Problem №7
Worms

Team:
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Problem.

Earthworms change the mechanical properties of soil and make the soil more porous. Investigate this process and introduce quantitative parameters.

Purpose and tasks

Purpose:

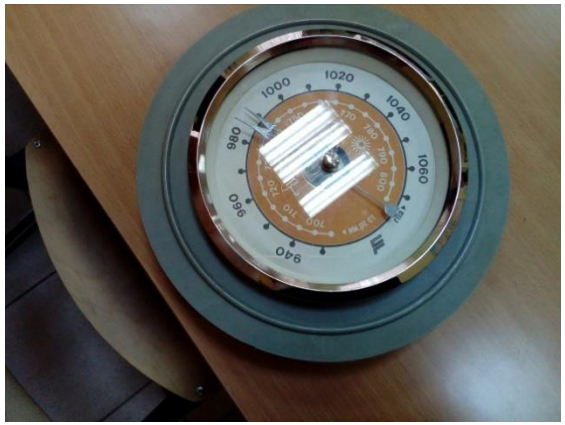
- Discover how earthworms change the mechanical properties of soil and make the soil more porous, introducing quantitative parameters

Tasks:

- Conduct experiments and confirm that earthworms change mechanical properties of soil
- Identify what quantitative properties can describe the process of changing the mechanical properties of the soil
- Make a conclusion, comparing theoretical part wirh experiment part

Equipment

- earthworms
- different types of soil
- thermometer
- barometer
- terrarium or a container
- pH meter
- scales



Earthworms

N earthworms = 10 , m = 4 g

Terrarium or other container.

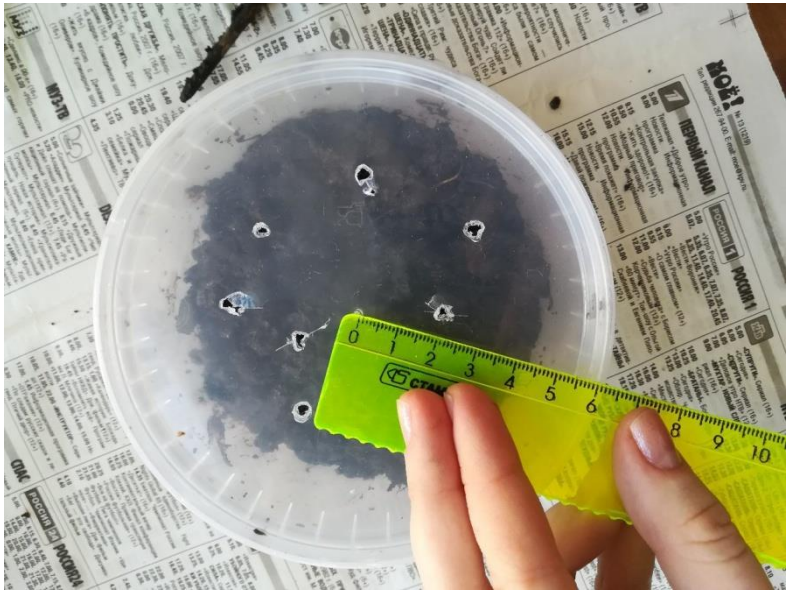
Earthworms can live in a plastic box. Mass of the box = 37 g. I made some holes at the bottom of a container (for removal of water surplus). Container was in a dark place, which is more favorable for the earthworms.

Soil

Soil is chernozem (Black soil). Mass of the soil= 500 g

Soil

I calculated the volume of soil using this formula $v = \pi * R^2 * H$ (R – radius, H – height). V ≈226cm³.



Soil acidity.

I know that ph of the soil should be about 7 for normal life of worms.

Temperature

Temperature should be between +8°c and +27°c

Moisture

A required moisture level of soil for worms is 75-80%. To determine the moisture level, it is necessary to take a small lump of earth, where worms live, and squeeze it. If there are drops of water leaking out, then the moisture is high.

Food

Earthworms eat residues. I was feeding the earthworms with carrot cleanings.

Air pressure.

Air pressure should be between 755-765 mm Hg.

