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Determining the water capacity demand of the soil in the study area

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Abstract: Currently, in a period of expected climate change, specific soil conditions are observed in every part of our country. In restoring the soil structure, various chemical elements in the soil, their structure, mechanical composition, satisfaction of water demand, as well as the application of organic and mineral fertilizers to the soil and its water-holding capacity are of great importance. The main task of today is to analyze the data obtained from the analysis of the formation of soil structure depending on physicochemical factors - the amount of precipitation, the amount of water and its porosity, the type of soil, and its mechanical composition.

Keywords: Soil, water, irrigation, climate, permeability, temperature, humidity, mechanical composition, capacity.

Introduction: The mechanical elements of the soil adhere to each other, forming lumps (aggregates) of various sizes and shapes. Its property of forming aggregates from mechanical elements is called the property of forming structures. In soil science, the structure of the soil is understood as its property of separating into soil aggregates (lumps) of various shapes and sizes. From the point of view of agronomy, only lumps that are not washed away by water, that is, are strong, are considered the best.

Soil is an important object for the growth and development of plants. There were different views on the properties of soil in different periods of development of agriculture. Of course, these views were evaluated relatively depending on the growth and development of plants in this soil. If a plant grows well and produces fruit in this soil, then this soil is called good, and vice versa, bad. Soil is considered a source of nutrients and water necessary for plant life, and its structural state is one of the important factors affecting its fertility. Such clods are water-resistant, and the soil formed from them is called strong structural soil. Structureless soils are composed of clods that easily crumble under the influence of water.

Depending on the size of the clods, soils are divided into the following types:

- clods with a diameter of more than 10 mm - megastructural;

- clods with a diameter of 0.25 to 10 mm - macrostructural;

- Particles smaller than 0.25 mm in diameter are classified as microstructured soil.

Clasts from 1 to 3 mm in size are considered the best water-resistant clasts from an agronomic point of view. The rate of formation of the topsoil layer is approximately 2.5 cm per 100-1000 years. This indicator varies depending on the climate, grasslands, soil type and land use. Many living organisms, such as bacteria, fungi, worms, insects, participate in soil formation. This process is very slow in deserts, high mountains and regions close to the Arctic Circle.

This layer is very thin in our climatic conditions, and in the climate of Uzbekistan it takes more than a hundred years for one centimeter of fertile soil to form, unless other negative factors interfere with this process, of course. Therefore, the amount of land suitable for growing crops is also very limited: all agriculture in Uzbekistan is concentrated along rivers and in narrow strips of land between mountains and deserts. It would not be wrong to say that only 9.5% of the land in our country feeds the population of the republic. This is very valuable capital - not a reserve, but precisely the capital that needs to be preserved.

Soil provides crops from which food, clothing and most of the clothing for human needs are obtained. The population of the country is growing, and with it the needs are also increasing. Man conquers new lands without caring about the old ones. The areas suitable for cultivating the land are decreasing. And their quality is decreasing... The process of deterioration of the quality of the land, the decrease in its productivity is land degradation. In arid climates, land degradation often turns into desertification, when fertile land turns into a desert.

In a soil with a strong structure, due to the large volume of non-capillary pores, all precipitation and irrigation water are absorbed and stored well, and air exchange is much better in it than in fine-grained soil. Therefore, due to the sufficient amount of water and air in the structured soil, favorable conditions for the life of microorganisms are created, as a result of which nutrients necessary for plant life accumulate in the soil.

The soil does not have a solid permanent structure. It is formed by the following factors:

a) mechanical factors - under the influence of tractors, people, and animals moving in the fields, and the working bodies of working tools;

b) physicochemical factors - under the influence of rainwater and the ammonium and hydrogen ions contained in them, the calcium and magnesium absorbed by the humus are squeezed out and the strength of the soil structure decreases; due to the crushing of soil particles under the influence of water discharge and, especially, during irrigation, the air squeezed out by the water;

c) biological factors - under the influence of aerobic bacteria, the soil can be broken down into small particles as a result of the decomposition of humus, which binds the soil particles together.

Soil samples, sieves with a base and lid, with holes of 10, 7, 5, 3, 2, 1, 0.5 and 0.25 mm in diameter, a 1-liter cylinder with a diameter of 7 cm and a height of 45 cm, 8 large and 9 small porcelain numbered cups, electronic scales, a water bath, a container or cylindrical tub with a diameter of 30-40 cm and a height of 30-35 cm.

To restore the soil structure, annual and perennial grasses are planted in crop rotation, and organic fertilizers are also applied to the soil. The humus layer is renewed to form structural lumps and strengthen them. When planting annual plants and plowing the land with a peat plow in the fall, the structure of fine particles of the topsoil of the fields is partially restored.

During plowing, the scythe plow throws the top layer of soil with fine particles, along with plant residues, to the bottom of the furrow, while the main body turns the soft, firm, lumpy soil of the lower layer, enriched with humus due to the anaerobic decomposition of organic matter, to the surface.

There are several methods for studying the structural state of the soil.

These are: 1) N.I. Savvinov's method - a method based on macroaggregate analysis by sieving the soil;

2) V.R. Williams and P.A. Andrianov's method for determining the water resistance of soil macrostructures;

3) K.K. Gedroys' method for determining the resistance of soil microstructural elements;

4) D.T. Vilensky's drop method for determining the water resistance of aggregates.

This method was developed at the Department of Agriculture of the Moscow Agricultural Academy named after K.A.Timiryazev and is based on macroaggregate analysis by sieving the soil.

