Optimization functions of the salted soils in Southern Ural

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On commence l'expérience champêtre selon l'augmentation de la fertilité de la chernozem à alcalis avec l'utilisation des matières premières naturelles, phytoamélioration et conditionneur. La chernozem à alcalis contient la quantité basse d'éléments nutritifs et possède la fertilité basse. Les facteurs principaux réduisant la fertilité sont aussi les propriétés physiques défavorables, fort dispersion de la masse du sol et le contenu des sels toxiques.

Introduction

A composite geomorphologic constitution and the different high-altitude levels of Southern Ural stipulate a non-uniform distribution of climatic resources that finds reflection in soils formation processes and soil mantle. The non-uniformity and complexity of a soil mantle is conditioned also by variety of geologic depositions and structure soil formation rocks. The high contents of readily soluble salts from the tertiary seas in conditions of an arid climate promote formation such soils as solonetz and solontchak. The originating of the solonetzing processes promotes also high contents of feldspars in a structure volcanic and metamorphic of rocks, the weathering results which one in enrichment of soils by natrium.

Recently the area salted soils has started to increase. The increase in the area occurs as a result of strengthening anthropogenic loadings, an irrigation and change of a hydrology of a landscape. Strengthening of negative processes probably in conditions of increase of dryness a climate.

The solonetz and solontchak have low fertility. The productivity these soils remain to lowest and in such condition they can not serve agriculture base. The improvement of properties these soils increase of their fertility and productivities is a rather composite problem. Pacing factors lowering their fertility are the unfavorable physical characteristics, strong physical weathering and salinization. Increase of efficiency salted soils demands development adapted, ecologically and economically proved system of meliorative actions.

Materials and Methods

Studies were conducted on alkalized chernozem. With the purpose of development of technology of optimization agrarian and ecological functions with the purpose of increase of productivity of agricultural crops there has been begun field experience. For increase of fertility of soil have been used natural raw, phytomelioration and conditioners. Field experience has been made by technique B.A. Dospekhov (1979).

Soil samples collected from genetic horizons were assayed for total humus by Tyurin; hydrolyzed nitrogen, by the Kjeldahl method; total phosphorus, by the wet ashing with potassium perchlorate; mobile phosphorus, by the Chirikov method; pH of aqueous suspensions, by potentiometry; exchangeable sodium, by displacement with ammonium acetate and quantitation on a flame photometer using the Antipov-Karataev and Manaeva method; base exchange capacity, by the Shaimukhametov method and aqueous extraction was analyzed by the standard technique (Arinushkina, 1961; Agrochemical Methods of Soil Studies, 1976). Chemical compound of natural raw by according to a management Chemistry and genesis of peat and sapropels (1962). The obtained data were statistically processed (Dmitriev, 1995).

Results

Apparently from the data presented in table 1, the maximum quantity of the water-soluble salts corresponding an average level is found out in horizon B1 on depth 39-60 sm. Calculation of structure chemical compound hypothetical salts shows, that in a soil structure prevails sodium sulphate. Among toxic salts for plants also are found out $Mg(HCO_3)_2$ and $MgCl_2$, and their share in structure of a aqueous extract for horizon Ap makes more than 60 %. It is known, that such salt structure interferes with use of gypsum for reclamation on salted soils (Yanturin et all, 1994). It is necessary to note, that if in humus-accumulative horizon the maintenance of exchange sodium corresponds to a "weak" degree sodisation, with depth (horizons B and BC) its values reach a "strong" degree (tab. 1).

Table 1. Composition of aqueous extract of alkalized chernozem

Horizon, sample depth, cm	Solids, %	HCO^{3-}	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^+
Ap 0-20	0,14	0.72	0.584	0.889	0.62	0.9	0.673
		0.044	0.021	0.043	0.012	0.011	0.015
A1 20-39	0,32	0.568	2.225	1.41	1.84	1.04	1.323
		0.035	0.079	0.068	0.037	0.012	0.030
B1 39-60	0,62	0.7	4.32	3.88	3.32	2.68	2.900
		0.045	0.151	0.186	0.066	0.032	0.067
B2 60-82	0,30	0.447	4.03	0.687	0.62	0.98	3.565
		0.027	0.143	0.033	0.012	0.012	0.082
BC 82-100	0,29	0.328	3.819	0.646	0.6	1.0	3.193
		0.020	0.136	0.031	0.012	0.012	0.073
C 100-117	0,25	0.272	3.767	0.606	0.54	0.88	3.225
		0.017	0.134	0.029	0.011	0.011	0.074
D 117-137	0,33	0.568	4.222	1.091	0.54	1.16	4.181
		0.035	0.15	0.052	0.011	0.014	0.096
Numerator – mg-Eq/100 soil; the Denominator – %							

