Helping plants during drought

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Photo 1. Black lines on the cups show the level of. Moistened soil.

Climate changes, primarily a decrease in precipitation and an increase in solar activity, lead to a number of negative consequences, in particular to soil and air drought and consequently to crop losses. Is there any chance to help plants? How can we promote the development of the root system, accelerate its development in depth and ensure the survival of crops?

We simulated a typical case of soil drought when grain (wheat) was sown in dry soil and remained there for a certain time. Then a light rain fell and moistened the soil to a depth of 5-6 cm. Insignificant precipitation led to the germination of grain up to the “awl” stage. Consequently the root system started growing from the depth of 2 cm (sowing depth) to the depth of moist soil. How will young plants and their roots behave?

At first glance, the roots will stop growing or will grow sideways, along the border between dry and wet soil. That is the way the wheat roots behave on reaching the plow sole. In this they are helped by a kind of "grease" which forms root secretions, or exudates. They are a kind of slime consisting of polysaccharides, lignin, amino compounds, vitamins, etc. Exudates are necessary as a nutrient medium, or food for bacteria that form a rhizobial cover around the roots. It is difficult to overestimate its value for plants: it helps to transfer the plant remains into a form available for consumption by plants, to reduce friction when the root advances into completely dry soil. This natural process is helped by the so-called root formers - products that reduce grain energy consumption for the formation of exudates. Most of them also contain components that are "tasty" for bacteria. That is why they are considered as prebiotics - nutrient medium or food for bacteria. If we add live bacteria, we will get a pre-probiotic, which we found out 12 years ago and called Bio-gel. This product patented in different countries also contains the so-called signaling molecules (SM). These are special substances

Photo The plants state after 10 days.

that notify a young plant about the approach of drought. Accordingly, the grain begins to release most of its energy in the form of starch and complex sugars for the formation of a deeply located root. This can be demonstrated with the help of simple laboratory experiments, using plastic cups of 500 ml each, filled with dry calcined sand, which has been moistened from above by 50 mm. For this 50 ml of drinking water was added into each cup.

The structure of dry sand makes it possible to saturate the upper layer by 100%. Below, the sand is completely dry, which perfectly simulates soil drought with surface-moistened soil.

The experiment was conducted in four repetitions, five plants each. Before moistening the soil 5 seeds were sown in each cup at the depth of 2 cm. The weight of 20 grains of the LG Arnova winter wheat variety is 1g (accurate to 1%), which is convenient for the experiment.

In order to check how CMs help the root of a young plant to penetrate through dry soil in search of a moistened layer that lies below, the experiment was supplemented by moistening the bottom layer of soil in cups 3 and 4 to a height of 1 cm.

After 10 days, as a result of the simulated drought, the plants began to wither. You can see it in photos 2-5 where in control variant 1 (cups 1 and 2) 70-80% of plants have withered or broken down. Not much better is the situation in control variant 1, cups 3 and 4, where the lower soil layer was moistened to the height of 1 cm. A bit better situation is observed in experiment variant 2 (cups 1 and 2) where Bio-gel was used, the amount being 0.5 l/t, for plant inoculation. The number of dead plants here does not exceed 30%. At the same time, in cups 3 and 4 with sand moistened at the bottom, there are practically no dead plants.

The situation is a little better in experiment variant 3, which in its tendency repeats experiment 2. Here the amount of Bio-gel was increased to 2 l/t of seeds.

Variant 4 where the Bio-gel amount was increased to 3.5 l/t did not demonstrate better results compared to variants 3 and 4.

Confirmation of previous conclusions regarding the effect of different Bio-gel doses on plant survival in drought conditions is demonstrated by Figure 6. In it, line 1 corresponds to the level of sand in the cups. Line 2

Photo 6. The effect of different doses of Bio-gel.

corresponds to the level of moistened sand. Line 3 visualizes the moisture level at the bottom of the cup. Line 4 shows the cup bottom line.

That is, the moistened layer above the cup bottom or line 4 is about 1 cm. To reach it, the plant roots must overcome a layer of completely dry sand (about 6 cm). Bio-gel (2 l/t) helps them in it.

Photos 7-10 show the state and number of plants which survived soil drought without moistening the low layer of dry soil.

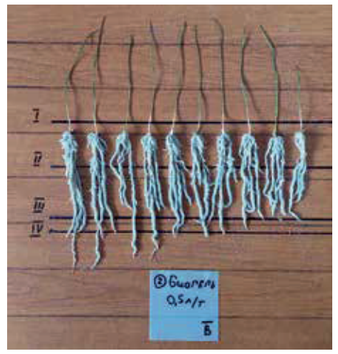
Based on the above experiments we can state that the optimal amount of Bio-gel is 2 l/t of seeds.

Table 1. The weight of plants with sand sticking to them and without sand, it being washed away.

N	Experiment	Weight	%	Notes
1	Control	43,92	100	
2	Control + Water	49,67	114	On the cup bottom
3	Bio-gel 0,5 l/t	46,3	105	
4	Bio-gel 0,5 l /t + water	62,3	142	On the cup bottom
5	Bio-gel 2 l/t	50,54	115	
6	Bio-gel 2 l/t + water	78,3	178	On the cup bottom
7	Bio-gel 3,5 l/t	45,0	102	
8	Bio-gel 3,5 l/t + water	58,6	133	On the cup bottom

WHAT ARE THE RESULTS OF THE EXPERIMENTS?

- Applying Bio-gel pro-prebiotic in the drought simulating experiment positively affects the plants survival.
- The optimal dose of Bio-gel applied is 2 l/t.
- The sand sticking to the roots helps to accumulate the moisture reserve due to the exudates and this helps plants to survive.
- The presence of small water amounts on the cup bottom accelerates root growth in depth, which confirms the ability of plants to “feel” water in the lower soil layers.
- It is important to note that despite water presence on the cup bottom in the control variant with no Bio-gel used, the roots of most plants could not overcome a layer of dry sand, which caused their death.
- At the same time, it is possible to note the positive effect of Bio-gel on the formation of a large root system.
- It should be noted that the above experiments have only a qualitative nature and require statistically justified clarification ⊡



Photos 7-10. State of plants under drought conditions without moistening the low layer of dry soil.