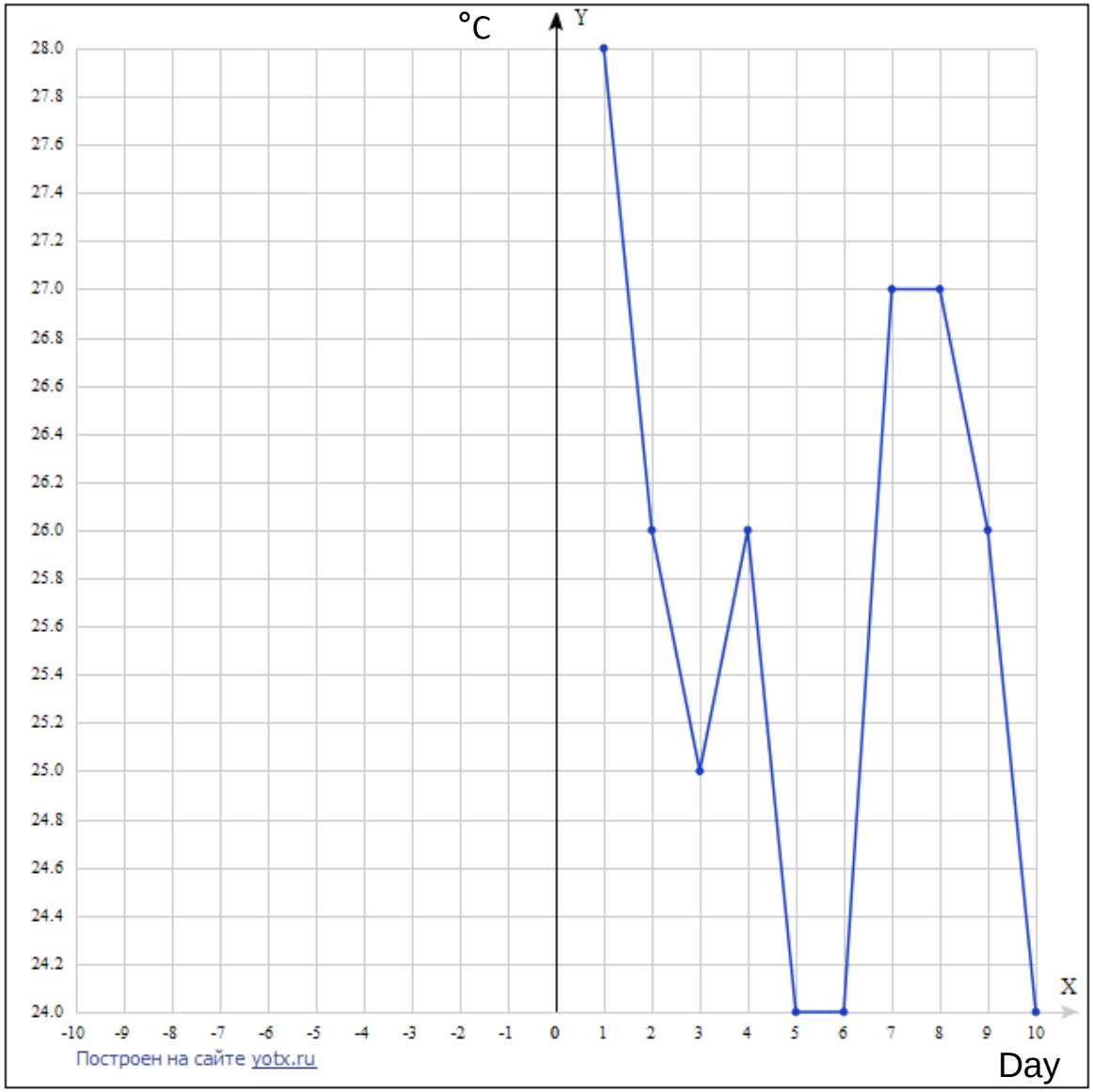
Ten days later

Volume of the soil ten days later ≈452cm³

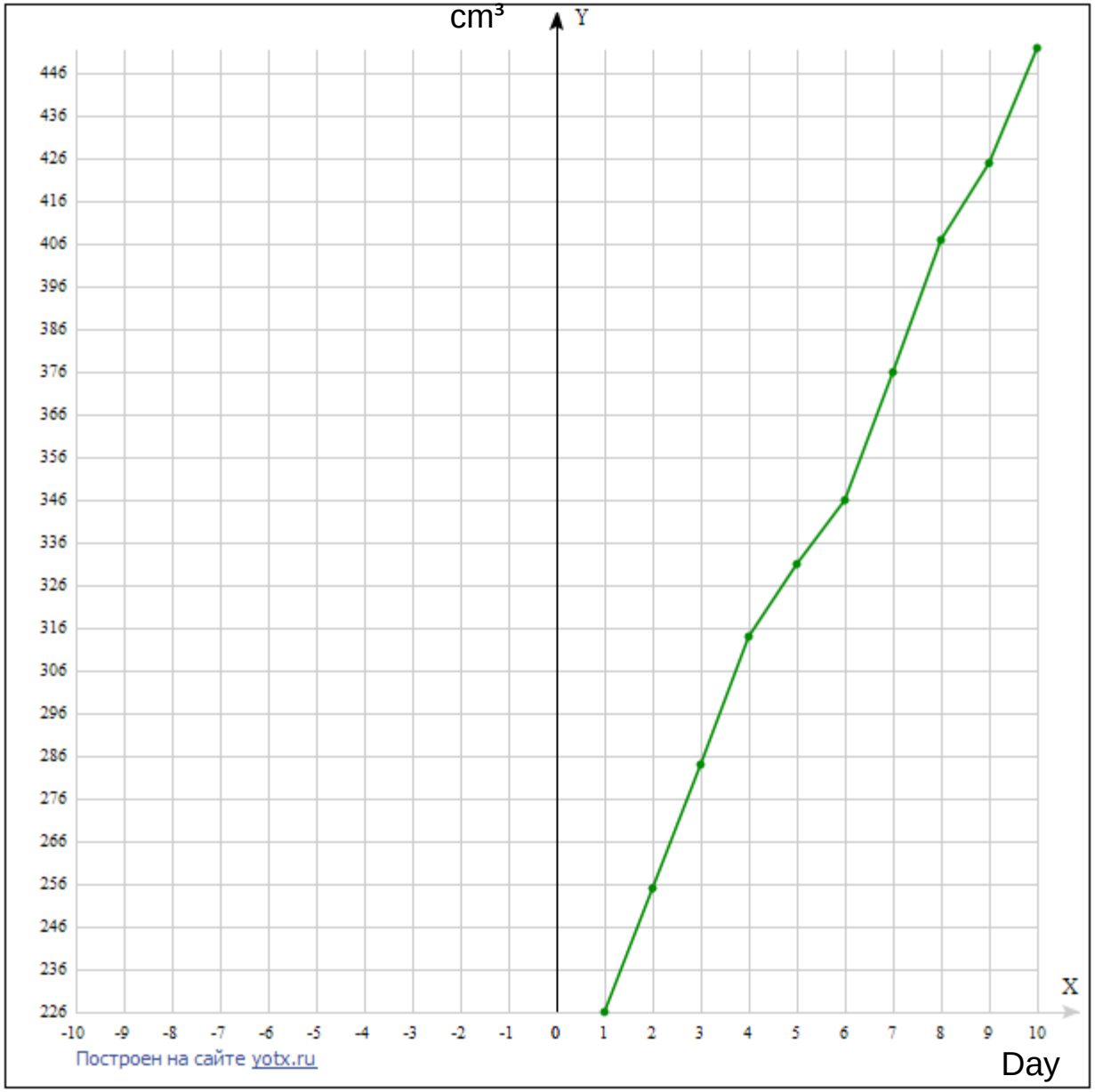
Change of quantities properties

Day	Air temperature (°C)	Mass of the soil (g)	Volume of the soil (cm^3)	Mass of the worms (g)	Number of worms	Air pressure (mm Hg)
1	28	500	226	4	10	755
2	26	-	255	-	-	756
3	25	-	284	-	-	756
4	26	-	314	-	-	757
5	24	-	331	-	-	758
6	24	-	346	-	-	760
7	27	-	376	-	-	760
8	27	-	407	-	-	759
9	26	-	425	-	-	764
10	24	500	452	4	10	760
Average	25,7	500	-	4	10	758,5

