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Review

Review for Soil with Excess Moisture

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Abstract

Soil is one of the natural factors representing the environment over which occurs during the process of watering and acts as a "reservoir" of water storage. Soil is a porous medium that cannot hold a lasting only a certain amount of water, excess water either through ground water seepage and moisten the lower strata either be retained on the surface water ponding. Excess moisture temporary or periodic: Prolonged excessive wetting, wetting the medium term, the short wetting, wetting of varying duration (short-extended). After excess moisture source and intensity: moderate excess ground moisture; strong excess ground moisture; overate excess moisture from precipitation; strong excess moisture from precipitation; excess moisture from precipitation under phreatic intake; excessive humidity combined: groundwater and precipitation; excessive humidity in coastal streams; flood excess moisture; excess of moisture and salts. Heavy rainfall produces excessive humidity in cool areas where evapotranspiration is low and with low soil permeability. Depression relief favors the appearance of excess moisture in the rainy season on clay-rich soils. Low renewal of the air in the soil results in the accumulation of large amounts of CO_2, the CO_2 content of the air in the soil than 1% by plants suffer. Excess moisture causes reduced soil aeration, slowing oxidation and mineralization grading the pharmaceutical insufficient debris. Remove excess moisture by means of a network of drainage channels, as compared with the removal of excess moisture by a network of open channels, has a number of advantages, such as small area removed from the culture, ease of agricultural works by mechanical means, simple maintenance work, lack of widespread outbreaks of weeds, pests and diseases etc. The disadvantage is the high cost of pipes, drainage filter material and execution.

Keywords: soil humidity, temporary moisture, periodic moisture, water ponding.

1. Introduction

Canarache A., 1990, [19] show that the limits of variation of the three phases of soils in Romania are: the solid 45-60%, 15-35% water and 5-40% air. After cartogram humus content presented Davidescu, 1999, [20] in the meadow Somes Mic, humus content is between 3.5 and 4.5% and after cartogram of agricultural soil textural classes agricultural soils from Somes Mic valley are heavy regional soils [19]. Hydrological regime of the soil [19]: continuous freezing; periodic percolation and percolation; un-percolation; exudative; irrigation.

On a global scale, the climate is the dominant factor in the formation of the ground, unlike the topographic factor which has a local influence, being a space variable which gives a vertical differentiation [15]. In our country the land of excess moisture occupies about 8.62 million ha or 36.3% of the area in Transylvania being found approximately 2,200,000 ha [19]. In the last decade, the Cluj county among the largest area occupied by agricultural land (426,205 ha) of the North-West region (NUTS II) surface which occupies about 5% of the land of the county [23]. Following the "Study on degraded land inventory of the land in order to bring agricultural and forestry land productive cycle, Cluj" (designer EXPERCO ISPIF SRL, beneficiary Directorate General for Agriculture and Food Industry Cluj,

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2003), cumulative area of damaged areas inventoried is of 69720 ha in Cluj County. Inventory of damaged areas was based on the methodology developed by Academician Mircea Moţoc, including evaluation of degradation forms based on degradation types and conditions of pollution [22].

Land areas affected by excess moisture is 15.4% of total degraded land, in the county of Cluj, respectively 1.60% of the total land of Cluj County. The total area of degraded land in Cluj county is 10.45% of the county's land of 667,440 ha [21]. Of the total area of degraded land in the county of Cluj, 14905.3 ha are public domain, 2695.5 ha private state property, respectively 52119.2 ha private property [19].

Excess water is determined by the upper limit of the aeration and humidity field capacity or higher than 70% of the total porosity [19].

Obrejan et al., 1966, mentions the following relation which expresses the water dynamic regime which puddle on the soil surface [8, 11, 19]:

$$D = P + D - S - I - E - T,$$

where:

d = volume of surface water;

P = amount of rainfall;

D = inflow of surface water;

S = volume of water drained from the land surface;

I = amount of water infiltrated into the soil;

E = amount of evaporated water;

T = amount of water sweating.

