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Ecological sustainable of agricultural soils of Russian Southern Far East

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Аннотация

На юге российского Дальнего Востока наиболее плодородными являются луговые черноземовидные, лугово-бурые, остаточно-пойменные и луговые глеевые осушенные почвы. Балл бонитета этих почв составляет 85-100. Многие из этих почв подвержены переувлажнению, деструкционным процессам природного и антропогенного характера. Основными их таких процессов являются склоновый сток, наводнения, снижение плодородия, переуплотнение, различные виды загрязнения. Потери гумуса ежегодно составляют 0,25-0,45 т, интенсивность смыва почвы 5-40 т/га в год, густота овражно-балочной сети 200-50 м²/год, загрязнение почв пестицидами превышает ПДК в среднем в 1,5 раза. Немаловажным фактором ухудшения экологического состояния почв являются стихийные свалки и карьеры. Под ними, до существующим данным, занято 1,6 тыс. га. Этот вид нарушения экологии почв является трудно контролируемым. В целом экологическое состояние почв юга Дальнего Востока считается удовлетворительным. Однако, на отдельных территориях она возрастает до критической.

Ключевые слова: юг российского Дальнего Востока, сельское хозяйство, экология, почва, деструкция.

Abstract

In the south of the Russian Far East, the most fertile are meadow chernozem-like, meadow-brown, residual-floodplain and meadow gley drained soils. The bonitet score of these soils is 85-100. Many of these soils are subject to waterlogging, destructive processes of a natural and anthropogenic nature. Their main processes are slope runoff, floods, decreased fertility, overconsolidation, and various types of pollution. Losses of humus annually amount to 0.25-0.45 t, soil leaching intensity is 5-40 t / ha per year, the density of the ravine-girder network is 200-50 m² / year, soil pollution with pesticides exceeds the MPC by an average of 1.5 times. An important factor in the deterioration of the ecological condition of soils are natural dumps and quarries. Under them, up to the existing data, 1.6 thousand hectares are occupied. This type of disturbance of soil ecology is difficult to control. In general, the ecological condition of soils in the south of the Far East is considered satisfactory. However, in some territories it increases to critical.

Keywords: south of the Russian Far East, agriculture, ecology, soil, destruction.

The soil of the southern Far East was formed in specific climatic, geological and landscape conditions. Agriculture is confined to the flat part of the territory, which occupies about 30% of the total area. The most accumulation of humus occurs in island and coastal zone of the southern Far East. With the increase in continentality of climate humus horizon

decreases. Feature of Far Eastern humus are acidic properties. Heavy granulometric composition of the soil is common throughout the South of the Far East (with the exception of the floodplain soils and their variants). Soils are predominantly poorly water permeable. The consequence of this is waterlogging of soils and bogging low places. The greatest degree of bogging observed on Sakhalin Island [1].

Agricultural soils of the southern Far East is mainly represented by brown-podzolic and meadow-brown soils on the territory of the Western-Maritime lowland and Middle-Amur lowland, meadow chernozem-like soils of the Amur – Zeya lowland. The meadow chernozem-like soils and residual floodplain soils are most fertile. In the Amur region and the Khabarovsk region, the fertility of the soil affected by the catastrophic floods, tillable land is poorly protected from flooding.

The use of soils of the southern Far East is usually associated with land reclamation, because they are waterlogged. Soils susceptible to degradation due to the influence of destructive natural processes and the negative impact of anthropogenic processes. The meadow chernozem-like soil are most fertile in the Amur-Zeya lowland. The profile of these soils is of relatively thick humus layer - about 30-40 cm. Tillable soils of the Khabarovsk region and the Jewish Autonomous region have a thin humus horizon, which rarely exceeds 15-20 cm. Soil waterlogged and take to erosion processes, which leads to low soil fertility of the tillable land of the Khabarovsk region and Jewish Autonomous region. According to reports, at present in the region for more than 8% of agricultural land is subject to water and wind erosion, over 42% waterlogging, 20% bogging. More than 76% of agricultural lands are located on middle and high acidic soils [1].

The qualitative condition of the soils of the Sakhalin region has a great influence its island location, great rainfall, waterlogged and bogged areas. Adverse natural conditions contribute to low productivity of the soils in this area. Since 1992, the balance of nutrients was consistently negative; soil acidity increases (82% of the soils). More than half of the soils with a low content of phosphorus and 40% with low potassium content.

Major agricultural soils of the Primorye region have fertility low to medium. The humus content of predominantly low to medium, most of the soils have middle acidity, the content of phosphorus is very low and potassium – middle. Thus, the tillable soils of the Southern Far East mainly middle acidity, middle fertility, was the influence of natural destruction processes.

The ecological condition of the land is characterized by a degree of degradation. Decomposition processes leading to soil degradation, have different mechanisms of existence and are natural or anthropogenic. All these processes affect soil properties and soil fertility. The main decomposition processes leading to soil degradation, are presented in the picture.

The level of degradation processes can be global, regional or local. The many types of soil degradation makes it unsuitable for agriculture, or contribute to the irreversible destruction of the soil cover.

The soil degradation associated with agricultural production, therefore, agricultural soils most susceptible to decomposition processes. On the territory of the southern Far East these processes include plane wash, water and wind erosion, waterlogging and flooding. Water erosion is in most areas of the Primorye, Khabarovsk, and Amur region. Waterlogging is typical for the whole area of the southern Far East. The consequences of the existence of these processes are expressed in the depletion of the soil. In addition, human activities such as vehicle operation, construction, affect the development of the processes of soil degradation, for example, soil pollution, violation and mixed soil horizons [2,3].