Table 2. Chemical properties of alkalized chernozem

Horizon, sample depth, cm	pH H_2O	Total humus	P_2O_5		N hydro-lysable	Na^+	BEC	Na, % from BEC
			mobile	total				
		%	mg/100 г soil		mg/kg of soil	mg-Eq/100 soil		
Ap 0-20	8,22	3,72	1,19	56,43	70	0,3	26,04	1,15
A1 20-39	8,76	3,38	1,19	50,10	84	0,2	22,38	0,67
B1 39-60	8,10	1,82	1,48	18,81	28	0,3	2,33	0,13
B2 60-82	8,11	0,82	0,38	18,84	28	0,6	11,20	4,91
BC 82-100	8,14	0,47	0,36	40,70	28	0,6	6,10	9,84
C 100-117	8,40	0,36	0,12	Traces	56	0,8	7,74	9,69
D 117-137	8,12	0,17	0,64	56,40	56	0,1	8,92	1,12

The maintenance total humus in the top humus-accumulative horizon low (3.72 % in horizon Ap and 3.38 % - in A1) below which it sharply decreases to 1.82 % and less (tab. 2). Obviously, low maintenance of the total humus is connected with some erosion the given site as on a virgin soil this quantity for horizon A1 makes 4.24 %. Reaction in all soil profile alkaline about a maximum of reaching 8.76 units pH in horizon A1. The capacity of base exchange capacity (BEC) in the top horizons changes within the limits of 22-26 mg-Eq/100 r soil and further, as well as the maintenance of the total humus, sharply decreases by the end of soil profile. The maintenance of nutritious elements - mobile and total phosphorus, hydrolysable forms of organic nitrogen as a whole is characterized as "very low".

Thus, the high maintenance of toxic salts, the low maintenance total humus, insufficient quantity of nutritious elements does not allow to receive steadily high crops of agricultural crops in the given conditions.

Discussion and conclusions

In a complex of the actions directed on increases of fertility alkalized chernozem was accepted the decision on use of natural raw material, phytomelioration and conditioners. This natural raw material possesses fertilizer and reclaiming properties and alongside with system properties is harmlessly secure and has a genetic affinity to soils of locale.

As natural raw material, directed on optimization of functioning alkalized chernozem of some in conditions of field experience have been used:

1. Straw (finely crushed);
2. Zeolites of a Tuzbek deposit;
3. Labus (the floating vegetative islands which basis makes *Comarum palustre* L. and kinds of a sort *Carex* L.). The maintenance of organic substance on the average the sample has made 50-60 %, the maintenance of the total nitrogen – 28020 mg/kg, hydrolysable nitrogen – 1493 mg/kg or 5.3 % from the total, quantity of total phosphorus – 376.2 mg/100 g, mobile phosphorus – 1.2 mg/100 g, pH H_2O – 6.72, pH KCl – 6.48). From the resulted data it is visible, that the substratum of floating island is rich with organic substance, total forms of nitrogen and phosphorus, is characterized by neutral reaction. Security mobile nitrogen very high. Hence, this material possesses enough high nutritional value;
4. Sapropel from a bottom of lake Tchebarkul. Possesses following chemical property: organic substance – 5.88 %, total nitrogen – 5076 mg/kg, hydrolysable nitrogen – 196 mg/kg, total phosphorus – 120 mg/100 g, mobile phosphorus – 17.4 mg/100 g, pH H_2O – 8.06, from 10 % HCl boil roughly;
5. *Melilotus albus* Medik. (as phytomelioration) in common with conditioners Deman (as the humus-accumulative horizon is characterized by the low maintenance agronomic valuable units);
6. Sand (for simplification fine texture);
7. Manure;
8. *Onobrychis sibirica* (Sirj.) Turcz. ex Grossh (as phytomelioration)
9. *Medicago sativa* L. (as phytomelioration)

Field experience has been incorporated by spring of 2005. Carrying out of researches in current of five years is planned.

Literature

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