The excess of water caused by the ground water may be expressed quantitatively by the formula:

$$g = P + D + (G + A - Sad) - I - E - T,$$

where:

g = increase or decrease in groundwater level;

P = amount of rainfall;

D = inflow of surface water;

G = inflow of groundwater;

A = volume condensation of atmospheric moisture;

Sad = groundwater outflow boundary is drained off;

I = amount of water infiltrated into the soil;

E = amount of evaporated water;

T = amount of water sweating.

Land developed for irrigation, watering large enforcement may result in raising the groundwater level and the appearance of excess moisture [7, 8]. The work applied repeatedly to the soil with tractors and heavy equipment, especially when the water content is close to that corresponding to the capacity of the water in the field, determining soil compaction, reduced permeability and the occurrence of excess humidity. In Romania, it is estimated that anthropogenic compaction process affects about 66% of the arable land [3, 19]. Excess soil moisture can be periodically - when it takes less than 30 days, extended - when it takes 30-60 days, or permanently [1, 10, 19]

Excess moisture in the soil is determined by internal and external factors. Internal factors relate to poor drainage of the soil, which may be caused by the fine texture of the rock or soil formation with the presence of argillic horizons. External factors such as weather can be (abundant precipitation), hydrological (flooding surface water courses), hydro (high water table) and geomorphological (relief depression) [1, 4, 14].

2. Results and Discussions

The consequences of excess moisture on agricultural land. Reserve air in the soil depends on the groundwater level because only when it is deeper than 1 m shall ensure a regular exchange of gases between soil and atmosphere [9, 12, 17].

Soils with excess moisture warm up heavily in the spring seeding will be later. Due to strong evaporation soils remain cool in summer [11, 12, 19]. Excess moisture creates favorable conditions that facilitate the development and proliferation of weeds and parasitic fungi that cause diseases of agricultural plants [2, 9, 11]. In the area Dorneşti-Siret-Frătăuţi Noi, Suceava county, excess water caused the decline in production of main crops, as follows: potato 8-14 t/ha, maize 1.5-3.0 t/ha, sugar beet 7-16 t/ha and for wheat with 1.2-1.5 t/ha [19].

Groundwater level is maintained lowered as required by crops, not only during their growing season, but also beyond, in order to ensure the normal aeration and soil thermal regime in order to carry on normal soil microbiological processes influencing so favorably on agricultural production [10, 12, 13].

Horizontal drainage with tubes drains (tubular drainage) is the best type of drainage and it can be done with ceramic tubes, concrete pipes and plastic pipes [8].

Tubes to achieve drains must meet a number of conditions such as: long service life, unadulterated by chemical agents in the soil, deformable, to avoid the formation of deposits on the inside, are not damaged during transport and handling, do not require high costs of labor, and these conditions are met, to a greater or lesser extent, depending on the material they are made of tubes [5, 8]

Ceramic tubes are manufactured in the usual manner, with diameters between 50-250 mm, having wall thickness of 8-26 mm. The length of the ceramic tube is 33 cm, for diameters smaller than 12 mm and of 50-80 cm, often larger than 60 cm for larger diameters [5]. Using for a very long time the ceramic tube drainage is due to the advantages they present, namely: reduced power consumption, local raw material (clay). As disadvantages include: the heavy tubes, making it difficult to transport, are brittle, leading to large losses during handling: they are adversely affected by frost action [5, 8].

