Bio-gel is an insurance policy against drought

(implementation results)

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Today's huge losses caused by drought, especially in the central part of Ukraine, hit both the pockets of agricultural producers and the country's economic indicators. And the hope for an increase in the precipitation amount at the time of global warming seems quite unrealistic. Thus, the way out of the situation should be found as soon as possible, as sowing of winter crops is underway.

The TEKMASH Institute Ukrainian company has been engaged in the development of technologies and products aimed at overcoming the effects of drought for 12 years. The powerful production facilities in the south of Ukraine in Kherson (at present transferred to Cherkasy) as well as numerous implementations in Kherson, Mykolaiv, Odessa regions and in the Oleshki desert helped to create an optimal technology of fighting drought and its consequences. The basis of the Bio-gel composition is natural bacteria which have been hardened by high temperatures (+70-75°C). The microorganisms that have survived under such conditions can withstand the soil surface heating by the sun, ultraviolet effect and nocturnal temperature changes.

During such an autumn drought as the current one, seed inoculation with Bio-gel and later spraying green sprouts with Bio-gel and any chemical or organic fertilizers mixed in a tank is practically a saving step. As the organic product is absolutely safe for people and animals, there are no restrictions as to its application.

Here we give examples of the Bio-gel organic product application during 2023-2024.

Growing soybeans without mineral fertilizers

Zahyd-Men company (Volyn region) grows the Tytan soybean domestic variety developed by the Vinnitsa fodder institute on the field of 460 ha. The growing conditions in 2024 were very bad, the precipitation amounted to only 105 mm, the soil and atmosphere drought lasted all the summer. The farmers did not use any mineral fertilizers or fungicides. Germination of gel-treated seeds was about 98.5%, sowing depth being 2.5-3 cm, sowing time being April 4 - May 5. Bio-gel was used for seed treatment (0.5 l/t) and for spraying (3 l/ha+ 1.5 l/ha + 1.5 l/ha + 1.5 l/ha = 7.5 l) together with some classical enzymes (auxins, phenolic acid, etc). Before harvesting the average number of beans was 39 pc/plant. Practically all beans contained 3, sometimes 4 seeds. Biological yield assessment makes about 4 t/ha, crop density being 650,000 per hectare; as to Sirelia, another soybean variety of French selection, its biological yield assessment was 3.6 t/ha, crop density being 700,000 per hectare.

As you can see in the photo, soybeans are big and clean, without signs of damage or disease.

Corn: one dollar invested, five dollars received

Similar experiments were conducted with corn in 2023 in the Chernihiv region by the RAGT company on its demonstration field of 0.1 ha (Nizhyn district), the soils there being sandy, the predecessor being soybean. The sowing rate was 71.5 thousand per hectare, the sowing date was May 3, 2023, the harvest date was October 10, 2023. As for the fertilizers applied, it was KCl (200 kg/ha) in autumn before plowing and urea in spring by a seeder. From April to the middle of July the weather conditions were favorable for plants. But because of high temperatures and low moisture content of sandy soils, atmospheric and soil drought appeared in the second half of summer which caused almost total death of corn and sunflower crops on most farms.

The results obtained by the RAGT company seem convincing against this background, especially where Bio-gel was applied. The average yield there varied from 12 to 13 t/ha, the grain moisture being 14%.

At the same time, the control plot with no Bio-gel applied yielded only 6.02 t/ha, that is, half as much.
To achieve this rather high hybrid productivity, the RAGT company used a dynamic response technology to the plants state. Their agrophone was as follows: in autumn they applied KCl (200 kg/ha); in spring they applied urea (100 kg/ha). The further treatments were as follows:

1) Bio-gel (2 l/ha) in April by spraying before closing moisture;
2) Bio-gel (1.5 l/ha) as fertigation at the 2-4 leaves stage, Zn and K being added;
3) Bio-gel (2 l/ha) as fertigation at the 6-7 leaves stage, pentyl acid, K, P and micro element complex being added;
4) Bio-gel (2 l/ha) as fertigation seven days after the previous spraying.

All in all 7.5 l/ha was used (2+1.5+2+2), besides, macro and micro-element complexes were added. The estimated cost of using the technology in 2023 prices was 6000 gr/ha ($160). The yield obtained (12-13 t/ha) at minimal price ($80) brought about $1040, or 38 000 grivna in 2023 prices. Thus, the average profitability of agricultural production was not less than 650%, for one dollar invested in technology the farmer received at least $5.5 in profit.

