Bio-gel: signaling molecules warn about stress

Conversation with Sergiy Osypenko and Alexander Tarasenko about the new paradigm of plant health care

When the ZERNO journal published an interview with academician Sergiy Osypenko, its readers were greatly interested in his two unique inventions: HTD-technology and Bio-gel which was created due to it. Some of the readers asked for additional information, some of them already used the product but did not know anything about its creators. That is why we decided to ask Sergiy Osypenko for some additional information. Alexander Tarasenko, chief technologist of TEKMASH Institute, also took part in the conversation.

Humates which ruined their own reputation

- Mr. Sergiy, as far as I know you do not have an agronomic education. What prompted you to get involved in agriculture, what knowledge was needed for it?

- You are right, I do not have agronomic education and, in my opinion, it is good. Otherwise I would make the same mistakes as other scientists. In part, agronomy dominates over physics and chemistry. Fertility is based on humic compounds in the form of humic acids (HA) and fulvic acids (FA). As you know, they are poorly soluble (otherwise they would be washed away by the rains). Their salts are produced using chemistry: sodium or potassium humates with pH=11 which have no connection with the very concept of fertility. Naked chemistry! For simplicity: the recipe for lemonade is to squeeze a lemon into water and add sugar. While playing, children put some baking soda into the juice solution. It is hissing! As a result we get calcium salts of citric acid which are tasteless and useless, unlike lemonade. The same is true for humates. Just see the reaction of humates to mineralized water from the Ingulets River in the Kherson region (fig. 1). A precipitate in the form of hydroxides Ca+2, Fe+2 appears. The brine from these oxides kills all living things. Salts glistens on the vegetables in the sun. So what? The Germans classify potassium and sodium humates as organic! The same does our Organic-Standard! We made our humates using not chemistry but physics: turbulence, cavitation, friction. The product name was Humat-gel. But nobody bought it because nobody believed us, as humates have done their dirty work. That's when I started studying the effect of organic substances on soil fertility. First I took up inoculants. And again something is unclear: a lot of companies sell their products, boast about milliards of useful bacteria titres in one gram but… I went to a biological factory in Kherson and almost suffocated there: it appeared that these "useful" bacteria are grown on meat peptone agar (MPA), that is, on meat wastes and similar components. They multiply into billions and are sold as a probiotic to increase soil fertility. But what do they eat in the soil? There is no meat there. Is it possible that they are eaten by "hungry" soil bacteria, thus they are not probiotics but prebiotics, the food of "wild" bacteria. We made some experiments and it turned out that they are more prebiotics than probiotics. This made me even more interested as it is a giant industry, numerous academicians are engaged in it, growing new strains. I started reading scientific articles such as "Growing … alfalfa variety using Azotobacter strain…" And I made sure that if there are, say, 20 main crops, then there are several hundreds of bacterial strains. That is, tens of thousands of scientific works will be written though farmers will hardly benefit from it.

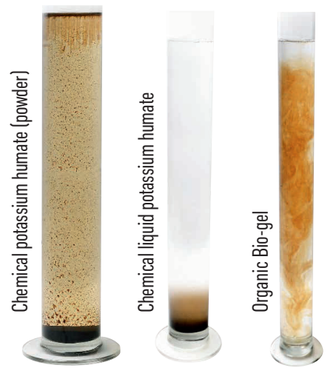


Fig. 1 Humate reaction to mineralized water

Tasteless borsch

- However, how exactly have you managed to increase soil fertility?

- We started growing bacteria from fertile soils in their habitat, that is, in soils.

- But there are a lot of them there, aren't there?

- There are few, only tens of thousands in one gram of soil because organic compounds of soils are scarcely available for them. Let's draw an analogy with people. Can you imagine making borsch without using fire? We cut carrots, cabbage, potatoes, put them into a pan, add water and serve it on the table. This kind of borsch was served to my grandchildren in a naturopathy camp. "Dad, it was not tasty at all but it is good for our health". So the question is: why is it not tasty and for whom?

