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SOIL SALINIZATION ESTIMATION BY METHOD OF VERTICAL ELECTRICAL SOUNDING

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Annotation: *The executed researches on brown solonized soils show the dependence of electrical resistance of soils by degree of salinization as well as humidity and temperature of soils that determines changing of parameters of vertical electrical sounding alongside the soil depth of soil horizons and microrelief. The objective of researches is to prove that value of vertical electrical sounding (VES) shall depend on soil salinization types, soil density and organic content of soil. It is necessary for study of and evaluation of VES data.*

Key words: *soil salinization, vertical electrical probing , resistance dependence from W, t°.*

Objects of research.

The brown soils of Dagestan and Iran have been selected for scientific research [3, 4, 7].

The methods of research consisted of estimation and evaluation of electrical features of soils by methods of vertical electrical probing within field conditions in seasonal changings and laboratory conditions by determining water and physical and agrochemical features of soils [4, 5, 6].

Experimental part.

The evaluation of soil salinization has great agro-ecological importance. The Vertical Electrical Sounding method is widely employed for soil salinization evaluation together with physical and chemical methods of researches. However, the results received by using this method depend on content of salts as well as their ratio, humidity, temperature, density, high humus content. They differ within vegetation period on proper elements of microrelief in the structure of topsoil. Our field study and researches are subject to find out these issues.

Usage of Vertical Electrical Sounding Data for characterizing genesis and soil fertility.

The Vertica Electrical Sounding is one of geo-physical method of expressive determination of soil features mainly for soil salinization degree determination [7].

As for data received by Ms. Pozdnyakova A.D. [4] the electrical resistance of soils reflects its genesis and soil and their productive capacity. We can judge about the value and type of pedogenesis process inside the soil profiles. As for the data the resistance of virgin and soddy podzol soils has reached a few hundreds and even thousands of Ohms.

In peat lands this value (pk) was within 40-60 Ohm/m. The curved pk of virgin of soddy podzol soils have shown three-layer structure $\rho A п < \rho A2 > \rho B$. It is determined that there is dependence of electrical resistance due to sum of uptake bases, amount of uptake and content of humus.

Ms. Kopikova L.P. [2] has determined the dependence of soil electrical conductivity from their salinization. The study of electrical conductivity of soil solutions of chloride-sulfate type of salinization with concentration of 1-25 gr/l has allowed to determine high coefficients of correlation with its mineralization (r = 0,91; for n = 90) and with sodium-absorption ratio – SAR (r= 0,79; n = 90).

Author offers classification of solutions toxic property (At humidity from HB to 0,7 HB) for sulfate – calcium – magnesium type of salinization. Non-toxic and medium toxic salts have electrical conductivity cm/m $*10^{-1}$ at 18°C accordingly 4-7 and 10-13; the content of high-soluble salts C at HB accordingly 6-9 and 13-18 gr/l [2].

As for received data we discovered the general trend of changing electrical resistance in soils of piedmont and maritime lands of Dagestan: it has been decreasing from highlands to maritime lands [3].

As well the received data have shown that electrical resistance of solonchaks was 0. It corresponds to water-soluble salts of higher than 4% (4-30%). The subsaline soils having the content of water-soluble salts less than 1% had electrical resistance within 20 to160 Ohm/m [3].

As it is shown on below stated Table 1 the soil has acid suspension effect: pH of sustension is lower than pH (H2O) of filtered solution. Mostly it is typical for sample No. 3 than for Sample No.4 pH (KC1) differs from pH(H2O) of extraction. The highest resistance U (Ohm) is typical for Soil Sample No.2 where general alkalinity is greater, more loss during heating, lower density and greater humidity. The lowest resistance U (Ohm) is typical for Sample No.3 where EC (MS) is greater, the density of soils is greater and pH (H2O) is greater as well.

Table 1

The connection of VES data with Soils features (Aп)

Value	Sample Soil			
	1	2	3	4
W, %	0,3	3,1	0,7	0,2
pH (H_2O) – extraction	8,0	7,9	8,3	7,9
PHkc1 –suspension	7,6	7,6	7,6	7,4
pH (H_2O) – suspension	6,6	6,6	6,4	6,7
OB gr/cm^3	1,7	1,2	1,6	1,4
Density of solid phase, gr/cm^3	2,3	2,2	2,7	2,3
Loss at heating	29,6	35,3	29,0	26,8
Alkalinity (general*)	0,7	1,4	1,1	0,2
TDS ppm	203	291	456	298
EC (ms)**	309	414	686	443
U (Ohm) ***	6,9	11,2	4,7	5,1
V	18,2	34,8	18,7	16,7
K, %	25,8	7,4	16,7	16,8

**) concentration of salts*
***) electrical conductivity*
****) resistance by method of VES*
V- voltage within VES
SOILS : 1,3 – brown semi desert alkaline solonized , Iran
2- Brown semi desert solonized, Iran
4- Gray desert soil , Uzbekistan

Influence of soils humidity over the VES.

