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Ecological-hydrological evaluation of Humic Gleysols drained by plastic and ceramic drainage during 15 years*

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1 Introduction

Fine carbonate-free loesslike loams are widespread in zone of broad-leaved forests of the southern Nonchernozem region. Humic Gleysols form on these rocks with a low or moderate permeability (filtration koefficient – 0.1-0.2 m/day). The use of these soils is complicated by their intensive overwetting (usually in spring). That is way Humic Gleysols need additional study. There is special interest in solving the following problems:

1. evaluation of the merit of draining Humic Gleysols;
2. comparative stude of drainage action of different types of material drenage, particular trench ceramic and non-trench plastic drainage;
3. analysis of the variation of the hydrological regime of Humic Gleysols as a result of drainage.

2 Materials and Methods

Experimental reclamation test area was created in 1987 year in thee Moscow region. As a whole, the territory of the reclamation soil hydrological station is confined to the

high-land area of the Moscow River-Oka plain, and geomorphologically it is smoothed moraine area.

Six autonomous drainage systems were constructed in the test area, each of which had an area of 2.0-4.0 hectares with observation shafts and drops at the exit of a collector for measuring the drainage runoff. The system was constructed in threefold repetition for each experiment variant. The non-trench plastic drainage was installed by an MD-4.5 drain layer to a depth of 1-1.2 m, and the ceramic trench drainage was installed by an Etts-202 drain layer to the same depth. In both variants, the same interdrain distance of 16 m was maintained. All studied soils are located on a modern plowed field.

We examined the ecological-hydrological conditions typical of Undrained Humic Gleysols with natural water regime and Humic Gleysols drained. The elements of the water regime were studied during 15 years (1988-2003).

3 Results and Discussion

The wetness regime of Humic Gleysols is distinguished by significant contrast (Zaydelman, Kovalev, 1994). Independently of the wetness of the year, immediately after snowmelt, the entire profile was flooded. This state of the soil was also observed in autumn in the period of abundant presipitation. Tne soil wetness in this case was usually in the interval between the MFMC (maximal field moisture capacity) and FMC (full moisture capacity). At the beginning and middle of the year, the wetness of the soil (espetially in surface horizons) dropped below the MFMC (or below 0.78 MFMC). In individual years in layers 30-50 cm thick for a brief perod, it dropped to the WM (wilt moister).

A typical feature of the wetness regime of undrained soils is the development of a two-stage perched water table in their profile. Its upper stage is confined to the plow layer, and the lower was situated at the depth of 70-75 cm. Between these two horizons of total inundation, there are zones with wetnwss equal to the MFMC-FMC.

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Observations show that drainage in wet, moderate, and dry years has very substantial influence on the wetness regime of Humic Gleysols. Its action in these soils appears in the fact that it completely or almost completely eliminates the presence of free gravity moister at the level of full flooding (FMC). In the presence of drainage in Humic

Gleysols, not only is the two-stage state of the perched water table eliminated, but the gravity moister at the level of FMC also disappears from the lower horizons. In this case, the soil wetness throughout most of the warm period turns out to be equal to WCBR (wetness of capillary bond ruture)-MFMC.

The results of observations of the wetness regime of soils let us identify definite differences in the action of ceramic trench and plastic non-trench drainage. In wet years, according to our data, plastic drainage causes mere intensive drainage of the soils than ceramic trench drainage.

Independently of the type of drainage, it always turns out to be the cause of deep drainage of surface horizons in the period of summer drought. The soil wetness at the level of WM-WCBR in moderate and dry years is traced in the series of 60-80 cm.

It has been established that, throughout the entire cycle of investigation, the yield of agricultural crops in undrained Humic Gleysols was always substantially smaller than on drained soil (Kovalev, Huwe, 1999). This circumstance confirms the tcological and economic merit of draining Humic Gleysols for cultivated localized crops.

4 Conclusions

The data obtained show that the modern agronomical utilization of Humic Gleysols in an undrained atate take place inder conditions of a natural, very unstable water regime. This leads to practically complete soaring of the yield of grain crps in wet years or its decrease in moderate and dry years. It is established that drainage complitely eliminates the formation of the two-stage perched water tabke which is typical of these soils under natural conditions. On drained Humic Gleysols conditions form which are favorable for the cultivation of crops of field rotation, especially grain crops. The tendency of more intensive influence of non-trench plastic drainage on wetness regime of these soils is established.

5 References

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