due to the presence of decayed biotic material in the waterlogged soil samples[5]. These materials are usually water insoluble and are not further decomposed in presence of high concentration of preserving salts, which already present in the soil. Similarly, the nitrogen concentration also shows the similar trends. The plausible reason is that the equilibrium of above said biotic components and hardly affected in most transformations. It is interesting to note that due to high ionic concentration and presence of various metal cations as impurities free phosphate concentration is quite low in the soil samples of waterlogged Indira Gandhi canal scheme command areas.

TABLE-2
NORMAL/SCRAPPED SALTY CRUST OF WATERLOGGED AREA SOIL STATUS OF INDIRA GANDHI CANAL SCHEME COMMAND AREAS

Soil quality	Physical characteristics		Chemical characteristics									
	pH	EC mmhos/cm	OC (%)	N (%)	P (kg/ha)	K (kg/ha)	Ca (ppm)	Mg (ppm)	Zn (ppm)	Fe (ppm)	Cu (ppm)	Mn (ppm)
Normal Soil	7.95	0.7	0.53	45.69	30	384	60	30	0.61	6.8	1.02	3.45
Denatured Soil	8.45	70	0.56	48.27	16	403	385	66	0.47	8.35	0.54	3.25

The alkali and alkali earth metal (Na^+, K^+, Ca^{2+}, Mg^{2+}) ion concentration in scrapped soil is also found higher than that of the reference soil. Increased contents of these bounded cations in form of inorganic exchanging three-dimensional network of resinous structures of these samples. As regards micronutrients levels of Zn^{2+}, Fe^{2+},Cu^{2+}, Mn^{2+}, *etc*., their effective concentration is reduced due to acute waterlogging[6] (Table-2).

Experimental data of Table-3 reveal that the germination is delayed appreciably at all the test pots of saline soil treatments. This may be attributed partly to its detrimental effect on the soil eco-system and partly to the poisonous nature. These factors suppress the probability of germination and growth. Some abnormalities at the intermediate levels owe to the differences in the dormancies of the corresponding seeds germinated. The growth of the plants in first 20th days is gradually retarded with increasing doses of the saline soils than that of the control plant growth. Similarly, in between 20th and 45th days, rate of growth is found to be retarded. With lapse of time (between 45th and 70th days period) the critical stage is reached even at lower level (pot no. 2) when sufficient period has been available for degradation of destructive concentration of the denatured soil.

It appears during this period some plant hormones (growth promoting and fruit forming) are formed. These are responsible for remarkable fast growth rates in pot no. 2 and comparable to that of the reference pot no. 1.

With increasing levels of saline soil, biomass/crop yields are suppressed slightly. This suggests that saline soil pose adverse effects on the hormonal mechanism responsible for puberty and crop yield[7,8]. The yield of pot no. 2 is reduced slightly because at this levels soil eco-system is disturbed only slightly. Decrease in biomass suggests that adverse effects of denatured soil on metabolic activities of wheat plant. It is noted that the destructive effect of the denatured soil with higher doses (pot no. 3 and 4) was so pronounced that the pot condition deteriorated day by day due to salinity.

TABLE-3
CROP IMPACT INVESTIGATIONS WITH THE SOIL FROM WATERLOGGED AREAS

S. No.	Characteristics/ Investigations	Pot No. 1	Pot No. 2	Pot No. 3	Pot No. 4
1	Germination (days)	7	10	14	N.D.
2	Shoot Growth (cm)				
	20^{th} day	18.0	16.0	11.2	–
	45^{th} day	38.1	34.4	N.D.	–
	70^{th} day	79.2	78.0	N.D.	–
3	Crop yield (g)	2.05	1.96	–	–
4	Biomass (g)	6.39	6.22	–	–
5	Weight of fodder (4-3) (g)	4.34	4.26	–	–

N.D. = Not detected

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