- In my opinion, borsch cannot be tasty without a pork rib. However, seriously, since a man had mastered fire, food was cooked using heat, so it is digested more easily and has a pleasant taste. But a lot of vegetables should be eaten raw. Maybe that uncooked borsch is still tasty?

- To my mind, no. It cannot be tasty for the bacterial community weighing about 2.5 kg (the liver weight is only 1.5 kg) that lives inside your body. So both meat and beets should be boiled for stomach bacteria to digest them. That is why we cooked our "borsch" as a mixture of various natural components: peat, sapropel, humus, a mixture of Ukrainian chernozem, alumina, sandy loam. Each kind of soil is characterized by its bacteria.

Fig. 2 What Bio-gel is made of?

Chernozem contains nitrogen-fixing and phosphorus-mobilizing bacteria, sandy loam has oligotrophs which can stand +60 degrees C on soil surface.

- It seems quite simple: just make a mixture of elements which are easily digested.

- I agree, it's simple but that is not all. You can't cook it in a pan because it will kill the microbiota. You must heat it very slowly and stir. But you need thousands of liters! It took years of work and hundreds of experiments to cope with this problem. We used only our own money, because we believed in success.

- I can't imagine that you were the first who came up with this idea.

- Certainly not. A hundred years ago farmers transferred some soil from the field where legumes had been grown to new fields. During the war Germans exported our soil. My father came from Visokopillya (Kherson region) where the layer of chernozem amounts to one and a half meters. He told me about it. To my mind, Germans shouldn't have done it, they'd better take away bacteria!

- Yes, I happened to see strange rectangles of chernozem fields among local podzol in Bavaria. Taking away bacteria sounds unexpected.

- A healthy soil contains various kinds of bacteria and fungi, both useful and not useful, that is, pathogenic. - Alexander Tarasenko joined our conversation. - They live in peace and harmony until human intervention by chemical loading of soils and plants destroys some and stimulates others. This is how an imbalance in the soil appears, that is, diseases similar to human dysbacteriosis. People fight with it using chemistry, thus a closed circle occurs. I don't think we should divide bacteria into useful and harmful. It is scientists' invention. As I see it, they can't exist without each other. So we took different soils with their biological diversity. The experiments made on hundreds of thousands of hectares proved our rightness.

Composition of product hardened by temperature

- So your Bio-gel is a purely biological product. But in what way is it different from dozens of other ones on the market?

- The first difference consists in the fact that we use all microorganisms of the live soil without exception. - Sergiy's words sound convincing as they are backed by years of research and experiments. - Doctors use such a method of dysbacteriosis treatment: they take some healthy microflora from a healthy person and administer it to a person with dysbacteriosis. It works rather fast as the microflora is renewed. It is the most ecological treatment! Another question is: why should we introduce into soil exactly Rhizobium or Bacillus subtilis in high concentration? Are we not disturbing the balance of the "bacterial portrait of the soil" as we call it? And what are the consequences? They are disappointing as the result of any intentional intrusion. For example, some inhabitants of North Africa were taken to Paris some dozens of years ago to renew European blood. Several "multi-coloured" marriages took place. The first mixed population was promising: talented actors, sportsmen, TVstars. In the second one the number of underdeveloped children increased, the third one was critical. The present-day demographical situation is well-known. To my mind, such "picking raisins from buns" is to be stopped! Why do we bring Japanese or American microorganisms to Ukraine? Since when have Japanese soils become better than Ukrainian ones?

- **Yes, I have always been impressed by Israeli agrotechnologies as this country lacks soils in general. And can you tell us about your production technology?**
- I haven't yet mentioned the main thing: we harden bacteria with high temperatures, prepare them for future stressful situations. For this we reproduce bacteria in the natural habitat. Their number increases to tens of billions. At the same time tasty "borsch" is being cooked for them. The raw materials are crushed and mixed. The temperature is constantly growing.

Fig. 3 Bacteria hardening

At this some bacteria die producing signaling molecules (SM) - "molecules of fear". Plant seeds inoculated with such SM prepare the future plant to heat stress in advance. As a result the plant growth energy is used for the formation of a powerful root because it is the root which ensures the plant survival during drought. By the way, this is discussed in detail in the publication "The price of colonizing a foreign planet" ("TerraZemlya" N1, 2022).