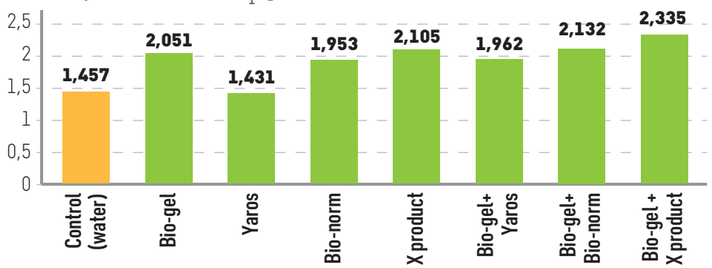
Transcarpathia: again one to five

Another example comes from another region,
the Carpathia Product company in Transcarpathia. The soybean (GMO PS0035NR2) variety is of mid-early ripening and of low productivity. It was sown on May 25, 2024 on 18 ha, the field was divided into two parts, 9 hectares each: with and without Bio-gel applied (control variant). The predecessor was corn, the sowing depth was 2.5 cm. The rainfall amount in the spring was sufficient (430 mm) but June and July were quite dry. The last rain (46 mm) was on August 2. The later period till the beginning of September was characterized by atmospheric and soil drought. The Bio-gel product was applied three times beside seed inoculation, all in all 5.2 l/ha were used.

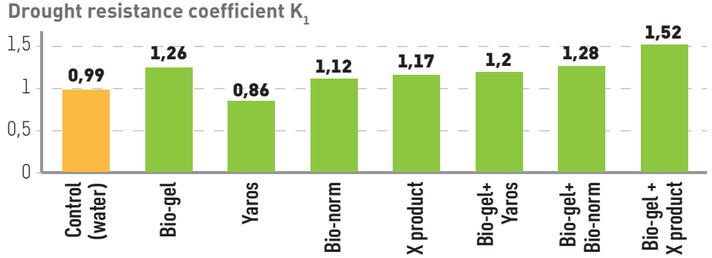
Bio-gel was applied:
1) three weeks before sowing for stubble destruction together with glyphosate at the rate of 1 l/ha (May 3, 2024);
2) for treating seeds at the rate of 1.5 l/ha (May 25, 2024);
3) as plant nutrition together with micro fertilizers at the rate of 2 l/ha (June 30, 2024);
4) at the second plant feeding, the rate being 2 l/ha (July 21, 2024).

The average yield in the control variant was 2.92 t/ha, while with Bio-gel applied it was 3.45 t/ha, the difference

Mass of plant wet roots, M_1, g



Drought resistance coefficient K_1



being 0.53 t/ha. As at present soybeans cost 20 000 grivna/t, the additional income due to the Bio-gel application makes: 0.53 t/ha x 20 000 grivna/t = 10600 grivna ($250). As the Bio-gel price is $10/l, the cost of 5.2 l is $52. Thus the estimated cost/profit ratio is 1:5. It means that each monetary unit of expenditure gives 5 monetary units of additional profit!

According to a purely formal assessment, Bio-gel increases the vegetation period. You can observe it visually: while the plants in the control had already ripened, the plants with Bio-gel were still vegetating, thus increasing the weight of grains and improving their quality. The delay lasted about two weeks. In our opinion, the explanation of this phenomenon is simple. Every variety is characterized by its own vegetation period but present day extreme growing conditions, such as soil and atmosphere drought, ultraviolet radiation, magnetic storms, shorten this period substantially. Such shortening affects grain quantity and quality. Our Bio-gel product is a natural adaptogen which adapts plants to unfavorable external factors, it acts as an anti stress to soil and atmosphere drought.

Barley and Bio-gel

The field experiments with Bio-gel applied were done with spring barley in the Odessa region in 2024 by the Institute of climate-oriented agriculture, NAAS.