In agricultural production, the severity of the environmental situation increases with increasing level of intensification, mainly in the use of agrochemicals: herbicides, pesticides, mineral fertilizers. Thus, reduction of soil fertility depends on destruction processes of natural and anthropogenic character, the main ones to the Southern Far East are soil erosion, waterlogging, soil panning, pollution by agrochemicals.

Primorye region in the far East has a more land development and plowed. The share of protected conservation lands in the territory of Primorye close to the area of such lands in the Russian Federation.

According by published data the number of anthropogenic and economic disturbed lands are 5.7 % of total area. In fact, the area of disturbed lands are higher.

Different lands with adverse environmental conditions, which are determined by the source, the natural properties lying within their limits of soils.

These adverse factors reducing the productivity of tillable land, should be governed by Federal and regional Programs maintain soil fertility. However, from the point of view of effectiveness monitoring is an important consideration for those lands that have been degraded under the influence of incorrect treatment on the part of landowners.

There are no data of the soil violation, gully, buried soils and those with transformed profile. This is because the identification and control of such lands requires surveys with the involvement of experts. This survey must be conducted on the entire area of tillable land. But currently being identified local violations of the ecological condition of soils on which it is impossible to say the scale of the violations on the territory of the southern Far East.

The same applies to the area of eroded land. The table presents data from surveys of previous years. In connection with the active use of tillable land at present these data are subject to change upwards [4].

In present time the issue of identification of soil fertility violations and the control of use agricultural land is important. The Rosselkhoznadzor (Russian farming control) regularly reveals the facts of soil degradation, but they do not reflect the actual situation on this issue. Therefore, a revision of the methodology for assessing degradation and correction of the results of monitoring lands [5].

The types of violations, unfortunately, do not contain detections of land contaminated by heavy metals. In addition, it is impossible to understand how significant was kind of violation. For example, the question arises, how the failure to provide documents agrochemical inspection is associated with impaired fertility. As we know, a violation of soil fertility is a significant reduction of humus and plant nutrients. Therefore, no comparison of these indicators with data from previous surveys can only assume the presence of such violation. In this case, the problem is the lack of data from previous surveys of soil condition. To monitor changes in ecological state of soils it is necessary to oblige all owners and users of land to conduct a survey of land not less than once in 5 years. Unfortunately, such a measure is the result of difficulties of a legal character (it is not legally defined, so to oblige the farmer it is impossible to carry out). In addition, the survey is very expensive. While Russian farmers financial resources are very limited.

However, assessment of the severity of the environmental situation on the Far Eastern agricultural lands requires the development of clear criteria. It is three types of soil degradation: physical, chemical and biological. However, they are not only limited to a variety of degradation processes. It is proposed to supplement the above types of degradation processes, which have a wide distribution in the agricultural sector: 1) phytosanitary, 2) technical, 3) economic-organizational, 4) reclamation [1].

Criteria of fertility decline and environmental degradation, should be based on the level of land degradation, The most detailed and evidence-based characteristics of soil ecosystems and the economic use of lands in accordance with their nature and economic significance was presented by V. N. Sheptukhov with co-workers [6]. My colleagues and I adapted it with consideration of the peculiarities of the Far East. Qualitative description of soil condition and land degradation is given for two groups of areas: natural biocenoses and agroecosystems. In either case, degraded soils are subject to environmental danger of breaking the ecological balance.

In assessing the degree of land degradation can be based on this levels. In addition, this requires quantitative indicators of soil quality for each level of degradation. This is

important to more clearly differentiate levels of degradation. Such indicators grouped us in areal, morphometric, physical and hydrophysical, chemical. Figures are averages for soils of the southern Far East. This indicators can be used to assess the environmental condition of the land and allow for quantitative characteristics to determine the environmental status and the level of soil degradation and land under various forms of destructive processes.

Conclusions:

1. Establishing criteria of fertility decline and environmental degradation on agricultural lands are important for effective soil conservation and control of their fertility. Without this, it is impossible efficient and environmentally oriented cultivation of crops.
2. Legislated the following evaluation criteria reduction of soil fertility: organic matter content (humus), the content of mobile phosphorus and exchange potassium and an increase in the acidity of soils. To these indicators for the conditions of the southern Far East it is necessary to add the power of tillable horizon and its density. These indicators reflect the degree of manifestation of negative destruction processes.
3. In transactions with land plots of agricultural purpose (registration of ownership, tenure, and lease for a term of 5 years or more) landowners (land users) should carry out a full survey of the land, which subsequently will be used as control data.

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The efficiency of use of agricultural land to the Far Eastern South

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Аннотация

Представлен земельный фонд южной части Дальнего Востока и его распределение по видам земельных угодий. Представлено наличие сельскохозяйственных угодий (пашни) в муниципальных районах Приморского края, выделены наиболее освоенные и плодородные районы. Структура и динамика урожайности основных сельскохозяйственных культур. А также различия в урожайности между муниципальными районами. Виды основных производителей сельскохозяйственной продукции и наличие у них пашни. Соотношение обрабатываемых и не вовлеченных в производство сельскохозяйственных земель. Средняя стоимость сельскохозяйственной продукции и средний доход хозяйств в расчете на 1 га (по муниципальным районам). Различия в эффективности использования пашни. Причины низкой эффективности использования пашни –