- **Yes, your publication mainly dealt with the philosophy of plant growing. But you crush the stuff, that is, you kill bacteria.**
- By no means, and it took years of research. It is with this problem that the patents of USA, Europe, Asia, Ukraine dealt. We have a lot of know-how.

- **And what about soil? What are the results of the colonization?**
- This question is correct and very interesting. The soil becomes loose, structured, saturated with oxygen. In a couple of years time the plant can be dug out with bare hands (fig. 4).

Bio-gel main feature is synergy of compounds

- **So what is Bio-gel? What is its main feature? What is its active substance?**
- You ask standard questions. We have been studying Bio-gel for 12 years and still I cannot answer your question because the more we study, the more we find out and try to improve. As a result, the product modifications appeared under the trademark of LEANUM registered as an organic fertilizer, under the trademark of Sterk-bio as a bio product, under the trademark of Vitamin O7 as Bio-gel dry concentrate. So we are going ahead while the horizon is getting farther and farther. As you know, there is no final goal, there is only a path to it.

- **However, the chemical composition of the product exists. Is it possible to analyze the composition and separate the elements of Bio-gel?**
- OK, there exists synergism of compounds or combination of components according to the formula 1+1=11, 1+1+1=111. In other words, if there is a new technology, it means either saving money, or increasing productivity, or something that is

Fig. 4 After two years of Bio-gel application

Fig. 5 TEKMASH young technicians

known and understood by everyone. Our achievement is not a new product, not a new technology. We have created a world new platform when all the indexes rise simultaneously. It is a so-called paradigm: a new approach to well-known things.

- **Our readers are farmers while your answer is philosophical. Can you explain it in clear categories, physical, chemical, agronomical, which are understandable to our readers?**
- Today's popular motto is "Harvest through soil fertility". That's what we have done. The Kherson regional station of young naturalists took first place in the All-Ukrainian competition with the slogan "Harvest through soil fertility" for two years in a row due to using Bio-gel. Increases in the vegetable harvest reached 50%. But under modern conditions of chemical and heat stress, powerful ultra radiation, crazy prices for fertilizers everybody is trying to "milk" farmers and nature begins to oppose us. Everybody stresses the importance of a bigger root system and we claim that we have found the

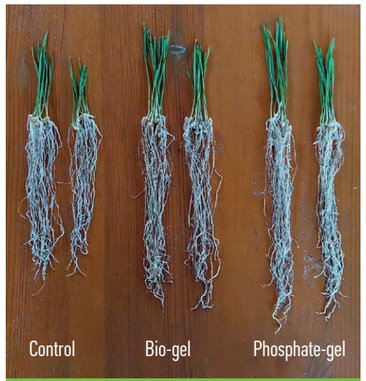
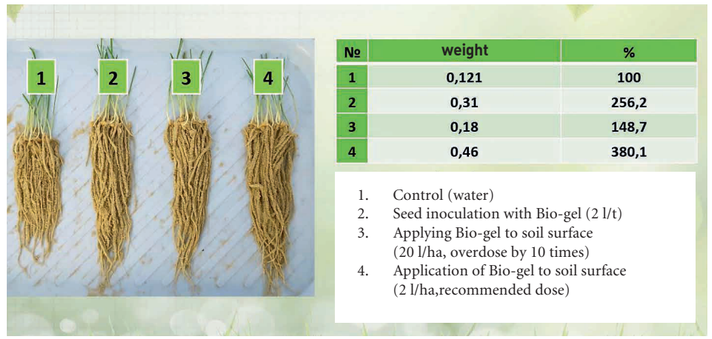


Fig. 6.