Kotenko M.E. has discovered that electrical conductivity of brown chestnut soils depends not only on degree of salinization but on humidity and degree of high humus content that is necessary to take into account when reading the data of vertical electrical sounding [3].

From theoretical point of view when the temperature changes from 0 to 20° the content of CO_2 in soils changes from 171 to 87,8 mg/100 gr of water that influence over the solubility $CaCO_3$, $MgCO_3$. The solubility of separate residues is changed differently at proper temperatures. So, at 2C° the solubility $MgCl_2$ equals to 54,6 mg/l; $MgSO_4$ – 18; $MgCO_3 *H_2O$ – 0,13. With increase of temperature the absorption capacity of multivalent cations with lower entropy and higher energy of hydration. At increase of humidity it is more preferable to absorb cations with lower energy of hydration and with higher entropy of dissolution.

As for the data received at increase of temperature from 20° to 40° absorbing of Ca by the soil constituted 204% , Mg – 55%, Na- 21% (6). As well as according to received data the value of electrical resistance of soddy-podzolic soils was 60-300 Ohm/m, for gley soil – 40-180 ohm/m; for rock – 60-80 Ohm/m.

As we see from the received data the solonized soil has greater density of solid phase , as well as greater electric conductivity, smaller electric resistance, greater content of water soluble salts, greater pHkc1 of suspension and pH(H_2O) of water extraction. If to compare Sierozem with other soils it has lower quantity of losses at heating, lower humidity of soil, lower pHkc1 of suspension and pH(H_2O) of water extraction.

The value of suspension effect pH(H_2O) minus pH(H_2O) of suspension is higher in solonized soil (1,4) and lower in brown saline soils (1,3) and in sierozem [1, 2].

Seasonal changes of temperature and humidity of soils and their affect to soil electrical conductivity.

The electrical resistance of soil changes as per seasonal dynamics. However, these features differ for separate groups of soils, horizons and for soils developed in different elements of mezo and micro relief.

Gyulalyev Ch.G [1] has determined the consequence of changing electrical and chemical characteristics of soil upon temperature and humidity. The author has shown that increase of surface and volume of soil has caused linear increase of electrical and physical coefficients.

When increasing the temperature from 5° to 40 ° electrical and physical coefficients has increased inline. With increase of humidity they started to increase more intensive. After the electrical conductivity has continued to rise but not so fast.

According to the data obtained, the seasonal dynamics of readily soluble salts in the profile of the chestnut soils of Dagestan showed a change in the type of salinity during the year. The change of the sulfate-chloride type of salinity to the sulfate or chloride-sulfate type of salinity was established.

It is shown that the electrical conductivity of soils increases with an increase in soil salinity and ionic strength of the solution. However, the effect of sodium and calcium salts, carbonates and sulfates on it is different. Solubility of salts depends on pH, temperature, humidity, complexing ability of soil solutions.

According to the data obtained for the chestnut saline soils of Dagestan, a large scatter of the values of specific electrical resistances along the surface and along the soil profile was established.

At the same time, the electrical resistance at the soil surface was 71-82 Ohm / m, although the soils differed at the typical level and in the degree of salinity and solonetzicity, which is associated with an insignificant moisture content of the upper soil layer. So, in the upper layer of the salt marsh, the moisture content was less than 5-7%, and already in the layer of 12 cm, it varied in the range of 12-18%. With a water-soluble salt content of 4-30% in the salt marsh, the electrical resistance was close to zero, and in slightly saline soils with a salt content of less than 1%, the electrical resistance varied in the range of 20-160 Ohm / m.

The influence of the nature and degree of salinity on the state of crops of individual crops.

The effect of salinity on individual crops is very different. Thus, a decrease in yield by 25% is observed in soybeans at 5.7 Mmo / cm and in barley at 13.0. A decrease in yield by 10% is observed in soybeans at 3.8 Mmo / cm and in barley at 10.0.

With the predominance of less harmful salts in the soil solution, plants are mainly subjected to osmotic pressure; with the predominance of more harmful salts, plant intoxication increases and salts cause an inhibitory effect on individual enzymes [8]. Moreover, some plants are resistant to chlorine, others to sulfates. Plants growing in conditions of chloride salinization have a higher degree of salt tolerance, but at the same time they are less drought-resistant and cold-resistant in comparison with plants developing in conditions of sulfate salinization.

Conclusion

The method of vertical electric sounding used to assess the degree of salinity is rapid and convenient for use in the field. However, when interpreting the data, it is necessary to take into account that the data obtained depend not only on the content of water-soluble salts in the soil, but also on their composition, soil moisture, density, temperature, humus content, pH, and Eh. This determines the change in soil salinity in seasonal dynamics and in the structure of the soil cover and should be taken into account when interpreting the sounding data in the agroecological assessment of lands.

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