The main drawback of ceramic tube drains is due to the possibility of reducing or even stopping the leakage section following the deposit of fine sand or clay sediments, ferruginous or calcareous deposits. Clogged drain section can reduce the penetration of roots of trees or shrubs, particularly poplar roots. For this reason, the crossing belts of trees or shrubs is recommended grouting joints or using plastic pipes with holes [5]. Concrete pipes are rarely used for absorbent drains and more frequently for collector drains, their diameter is from 100 to 600 mm. Drains with concrete pipes carry water well and have the advantage of on-site manufacture. It presents the disadvantage that the groundwater containing sodium and magnesium sulfates higher than 1-3% attack and destroy the material. Also, the presence in the ground water of carbon dioxide creates an acidic environment destroying concrete pipes. These drawbacks limit the scope of use of such drains [5].

Plastic tubes were inserted into the drainage technique in our country since 1960 and won a share large enough due to the advantages it presents. Thus, the tubes of plastic material provides a better continuity of the line of drainage because of fewer joints, weight of the same diameter is smaller (by 10 to 15 times less), so that ease of transport, allowing a greater degree mechanization and productivity is running higher execution cost is reduced. In addition, plastic tubes are not affected by the loss or destruction of handling and chemical action of mineralized ground water. Plastic tubes are made of polyvinyl chloride (PVC) or polyethylene (PE) high density and low pressure [5].

Horizontal drainage network - through which the capture and removal of excess water and lowering the ground water level - is formed, from the functional point of view, of drain-absorbing and collecting drain outlet. Absorbent drains, regulation elements of the water regime in the soil, serving to direct drainage of the soil, having a dual role: firstly to capture the excess water and secondly carrying the excess water to the nearest collector.

Collection-exhaustion drains, elements of collection and exhaust, receive water from the absorbent drains and evict it in an emissary. Collecting-exhaustion network may be the type of closed or open drains of the channels. Absorbing compound drainage network and discharge-collection network, along with construction of the network, is a drainage system [5, 8]

In a drainage system for the abstraction of water, the absorbent drains are situated in the plane in the form of parallel rows, generally equidistant, perpendicular or at an angle to the collector. Depending on the slope, adjustment elements (absorbent drainage) can be placed in three schemes: longitudinal, transverse and intermediate. The scheme consists of longitudinal rows of absorbent drains location parallel to the steepest slope, drains having a route around the contour direction.

This location is applied on land with low slopes under 0,005, ensuring water drainage slope of absorbent drains. On these grounds, if drains were not placed on the greatest slope line to ensure water flow is required land leveling on slopes in the direction of the drains or insurance required by the implementation of the drains, increasing the depth of drains toward the downstream end. Both leveling and depth downstream drains are expensive solutions, which advocates for placing drains in longitudinal scheme. Absorbent drains are disposed towards the jack with the ground water flow, the power of absorption is low, and therefore the distance between the drain must be reduced, the cost of such a drain is increased.

Land with excess moisture must be taken of the danger of secondary salinization. The sequence of crops is established such as to allow the weed destruction and a good coverage of the soil in order to avoid the establishment of an upward stream of water. Once the breeding application is done, besides clearing of weeds and good aeration of the soil, which is so necessary on dammed and drained land [5, 6, 14, 16, 18].

With our country in the plains and lowlands is an area of over 4.4 million hectares of agricultural land with groundwater located at medium between l and 6 m. In wet years and periods of high levels in natural waterways, the groundwater increases excessively and wet the root zone of plants in an area of 1.0-1.5 million ha. of which approx. 0.5 million are salt varieties [6, 19].

3. Conclusions

By expanding irrigation, areas affected by high groundwater levels increase every year, approximating at approx. 3.2 million ha. To lower and maintain groundwater levels in these areas to a depth from which it does not harm the soil and plants, in terms of modern agriculture, intensive-economic-rational and efficient underground drainage should apply [18].

The underground drainage of agricultural land means the elimination from the root development area, the water and salt in excess, damaging soils and crops, removal is done through a network of drains [6, 18, 19].

Underground drainage network through its elements for regularization (absorbent drains) and collection-exhaust must ensure groundwater lowering and maintaining a depth that does not harm the crop and soil, depth named ditch norm or drainage depth [5, 6].

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