In this method of studying the state of soil structure:

a) a soil sample is taken from the area to be examined and dried in air. Then 2.5 kg is weighed from it on a scale, passed through sieves with different mesh sizes and separated into the following 9 fractions: larger than 10 mm; 10-7; 7-5; 5-3; 3-2; 2-1; 1-0.5; 0.5-0.25 and smaller than 0.25 mm. A tray is placed on the bottom of the sieves to collect dust particles, and the top is covered with a lid to prevent soil particles from being scattered during sieving;

b) after sieving, each fraction is weighed separately on a scale and calculated as a percentage, with 2.5 kg of soil being taken as 100%;

c) To determine the percentage of strength of aggregates weighing 50 g, an average sample is taken. For this, an amount of soil equal to half the percentage of the fraction expressed in grams is taken from each sieve. In order to avoid clogging the holes of the lower sieve, the average sample may not be taken from a fraction with a diameter of less than 0.25 mm (although it is taken into account when calculating the average sample). The average sample is taken twice;

g) The average sample obtained is placed in a cylinder filled with water and left undisturbed for 10 minutes. This is done to allow air to escape, which could mechanically damage the pieces during subsequent operations.

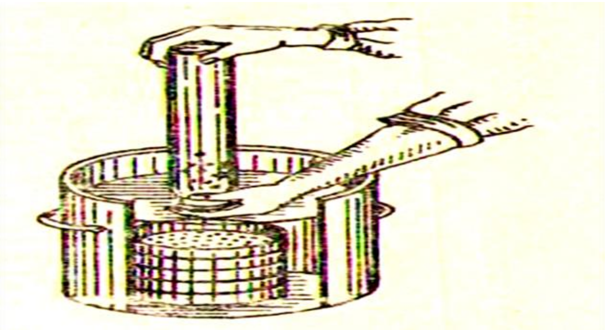

Figure 1. Passing soil from a cylinder through a set of sieves

Figure 2. Laboratory equipment for determining the state of soil structure

During the experiment, after 1-2 minutes, although most of the air has been released from the soil, a small part remains in the form of bubbles in large voids, and the remaining air is expelled. To do this, water is poured into the cylinder to the top, covered with a glass, quickly turned to a horizontal position, and then returned to a vertical position. After that, air begins to separate from the soil in the form of small bubbles; d) 10 minutes after the soil sample is placed in the cylinder, the cylinder is covered with a glass, quickly turned over and held in this position for several seconds until large soil particles fall to the bottom. Then the cylinder is brought to its original position and the soil is expected to sink to the bottom. This operation is repeated 10 times. When the cylinder is turned over, weak aggregates and lumps with a diameter larger than 10 mm are separated into components;

e) 5 sieves with a diameter of 20 cm, a height of 3 cm and holes of 0.25; 1; 2; 3; 5 mm are placed one above the other in a cylindrical bath filled with water. The water level should be 5-6 cm above the edge of the upper sieve. j) After the cylinder has been inverted ten times, it is brought onto the sieves. The cylinder is inverted and the window is opened under water. The soil mass in the cylinder falls onto the upper sieve. To ensure even distribution of the soil, the cylinder is rotated on the sieve without removing it from the water. After the main mass (larger than 0.25 mm) falls onto the surface of the sieve, 40-50 seconds later the mouth of the cylinder is closed again with a window under water and removed from the water;

h) The sieved soil mass is sieved: for this, without removing the sieves from the water, all the sieves are raised 5-6 cm and quickly immersed in water again. They are held in this position for 2-3 seconds until the lumps fall back onto the sieve. Then the set of sieves is slowly raised and quickly immersed again. The upper sieves (5, 3 and 2 mm) are removed after shaking ten times, and the lower one is additionally shaken five more times and removed from the water;

i) The lumps on the sieves are washed in a large porcelain bowl with a stream of water from the washing device, after removing excess water, they are placed in small porcelain bowls that have been previously weighed and numbered;

k) Then the bowls are placed in a thermostat and the soil is dried at 1050C for 4 hours, then cooled in a desiccator for 2 hours.

l) The mass of dried pellets is determined separately. The mass of water-resistant pellets is multiplied by 2.

$$x = \frac{a \text{ x } 100}{H}$$

Where: x – water resistance of the aggregate, in percent

a – mass of water-resistant aggregate, in g.

N – total mass of the analyzed soil, in g. 100 %

$$x = \frac{5 \text{ x } 100}{50} = 10 \text{ \%}$$

For example, if 50 g of soil (N) contains 5 g of aggregate (a) with a diameter of 5-3 mm, the percentage will be as follows:

CONCLUSION

During the field research, the climatic conditions in the experimental field area were perennial values. The soil of the experimental field is a light gray, medium loamy soil with a low humus content, and the absorption of mineral colloids is very fast. The water-physical properties of the experimental field soil are density, solid phase density, soil porosity, maximum hygroscopicity, and moisture reserve. Depending on the degree of soil moisture, it is high or low, depending on the soil layer, so that the capillary pores are filled with water to the lower layers of the soil, and during sharp changes in air temperature, it is low in winter and high in autumn. The limited field moisture capacity of the soil is understood as the ability of the soil to retain water absorbed into the soil to varying degrees in the layers. The higher the moisture capacity of the soil at the experimental site, the more sufficient moisture is provided in the soil for plants. Soil sampling was continued until a constant moisture content was reached. The constant moisture content was taken as the limited field moisture capacity. To determine the limited field moisture capacity, samples were taken from the plots at the start of the experiments and the moisture content was determined.

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