

Reclamation of Solonetz Soils in the USSR and Principles for Planning Reclamation Work

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In the USSR, according to the data of an incomplete soil survey, there are about 100 mln. ha, of soils with different degrees of alkalinity and patches of solonetztes accounting for more than 25—30% of the total area. Approximately 20 mln. ha. of these soils constitute arable lands.

Solonetztes are widespread in the northern, central and western parts of Kazakhstan, in West Siberia, Povolzhje, the southern regions of the Ukraine and in Transcaucasia.

Under natural conditions these soils are characterized by low fertility, the severest soda-saline ones being absolutely infertile. Arable land spotted by solonetztes, is difficult to cultivate due to its variability in moisture content, compactness and fertility.

Solonetz soils are characterized by extremely diverse physico-chemical properties and conditions of occurrence which necessitate the choice of very different methods for their reclamation. In the Soviet Union, methods are based on academician K. K. GEDROI's sodium-exchange-adsorption theory in which the degree of soil alkalinity is determined by the adsorbed exchangeable sodium content.

The available soil survey material contains insufficient soil salinity and alkalinity data. This lack of data often makes it necessary for state and collective farms to carry out additional investigations and to compile cartograms of solonetzic and saline soils by enlisting the services of zonal agro-chemical laboratories, expeditions of the "Giprosem" (State Designing Institute of Land Management), and "Giprovodkhoz" (State Designing Institute of Reclamation Construction).

Soil survey and reclamation work in the main regions of solonetzic soil are accompanied by improved methods of ameliorating solonetz soils found by the trial of various chemical amendments and soil cultivation methods.

Proceeding from the results of field experiments, the research institutes make regional recommendations which are used by designing and production bodies in elaborating reclamation projects and developing solonetz soils.

Scientific data as well as production experience relating to the development of solonetzic soils in different regions show the effectiveness of solonetz reclamation especially under conditions of sufficient moisture.

In 3 to 5 years of reclamation the low fertility or completely infertile

solonetztes produce as well as the zonal soils. The Ukraine, Rostov area, Armenian, Azerbaijan, Moldav and Kirkhiz Union Republics can be credited with having improved large areas of solonetz soils by the application of chemical amendments or by a complex of agrotechnical measures, the latter being based on a knowledge of the soil moisture regime and the chemistry of the soil salinity.

The soda-saline (alkali) solonetztes with shallow ground waters need the application of the most complicated reclamative measures. These are ameliorated by drainage and leaching and the addition of such ameliorants as gypsum, sulphuric acid and iron sulphate. The gypsum, as well as other amendment requirements, is calculated according to the soda and exchangeable sodium content in the layers of the soil to be reclaimed.

The positive effect of chemical amendment manifests itself not only in soda neutralization and the replacement of exchangeable sodium, but also in improvement in the permeability of the reclaimed layer.

The reclamation of meadow solonetztes, characterized by neutral or mixed salinity, is accomplished by applying special mechanical treatment methods without disturbing the illuvial horizon. The installation of drainage systems makes it possible to apply chemical amendments as well.

Reclamation of the neutral saline steppe solonetztes mainly involves a complex of measures (agrobiological method) including, first deep ploughing (three-stage, plantage, layer by layer) which brings the Ca salts into the plough layer.

The agrobiological method implies additional moisture accumulation, fertilization and the sowing of ameliorating crops.

Deep reclamative ploughing brings about a radical improvement in the water-physical properties of soils.

Chemical amelioration is almost ineffective in dry-farming regions with an annual precipitation below 200 mm.

Great areas of complex solonetzic soils were brought into agricultural production during the period of virgin soil development. Reclamative improvement of such soils is conditioned by plough layer thickness and degree of cultivation.

Deep moldboard ploughing, fallowing, snow retention and the sowing of perennial grasses are applied to meadow solonetztes.

The meadow-steppe and steppe solonetztes with Ca salts close to the soil surface are reclaimed by the agrobiological method, whereas chemical amelioration is applied to reclaim solonetztes with deep-seated Ca salts. The gypsum-containing materials are introduced in two steps: before deep moldboard ploughing and at superficial loosening of the soil. Reclamation takes from 2 to 4 years, including the sowing of perennial grasses.

The endurance of reclamative measures applied in various zones of this country have not yet been sufficiently studied. The tentative suggestions for the interval between the application of agrobiological and chemical amelioration are 5—6 and 7—10 years respectively.

The reclamation of soda-saline solonetztes, using drainage, is economically justified if they are intended for the cultivation of the most valuable crops (cotton, grapes, etc.).

Improvement (with or without drainage installation) of meadow solonetztes of mixed salinity type for growing cereals has not found wide application.

Applying gypsum and other chemical amendments is at present confined to the steppe and meadow-steppe solonetztes with neutral salinity and a deep occurrence of calcium carbonates and gypsum.

Reclamation of sodic solonetz-solonchaks for growing cotton and grapes is being carried out on comparatively small areas of the Armenian and Azerbaijan SSR.

The Ukrainian SSR, the Rostov, Volgograd, Omsk, Novosibirsk and some other areas of the RSFSR as well as the Kazakh SSR are engaged in improving solonetz soils with Ca salts located close to the soil surface.

The amount of this reclamative work is expected to grow in the future.

Deep reclamative ploughing of solonetzic soils has been reported to give positive results in most of the dry-farming regions.

Natural ground gypsum is the most frequently applied amendment. Phosphogypsum, sulphuric acid and iron sulphate (industrial by-products) are used in small amounts.

The solution of the problem of drying phosphogypsum at chemical industry enterprises, may promote its application in agriculture in relation to natural gypsum.

The expansion of the use of sulphuric for reclaiming solonetz soils requires an overall theoretical basis and involves the solution of a number of technical problems.

A series of field experiments should be established to study and ascertain the reclamative effect of iron sulphate.

Researchers must focus on the elaboration of the theoretical problems with regard to the degree of soil alkalinity methods of reclamation, dosages of ameliorants and the duration of reclamative measures applied.