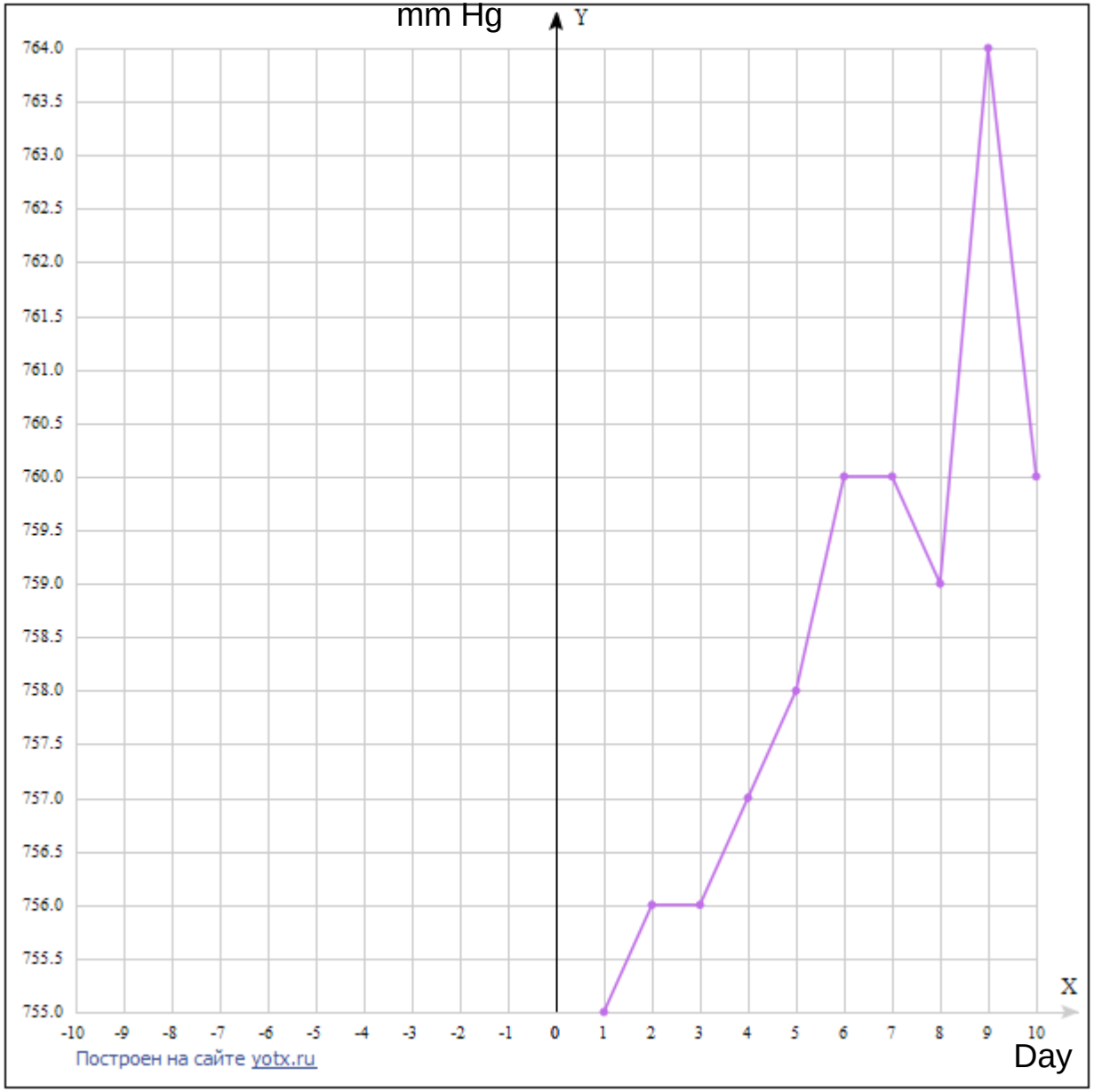
Graph of air temperature



Graph of soil volume



Graph of air pressure



Watering, feeding and loosening timetable

- Earthworms were placed in thier container on 10.04.18
- Timetable of watering: 10.04.18, 12.04.18,14.04.18,16.04.18,18.04.18
- Timetable of loosening: 10.04.18, 14.04.18,18.04.18.
- Timetable of feeding: 10.04.18, 16.04.18.

Comparison

Soil in the 1st day

Soil ten days later

Comparison

Soil in the 1st day

Soil ten days later

Soil porosity

Comparison

Soil without earthworms

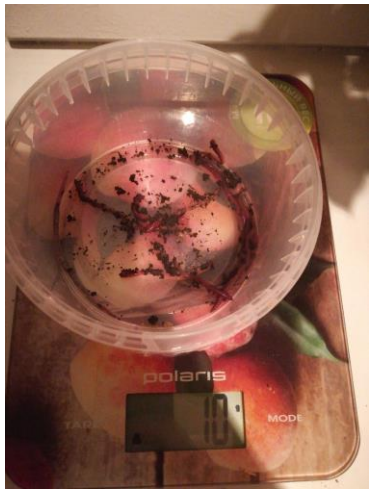
Soil with earthworms

Changing the terms of habitat of earthworm

I did experiments with different kind of soil. I did experiments with sand and with glay soil. As we thought, these conditions are not suitable for worms.

Sand

Glay soil



Conclusion

- Earthworms changed the mechanical properties of soil and made the soil more porous;
- In ten days the volume of the soil has increased almost twice;
- Soil has loosing and become more porous;
- The soil became more friable and changed its structure (break into smaller fractions).

Information resource.

- http://www.gardenia.ru/pages/4ervi_002.htm
- https://ru.wikipedia.org/wiki/Земляные_черви
- http://www.agro-biz.ru/ribovodstvo/razvedenie-dozhdevyih-chervey-dlya-rybalki-usloviya-razvedeniya.html
- http://pro-hor365.ru/kak-opredelit-kislotnost-pochvyi/

Soil porosity

To determine the porosity of the soil, we need soil, water and a syringe. We pour water into the soil without worms and into the soil with worms. We measure the volume of water that flooded the soil. This volume will be approximately equal to the volume of air between the soil particles

Additional sides

For the normal life of worms, the acid pH of the medium should be about 7. To determine the acidity of the soil, I need a litmus test. In the earth it is necessary to make a small depression and to collect earth from vertical walls about 50 grams of the earth. We moisten the soil samples obtained with distilled water. We squeeze the paper together with the wet earth. The color of the litmus paper will be changed depending on the acidity. The pH of my soil environment is close to 7, i.e. suitable for living worms