We studied the Bio-gel effect on spring barley morphological indicators. Both seed treatment and soil spraying were favorable for the yield structure (the number of ears increased by 8 and by 11 pc/m^3, the weight of the above-ground plant mass increased by 19 g/m^3 and 8 g/m^3, the plant height increased by 5.7 and 4.6 cm, the weight of 100 grains increased by 1.84 g and 3.51 g), while the biological productivity increased by 0.23 and 0.22 t/ha, respectively. The actual yield of the spring barley after harvesting with the Sampo-130 combine was 3.8 and 3.07 t/ha (after applying Bio-gel for seed treatment and for soil spraying, respectively), while in the control variant it was 2.85 t/ha, which is by 0.23 and 0.22 t/ha less. Thus we can make a conclusion: Bio-gel use for seed treatment or for soil spraying increases the spring barley yield by 0.22-0.23 t/ha on the non-irrigated lands in the Odessa region conditions.

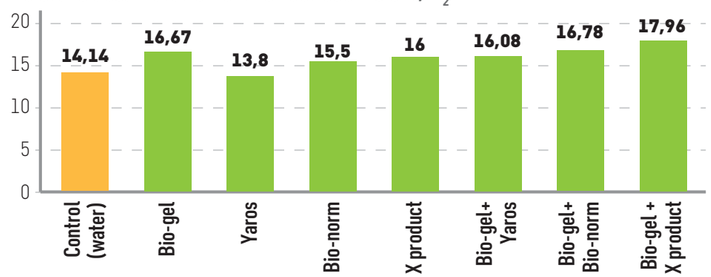
Sheaf examples: control, seed treatment with Bio-gel, soil spraying with Bio-gel.

Comparative and synergistic effect on wheat

In order to study the effect of climate changes, namely that of drought, and possible synergism in the complex use of various biological products popular in Ukraine, we conducted our own research of these products efficiency.

The generally accepted concept of creating a deeply located, branched root system of a young plant was used as the criteria for combating drought. As seed germination takes place at the initial stage of plant development, the seed energy is used both for root growth and for plant's green part formation. Consequently, the accelerated growth of the plant root causes slower development of the plant vegetating part (plant top). Besides, the use of some microbiological products requires additional feeding for microbiota used for seeds inoculation. As our experiments have shown, it is the root secretion that consumes 12-30% of seed energy and creates a root rhizobial cover. In case of drought this cover accumulates additional moisture, which is very favorable for plant drought resistance. The biological products can contribute to moisture accumulation, especially by the plant root.

Moisture accumulation of the root coefficient, K_2



To characterize the above factors the following laboratory experiment was conducted. Five seeds were sown into half liter capacities, each containing 1 kg of very hot sand (its heating to 120°C lasted for one hour).
The number of repetitions was 5, that is, 25 seeds were used in each experiment variant. The Arnova wheat variety seeds were sown to a depth of 2 cm in lightly moistened sand (2.5% humidity).

The watering rate was 30 ml per capacity, the same amount of water was added every three days. Thus, in ten days the amount of water used was 25+30+30+30=115 ml, which corresponds to minimally favorable conditions for seed germination. In the daytime the temperature in the laboratory was about 30-31°C, while at night it was 18-20°C, the relative humidity being 51-54%. Relatively high temperatures accelerated plants development. In 10 days the plants were removed from the sand, carefully washed and dried with paper napkins. In our opinion, the sticking sand retains a considerable part of moisture (2.5-4%) when the soil dries during drought period, its humidity being reduced to less than 0.2-0.4%.

K_1 and K_2 coefficients were introduced to characterize the effect of various biological products on plant drought resistance and the mass ratio of plant's moistened roots to moistened tops. It is clear that the more seed energy is used for the development of roots, not the tops, the higher is K_1. Not less important is K_2, the moisture accumulation of the plant, or rather its root, as the main moisture accumulator

$$K_2 = M_1 / m_1,$$

where M_1 and m_1 are masses of wet and dried roots.

The picture illustrates the substantial difference in moisture accumulation depending on plant inoculation with different biological products.

The analysis of the results obtained makes it possible to draw the following conclusions:

- in the control variant (N_1) the seed initial energy is equally spent on stem and root formation (K_2=0.99) which reduces the plant's chances of survival during drought;
- all products, except N_3, have the K_2 coefficient > 1, that is, the root mass is bigger than the top mass;
- in case Bio-gel is added to N 1, 3, 4, 5 (variant 2), K_2 coefficient is much bigger, which testifies to the synergism or strengthening effect;
- the maximum efficiency belongs to product N5 with Bio-gel added, K_2=1.52, that is, the root mass is one and a half times bigger than the top mass;
- the K_2 moisture retention coefficient tends to grow from left to right due to the products synergism with Bio-gel. ⊡