№	weight	%
1	0,121	100
2	0,31	256,2
3	0,18	148,7
4	0,46	380,1

1. Control (water)
2. Seed inoculation with Bio-gel (2 l/t)
3. Applying Bio-gel to soil surface (20 l/ha, overdose by 10 times)
4. Application of Bio-gel to soil surface (2 l/ha,recommended dose)

winter wheat

Fig. 7 Fighting drought

Table 1.
Bio-gel composition

• HARDENED BACTERIA +75°
• SIGNALING MOLECULES
• AMINO ACIDS 18 pc. (glycine, lysine, leucine and other)
• ENZYMES
• VITAMINS B_1, B_2, PP, E, A ...
• MACRO & MICROELEMENTS (organic)
• HUMIC & FULVIC ACIDS (organic)

Table 2.
SYNERGISM: seven in one

• GROWTH NORMALIZER
• PLANT DETOXIFIER
• BIOLOGICAL FUNGICIDE
• PRO- & PREBIOTIC
• STUBBLE DESTRUCTOR
• ADAPTOGEN
• ROOT FORMATION

universal approach to it. We are not trying to press farmers. In our experiments the control variant is the technology used by the farmer, that is, the agronomist's choice remains in effect. In this way we start considering the agronomist as our friend and offer him our help because he can make a mistake choosing products for spraying crops. Our proposal is very simple: add Bio-gel, the amount being 2 l/ ha for spraying or/and 2 l/1000 kg of seeds for inoculation. That's all! We do not suggest any new technology! Any farmer or agronomist has his own methods of getting high profits. Our proposal is a kind of loss insurance. For example, you've got an old herbicide, then add to it Bio-gel, 2 l/ha, it will become by 30% more effective, thus ensuring a significant increase in the harvest. That is why we say that Bio-gel is an insurance policy against drought and similar stressful situations or mistakes.

- **It sounds as an advertisement. Every producer praises his products but few can prove their effect.**
- Just look: signaling molecules prepare future plants for lack of moisture, for atmospheric and soil drought. Just imagine: the fire alarm in your estate went off but you are not at home, you are on vacation. In this case the house will burn down because the fire extinguishing system will not work. But Bio-gel contains everything necessary for extinguishing fire: amino acids, vitamins, microelements, complex sugars, HA and FA from that "tasty borsch". And the most important thing: bacteria hardened by heat which will create the rhizosphere near the root, thus retaining moisture and developing a powerful root system. These are the secrets. What is the most important thing? It is up to you to decide.

Icing on the cake

- **I see your great ambitions as far as Bio-gel is concerned.**
- Greater than you can imagine. But the ambitions are not only mine, I am not a recluse. I belong to a community of like-minded people: TEKMASH Institute. We worked together, sold the product in 12 countries, took first place in sales of organic fertilizers in Ukraine. We also cooperated with international companies working in Ukraine.

- **And what about Sterk-bio? Are they twin products?**
- They are similar but one of them contains more signaling molecules, while the other has more anaerobic bacteria, because anaerobic bacteria that can exist without oxygen should first of all loosen the soil suffering from chemical load because of microbiota absence. When oxygen arrives, anaerobic bacteria will start working and the soil will recover.

- **And still, why do you deal with different companies, use different trademarks and different composition of the product?**
- For now, this is our know-how,- Alexander Tarasenko smiled. I will tell you about it as soon as I patent it.

- **OK. Will there be any icing on the cake?**
- Yes, it's our new technology of inoculation through soil surface, that is, first sowing, then inoculating. We were the first to try it and the results are amazing! The technology is named after me for my grandchildren to remember their dad. To be honest, when I worked for the defense industry in the Soviet Union and then with energy engineers and chief engineers of the leading industrial complexes of Ukraine, I looked a bit disrespectfully at the agricultural sector: what can you expect of those simple workers who often lack any education? But now I must acknowledge my great respect for them. Most of them are silent and strong like oxen of the gray Ukrainian breed, precisely those Chumatsky ones. And I see the Ukrainian future based on their work as they will never leave their land, they will not allow it to overgrow with weeds, will not allow the enemy to march on it, as it happened in Mykolaiv, when simple farmers with rifles stopped the Muscovites. Simple workers against the regular army! I saw it with my own eyes! I am sure that the people who live here will never betray their land!